NEEDHAM PLANNING BOARD
Tuesday, March 23, 2021
7:15 p.m.

Virtual Meeting using Zoom
Meeting ID: **826-5899-3198**
(Instructions for accessing below)

To view and participate in this virtual meeting on your phone, download the "Zoom Cloud Meetings" app in any app store or at www.zoom.us. At the above date and time, click on "Join a Meeting" and enter the following Meeting ID: 826-5899-3198

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Direct Link to meeting: https://us02web.zoom.us/s/82658993198

1. Discussion and Vote Planning Board Recommendations:

   Article 1: Amend Zoning By-Law – Highway Commercial 1 Zoning District
   Article 2: Amend Zoning By-Law – Highway Commercial 1 Zoning District Schedule of Permitted Special Permit Uses
   Article 3: Amend Zoning By-Law – Map Change to Highway Commercial 1

2. Minutes.

3. Correspondence.

4. Report from Planning Director and Board members.

(Items for which a specific time has not been assigned may be taken out of order.)

ARTICLE 1: AMEND ZONING BY-LAW – HIGHWAY COMMERCIAL 1 ZONING DISTRICT

To see if the Town will vote to amend the Needham Zoning By-Law as follows:

1. Amend Section 2.1, Classes of Districts, by adding the following term and abbreviation under the subsection Industrial:

   "HC-1 -- Highway Commercial 1"

2. Amend Section 3.2, Schedule of Use Regulations, by adding a new Section 3.2.7 as follows:

   "3.2.7 Uses in the Highway Commercial 1 District

   3.2.7.1 Permitted Uses

   The following uses are permitted within the Highway Commercial 1 District as a matter of right:

   (a) Uses exempt from local zoning control pursuant to M.G.L. Chapter 40A, Section 3.

   (b) Public parks and playgrounds, municipal buildings or uses.

   (c) Retail establishment (not including grocery stores) or combination of retail establishments serving the general public where each establishment contains less than 5,750 square feet of floor area and where all items for sale or rent are kept inside a building.

   (d) Manufacturing clearly incidental and accessory to a retail use on the same premises and the product is customarily sold on the premises.

   (e) Craft, consumer or commercial service establishment dealing directly with the general public.

   (f) Laundry or dry--cleaning pick-up station with processing done elsewhere.

   (g) Professional, business or administrative office, but not including any of the following: a medical clinic or Medical Services Building or medical, surgical, psychiatric, dental, orthodontic, or psychologist group practices comprised of three or more such professionals (hereinafter "Group Practices") or physical therapy, alternative medicine practices, wellness treatments, including but not limited to, acupuncture, yoga, chiropractic and/or nutrition services. "Professional" shall include professional medical, surgical, psychiatric, dental, orthodontic or psychologist practice by a group of two or fewer such professionals ("Non-group Practice").

   (h) Bank or Credit Union.

   (i) Medical Laboratory or laboratory engaged in scientific research and development and/or experimental and testing activities including, but not limited to, the fields of biology, genetics, chemistry, electronics, engineering, geology, medicine and physics, which may include the development of mock-ups and prototypes.

   (j) Radio or television studio.

   (k) Light non-nuisance manufacturing, including, but not limited to, the manufacture of electronics, pharmaceutical, bio-pharmaceutical, medical, robotic, and micro-biotic products, provided that all resulting cinders, dust, flashing, fuses, gases, odors, smoke, noise, vibration, refuse matter, vapor, and heat are effectively confined in a building or are disposed of in a manner so as not to create a nuisance or hazard to safety or health.

(l) Telecommunications facility housed within a building.

(m) Other customary and proper accessory uses incidental to lawful principal uses. Further provided, accessory uses for seasonal temporary outdoor seating for restaurants serving meals for consumption on the premises and at tables with service provided by waitress or waiter shall be allowed upon minor project site plan review with waiver of all requirements of Section 7.4.4 and 7.4.6 except as are necessary to demonstrate compliance with Section 6.9 by the Planning Board or Select Board in accordance with Section 6.9.

(n) More than one building on a lot.

(o) More than one use on a lot.

3.2.7.2 Uses Permitted b~~B~~y Special Permit

The following uses are permitted within the Highway Commercial 1 District upon the issuance of a Special Permit by the Special Permit Granting Authority under such conditions as it may require:

(a) Light-rail train station.

(b) Adult day care facility.

(c) Private school, nursery, or kindergarten not otherwise classified under Section 3.2.7.1 (a).

(d) Retail establishment (not including grocery stores) or combination of retail establishments serving the general public where any establishment contains more than 5,750 but less than 10,000 square feet of floor area and where all items for sale or rent are kept inside a building.

(e) Equipment rental service but not including any business that uses outside storage.

(f) Grocery store provided it does not exceed 10,000 sq. ft. of floor area.

(g) Eat-in or take-out restaurant or other eating establishment except that a lunch counter incidental to a primary use shall be permissible by right.

(h) Veterinary office and/or treatment facility and/or animal care facility, including but not limited to, the care, training, sitting and/or boarding of animals.

(i) Indoor athletic or exercise facility or personal fitness service establishment, which may include outdoor pool(s) associated with such facilities.

(j) External automatic teller machine, drive-up window or auto-oriented branch bank accessory to a bank or credit union permitted under Section 3.2.7.1(h) hereof.

(k) Group Practices as defined in Section 3.2.7.1(g) and alternative medicine practices, physical therapy, and wellness treatments facilities including, but not limited to, acupuncture, yoga, chiropractic and/or nutrition services. Such uses may have customary and proper accessory uses incidental to the lawful principal uses, including but not limited to, pharmacies.

(l) Live performance theater, bowling alley, skating rink, billiard room, and similar commercial amusement or entertainment places.

(m) Apartment or multi-family dwelling provided that (1) the proposed apartment or multi-family dwelling complies with the lot area per unit requirements for apartments in the A-1 district as detailed in Section 4.3, (2) no more than 240 dwelling units shall be permitted in the Highway Commercial 1 District, (3) at least 40% but not more than 70% of all dwelling units within any project shall be one-

bedroom units, and (4) at least 12.5% of all dwelling units shall be Affordable Units as defined in Section 6.12."

3. Amend Section 4.7.1, Specific Front Setbacks, by deleting the following provisions:

"(b) On the easterly side of Gould Street from Highland Avenue northerly to land of the New York, New Haven and Hartford Railroad Company, there shall be a fifty (50) foot building setback line;

(c) On the northerly side of Highland Avenue from Gould Street northeasterly to the property of the Commonwealth of Massachusetts, there shall be a fifty (50) foot building setback line."

4. Amend Section 4.10, Dimensional Regulations for Industrial-1 District, by deleting Section 4.10.4, which refers to Section 4.7.1 (b) and (c).

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~~4.~~5. Amend Section 4, Dimensional Regulations, by adding a new Section 4.11 Dimensional Regulations for Highway Commercial Districts as follows:

"4.11 Dimensional Regulations for Highway Commercial Districts

4.11.1 Highway Commercial 1

Minimum Lot Area (Sq. Ft.)	Minimum Lot Frontage (Ft.)	Front Setback (Ft.) (1)	Side Setback (Ft.) (1) (3)	Rear Setback (Ft.) (1) (3)	Maximum Height (Ft.) (1)	Maximum Stories (1)	Maximum Lot Coverage (2) (4)	Floor Area Ratio (5) (6)
20,000	100	5	10	10	56	4	65%	1.00

(1) a. All buildings shall be limited to a height of 56 feet and four stories, except that buildings within 200 feet of Highland Avenue or the extension of the right-of-way line as described below in paragraph c. and buildings within 200 feet of Gould Street shall be limited to a height of 35 feet and 2 ½ stories as-of-right. If the height of a building is increased above the height of 35 feet, the front setback shall be increased to 15 feet and the side and rear setbacks to 20 feet except that, along the MBTA right-of-way the side and rear yard setbacks shall be 10 feet.

b. By Special Permit from the Planning Board, the maximum height of a building may be increased to the following limits within 200 feet of Highland Avenue or the extension of the right-of-way line as described below in paragraph c. and within 200 feet of Gould Street: (i) 3 stories and 42 feet; or (ii) 3 stories and 48 feet, provided the additional height is contained under a pitched roof or recessed from the face of the building in a manner approved by the Planning Board. By Special Permit from the Board, the maximum height of a building may be further increased to the following limits: 5 stories and 70 feet provided the building is not located within 200 feet of Highland Avenue or the extension of the right-of-way line as described below in paragraph c. or within 200 feet of Gould Street. ~~If the height of a building is increased above the height of 42 feet, or 48 feet if under a pitched roof or recessed as aforesaid, the front setback shall be increased to 15 feet and the side and rear setbacks to 20 feet except that, along the MBTA right-of-way the side and rear yard setbacks shall be 10 feet.~~

c. The line from which the setbacks from Highland Avenue shall be measured is that line which starts at the point of curvature on Highland Avenue at Gould Street marked by a stone bound/drill hole (SB/DH) and runs northeasterly N63º56'51"E by the Highland Avenue 1980 State Highway

Alteration 361.46 feet to a stone bond/drill hole, then continues on the same northeasterly course an additional 330.54 feet for a total distance from the first mentioned bound of 700 feet. Reference is made to a plan entitled "Plan of Land Gould Street, Needham, MA", prepared by Andover Engineering, Inc., dated July 27, 2000, last revised September 20, 2001, recorded in the Norfolk County Registry of Deeds as Plan No. 564 of 2001, Plan Book 489.

d. Buildings and structures abutting Highland Avenue, Gould Street and/or the layout of Route 128/95 shall be set back at least 20 feet from said streets and said layout. Notwithstanding the location or height of any building and structures, a 20-foot landscaped, vegetative buffer area shall be required along the aforementioned street frontages and said layout in order to screen the development. Driveway openings, sidewalks, walkways and screened mechanical equipment shall be permitted in the buffer area.

e. Structures erected on a building and not used for human occupancy, such as chimneys, heating-ventilating or air conditioning equipment, solar or photovoltaic panels, elevator housings, skylights, cupolas, spires and the like may exceed the maximum building height provided that no part of such structure shall project more than 15 feet above the maximum allowable building height, the total horizontal coverage of all of such structures on the building does not exceed 25 percent, and all of such structures are set back from the roof edge by a distance no less than their height. The Planning Board may require screening for such structures as it deems necessary. Notwithstanding the above height limitations, cornices and parapets may exceed the maximum building height provided they do not extend more than 5 feet above the highest point of the roof.

f. For purposes of clarity, the required building setbacks and allowed envelopes (including setbacks) for allowance of additional height above 35' for the as-of right circumstance and 42'/48' for the special permit circumstance are shown on figures 1 and 2 below.

Figure 1:

Figure 2:

(2) Maximum lot coverage shall be 65% for all projects. However, if a project is designed such that at least 65% of the required landscaped area immediately abuts at least 65% of the required landscaped area of an adjoining project for a distance of at least 50 feet, the maximum lot coverage may be increased to 75%.

(3) No side or rear yard setback is required for shared parking structures between adjoining properties, but only on one side of each lot, leaving the other side or rear yards open to provide access to the interior of the lot.

(4) A minimum of 20% of total lot area must be open space. The open space area shall be landscaped and may not be covered with buildings or structures of any kind, access streets, ways, parking areas, driveways, aisles, walkways, or other constructed approaches or service areas. Notwithstanding the preceding sentence, open space shall include pervious surfaces used for walkways and patios. (Pervious surfaces shall not preclude porous pavement, porous concrete, and/or other permeable pavers.)

(5) A floor area ratio of up to 1.35 may be allowed by a special permit from the Planning Board. In granting such special permit, the Planning Board shall consider the following factors: the ability of the existing or proposed infrastructure to adequately service the proposed facility without negatively impacting existing uses or infrastructure, including but not limited to, water supply, drainage, sewage, natural gas, and electric services; impact on traffic conditions at the site, on

adjacent streets, and in nearby neighborhoods, including, but not limited to, the adequacy of the roads and intersections to safely and effectively provide access and egress; the environmental impacts of the proposal; and the fiscal implications of the proposal to the Town. In granting a special permit, the Planning Board shall also consider any proposed mitigation measures and whether the proposed project's benefits to the Town outweigh the costs and adverse impacts, if any, to the Town.

(6) The calculation of floor area in determining floor area ratio shall not include parking areas or structures.

4.11.2 Supplemental Dimensional Regulations

~~(1) Parking structures shall be set back at least 100 feet from Highland Avenue and/or Gould Street.~~ Notwithstanding Section 3.2.7.1(m) and any other provision of this Section 4.11 to the contrary, a parking garage, even if it is for an as-of-right development, may not exceed 44 feet in height, may not have a building footprint in excess of 42,000 square feet and may not be located within 250 feet of Highland Avenue or the extension of the right-of-way line described in Section 4.11.1 (1) (c) or within 200 feet of Gould Street. Notwithstanding the above, the maximum height of a parking garage may be increased to 55 feet by Special Permit from the Planning Board. For purposes of clarity the height, coverage and location requirements for the as-of-right and special permit parking garage circumstance are shown on figure 3 below.

(2) Parking structures may have an active ground floor use, such as retail, office, institutional, or display. Structured parking must be located at least 20 feet from adjacent buildings, ~~-~~but may be attached to the building it is servicing if all fire and safety requirements are met.

(3) Buildings abutting Highland Avenue and/or Gould Street must have a public entrance facing one street on which the building fronts. This requirement may be waived by special permit from the Planning Board for buildings abutting the 20-foot landscaped setback on Gould Street and Highland Avenue where the arrangements for pedestrian access are such that entrances facing these streets are not the best design option.

(4) Maximum uninterrupted facade length shall be 200 feet.

~~(5) Notwithstanding Section 3.2.7.1(m) and any other provision of this Section 4.11 to the contrary, a parking garage, even if it is for an as-of-right development, may not exceed 44 feet in height, may not have a building footprint in excess of 42,000 square feet and may not be located within 250 feet of Highland Avenue or the extension of the right-of-way line described in Section 4.11.1 (1) (c) or within 200 feet of Gould Street without the issuance of a special permit by the Planning Board. A parking garage for an as-of-right development may, however, be located within the area beyond said setbacks as-of-right if the parking garage is located easterly or northeasterly of said 200 feet or 250 feet setbacks. For purposes of clarity the height, coverage and location requirements for the as-of-right circumstance are shown on figure 3 below.~~

(5) All setback, height, and bulk requirements applicable to this Section 4.11 are contained in this Section and no additional requirements occasioned by this district abutting Route 128/95's SRB district shall apply.

~~(6)~~ Figure 3

4.11.3 Special Permit Provision

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The Planning Board may, by special permit, waive any or all dimensional requirements set forth above in this Section 4.11 (including sections 4.11.1 and 4.11.2), by relaxing each by up to a maximum percentage of 25% if it finds that, given the particular location and/or configuration of a project in relation to the surrounding neighborhood, such waivers are consistent with the public good, and that to grant such waiver(s) does not substantially derogate from the intent and purposes of the By-Law. This section does not authorize the Planning Board to waive the maximum height regulations, maximum story regulations, reduce the 20 foot landscaped buffer area requirement along Gould Street, Highland Avenue and the layout of Route 128/95, reduce the 200~~100~~ foot garage setback requirement along Gould Street and the 250-foot limit along Highland Avenue, or reduce the 20% open space requirement of Section 4.11.1(4), except as specifically provided in Section 4.11.1(1) for pitched or recessed roofs. (By way of example, a 15' front yard setback could be waived to 11.25' or the 20,000 sq. ft. minimum lot area could be waived to 15,000 sq. ft.)

4.11.4 Special Permit Requirements

In approving any special permit under Section 3.2.7.2 and/or ~~this~~ Section 4.11, or for any Project proceeding under the Highway Commercial 1 district provisions which constitute a Major Project under Section 7.4.2, the Planning Board shall consider the following design guidelines for development: (a) The proposed development should provide or contribute to providing pedestrian and neighborhood connections to surrounding properties, e.g., by creating inviting buildings or street edge, by creating shared publicly accessible green spaces, and/or by any other methods deemed appropriate by the Planning Board; (b) Any parking structure should have a scale, finish and architectural design that is compatible with the new buildings and which blunts the impact of such structures on the site and on the neighborhood; (c) The proposed development should encourage creative design and mix of uses which create an appropriate aesthetic for this gateway to Needham, including but not limited to, possible use of multiple buildings to enhance the corner of Highland Avenue and Gould Street, possible development of a landscape feature or park on Gould Street or Highland Avenue, varied façade treatments, streetscape design, integrated physical design, and/or other elements deemed appropriate by the Planning Board; (d) The proposed development should promote site features and a layout which is conducive to the uses proposed; (e) the proposed development should incorporate as many green building standards as practical, given the type of building and proposed uses; ~~(~~(f) the proposed development should be designed and conditioned to reduce or mitigate adverse impacts on adjacent properties or the surrounding area such as those resulting from excessive traffic congestion or excessive demand for parking; and (g~~f~~) The proposed development shall include participation in a transportation demand management program to be approved by the Planning Board as a traffic mitigation measure, including but not limited to, membership and participation in an integrated or coordinated shuttle program."

6. Amend Section 5.1.3, Parking Plan and Design Requirements, by adding at the end of the second sentence of subsection (j) which reads "Such parking setback shall also be twenty (20) feet in an Industrial-1 District" the words "and Highway Commercial 1 District."

7. Amend Section 6.5.1 of Section 6.5 Limited Heliports, by adding after the words "Industrial Districts," in the first sentence, the words "and in the Highway Commercial 1 District,".

8. Amend Section 6.12, Affordable Housing, by revising the first paragraph to read as follows:

~~5.~~ "Any mixed-use building in the Neighborhood Business District (NB) with six or more dwelling units shall include affordable housing units as defined in Section 1.3 of this By-law. Any building in the Highway Commercial 1 District with six or more dwelling units shall include affordable housing units as defined in Section 1.3 of this By-law. The requirements detailed in paragraphs (a) thru (i) below shall apply to a development that includes affordable units in the Neighborhood Business District. The

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requirements detailed in paragraphs (a), (c), (d), (e), (f), (g), and (h) below shall apply to a development that includes affordable units in the Highway Commercial 1 District."

~~6.~~9. Amend Section 7.2.5 of Section 7.2 Building or Use Permit, by adding after the words "Industrial-1 District," in the first sentence, the words "Highway Commercial 1 District,".

~~7.~~10. Amend Section 7.4.2 of Section 7.4 Site Plan Review, by adding in the first sentence of the last paragraph, the words "Highway Commercial 1 District," after the words "Highland Commercial-128,".

~~8.~~11. Amend Section 7.7.2.2, Authority and Specific Powers (of Design Review Board) by adding after the words "Industrial-1 District," in the first sentence of the second paragraph, the words "Highway Commercial 1 District,".

Or take any other action relative thereto.

INSERTED BY: Planning Board
FINANCE COMMITTEE RECOMMENDS THAT:

Article 1 Information: The Council of Economic Advisors (CEA), which was created by the Select Board to evaluate Town-wide economic conditions and make recommendations to promote and encourage new and existing businesses, undertook a review of all Industrial Zoning Districts in 2012, and, after focusing its efforts on three different areas along Route 128, held numerous public meetings with residents, neighbors, public officials, businesses and landowners in 2014 about potential zoning initiatives. As requested during those discussions, the CEA obtained a build-out analysis, a traffic impact report based on that analysis, and elevation drawings to better understand the impact of any proposed development. After examining the results of those reports, the CEA in 2017 reached out again to the various stakeholder groups and presented its preliminary recommendations to upgrade the zoning adjacent to Route 128 in order to make these areas more economically competitive. The Planning Board, having reviewed the proposals from the CEA, determined in 2019 to move forward on only one area; the area circumscribed by Route 128, Highland Avenue, Gould Street, and the railroad track. A rezoning plan for the noted area was then developed and presented to the October 2019 Special Town Meeting where it received a majority vote but fell short of the 2/3 vote required for passage. Concerns with the overall density profile, traffic impact, use profile and lack of sustainable development principles were noted by Town Meeting members.

In response to input received at the October 2019 Special Town Meeting, a Town-wide Community meeting was held in January 2020 with residents, neighbors, public officials, businesses and landowners to further develop and refine the Town's overall land use goals and strategy for the district. Additionally, a working group comprising representatives from the Planning Board, Select Board, Finance Committee, and Council of Economic Advisors was established to review the policy objectives of the district and to offer strategies to address the concerns raised at both the October 2019 Special Town Meeting and the January 2020 Community meeting. The working group commissioned an updated traffic study of the district to determine the capacity of the Town's traffic infrastructure to accommodate development at variable density and use profiles. 3D modeling and an updated fiscal impact analysis of the district were completed once the density and use profile of the district were finalized consistent with the capacity of the Town's traffic infrastructure to accommodate development at variable density and use profiles.

Briefly, the following four modifications have been made from the 2019 rezoning proposal to the current 2021 proposal as follows: (1) The overall density of development within the district has been reduced. (2) The maximum building height within the district has been reduced by one story for both the as-of-right and special permit condition. (3) Permitted uses within the district have been expanded to include multi-family dwellings. (4) Special permit criteria for permit issuance has been expanded to include green building standards. The proposed use and dimensional changes to this area, to be rezoned Highway Commercial 1 ("HC1"), are detailed below.

The amendments to Section 3.2 detail the uses allowed by right and those by special permit. In addition, by listing the uses rather than using the current somewhat antiquated table of uses, the uses can be clarified and brought up to date. Key changes to the use table include allowing up to 240 units of multi family dwelling units; allowing greater retail by special permit for more than 5,750 sq. ft. and less than 10,000 sq. ft. (current limit 5700 sq. ft.);allowing grocery stores of up to 10,000 square feet by special permit; clarifying medical services allowed by right and by special permit (as was done in the Needham Crossing zoning); standardizing the medical laboratory and research and development defined uses; allowing by right more than one use and more than one building on a lot; changing theaters, bowling alleys, skating rinks, billiard rooms and similar commercial amusement or entertainment places from by right to special permit; deleting indoor movie theaters from allowed uses; precluding single family detached dwellings from allowed uses; and precluding certain industrial uses in the district including, inter alia, commercial garages, contractor's yards, lumber or fuel establishments, Medical Clinics, and previously allowed warehousing, manufacturing and industrial services. The purpose of the use changes are: (1) to ensure that uses allowed by right or by special permit will maximize the economic value of redevelopment to the Town; and (2) to subject certain uses presently allowed by right to the special permit process so that they may be properly vetted by the permit granting authority as to impacts and mitigation.

The amendments to Section 4 would create the dimensional requirements for the new Highway Commercial 1 zone. The proposal under the new Section 4.11 establishes height restrictions for the district based upon measured distance from Gould Street and Highland Avenue. For the as-of-right circumstance development within 200 feet of Gould Street and 200 feet of Highland Avenue would be limited to a maximum height of 35 feet and 2 ½ stories and beyond 200 feet to a maximum height of 56 feet and 4 stories. For the special permit circumstance development within 200 feet of Gould Street and 200 feet of Highland Avenue would be limited to a maximum height of 42 feet (48 feet if under a pitched roof or recessed from the face of the building) and 3 stories and beyond 200 feet to a maximum height of 70 feet and 5 stories. (The current zoning allows 30 feet or two stories.) The proposal would change the front setback to 5 feet unless the building height exceeds 35 feet, in which case the front setback increases to 15 feet, or the building sits on Highland Avenue, Gould Street and/or the layout of Route 95/128, where a 20-foot landscaped vegetative buffer is proposed. (Current front setback is 20 feet except along Gould and Highland where a 50-foot building setback is imposed.) The side and rear setback would change to 10 feet unless the building height exceeds 35 feet, in which case the setback is increased to 20 feet for all side and rear setbacks not abutting the MBTA right-of-way. (The current side setback is 20 feet and the current rear setback is 10 feet). For informational purposes, the required building setbacks and allowed envelopes (including setbacks) for additional height above 35 feet are shown as Figure 1 for the as-of-right condition and as Figure 2 for the special permit condition in the zoning article.

The new zoning creates a maximum lot coverage requirement of 65% and an open space requirement of a minimum of 20%. (The current zoning contains no such requirements.) Changes are also proposed to the maximum floor area ratio ("FAR"); a maximum FAR by right would be 1.00; the FAR may be increased up to 1.35 by special permit provided certain findings are made. The amendment clearly sets out the specific factors which will allow the exercise of the Board's special permit granting authority. The proposed zoning also sets out the maximum uninterrupted façade length that is allowed—200'. (The current zoning allows a FAR of only 0.5 and only in very limited special circumstances 0.65-0.75.)

Finally, the new zoning restricts the bulk, height and location of a parking garage, even if it is for an as-of-right development. A parking garage may not exceed 44 feet in height, may not have a building footprint in excess of 42,000 square feet nor may it be located within 250 feet of Highland Avenue or within 200 feet of Gould Street. Notwithstanding the above, the maximum height of a parking garage may be increased to 55 feet by Special Permit from the Planning Board.

Because the Planning Board has concluded that the future development of this critical commercial area along Route 128 depends on Needham's ability to be responsive to the requirements of new or proposed uses or construction, it recommended the adoption of Section 4.11.3 which tracks in part the language from

the New England Business Center district zoning adopted in 2011This amendment will impart greater flexibility in the Zoning By-Law by allowing the Planning Board to relax certain dimensional requirements up to a maximum of 25% by special permit but only after making very specific findings as to the propriety of the waivers as to a particular project, use and location. Exempted from this provision are height and story requirements, the 20- foot landscaped buffer area requirement along Gould Street, Highland Avenue and the layout of Route 128/95, the 200-foot parking garage setback requirement along Gould Street, the 250-foot parking garage setback requirement along Highland Avenue, and the 20% open space requirement.

Based on the build-out analysis, traffic report, dimensional analysis, consultant findings and information, and meeting testimony, the Planning Board confirmed that certain dimensional requirements, including front setback, height, floor area ratio, and side setbacks, and use requirements were constraining development under the current zoning rules. The current zoning effectively precludes additional development. As the Town's consultant concluded, realistic development expansion potential under the current zoning is essentially zero, and, given the properties' regionally prime commercial location along Route 128, the area is significantly underperforming economically, to the detriment of the Town. Further the Board found that the current industrial district zoning at the property was not reflective of the Town's land use policy goals for this gateway location and that a conversion to a mixed-use district consistent with the land use profile of the remainder of the Highland Avenue corridor was warranted. With rezoning, in time, this area should attract significant high value redevelopment consistent with the Town's land use objectives, which will be overseen by the Planning Board under its site plan review and special permit obligations.

ARTICLE 1: AMEND ZONING BY-LAW – HIGHWAY COMMERCIAL 1 ZONING DISTRICT

To see if the Town will vote to amend the Needham Zoning By-Law as follows:

1. Amend Section 2.1, Classes of Districts, by adding the following term and abbreviation under the subsection Industrial:

   "HC-1 -- Highway Commercial 1"

2. Amend Section 3.2, Schedule of Use Regulations, by adding a new Section 3.2.7 as follows:

   "3.2.7 Uses in the Highway Commercial 1 District

   3.2.7.1 Permitted Uses

   The following uses are permitted within the Highway Commercial 1 District as a matter of right:

   (a) Uses exempt from local zoning control pursuant to M.G.L. Chapter 40A, Section 3.

   (b) Public parks and playgrounds, municipal buildings or uses.

   (c) Retail establishment (not including grocery stores) or combination of retail establishments serving the general public where each establishment contains less than 5,750 square feet of floor area and where all items for sale or rent are kept inside a building.

   (d) Manufacturing clearly incidental and accessory to a retail use on the same premises and the product is customarily sold on the premises.

   (e) Craft, consumer or commercial service establishment dealing directly with the general public.

   (f) Laundry or dry-cleaning pick-up station with processing done elsewhere.

   (g) Professional, business or administrative office, but not including any of the following: a medical clinic or Medical Services Building or medical, surgical, psychiatric, dental, orthodontic, or psychologist group practices comprised of three or more such professionals (hereinafter "Group Practices") or physical therapy, alternative medicine practices, wellness treatments, including but not limited to, acupuncture, yoga, chiropractic and/or nutrition services. "Professional" shall include professional medical, surgical, psychiatric, dental, orthodontic or psychologist practice by a group of two or fewer such professionals ("Non-group Practice").

   (h) Bank or Credit Union.

   (i) Medical Laboratory or laboratory engaged in scientific research and development and/or experimental and testing activities including, but not limited to, the fields of biology, genetics, chemistry, electronics, engineering, geology, medicine and physics, which may include the development of mock-ups and prototypes.

   (j) Radio or television studio.

   (k) Light non-nuisance manufacturing, including, but not limited to, the manufacture of electronics, pharmaceutical, bio-pharmaceutical, medical, robotic, and micro-biotic products, provided that all resulting cinders, dust, flashing, fuses, gases, odors, smoke, noise, vibration, refuse matter, vapor, and heat are effectively confined in a building or are disposed of in a manner so as not to create a nuisance or hazard to safety or health.

(l) Telecommunications facility housed within a building.

(m) Other customary and proper accessory uses incidental to lawful principal uses. Further provided, accessory uses for seasonal temporary outdoor seating for restaurants serving meals for consumption on the premises and at tables with service provided by waitress or waiter shall be allowed upon minor project site plan review with waiver of all requirements of Section 7.4.4 and 7.4.6 except as are necessary to demonstrate compliance with Section 6.9 by the Planning Board or Select Board in accordance with Section 6.9.

(n) More than one building on a lot.

(o) More than one use on a lot.

3.2.7.2 Uses Permitted by Special Permit

The following uses are permitted within the Highway Commercial 1 District upon the issuance of a Special Permit by the Special Permit Granting Authority under such conditions as it may require:

(a) Light-rail train station.

(b) Adult day care facility.

(c) Private school, nursery, or kindergarten not otherwise classified under Section 3.2.7.1 (a).

(d) Retail establishment (not including grocery stores) or combination of retail establishments serving the general public where any establishment contains more than 5,750 but less than 10,000 square feet of floor area and where all items for sale or rent are kept inside a building.

(e) Equipment rental service but not including any business that uses outside storage.

(f) Grocery store provided it does not exceed 10,000 sq. ft. of floor area.

(g) Eat-in or take-out restaurant or other eating establishment except that a lunch counter incidental to a primary use shall be permissible by right.

(h) Veterinary office and/or treatment facility and/or animal care facility, including but not limited to, the care, training, sitting and/or boarding of animals.

(i) Indoor athletic or exercise facility or personal fitness service establishment, which may include outdoor pool(s) associated with such facilities.

(j) External automatic teller machine, drive-up window or auto-oriented branch bank accessory to a bank or credit union permitted under Section 3.2.7.1(h) hereof.

(k) Group Practices as defined in Section 3.2.7.1(g) and alternative medicine practices, physical therapy, and wellness treatments facilities including, but not limited to, acupuncture, yoga, chiropractic and/or nutrition services. Such uses may have customary and proper accessory uses incidental to the lawful principal uses, including but not limited to, pharmacies.

(l) Live performance theater, bowling alley, skating rink, billiard room, and similar commercial amusement or entertainment places.

(m) Apartment or multi-family dwelling provided that (1) the proposed apartment or multi-family dwelling complies with the lot area per unit requirements for apartments in the A-1 district as detailed in Section 4.3, (2) no more than 240 dwelling units shall be permitted in the Highway Commercial 1 District, (3) at least 40% but not more than 70% of all dwelling units within any project shall be one-

bedroom units, and (4) at least 12.5% of all dwelling units shall be Affordable Units as defined in Section 6.12."

3. Amend Section 4.7.1, Specific Front Setbacks, by deleting the following provisions:

"(b) On the easterly side of Gould Street from Highland Avenue northerly to land of the New York, New Haven and Hartford Railroad Company, there shall be a fifty (50) foot building setback line;

(c) On the northerly side of Highland Avenue from Gould Street northeasterly to the property of the Commonwealth of Massachusetts, there shall be a fifty (50) foot building setback line."

4. Amend Section 4.10, Dimensional Regulations for Industrial-1 District, by deleting Section 4.10.4, which refers to Section 4.7.1 (b) and (c).

5. Amend Section 4, Dimensional Regulations, by adding a new Section 4.11 Dimensional Regulations for Highway Commercial Districts as follows:

"4.11 Dimensional Regulations for Highway Commercial Districts

4.11.1 Highway Commercial 1

Minimum Lot Area (Sq. Ft.)	Minimum Lot Frontage (Ft.)	Front Setback (Ft.) (1)	Side Setback (Ft.) (1) (3)	Rear Setback (Ft.) (1) (3)	Maximum Height (Ft.) (1)	Maximum Stories (1)	Maximum Lot Coverage (2) (4)	Floor Area Ratio (5) (6)
20,000	100	5	10	10	56	4	65%	1.00

(1) a. All buildings shall be limited to a height of 56 feet and four stories, except that buildings within 200 feet of Highland Avenue or the extension of the right-of-way line as described below in paragraph c. and buildings within 200 feet of Gould Street shall be limited to a height of 35 feet and 2 ½ stories as-of-right. If the height of a building is increased above the height of 35 feet, the front setback shall be increased to 15 feet and the side and rear setbacks to 20 feet except that, along the MBTA right-of-way the side and rear yard setbacks shall be 10 feet.

b. By Special Permit from the Planning Board, the maximum height of a building may be increased to the following limits within 200 feet of Highland Avenue or the extension of the right-of-way line as described below in paragraph c. and within 200 feet of Gould Street: (i) 3 stories and 42 feet; or (ii) 3 stories and 48 feet, provided the additional height is contained under a pitched roof or recessed from the face of the building in a manner approved by the Planning Board. By Special Permit from the Board, the maximum height of a building may be further increased to the following limits: 5 stories and 70 feet provided the building is not located within 200 feet of Highland Avenue or the extension of the right-of-way line as described below in paragraph c. or within 200 feet of Gould Street.

c. The line from which the setbacks from Highland Avenue shall be measured is that line which starts at the point of curvature on Highland Avenue at Gould Street marked by a stone bound/drill hole (SB/DH) and runs northeasterly N63º56'51"E by the Highland Avenue 1980 State Highway Alteration 361.46 feet to a stone bond/drill hole, then continues on the same northeasterly course an additional 330.54 feet for a total distance from the first mentioned bound of 700 feet. Reference is made to a plan entitled "Plan of Land Gould Street, Needham, MA", prepared by Andover

Engineering, Inc., dated July 27, 2000, last revised September 20, 2001, recorded in the Norfolk County Registry of Deeds as Plan No. 564 of 2001, Plan Book 489.

d. Buildings and structures abutting Highland Avenue, Gould Street and/or the layout of Route 128/95 shall be set back at least 20 feet from said streets and said layout. Notwithstanding the location or height of any building and structures, a 20-foot landscaped, vegetative buffer area shall be required along the aforementioned street frontages and said layout in order to screen the development. Driveway openings, sidewalks, walkways and screened mechanical equipment shall be permitted in the buffer area.

e. Structures erected on a building and not used for human occupancy, such as chimneys, heating-ventilating or air conditioning equipment, solar or photovoltaic panels, elevator housings, skylights, cupolas, spires and the like may exceed the maximum building height provided that no part of such structure shall project more than 15 feet above the maximum allowable building height, the total horizontal coverage of all of such structures on the building does not exceed 25 percent, and all of such structures are set back from the roof edge by a distance no less than their height. The Planning Board may require screening for such structures as it deems necessary. Notwithstanding the above height limitations, cornices and parapets may exceed the maximum building height provided they do not extend more than 5 feet above the highest point of the roof.

f. For purposes of clarity, the required building setbacks and allowed envelopes (including setbacks) for allowance of additional height above 35' for the as-of right circumstance and 42'/48' for the special permit circumstance are shown on figures 1 and 2 below.

Figure 1:

Figure 2:

(2) Maximum lot coverage shall be 65% for all projects. However, if a project is designed such that at least 65% of the required landscaped area immediately abuts at least 65% of the required landscaped area of an adjoining project for a distance of at least 50 feet, the maximum lot coverage may be increased to 75%.

(3) No side or rear yard setback is required for shared parking structures between adjoining properties, but only on one side of each lot, leaving the other side or rear yards open to provide access to the interior of the lot.

(4) A minimum of 20% of total lot area must be open space. The open space area shall be landscaped and may not be covered with buildings or structures of any kind, access streets, ways, parking areas, driveways, aisles, walkways, or other constructed approaches or service areas. Notwithstanding the preceding sentence, open space shall include pervious surfaces used for walkways and patios. (Pervious surfaces shall not preclude porous pavement, porous concrete, and/or other permeable pavers.)

(5) A floor area ratio of up to 1.35 may be allowed by a special permit from the Planning Board. In granting such special permit, the Planning Board shall consider the following factors: the ability of the existing or proposed infrastructure to adequately service the proposed facility without negatively impacting existing uses or infrastructure, including but not limited to, water supply, drainage, sewage, natural gas, and electric services; impact on traffic conditions at the site, on adjacent streets, and in nearby neighborhoods, including, but not limited to, the adequacy of the roads and intersections to safely and effectively provide access and egress; the environmental impacts of the proposal; and the fiscal implications of the proposal to the Town. In granting a

special permit, the Planning Board shall also consider any proposed mitigation measures and whether the proposed project's benefits to the Town outweigh the costs and adverse impacts, if any, to the Town.

(6) The calculation of floor area in determining floor area ratio shall not include parking areas or structures.

4.11.2 Supplemental Dimensional Regulations

(1) Notwithstanding Section 3.2.7.1(m) and any other provision of this Section 4.11 to the contrary, a parking garage, even if it is for an as-of-right development, may not exceed 44 feet in height, may not have a building footprint in excess of 42,000 square feet and may not be located within 250 feet of Highland Avenue or the extension of the right-of-way line described in Section 4.11.1 (1) (c) or within 200 feet of Gould Street. Notwithstanding the above, the maximum height of a parking garage may be increased to 55 feet by Special Permit from the Planning Board. For purposes of clarity the height, coverage and location requirements for the as-of-right and special permit parking garage circumstance are shown on figure 3 below.

(2) Parking structures may have an active ground floor use, such as retail, office, institutional, or display. Structured parking must be located at least 20 feet from adjacent buildings, but may be attached to the building it is servicing if all fire and safety requirements are met.

(3) Buildings abutting Highland Avenue and/or Gould Street must have a public entrance facing one street on which the building fronts. This requirement may be waived by special permit from the Planning Board for buildings abutting the 20-foot landscaped setback on Gould Street and Highland Avenue where the arrangements for pedestrian access are such that entrances facing these streets are not the best design option.

(4) Maximum uninterrupted facade length shall be 200 feet.

(5) All setback, height, and bulk requirements applicable to this Section 4.11 are contained in this Section and no additional requirements occasioned by this district abutting Route 128/95's SRB district shall apply.

Figure 3

4.11.3 Special Permit Provision

The Planning Board may, by special permit, waive any or all dimensional requirements set forth above in this Section 4.11 (including sections 4.11.1 and 4.11.2), by relaxing each by up to a maximum percentage of 25% if it finds that, given the particular location and/or configuration of a project in relation to the surrounding neighborhood, such waivers are consistent with the public good, and that to grant such waiver(s) does not substantially derogate from the intent and purposes of the By-Law. This section does not authorize the Planning Board to waive the maximum height regulations, maximum story regulations, reduce the 20 foot landscaped buffer area requirement along Gould Street, Highland Avenue and the layout of Route 128/95, reduce the 200-foot garage setback requirement along Gould Street and the 250-foot limit along Highland Avenue, or reduce the 20% open space requirement of Section 4.11.1(4), except as specifically provided in Section 4.11.1(1) for pitched or recessed roofs. (By way of example, a 15' front yard setback could be waived to 11.25' or the 20,000 sq. ft. minimum lot area could be waived to 15,000 sq. ft.)

4.11.4 Special Permit Requirements

In approving any special permit under Section 3.2.7.2 and/or Section 4.11, or for any Project proceeding under the Highway Commercial 1 district provisions which constitute a Major Project under Section 7.4.2, the Planning Board shall consider the following design guidelines for development: (a) The proposed development should provide or contribute to providing pedestrian and neighborhood connections to surrounding properties, e.g., by creating inviting buildings or street edge, by creating shared publicly accessible green spaces, and/or by any other methods deemed appropriate by the Planning Board; (b) Any parking structure should have a scale, finish and architectural design that is compatible with the new buildings and which blunts the impact of such structures on the site and on the neighborhood; (c) The proposed development should encourage creative design and mix of uses which create an appropriate aesthetic for this gateway to Needham, including but not limited to, possible use of multiple buildings to enhance the corner of Highland Avenue and Gould Street, possible development of a landscape feature or park on Gould Street or Highland Avenue, varied façade treatments, streetscape design, integrated physical design, and/or other elements deemed appropriate by the Planning Board; (d) The proposed development should promote site features and a layout which is conducive to the uses proposed; (e) the proposed development should incorporate as many green building standards as practical, given the type of building and proposed uses; (f) the proposed development should be designed and conditioned to reduce or mitigate adverse impacts on adjacent properties or the surrounding area such as those resulting from excessive traffic congestion or excessive demand for parking; and (g) The proposed development shall include participation in a transportation demand management program to be approved by the Planning Board as a traffic mitigation measure, including but not limited to, membership and participation in an integrated or coordinated shuttle program."

6. Amend Section 5.1.3, Parking Plan and Design Requirements, by adding at the end of the second sentence of subsection (j) which reads "Such parking setback shall also be twenty (20) feet in an Industrial-1 District" the words "and Highway Commercial 1 District."

7. Amend Section 6.5.1 of Section 6.5 Limited Heliports, by adding after the words "Industrial Districts," in the first sentence, the words "and in the Highway Commercial 1 District,".

8. Amend Section 6.12, Affordable Housing, by revising the first paragraph to read as follows:

   "Any mixed-use building in the Neighborhood Business District (NB) with six or more dwelling units shall include affordable housing units as defined in Section 1.3 of this By-law. Any building in the Highway Commercial 1 District with six or more dwelling units shall include affordable housing units as defined in Section 1.3 of this By-law. The requirements detailed in paragraphs (a) thru (i) below shall apply to a development that includes affordable units in the Neighborhood Business District. The requirements detailed in paragraphs (a), (c), (d), (e), (f), (g), and (h) below shall apply to a development that includes affordable units in the Highway Commercial 1 District."

9. Amend Section 7.2.5 of Section 7.2 Building or Use Permit, by adding after the words "Industrial-1 District," in the first sentence, the words "Highway Commercial 1 District,".

10. Amend Section 7.4.2 of Section 7.4 Site Plan Review, by adding in the first sentence of the last paragraph, the words "Highway Commercial 1 District," after the words "Highland Commercial-128,".

11. Amend Section 7.7.2.2, Authority and Specific Powers (of Design Review Board) by adding after the words "Industrial-1 District," in the first sentence of the second paragraph, the words "Highway Commercial 1 District,".

Or take any other action relative thereto.

INSERTED BY: Planning Board
FINANCE COMMITTEE RECOMMENDS THAT:

Article 1 Information: The Council of Economic Advisors (CEA), which was created by the Select Board to evaluate Town-wide economic conditions and make recommendations to promote and encourage new and existing businesses, undertook a review of all Industrial Zoning Districts in 2012, and, after focusing its efforts on three different areas along Route 128, held numerous public meetings with residents, neighbors, public officials, businesses and landowners in 2014 about potential zoning initiatives. As requested during those discussions, the CEA obtained a build-out analysis, a traffic impact report based on that analysis, and elevation drawings to better understand the impact of any proposed development. After examining the results of those reports, the CEA in 2017 reached out again to the various stakeholder groups and presented its preliminary recommendations to upgrade the zoning adjacent to Route 128 in order to make these areas more economically competitive. The Planning Board, having reviewed the proposals from the CEA, determined in 2019 to move forward on only one area; the area circumscribed by Route 128, Highland Avenue, Gould Street, and the railroad track. A rezoning plan for the noted area was then developed and presented to the October 2019 Special Town Meeting where it received a majority vote but fell short of the 2/3 vote required for passage. Concerns with the overall density profile, traffic impact, use profile and lack of sustainable development principles were noted by Town Meeting members.

In response to input received at the October 2019 Special Town Meeting, a Town-wide Community meeting was held in January 2020 with residents, neighbors, public officials, businesses and landowners to further develop and refine the Town's overall land use goals and strategy for the district. Additionally, a working group comprising representatives from the Planning Board, Select Board, Finance Committee, and Council of Economic Advisors was established to review the policy objectives of the district and to offer strategies to address the concerns raised at both the October 2019 Special Town Meeting and the January 2020 Community meeting. The working group commissioned an updated traffic study of the district to determine the capacity of the Town's traffic infrastructure to accommodate development at variable density and use profiles. 3D modeling and an updated fiscal impact analysis of the district were completed once the density and use profile of the district were finalized consistent with the capacity of the Town's traffic infrastructure to accommodate development at variable density and use profiles.

Briefly, the following four modifications have been made from the 2019 rezoning proposal to the current 2021 proposal as follows: (1) The overall density of development within the district has been reduced. (2) The maximum building height within the district has been reduced by one story for both the as-of-right and special permit condition. (3) Permitted uses within the district have been expanded to include multi-family dwellings. (4) Special permit criteria for permit issuance has been expanded to include green building standards. The proposed use and dimensional changes to this area, to be rezoned Highway Commercial 1 ("HC1"), are detailed below.

The amendments to Section 3.2 detail the uses allowed by right and those by special permit. In addition, by listing the uses rather than using the current somewhat antiquated table of uses, the uses can be clarified and brought up to date. Key changes to the use table include allowing up to 240 units of multi family dwelling units; allowing greater retail by special permit for more than 5,750 sq. ft. and less than 10,000 sq. ft. (current limit 5700 sq. ft.);allowing grocery stores of up to 10,000 square feet by special permit; clarifying medical services allowed by right and by special permit (as was done in the Needham Crossing zoning); standardizing the medical laboratory and research and development defined uses; allowing by right more than one use and more than one building on a lot; changing theaters, bowling alleys, skating rinks, billiard rooms and similar commercial amusement or entertainment places from by right to special permit; deleting indoor movie theaters from allowed uses; precluding single family detached dwellings from allowed uses; and precluding certain industrial uses in the district including, inter alia, commercial garages, contractor's yards, lumber or fuel establishments, Medical Clinics, and previously allowed warehousing, manufacturing and industrial services. The purpose of the use changes are: (1) to ensure that uses allowed by right or by special permit will maximize the economic value of redevelopment to the

Town; and (2) to subject certain uses presently allowed by right to the special permit process so that they may be properly vetted by the permit granting authority as to impacts and mitigation.

The amendments to Section 4 would create the dimensional requirements for the new Highway Commercial 1 zone. The proposal under the new Section 4.11 establishes height restrictions for the district based upon measured distance from Gould Street and Highland Avenue. For the as-of-right circumstance development within 200 feet of Gould Street and 200 feet of Highland Avenue would be limited to a maximum height of 35 feet and 2 ½ stories and beyond 200 feet to a maximum height of 56 feet and 4 stories. For the special permit circumstance development within 200 feet of Gould Street and 200 feet of Highland Avenue would be limited to a maximum height of 42 feet (48 feet if under a pitched roof or recessed from the face of the building) and 3 stories and beyond 200 feet to a maximum height of 70 feet and 5 stories. (The current zoning allows 30 feet or two stories.) The proposal would change the front setback to 5 feet unless the building height exceeds 35 feet, in which case the front setback increases to 15 feet, or the building sits on Highland Avenue, Gould Street and/or the layout of Route 95/128, where a 20-foot landscaped vegetative buffer is proposed. (Current front setback is 20 feet except along Gould and Highland where a 50-foot building setback is imposed.) The side and rear setback would change to 10 feet unless the building height exceeds 35 feet, in which case the setback is increased to 20 feet for all side and rear setbacks not abutting the MBTA right-of-way. (The current side setback is 20 feet and the current rear setback is 10 feet). For informational purposes, the required building setbacks and allowed envelopes (including setbacks) for additional height above 35 feet are shown as Figure 1 for the as-of-right condition and as Figure 2 for the special permit condition in the zoning article.

The new zoning creates a maximum lot coverage requirement of 65% and an open space requirement of a minimum of 20%. (The current zoning contains no such requirements.) Changes are also proposed to the maximum floor area ratio ("FAR"); a maximum FAR by right would be 1.00; the FAR may be increased up to 1.35 by special permit provided certain findings are made. The amendment clearly sets out the specific factors which will allow the exercise of the Board's special permit granting authority. The proposed zoning also sets out the maximum uninterrupted façade length that is allowed—200'. (The current zoning allows a FAR of only 0.5 and only in very limited special circumstances 0.65-0.75.)

Finally, the new zoning restricts the bulk, height and location of a parking garage, even if it is for an as-of-right development. A parking garage may not exceed 44 feet in height, may not have a building footprint in excess of 42,000 square feet nor may it be located within 250 feet of Highland Avenue or within 200 feet of Gould Street. Notwithstanding the above, the maximum height of a parking garage may be increased to 55 feet by Special Permit from the Planning Board.

Because the Planning Board has concluded that the future development of this critical commercial area along Route 128 depends on Needham's ability to be responsive to the requirements of new or proposed uses or construction, it recommended the adoption of Section 4.11.3 which tracks in part the language from the New England Business Center district zoning adopted in 2011This amendment will impart greater flexibility in the Zoning By-Law by allowing the Planning Board to relax certain dimensional requirements up to a maximum of 25% by special permit but only after making very specific findings as to the propriety of the waivers as to a particular project, use and location. Exempted from this provision are height and story requirements, the 20- foot landscaped buffer area requirement along Gould Street, Highland Avenue and the layout of Route 128/95, the 200-foot parking garage setback requirement along Gould Street, the 250-foot parking garage setback requirement along Highland Avenue, and the 20% open space requirement.

Based on the build-out analysis, traffic report, dimensional analysis, consultant findings and information, and meeting testimony, the Planning Board confirmed that certain dimensional requirements, including front setback, height, floor area ratio, and side setbacks, and use requirements were constraining development under the current zoning rules. The current zoning effectively precludes additional development. As the Town's consultant concluded, realistic development expansion potential under the

current zoning is essentially zero, and, given the properties' regionally prime commercial location along Route 128, the area is significantly underperforming economically, to the detriment of the Town. Further the Board found that the current industrial district zoning at the property was not reflective of the Town's land use policy goals for this gateway location and that a conversion to a mixed-use district consistent with the land use profile of the remainder of the Highland Avenue corridor was warranted. With rezoning, in time, this area should attract significant high value redevelopment consistent with the Town's land use objectives, which will be overseen by the Planning Board under its site plan review and special permit obligations.

ARTICLE 1: AMEND ZONING BY-LAW – HIGHWAY COMMERCIAL 1 ZONING DISTRICT

To see if the Town will vote to amend the Needham Zoning By-Law as follows:

1. Amend Section 2.1, Classes of Districts, by adding the following term and abbreviation under the subsection Industrial:

   "HC-1 -- Highway Commercial 1"

2. Amend Section 3.2, Schedule of Use Regulations, by adding a new Section 3.2.7 as follows:

   "3.2.7 Uses in the Highway Commercial 1 District

   3.2.7.1 Permitted Uses

   The following uses are permitted within the Highway Commercial 1 District as a matter of right:

   (a) Uses exempt from local zoning control pursuant to M.G.L. Chapter 40A, Section 3.

   (b) Public parks and playgrounds, municipal buildings or uses.

   (c) Retail establishment (not including grocery stores) or combination of retail establishments serving the general public where each establishment contains less than 5,750 square feet of floor area and where all items for sale or rent are kept inside a building.

   (d) Manufacturing clearly incidental and accessory to a retail use on the same premises and the product is customarily sold on the premises.

   (e) Craft, consumer or commercial service establishment dealing directly with the general public.

   (f) Laundry or dry-cleaning pick-up station with processing done elsewhere.

   (g) Professional, business or administrative office, but not including any of the following: a medical clinic or Medical Services Building or medical, surgical, psychiatric, dental, orthodontic, or psychologist group practices comprised of three or more such professionals (hereinafter "Group Practices") or physical therapy, alternative medicine practices, wellness treatments, including but not limited to, acupuncture, yoga, chiropractic and/or nutrition services. "Professional" shall include professional medical, surgical, psychiatric, dental, orthodontic or psychologist practice by a group of two or fewer such professionals ("Non-group Practice").

   (h) Bank or Credit Union.

   (i) Medical Laboratory or laboratory engaged in scientific research and development and/or experimental and testing activities including, but not limited to, the fields of biology, genetics, chemistry, electronics, engineering, geology, medicine and physics, which may include the development of mock-ups and prototypes.

   (j) Radio or television studio.

   (k) Light non-nuisance manufacturing, including, but not limited to, the manufacture of electronics, pharmaceutical, bio-pharmaceutical, medical, robotic, and micro-biotic products, provided that all resulting cinders, dust, flashing, fuses, gases, odors, smoke, noise, vibration, refuse matter, vapor, and heat are effectively confined in a building or are disposed of in a manner so as not to create a nuisance or hazard to safety or health.

(l) Telecommunications facility housed within a building.

(m) Other customary and proper accessory uses incidental to lawful principal uses. Further provided, accessory uses for seasonal temporary outdoor seating for restaurants serving meals for consumption on the premises and at tables with service provided by waitress or waiter shall be allowed upon minor project site plan review with waiver of all requirements of Section 7.4.4 and 7.4.6 except as are necessary to demonstrate compliance with Section 6.9 by the Planning Board or Select Board in accordance with Section 6.9.

(n) More than one building on a lot.

(o) More than one use on a lot.

3.2.7.2 Uses Permitted by Special Permit

The following uses are permitted within the Highway Commercial 1 District upon the issuance of a Special Permit by the Special Permit Granting Authority under such conditions as it may require:

(a) Light-rail train station.

(b) Adult day care facility.

(c) Private school, nursery, or kindergarten not otherwise classified under Section 3.2.7.1 (a).

(d) Retail establishment (not including grocery stores) or combination of retail establishments serving the general public where any establishment contains more than 5,750 but less than 10,000 square feet of floor area and where all items for sale or rent are kept inside a building.

(e) Equipment rental service but not including any business that uses outside storage.

(f) Grocery store provided it does not exceed 10,000 sq. ft. of floor area.

(g) Eat-in or take-out restaurant or other eating establishment except that a lunch counter incidental to a primary use shall be permissible by right.

(h) Veterinary office and/or treatment facility and/or animal care facility, including but not limited to, the care, training, sitting and/or boarding of animals.

(i) Indoor athletic or exercise facility or personal fitness service establishment, which may include outdoor pool(s) associated with such facilities.

(j) External automatic teller machine, drive-up window or auto-oriented branch bank accessory to a bank or credit union permitted under Section 3.2.7.1(h) hereof.

(k) Group Practices as defined in Section 3.2.7.1(g) and alternative medicine practices, physical therapy, and wellness treatments facilities including, but not limited to, acupuncture, yoga, chiropractic and/or nutrition services. Such uses may have customary and proper accessory uses incidental to the lawful principal uses, including but not limited to, pharmacies.

(l) Live performance theater, bowling alley, skating rink, billiard room, and similar commercial amusement or entertainment places.

(m) Apartment or multi-family dwelling provided that (1) the proposed apartment or multi-family dwelling complies with the lot area per unit requirements for apartments in the A-1 district as detailed in Section 4.3, (2) no more than 240 dwelling units shall be permitted in the Highway Commercial 1 District, (3) at least 40% but not more than 70% of all dwelling units within any project shall be one-

bedroom units, and (4) at least 12.5% of all dwelling units shall be Affordable Units as defined in Section 6.12."

3. Amend Section 4.7.1, Specific Front Setbacks, by deleting the following provisions:

"(b) On the easterly side of Gould Street from Highland Avenue northerly to land of the New York, New Haven and Hartford Railroad Company, there shall be a fifty (50) foot building setback line;

(c) On the northerly side of Highland Avenue from Gould Street northeasterly to the property of the Commonwealth of Massachusetts, there shall be a fifty (50) foot building setback line."

4. Amend Section 4.10, Dimensional Regulations for Industrial-1 District, by deleting Section 4.10.4, which refers to Section 4.7.1 (b) and (c).

5. Amend Section 4, Dimensional Regulations, by adding a new Section 4.11 Dimensional Regulations for Highway Commercial Districts as follows:

"4.11 Dimensional Regulations for Highway Commercial Districts

4.11.1 Highway Commercial 1

Minimum Lot Area (Sq. Ft.)	Minimum Lot Frontage (Ft.)	Front Setback (Ft.) (1)	Side Setback (Ft.) (1) (3)	Rear Setback (Ft.) (1) (3)	Maximum Height (Ft.) (1)	Maximum Stories (1)	Maximum Lot Coverage (2) (4)	Floor Area Ratio (5) (6)
20,000	100	5	10	10	56	4	65%	0.75~~1.00~~

(1) a. All buildings shall be limited to a height of 56 feet and four stories, except that buildings within 200 feet of Highland Avenue or the extension of the right-of-way line as described below in paragraph c. and buildings within 200 feet of Gould Street shall be limited to a height of 35 feet and 2 ½ stories as-of-right. If the height of a building is increased above the height of 35 feet, the front setback shall be increased to 15 feet and the side and rear setbacks to 20 feet except that, along the MBTA right-of-way the side and rear yard setbacks shall be 10 feet.

b. By Special Permit from the Planning Board, the maximum height of a building may be increased to 3 stories and 42 feet~~the following limits~~ within 200 feet of Highland Avenue or the extension of the right-of-way line as described below in paragraph c. and within 200 feet of Gould Street~~: (i) 3 stories and 42 feet; or (ii) 3 stories and 48 feet, provided the additional height is contained under a pitched roof or recessed from the face of the building in a manner approved by the Planning Board~~. By Special Permit from the Board, the maximum height of a building may be further increased to the following limits: 5 stories and 70 feet provided the building is not located within 200 feet of Highland Avenue or the extension of the right-of-way line as described below in paragraph c. or within 200 feet of Gould Street.

c. (i) The line from which the 200-foot setback~~s~~ from Highland Avenue shall be measured is that line which starts at the point of curvature on Highland Avenue at Gould Street marked by a stone bound/drill hole (SB/DH) and runs northeasterly N63º56'51"E by the Highland Avenue 1980 State Highway Alteration 361.46 feet to a stone bond/drill hole, then continues on the same northeasterly course an additional 330.54 feet for a total distance from the first mentioned bound of 700 feet. Reference is made to a plan entitled "Plan of Land Gould Street, Needham, MA", prepared by

Andover Engineering, Inc., dated July 27, 2000, last revised September 20, 2001, recorded in the Norfolk County Registry of Deeds as Plan No. 564 of 2001, Plan Book 489. (ii) The line from which the ?? foot landscaped setback from Highland Avenue shall be measured is that line which starts at the point of curvature on Highland Avenue at Gould Street marked by a stone bound/drill hole (SB/DH) and runs northeasterly N63º56'51"E by the Highland Avenue 1980 State Highway Alteration 361.46 feet to a stone bond/drill hole.

d. Buildings and structures abutting Highland Avenue for the distance described in subsection (1)(c)(ii) above and/or abutting ~~,~~ Gould Street ~~and/or the layout of Route 128/95~~ shall be set back at least 20 (30? 50?) feet from said streets~~ and said layout~~. Buildings and structures abutting the layout of Route 128/95 beyond said Highland Avenue distance from stone bound to stone bound shall be set back at least 20 feet from said Route 128/95 layout. Notwithstanding the location or height of any building and structures, ~~a~~the required (30? 50?) or 20-foot setback shall be a landscaped, vegetative buffer area, which shall be required along the aforementioned street frontages and said layout in order to screen the development. Driveway openings, sidewalks, walkways and screened mechanical equipment shall be permitted in the buffer area.

e. Structures erected on a building and not used for human occupancy, such as chimneys, heating-ventilating or air conditioning equipment, solar or photovoltaic panels, elevator housings, skylights, cupolas, spires and the like may exceed the maximum building height provided that no part of such structure shall project more than 15 feet above the maximum allowable building height, the total horizontal coverage of all of such structures on the building does not exceed 25 percent, and all of such structures are set back from the roof edge by a distance no less than their height. The Planning Board may require screening for such structures as it deems necessary. Notwithstanding the above height limitations, cornices and parapets may exceed the maximum building height provided they do not extend more than 5 feet above the highest point of the roof.

f. For purposes of clarity, the required building setbacks and allowed envelopes (including setbacks) for allowance of additional height above 35' for the as-of right circumstance and 42'~~/48'~~ for the special permit circumstance are shown on figures 1 and 2 below.

Figure 1:

Figure 2:

(2) Maximum lot coverage shall be 65% for all projects. However, if a project is designed such that at least 65% of the required landscaped area immediately abuts at least 65% of the required landscaped area of an adjoining project for a distance of at least 50 feet, the maximum lot coverage may be increased to 75%.

(3) No side or rear yard setback is required for shared parking structures between adjoining properties, but only on one side of each lot, leaving the other side or rear yards open to provide access to the interior of the lot.

(4) A minimum of 25~~0~~% of total lot area must be open space. The open space area shall be landscaped and may not be covered with buildings or structures of any kind, access streets, ways, parking areas, driveways, aisles, walkways, or other constructed approaches or service areas. Notwithstanding the preceding sentence, open space may~~shall~~ include pervious surfaces used for walkways and patios. (Pervious surfaces shall not preclude porous pavement, porous concrete, and/or other permeable pavers.)

(5) A floor area ratio of up to 1.35 may be allowed by a special permit from the Planning Board. In granting such special permit, the Planning Board shall consider the following factors: the ability of the existing or proposed infrastructure to adequately service the proposed facility without negatively impacting existing uses or infrastructure, including but not limited to, water supply, drainage, sewage, natural gas, and electric services; impact on traffic conditions at the site, on adjacent streets, and in nearby neighborhoods, including, but not limited to, the adequacy of the roads and intersections to safely and effectively provide access and egress; the environmental impacts of the proposal; and the fiscal implications of the proposal to the Town. In granting a special permit, the Planning Board shall also consider any proposed mitigation measures and whether the proposed project's benefits to the Town outweigh the costs and adverse impacts, if any, to the Town.

(6) The calculation of floor area in determining floor area ratio shall not include parking areas or structures.

4.11.2 Supplemental Dimensional Regulations

(1) Notwithstanding Section 3.2.7.1(m) and any other provision of this Section 4.11 to the contrary, a parking garage, even if it is for an as-of-right development, may not exceed 44 feet in height, may not have a building footprint in excess of 42,000 square feet and may not be located within 250 feet of Highland Avenue or the extension of the right-of-way line described in Section 4.11.1 (1) (c) or within 200 feet of Gould Street. Notwithstanding the above, the maximum height of a parking garage may be increased to 55 feet by Special Permit from the Planning Board. For purposes of clarity the height, coverage and location requirements for the as-of-right and special permit parking garage circumstance are shown on figure 3 below.

(2) Parking structures may have an active ground floor use, such as retail, office, institutional, or display. Structured parking must be located at least 20 feet from adjacent buildings, but may be attached to the building it is servicing if all fire and safety requirements are met.

(3) Buildings abutting Highland Avenue and/or Gould Street must have a public entrance facing one street on which the building fronts. This requirement may be waived by special permit from the Planning Board for buildings abutting the ~~20~~??-foot landscaped setback on Gould Street and Highland Avenue where the arrangements for pedestrian access are such that entrances facing these streets are not the best design option.

(4) Maximum uninterrupted facade length shall be 200 feet.

(5) All setback, height, and bulk requirements applicable to this Section 4.11 are contained in this Section and no additional requirements occasioned by this district abutting Route 128/95's SRB district shall apply.

Figure 3

4.11.3 Special Permit Provision

The Planning Board may, by special permit, waive any or all dimensional requirements set forth above in this Section 4.11 (including sections 4.11.1 and 4.11.2), by relaxing each by up to a maximum percentage of 25% if it finds that, given the particular location and/or configuration of a project in relation to the surrounding neighborhood, such waivers are consistent with the public good, and that to grant such waiver(s) does not substantially derogate from the intent and purposes of the By-Law. This section does not authorize the Planning Board to waive the maximum height regulations, maximum story regulations, reduce the ~~20~~?? foot landscaped buffer area requirement along Gould Street~~,~~ and

Highland Avenue and 20 foot landscaped buffer area requirement along the layout of Route 128/95, reduce the 200-foot garage setback requirement along Gould Street and the 250-foot limit along Highland Avenue, or reduce the 250% open space requirement of Section 4.11.1(4)~~, except as specifically provided in Section 4.11.1(1) for pitched or recessed roofs~~. (By way of example, a 15' front yard setback could be waived to 11.25' or the 20,000 sq. ft. minimum lot area could be waived to 15,000 sq. ft.)

4.11.4 Special Permit Requirements

In approving any special permit under Section 3.2.7.2 and/or Section 4.11, or for any Project proceeding under the Highway Commercial 1 district provisions which constitute a Major Project under Section 7.4.2, the Planning Board shall consider the following design guidelines for development: (a) The proposed development should provide or contribute to providing pedestrian and neighborhood connections to surrounding properties, e.g., by creating inviting buildings or street edge, by creating shared publicly accessible green spaces, and/or by any other methods deemed appropriate by the Planning Board; (b) Any parking structure should have a scale, finish and architectural design that is compatible with the new buildings and which blunts the impact of such structures on the site and on the neighborhood; (c) The proposed development should encourage creative design and mix of uses which create an appropriate aesthetic for this gateway to Needham, including but not limited to, possible use of multiple buildings to enhance the corner of Highland Avenue and Gould Street, possible development of a landscape feature or park on Gould Street or Highland Avenue, varied façade treatments, streetscape design, integrated physical design, and/or other elements deemed appropriate by the Planning Board; (d) The proposed development should promote site features and a layout which is conducive to the uses proposed; (e) the proposed development should incorporate as many green building standards as practical, given the type of building and proposed uses; (f) the proposed development should be designed and conditioned to reduce or mitigate adverse impacts on adjacent properties or the surrounding area such as those resulting from excessive traffic congestion or excessive demand for parking; and (g) The proposed development shall include participation in a transportation demand management program to be approved by the Planning Board as a traffic mitigation measure, including but not limited to, membership and participation in an integrated or coordinated shuttle program."

6. Amend Section 5.1.3, Parking Plan and Design Requirements, by adding at the end of the second sentence of subsection (j) which reads "Such parking setback shall also be twenty (20) feet in an Industrial-1 District" the words "and Highway Commercial 1 District unless a deeper parking setback is required by Section 4.11."

7. Amend Section 6.5.1 of Section 6.5 Limited Heliports, by adding after the words "Industrial Districts," in the first sentence, the words "and in the Highway Commercial 1 District,".

8. Amend Section 6.12, Affordable Housing, by revising the first paragraph to read as follows:

"Any mixed-use building in the Neighborhood Business District (NB) with six or more dwelling units shall include affordable housing units as defined in Section 1.3 of this By-law. Any building in the Highway Commercial 1 District with six or more dwelling units shall include affordable housing units as defined in Section 1.3 of this By-law. The requirements detailed in paragraphs (a) thru (i) below shall apply to a development that includes affordable units in the Neighborhood Business District. The requirements detailed in paragraphs (a), (c), (d), (e), (f), (g), and (h) below shall apply to a development that includes affordable units in the Highway Commercial 1 District."

9. Amend Section 7.2.5 of Section 7.2 Building or Use Permit, by adding after the words "Industrial-1 District," in the first sentence, the words "Highway Commercial 1 District,".

10. Amend Section 7.4.2 of Section 7.4 Site Plan Review, by adding in the first sentence of the last paragraph, the words "Highway Commercial 1 District," after the words "Highland Commercial-128,".

11. Amend Section 7.7.2.2, Authority and Specific Powers (of Design Review Board) by adding after the words "Industrial-1 District," in the first sentence of the second paragraph, the words "Highway Commercial 1 District,".

Or take any other action relative thereto.

INSERTED BY: Planning Board
FINANCE COMMITTEE RECOMMENDS THAT:

Article 1 Information: The Council of Economic Advisors (CEA), which was created by the Select Board to evaluate Town-wide economic conditions and make recommendations to promote and encourage new and existing businesses, undertook a review of all Industrial Zoning Districts in 2012, and, after focusing its efforts on three different areas along Route 128, held numerous public meetings with residents, neighbors, public officials, businesses and landowners in 2014 about potential zoning initiatives. As requested during those discussions, the CEA obtained a build-out analysis, a traffic impact report based on that analysis, and elevation drawings to better understand the impact of any proposed development. After examining the results of those reports, the CEA in 2017 reached out again to the various stakeholder groups and presented its preliminary recommendations to upgrade the zoning adjacent to Route 128 in order to make these areas more economically competitive. The Planning Board, having reviewed the proposals from the CEA, determined in 2019 to move forward on only one area; the area circumscribed by Route 128, Highland Avenue, Gould Street, and the railroad track. A rezoning plan for the noted area was then developed and presented to the October 2019 Special Town Meeting where it received a majority vote but fell short of the 2/3 vote required for passage. Concerns with the overall density profile, traffic impact, use profile and lack of sustainable development principles were noted by Town Meeting members.

In response to input received at the October 2019 Special Town Meeting, a Town-wide Community meeting was held in January 2020 with residents, neighbors, public officials, businesses and landowners to further develop and refine the Town's overall land use goals and strategy for the district. Additionally, a working group comprising representatives from the Planning Board, Select Board, Finance Committee, and Council of Economic Advisors was established to review the policy objectives of the district and to offer strategies to address the concerns raised at both the October 2019 Special Town Meeting and the January 2020 Community meeting. The working group commissioned an updated traffic study of the district to determine the capacity of the Town's traffic infrastructure to accommodate development at variable density and use profiles. 3D modeling and an updated fiscal impact analysis of the district were completed once the density and use profile of the district were finalized consistent with the capacity of the Town's traffic infrastructure to accommodate development at variable density and use profiles.

Briefly, the following four modifications have been made from the 2019 rezoning proposal to the current 2021 proposal as follows: (1) The overall density of development within the district has been reduced. (2) The maximum building height within the district has been reduced by one story for both the as-of-right and special permit condition. (3) Permitted uses within the district have been expanded to include multi-family dwellings. (4) Special permit criteria for permit issuance has been expanded to include green building standards. The proposed use and dimensional changes to this area, to be rezoned Highway Commercial 1 ("HC1"), are detailed below.

The amendments to Section 3.2 detail the uses allowed by right and those by special permit. In addition, by listing the uses rather than using the current somewhat antiquated table of uses, the uses can be clarified and brought up to date. Key changes to the use table include allowing up to 240 units of multi family dwelling units; allowing greater retail by special permit for more than 5,750 sq. ft. and less than 10,000 sq. ft. (current limit 5700 sq. ft.);allowing grocery stores of up to 10,000 square feet by special permit;

clarifying medical services allowed by right and by special permit (as was done in the Needham Crossing zoning); standardizing the medical laboratory and research and development defined uses; allowing by right more than one use and more than one building on a lot; changing theaters, bowling alleys, skating rinks, billiard rooms and similar commercial amusement or entertainment places from by right to special permit; deleting indoor movie theaters from allowed uses; precluding single family detached dwellings from allowed uses; and precluding certain industrial uses in the district including, inter alia, commercial garages, contractor's yards, lumber or fuel establishments, Medical Clinics, and previously allowed warehousing, manufacturing and industrial services. The purpose of the use changes are: (1) to ensure that uses allowed by right or by special permit will maximize the economic value of redevelopment to the Town; and (2) to subject certain uses presently allowed by right to the special permit process so that they may be properly vetted by the permit granting authority as to impacts and mitigation.

The amendments to Section 4 would create the dimensional requirements for the new Highway Commercial 1 zone. The proposal under the new Section 4.11 establishes height restrictions for the district based upon measured distance from Gould Street and Highland Avenue. For the as-of-right circumstance development within 200 feet of Gould Street and 200 feet of Highland Avenue would be limited to a maximum height of 35 feet and 2 ½ stories and beyond 200 feet to a maximum height of 56 feet and 4 stories. For the special permit circumstance development within 200 feet of Gould Street and 200 feet of Highland Avenue would be limited to a maximum height of 42 feet (48 feet if under a pitched roof or recessed from the face of the building) and 3 stories and beyond 200 feet to a maximum height of 70 feet and 5 stories. (The current zoning allows 30 feet or two stories.) The proposal would change the front setback to 5 feet unless the building height exceeds 35 feet, in which case the front setback increases to 15 feet, or the building sits on Highland Avenue, Gould Street and/or the layout of Route 95/128, where a 20-foot landscaped vegetative buffer is proposed. (Current front setback is 20 feet except along Gould and Highland where a 50-foot building setback is imposed.) The side and rear setback would change to 10 feet unless the building height exceeds 35 feet, in which case the setback is increased to 20 feet for all side and rear setbacks not abutting the MBTA right-of-way. (The current side setback is 20 feet and the current rear setback is 10 feet). For informational purposes, the required building setbacks and allowed envelopes (including setbacks) for additional height above 35 feet are shown as Figure 1 for the as-of-right condition and as Figure 2 for the special permit condition in the zoning article.

The new zoning creates a maximum lot coverage requirement of 65% and an open space requirement of a minimum of 20%. (The current zoning contains no such requirements.) Changes are also proposed to the maximum floor area ratio ("FAR"); a maximum FAR by right would be 1.00; the FAR may be increased up to 1.35 by special permit provided certain findings are made. The amendment clearly sets out the specific factors which will allow the exercise of the Board's special permit granting authority. The proposed zoning also sets out the maximum uninterrupted façade length that is allowed—200'. (The current zoning allows a FAR of only 0.5 and only in very limited special circumstances 0.65-0.75.)

Finally, the new zoning restricts the bulk, height and location of a parking garage, even if it is for an as-of-right development. A parking garage may not exceed 44 feet in height, may not have a building footprint in excess of 42,000 square feet nor may it be located within 250 feet of Highland Avenue or within 200 feet of Gould Street. Notwithstanding the above, the maximum height of a parking garage may be increased to 55 feet by Special Permit from the Planning Board.

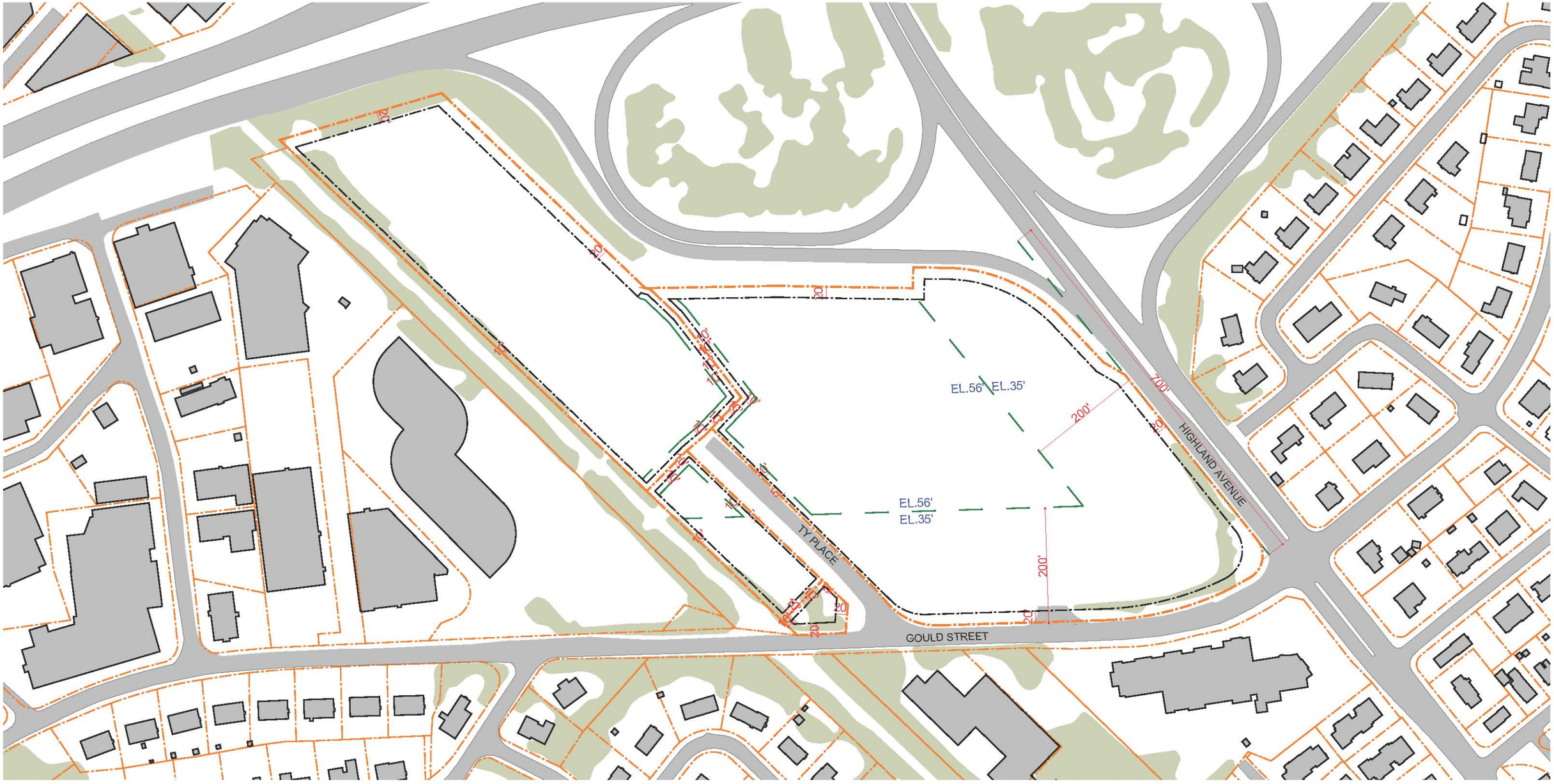
Because the Planning Board has concluded that the future development of this critical commercial area along Route 128 depends on Needham's ability to be responsive to the requirements of new or proposed uses or construction, it recommended the adoption of Section 4.11.3 which tracks in part the language from the New England Business Center district zoning adopted in 2011This amendment will impart greater flexibility in the Zoning By-Law by allowing the Planning Board to relax certain dimensional requirements up to a maximum of 25% by special permit but only after making very specific findings as to the propriety of the waivers as to a particular project, use and location. Exempted from this provision are height and story requirements, the 20- foot landscaped buffer area requirement along Gould Street, Highland Avenue

and the layout of Route 128/95, the 200-foot parking garage setback requirement along Gould Street, the 250-foot parking garage setback requirement along Highland Avenue, and the 20% open space requirement.

Based on the build-out analysis, traffic report, dimensional analysis, consultant findings and information, and meeting testimony, the Planning Board confirmed that certain dimensional requirements, including front setback, height, floor area ratio, and side setbacks, and use requirements were constraining development under the current zoning rules. The current zoning effectively precludes additional development. As the Town's consultant concluded, realistic development expansion potential under the current zoning is essentially zero, and, given the properties' regionally prime commercial location along Route 128, the area is significantly underperforming economically, to the detriment of the Town. Further the Board found that the current industrial district zoning at the property was not reflective of the Town's land use policy goals for this gateway location and that a conversion to a mixed-use district consistent with the land use profile of the remainder of the Highland Avenue corridor was warranted. With rezoning, in time, this area should attract significant high value redevelopment consistent with the Town's land use objectives, which will be overseen by the Planning Board under its site plan review and special permit obligations.

AS OF RIGHT ZONING

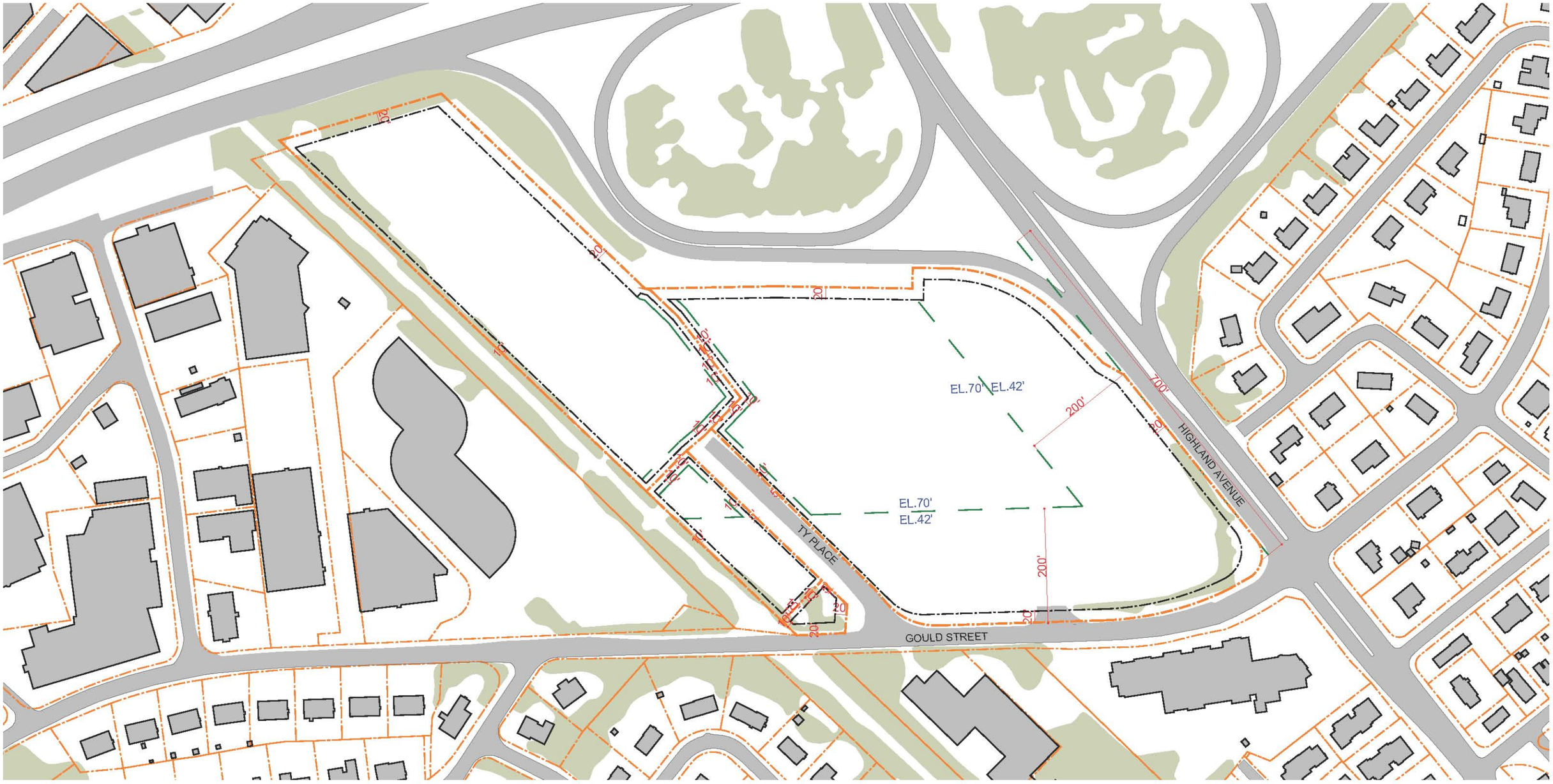
BUILDING SETBACKS
PROPERTY LINES



N

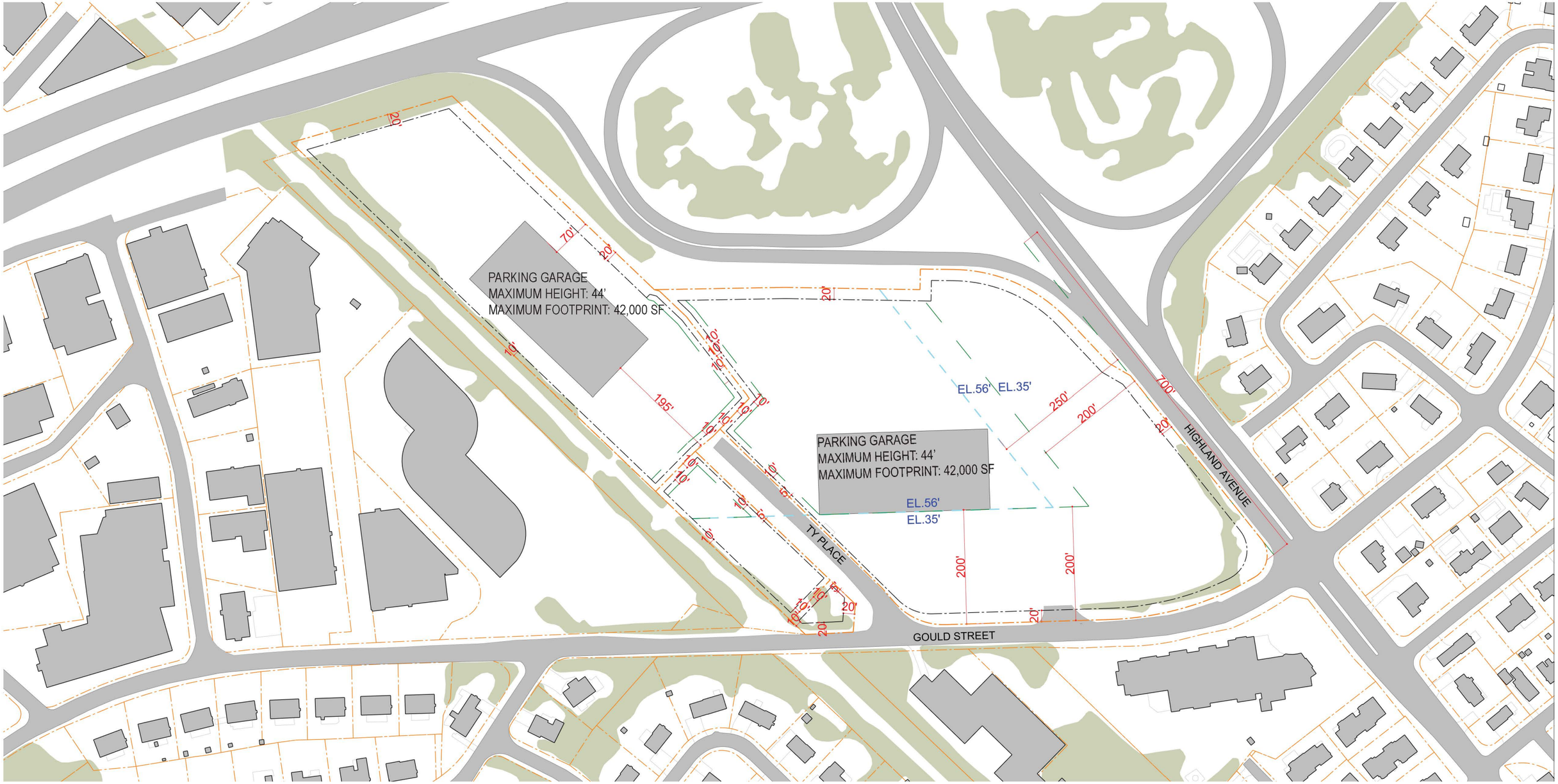
0 20' 40' 80' 160'

BUILDING SETBACKS
PROPERTY LINES



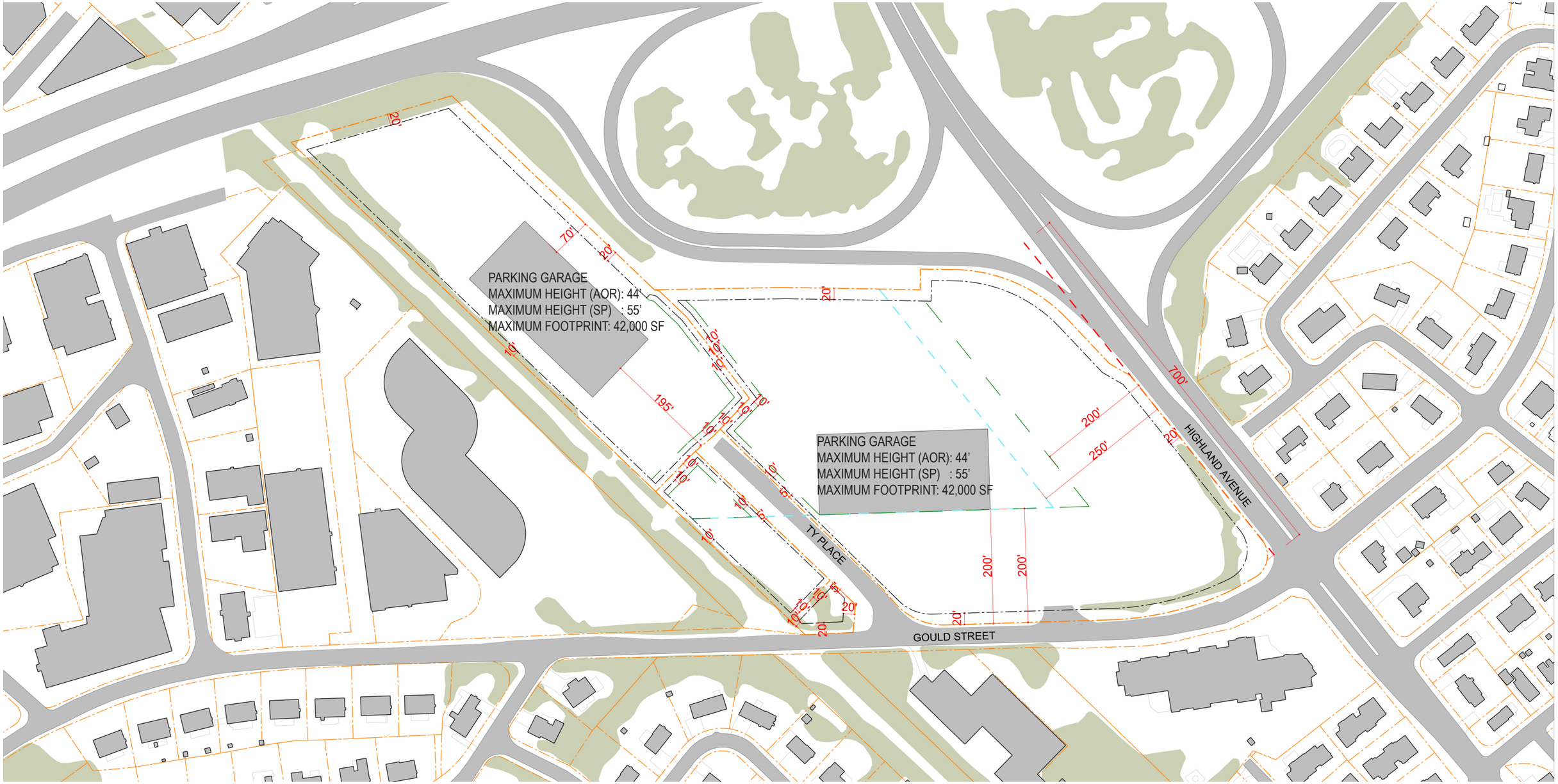
AS OF RIGHT PARKING LOCATION

BUILDING SETBACKS
PROPERTY LINES
HEIGHT LIMIT 56'
PARKING GARAGE LOCATION



PARKING GARAGE LOCATION

BUILDING SETBACKS
PROPERTY LINES
HEIGHT LIMIT (SEE ZONING SETBACK DRAWINGS)
PARKING GARAGE LOCATION
HIGHLAND AVE. EXTENSION



ARTICLE 2: AMEND ZONING BY-LAW – MAP CHANGE TO HIGHWAY COMMERCIAL 1

To see if the Town will vote to amend the Needham Zoning By-Law by amending the Zoning Map as follows:

Place in the Highway Commercial 1 District all that land now zoned Industrial-1 and lying between the Circumferential Highway, known as Route 128/95 and Gould Street and between the Massachusetts Bay Transit Authority (M.B.T.A.) right-of-way and Highland Avenue. Said land is bounded and described as follows:

Beginning at a stone bound on the northerly layout line of Highland Avenue at the intersection of Gould Street as shown on a plan recorded at the Norfolk County Registry of Deeds, Plan No. 564 of 2001, Plan Book 489; thence turning and running southwesterly, westerly and northwesterly along a radius of 44.00 feet a distance of 80.06 feet to a stone bound on the easterly sideline of Gould Street; thence running northwesterly, northerly, and northeasterly along a curve of radius of 505.00 feet of said sideline of Gould Street a distance of 254.17 feet to a point on the said easterly sideline of Gould Street; thence running N10º49'50"E a distance of 284.29 feet to a point on the said easterly sideline of Gould Street at the intersection of TV Place, a privately owned Right of Way; thence continuing N10º49'50"E a distance of 160.00 feet more or less to a stone bound as shown on a plan recorded at the Norfolk County Registry of Deeds Land Court Case No. 18430I; thence continuing N10º49'50"E a distance of 84.82 feet to a stone bound located at the intersection of the easterly sideline of Gould Street and the southerly sideline of the M.B.T.A. Right of Way as shown on a plan recorded at the Norfolk County Registry of Deeds Land Court Case No. 18430I; thence turning and running along said southerly M.B.T.A. Right of Way line northeasterly a distance of 1,219.55 feet as shown on a plan recorded at the Norfolk County Registry of Deeds Land Court Case No. 18430I, 18430J and 18430H to a point at the intersection of the westerly sideline of the Route 128 Right of Way and said southerly sideline of the M.B.T.A. Right of Way; thence turning and running S4º25'46"E a distance of 292.00 feet to a stone bound as shown on a plan recorded at the Norfolk County Registry of Deeds Land Court Case No. 18430H; then turning and running southwesterly along the Route 128 Right of Way a distance of 484.61 feet to a point; thence turning and running S13º34'58"W a distance of 451.02 feet as shown on a plan recorded at the Norfolk County Registry of Deeds, Plan No. 564 of 2001, Plan Book 489 to a point; thence turning and running S76º26'41"E a distance of 35.56 feet to a point; thence turning and running S13º34'58"W a distance of 67.34 feet to a point; thence running southwesterly along a curve of radius 245.45 feet a distance of 136.59 feet to a point; thence running southwesterly along a curve of radius 248.02 feet a distance of 38.04 feet to a point; thence running southwesterly along a curve of radius 1180.00 feet a distance of 140.09 feet to a point; thence turning and running S42º43'47"W a distance of 42.52 feet to a stone bound located in the westerly sideline of the Route 128 Right of Way; thence turning and running S63º56'51"W a distance of 361.46 feet to the point of beginning.

Or take any other action relative thereto.

INSERTED BY: Planning Board
FINANCE COMMITTEE RECOMMENDS THAT:

Article Information: Article 2 describes the geographical area proposed to be placed in the new Highway Commercial 1 zoning district. The affected area is generally bounded on the north by the Massachusetts Bay Transit Authority (M.B.T.A.) commuter railroad right-of-way, on the east by the Circumferential Highway, known as Route 128/95, on the south by Highland Avenue and on the west by Gould Street. The subject land is currently located in the Industrial-1 zoning district.

BARRETT
PLANNING GROUP LLC

March 13, 2021

Lee Newman
Planning Director
500 Dedham Avenue
Needham, MA 02492

Reference: 2021 Fiscal Impact Analysis, Highway Commercial I Rezoning

Dear Lee,

I am submitting our report on the fiscal impact of commercial and mixed-use development options for the proposed Highway I Commercial District. As noted in the report, we find that development in the proposed district would lead to the following fiscal outcome for the Town:

1. At maximum buildout with a floor area ratio (FAR) of 1.0, development in the new district would provide $6,733,100 in tax revenue per year and create demands on municipal services of approximately $ $381,000 per year. For development at this level, the net revenue would be $6,352,100, for a cost-revenue ratio of 0.046.

2. In addition, if development occurs at 1.3 FAR, development in the new district would provide $8,844,400 in tax revenue per year and create demands on municipal services of approximately $502,000 per year. The net revenue would be $8,342,400, for a cost-revenue ratio would be 0.060.

3. As for the mixed-use development options, a project comprised of multiple nonresidential uses (retail, lab space, and offices) and 170 apartments, with a combined total FAR of 1.0, would generate $5,807,600 in taxes per year and create demands on municipal and school services of approximately $1,340,015. The net revenue would be $4,467,585 for a cost-revenue ratio of 0.231.

4. A project comprised of multiple nonresidential uses and 226 apartments, with a combined total FAR of 1.35, would generate $7,508,500 in taxes per year and create demands on municipal and school services of approximately $1,725,700. The net revenue would be $5,782,800 for a cost-revenue ratio of 0.230.

5. Finally, you asked us to evaluate a potential mix of warehouse/distribution space and television studio. We estimate that the Town would receive $922,900 in tax revenue and spend approximately $179,000 for municipal services to meet the demands of these two uses. The net revenue would be $743,900, for a cost-revenue ratio of 0.241.

Under existing conditions, the parcels in the proposed district pay the Town about $490,500 in taxes per year. As a result, the gain in tax revenue from the new nonresidential options or the mixed-use development options will be anywhere from 11 to 18 times what the Town receives today.

Sincerely,

Judith A. Barrett

Judi Barrett
Barrett Planning Group LLC

FISCAL IMPACT ANALYSIS: HIGHWAY COMMERCIAL I

INTRODUCTION

In September 2019, the Needham Planning Department asked Barrett Planning Group to review a potential rezoning of four parcels (15 acres) at Highland Avenue and Gould Street west of the Route 128 highway layout. The Town subsequently decided to study the proposal further before presenting the proposed Highway Commercial I District to Town Meeting. We were asked to update our analysis in February 2021, and to expand it by including other uses not contemplated in the original concept for this district. For the new study, we reviewed and considered the following information:

1. Highway Commercial 1 Zoning District Planning Presentation, February 3, 2021;
2. Property Assessment and Tax Information, provided by the Needham Planning Department;
3. CoStar Office, Industrial, Retail, and Multifamily Market Data and Trends, Newton-Needham-Brookline-Dover Submarkets;
4. Town of Needham, FY 2021 Operating Budget;
5. Department of Revenue, Municipal Data Bank, Misc. Financial Data (Tax Rates, Assessed Values, Revenue Sources, Tax Levy); and
6. Buildout Analysis prepared by John Connery for Needham Planning Department (2015).

SUMMARY

The following chart compares the current assessed values and tax payments for the area included in our analysis to the estimated values and tax revenue of the same area, assuming the parcels are assembled and redeveloped under the proposed Highway Commercial I zoning.

TABLE 1. ASSESSED VALUE AND REVENUE CHANGE, 2021 PROPOSED HIGHWAY COMMERCIAL I

	Existing Conditions	If Redeveloped at 1.0 FAR for Nonresidential Uses	Gain/Loss at 1.0 FAR Outcome	If Redeveloped at 1.35 FAR for Nonresidential Uses	Gain/Loss at 1.35 FAR Outcome
Assessed Value	$19,087,100	$261,582,100	$242,495,000	$343,604,200	$324,517,100
Tax Revenue	$490,500	$6,733,100	$6,242,600	$8,844,400	$8,353,900
	Existing Conditions	**If Redeveloped at 1.0 FAR as Mixed-Use Option**	**Gain/Loss at 1.0 FAR Outcome**	**If Redeveloped at 1.35 FAR as Mixed-Use Option**	**Gain/Loss at 1.35 FAR Outcome**
Assessed Value	$19,087,100	$262,226,000	$243,138,900	$340,356,200	$321,269,100
Tax Revenue	$490,500	$5,807,600	$5,317,100	$7,508,500	$7,018,000
	Existing Conditions	**If Redeveloped at as Warehouse/TV Studio**	**Gain/Loss**		
Assessed Value	$19,087,100	$35,854,000	$16,766,900		
Tax Revenue	$490,500	$922,900	$432,400		

Source: Barrett Planning Group, with data from Town of Needham, Municipal Data Bank, and CoStar.

APPROACH AND METHODOLOGY

Proportional Valuation

Nonresidential development places different demands on municipal services depending on the class of use. For example, retail uses usually demand more from public safety personnel than any other municipal department, but industrial uses tend to require higher expenditures for public works. Food service establishments also require periodic inspections by the health department, and uses ranging from nursing homes and day care centers to performing arts centers require semiannual or more frequent inspections by health, fire, and building authorities. In some towns, nonresidential development of all types places demands on services traditionally thought of as "residential," e.g., public libraries. When a community invests in waterworks and sewer system upgrades, the benefits are often shared by residential and nonresidential ratepayers.

Recognizing that each class of use has both unique needs and needs common to all uses, fiscal impact analysts have developed models to identify, estimate, and assign service costs to various types of development. The most widely used model for estimating the cost to serve nonresidential land uses is known as *proportional valuation*. This two-part model embraces a long-standing fiscal impact principle: the average cost of nonresidential municipal services can be inferred from the relationship between nonresidential real property values and the total value of real property in a community, adjusted for type of community and size of tax base.

TABLE 2. PROPORTIONAL VALUATION ANALYSIS: EXISTING CONDITIONS, NEEDHAM

A	2021 General Fund Operating Budget	$190,247,800	*Town of Needham*
B	Less Education	$81,835,000	*Town of Needham*
C	Less Education Debt	$10,766,800	*Town of Needham*
D	Less Education Fixed Costs	$26,592,400	*Consultant Estimate*
E	Total Municipal	$71,053,600	*Town of Needham*
F	Non-Residential Real Property Value	$1,153,202,700	*Dept. of Revenue*
G	Total Real Property Assessed Value	$10,742,368,800	*Dept. of Revenue*
H	Ratio	0.107	*F/G*
I	Non-Residential Parcels	441	*Dept. of Revenue*
J	Total Parcels	10,211	*Dept. of Revenue*
K	Average Value: Non-Residential Parcel	$2,615,000	*FI*
L	Average Value: All Parcels	$1,052,000	*G/J*
M	Ratio	2.49	*K/L*
N	Refinement Coefficient	0.686	*Consultant (Burchell)*
O	Non-Residential Expenditures	$5,232,600	*Consultant*
P	Residential Expenditures	$185,015,200	*Consultant*

Average Cost Per Capita/Student, Adjusted

After establishing the approximate share of nonresidential expenditures under existing conditions, analysts can use a similar process to estimate the cost of services that will be used by new growth. For our 2019 study of Highway Commercial I, we applied the principles of proportional valuation to estimate the revenue and cost of services impact of new development under that plan. People familiar with that study may remember that a critical step in proportional valuation involves using a *refinement coefficient* to modify the average cost of nonresidential services in order to adjust for significant differences in scale between the proposed project and existing conditions in the tax base as a whole. We repeated the process for this report. However, since the new plan for the district includes options for mixed-use development with housing, the updated study is more complicated.

The development scenarios that could occur under the proposed zoning include multifamily units in mixed-use projects. This means the fiscal impact analysis must also consider the net new cost of residential demands on municipal services and schools. To estimate these costs, we used the following procedures.

The average cost of municipal (non-school) services used by Needham residents is $2,800. This represents the total cost of municipal services, $85,676,600, divided by the Town's estimated 2019 population, 30,970.[1] When we prepare a fiscal impact analysis, our goal is to simulate as much as possible what the Town's *net new cost of services* will be – that is, the *incremental cost* of services associated with growth. Toward that end, we adjusted the average cost of municipal services per capita, just as we modified the average cost for the nonresidential portion of this study. For the residential analysis, we eliminated costs that would not necessarily change just because the Town attracts a modest number of new residents. For example, the Town would not hire more personnel in the Town Manager's office or the management/administrative tiers of other general government offices or the public safety and public works departments just because the Town gained 330-400 new residents. Still, population growth will impose some additional burdens on day-to-day service delivery, and those burdens come with some costs.

To account for these new demands, we assumed the *average variable cost* in municipal departments is approximately 18 percent, so we used 82 percent of the average municipal cost of services to estimate the cost of new growth:

Average cost of new municipal services =	Existing cost of municipal services	X 82%	/ Existing Population
$2,300 =	$85,676,600	$70,254,800	30,970

The cost of new services was multiplied by the new household population assumptions for each mixed-use scenario to arrive at the estimated cost of new demands on town services.

The potential cost of new school services was estimated in a similar way. We consulted the detailed version of Needham's most recent Per Pupil Cost report from the Massachusetts

[1] U.S. Census Bureau, 2015-2019 American Community Survey (ACS) Five-Year Estimates).

Department of Elementary and Secondary Education (DESE) and identified what we assumed would be costs most directly affected by enrollment growth: teachers, instructional support personnel, instructional materials, and pupil services, including transportation. On a per-student basis, the sum of these expenditures is $7,530. Since the most recent report reflects FY 2019 conditions, we adjusted for inflation and non-inflation spending growth with a multiplier of 1.12. This explains how we arrived at the average cost per student for our study, $8,400.

The proportional valuation models for each of the development options the Town asked us to evaluate are presented on the following pages. They are:

1. **A nonresidential project with a maximum floor area ratio (FAR) of 1.0., comprised of:**
- Office: 280,305 sq. ft.
- Research Center/Lab: 280,305 sq. ft.
- Retail: 98,925 sq. ft.
- Total: 659,535 sq. ft.

2. **A nonresidential project with a maximum floor area ratio (FAR) of 1.35., comprised of:**
- Office: 368,200 sq. ft.
- Research Center/Lab: 368,200 sq. ft.
- Retail: 129,940 sq. ft.
- Total: 866,340 sq. ft.

3. **A mixed-use project with a maximum floor area ratio (FAR) of 1.0, comprised of:**
- Office: 197,860 sq. ft.
- Research Center/Lab: 197,860 sq. ft.
- Retail: 69,250 sq. ft.
- Apartments: 170
- Total: 659,535 sq. ft.

4. **A mixed-use project with a maximum floor area ratio (FAR) of 1.35., comprised of:**
- Office: 259,130 sq. ft.
- Research Center/Lab: 259,130 sq. ft.
- Retail: 91,460 sq. ft.
- Apartments: 226
- Total: 866,340 sq. ft.

5. **A warehouse/distribution facility and television studio mix as of right:**
- Warehouse: 158,900 sq. ft.
- TV studio: 90,002
- Total: 248,902 sq. ft.

Part II. Est. Impact of Five Development Scenarios
II.A. Office/Research/Retail Mix @ 1.0 FAR

	NEW PROJECT VALUE (Z)	$261,582,100	NOTES
A	New Value / Total Nonresidential Value	0.23	
B	Refinement Coefficient	0.321	
C	New Nonresidential Service Costs	$381,000	*(A*B*NonResTot)*
D	Est. Nonresidential Tax Revenue	$6,733,100	*Value/1000/*$25.74*
E	New Residential Service Costs		
F	Est. Residential Tax Revenue		
G	Net Revenue	$6,352,100	*D-C*
H	Cost/Revenue Ratio	0.060	*C/D*
	Project Use(s)		
I	Total Sq. Ft.	659,535	*From Town*
J	Office	280,305	*From Town*
K	Research Center	280,305	*From Town*
L	Retail	98,925	*From Town*
M	Warehouse	0	*From Town*
N	Residential (Units)	0	*From Town*
	Rent		
O	Office sq. ft.	$42.00	*CoStar*
P	Research Center sq. ft.	$60.00	*CoStar*
Q	Retail sq. ft.	$36.80	*CoStar*
R	Warehouse sq. ft.	$19.61	*Loopnet*
S	Residential (per unit)	$2,637	*CoStar*
	Income & Value		
T	Gross Nonresidential Income	$32,231,550	*Sq. ft.*rents*
U	Nonresidential Exp. Ratio 39.2%	$13,920,800	*CoStar*
V	Nonresidential NOI	$18,310,750	*T-U*
W	Residential Income	$0	
X	Residential Exp. Ratio 38%	$0	
Y	Residential NOI	$0	
Z	Submarket NonRes. Cap Rate 7%	$261,582,100	*Town; consultant modified*
AA	Submarket Res. Cap Rate 4.50%	$0	
AB	Total Value	$261,582,100	(Z+AA)

Part II. Est. Impact of Five Development Scenarios
II.B. Office/Research/Retail Mix @ 1.35 FAR

	NEW PROJECT VALUE (Z)	$343,604,200	NOTES
A	New Value / Total Nonresidential Value	0.30	
B	Refinement Coefficient	0.322	
C	New Nonresidential Service Costs	$502,000	*(A*B*NonResTot)*
D	Est. Nonresidential Tax Revenue	$8,844,400	*Value/1000/*$25.74*
E	New Residential Service Costs		
F	Est. Residential Tax Revenue		
G	Net Revenue	$8,342,400	*D-C*
H	Cost/Revenue Ratio	0.060	*C/D*
	Project Use(s)		
I	Total Sq. Ft.	866,340	*From Town*
J	Office	368,200	*From Town*
K	Research Center	368,200	*From Town*
L	Retail	129,940	*From Town*
M	Warehouse	0	*From Town*
N	Residential (Units)	0	*From Town*
	Rent		
O	Office	$42.00	*CoStar*
P	Research Center	$60.00	*CoStar*
Q	Retail	$36.80	*CoStar*
R	Warehouse	$19.61	*Loopnet*
S	Residential (Units)	$2,637	*CoStar*
	Income & Value		
T	Gross Nonresidential Income	$42,338,192	*Sq. ft.*rents*
U	Nonresidential Exp. Ratio 39.2%	$18,285,900	*CoStar*
V	Nonresidential NOI	$24,052,292	*T-U*
W	Residential Income	$0	
X	Residential Exp. Ratio 38%	$0	
Y	Residential NOI	$0	
Z	Submarket NonRes. Cap Rate 7%	$343,604,200	*Town; consultant modified*
AA	Submarket Res. Cap Rate 4.50%	$0	
AB	Total Value	$343,604,200	

Part II. Est. Impact of Five Development Scenarios
II.C. Office/Research/Retail/Residential Mix @ 1.0 FAR

	NEW PROJECT VALUE (Z)	$262,226,000	NOTES
A	New Value / Total Nonresidential Value	0.23	
B	Refinement Coefficient	0.289	
C	New Nonresidential Service Costs	$343,900	*(A*B*NonResTot)*
D	Est. Nonresidential Tax Revenue	$4,841,900	*Value/1000/*$25.74*
E	New Residential Service Costs[2]	$996,115	*See Assumptions*
F	Est. Residential Tax Revenue	$965,700	*Value/1000/*$13.03*
G	Net Revenue	$4,467,585	*(D+F)-(C+E)*
H	Cost/Revenue Ratio	0.231	*(C+E)/(D+F)*
	Project Use(s)		
I	Total Sq. Ft.*	659,535	*From Town*
J	Office	197,860	*From Town*
K	Research Center	197,860	*From Town*
L	Retail	69,250	*From Town*
M	Warehouse	0	*From Town*
N	Residential (Units)	170	*From Town*
	Rent		
O	Office	$42.00	*CoStar*
P	Research Center	$60.00	*CoStar*
Q	Retail	$36.80	*CoStar*
R	Warehouse	$19.61	*Loopnet*
S	Residential (Units)	$2,637	*CoStar*
	Income & Value		
T	Gross Nonresidential Income	$23,178,410	*Sq. ft.*rents*
U	Nonresidential Exp. Ratio 39.2%	$10,010,800	*CoStar for exp. ratio*
V	Nonresidential NOI	$13,167,610	*T-U*
W	Residential Income	$5,379,480	*Units * rents*
X	Residential Exp. Ratio 38%	$2,044,200	*CoStar for exp. ratio*
Y	Residential NOI	$3,335,280	W-X
Z	Submarket NonRes. Cap Rate 5.90%	$188,108,700	*CoStar for cap rate*
AA	Submarket Res. Cap Rate 4.50%	$74,117,300	*CoStar for cap rate*
AB	Total Value	$262,226,000	*Z+AA*

[2] 331 residents, 28 students

Part II. Est. Impact of Five Development Scenarios
II.D. Office/Research/Retail/Residential Mix @ 1.35 FAR

	NEW PROJECT VALUE (AB)	$340,356,200	NOTES
A	New Value / Total Nonresidential Value	0.30	
B	Refinement Coefficient	0.26	
C	New Nonresidential Service Costs	$401,500	*(A*B*NonResTot)*
D	Est. Nonresidential Tax Revenue	$6,224,600	*Value/1000/*$25.74*
E	New Residential Service Costs[3]	$1,324,200	*See Assumptions*
F	Est. Residential Tax Revenue	$1,283,900	*Value/1000/*$13.03*
G	Net Revenue	$5,782,800	*(D+F)-(C+E)*
H	Cost/Revenue Ratio	0.230	*(C+E)/(D+F)*
	Project Use(s)		
I	Total Sq. Ft.*	863,010	*From Town*
J	Office	259,130	*From Town*
K	Research Center	259,130	*From Town*
L	Retail	91,460	*From Town*
M	Warehouse	0	*From Town*
N	Residential (Units)	226	*From Town*
	Rent		
O	Office	$42.00	*CoStar*
P	Research Center	$60.00	*CoStar*
Q	Retail	$36.80	*CoStar*
R	Warehouse	$19.61	*Loopnet*
S	Residential (Units)	$2,637	*CoStar*
	Income & Value		
T	Gross Nonresidential Income	$29,796,988	*Sq. ft.*rents*
U	Nonresidential Exp. Ratio 39.2%	$12,869,300	*CoStar for exp. ratio*
V	Nonresidential NOI	$16,927,688	*T-U*
W	Residential Income	$7,151,544	*Units * rents*
X	Residential Exp. Ratio 38%	$2,717,600	*CoStar for exp. ratio*
Y	Residential NOI	$4,433,944	W-X
Z	NonRes Value: NonRes. Cap Rate 7%	$241,824,100	*Town; consultant modified*
AA	ResValue: Submarket Res. Cap Rate 4.50%	$98,532,100	*CoStar for cap rate*
AB	Total Value	$340,356,200	*Z+AA*

[3] 440 residents, 38 students.

Part II. Est. Impact of Five Development Scenarios
II.E. Warehouse/Distribution

	NEW PROJECT VALUE (AB)	$35,854,000	NOTES
A	New Value / Total Nonresidential Value	0.03	
B	Refinement Coefficient	0.55	
C	New Nonresidential Service Costs	$179,000	*(A*B*NonResTot)*
D	Est. Nonresidential Tax Revenue	$922,900	*Value/1000/*$25.74*
E	New Residential Service Costs	N/A	
F	Est. Residential Tax Revenue	N/A	
G	Net Revenue	$743,900	*D-C*
H	Cost/Revenue Ratio	0.241	*C/D*
	Project Use(s)		
I	Total Sq. Ft.	0	*From Town*
J	Office	0	*From Town*
K	Research Center	0	*From Town*
L	Retail	0	*From Town*
M	Warehouse	158,900	*From Town*
M.1	TV Studio (No Change)	90,002	*From Town*
N	Residential (Units)	0	*From Town*
	Rent		
O	Office	$42.00	*CoStar*
P	Research Center	$60.00	*CoStar*
Q	Retail	$36.80	*CoStar*
R	Warehouse	$19.61	*Loopnet*
S	Residential (Units)	$2,637	*CoStar*
	Income & Value		
T	Gross Nonresidential Income	$3,116,000	*Warehouse only*
U	Nonresidential Exp. Ratio 35%	$1,345,800	*CoStar for exp. ratio*
V	Nonresidential NOI	$1,770,200	*T-U*
W	Residential Income	$0	*Units * rents*
X	Residential Exp. Ratio 38%	$0	*CoStar for exp. ratio*
Y	Residential NOI	$0	W-X
Z	Submarket NonRes. Cap Rate 5.50%	$35,854,000	*Warehouse + TV Studio*
AA	Submarket Res. Cap Rate 4.50%		*CoStar for cap rate*
AB	Total Value	$35,854,000	*Z+AA*

March 20, 2021

Lee Newman
Planning Director
500 Dedham Avenue
Needham, MA 02492

Reference: 2021 Fiscal Impact Analysis, Highway Commercial I Rezoning

Dear Lee,

I am submitting a revised report on the fiscal impact of commercial and mixed-use development options for the proposed Highway I Commercial District. The purposes of this revision are to address comments you provided to us by email on Tuesday, March 16. As noted in the enclosed report, we find that development in the proposed district would lead to the following fiscal outcome for the Town:

1. At maximum buildout with a floor area ratio (FAR) of 1.0, development in the new district would provide $6,733,100 in tax revenue per year and create demands on municipal services of approximately $381,000 per year. For development at this level, the net revenue would be $6,352,100, for a cost-revenue ratio of 0.060.

2. In addition, if development occurs at 1.35 FAR, development in the new district would provide $8,844,400 in tax revenue per year and create demands on municipal services of approximately $502,000 per year. The net revenue would be $8,342,400, for a cost-revenue ratio would be 0.060.

3. As for the mixed-use development options, a project comprised of multiple nonresidential uses (retail, lab space, and offices) and 170 apartments, with a combined total FAR of 1.0, would generate $5,807,600 in taxes per year and create demands on municipal and school services of approximately $1,154,900. The net revenue would be $4,652,700 for a cost-revenue ratio of 0.199.

4. A project comprised of multiple nonresidential uses and 226 apartments, with a combined total FAR of 1.35, would generate $7,508,500 in taxes per year and create demands on municipal and school services of approximately $1,479,600. The net revenue would be $6,028,900 for a cost-revenue ratio of 0.197.

5. Finally, you asked us to evaluate a potential mix of warehouse/distribution space and television studio. We estimate that the Town would receive $922,900 in tax revenue and spend approximately $179,000 for municipal services to meet the demands of these two uses. The net revenue would be $743,900, for a cost-revenue ratio of 0.241.

Under existing conditions, the parcels in the proposed district pay the Town about $490,500 in taxes per year. As a result, the gain in tax revenue from the new nonresidential options or the mixed-use development options will be anywhere from 11 to 18 times what the Town receives today.

Sincerely,

Judith A. Barrett

Judi Barrett
Barrett Planning Group LLC

FISCAL IMPACT ANALYSIS: HIGHWAY COMMERCIAL I

INTRODUCTION

In September 2019, the Needham Planning Department asked Barrett Planning Group to review a potential rezoning of four parcels (15 acres) at Highland Avenue and Gould Street west of the Route 128 highway layout. The Town subsequently decided to study the proposal further before presenting the proposed Highway Commercial I District to Town Meeting. We were asked to update our analysis in February 2021, and to expand it by including other uses not contemplated in the original concept for this district. For the new study, we reviewed and considered the following information:

1. Highway Commercial 1 Zoning District Planning Presentation, February 3, 2021;
2. Property Assessment and Tax Information, provided by the Needham Planning Department;
3. CoStar Office, Industrial, Retail, and Multifamily Market Data and Trends, Newton-Needham-Brookline-Dover Submarkets;
4. Town of Needham, FY 2021 Operating Budget;
5. Department of Revenue, Municipal Data Bank, Misc. Financial Data (Tax Rates, Assessed Values, Revenue Sources, Tax Levy); and
6. Buildout Analysis prepared by John Connery for Needham Planning Department (2015).

SUMMARY

The following chart compares the current assessed values and tax payments for the area included in our analysis to the estimated values and tax revenue of the same area, assuming the parcels are assembled and redeveloped under the proposed Highway Commercial I zoning.

TABLE 1. ASSESSED VALUE AND REVENUE CHANGE, 2021 PROPOSED HIGHWAY COMMERCIAL I

	Existing Conditions	If Redeveloped at 1.0 FAR for Nonresidential Uses	Gain/Loss at 1.0 FAR Outcome	If Redeveloped at 1.35 FAR for Nonresidential Uses	Gain/Loss at 1.35 FAR Outcome
Assessed Value	$19,087,100	$261,582,100	$242,495,000	$343,604,200	$324,517,100
Tax Revenue	$490,500	$6,733,100	$6,242,600	$8,844,400	$8,353,900
	Existing Conditions	**If Redeveloped at 1.0 FAR as Mixed-Use Option**	**Gain/Loss at 1.0 FAR Outcome**	**If Redeveloped at 1.35 FAR as Mixed-Use Option**	**Gain/Loss at 1.35 FAR Outcome**
Assessed Value	$19,087,100	$262,226,000	$243,138,900	$340,356,200	$321,269,100
Tax Revenue	$490,500	$5,807,600	$5,317,100	$7,508,500	$7,018,000
	Existing Conditions	**If Redeveloped at as Warehouse/TV Studio**	**Gain/Loss**		
Assessed Value	$19,087,100	$35,854,000	$16,766,900		
Tax Revenue	$490,500	$922,900	$432,400		

Source: Barrett Planning Group, with data from Town of Needham, Municipal Data Bank, and CoStar.

APPROACH AND METHODOLOGY

Proportional Valuation

Nonresidential development places different demands on municipal services depending on the class of use. For example, retail uses usually demand more from public safety personnel than any other municipal department, but industrial uses tend to require higher expenditures for public works. Food service establishments also require periodic inspections by the health department, and uses ranging from nursing homes and day care centers to performing arts centers require semiannual or more frequent inspections by health, fire, and building authorities. In some towns, nonresidential development of all types places demands on services traditionally thought of as "residential," e.g., public libraries. When a community invests in waterworks and sewer system upgrades, the benefits are often shared by residential and nonresidential ratepayers.

Recognizing that each class of use has both unique needs and needs common to all uses, fiscal impact analysts have developed models to identify, estimate, and assign service costs to various types of development. The most widely used model for estimating the cost to serve nonresidential land uses is known as *proportional valuation*. This two-part model embraces a long-standing fiscal impact principle: the average cost of nonresidential municipal services can be inferred from the relationship between nonresidential real property values and the total value of real property in a community, adjusted for type of community and size of tax base.

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H	Ratio	0.107	*F/G*
I	Non-Residential Parcels	441	*Dept. of Revenue*
J	Total Parcels	10,211	*Dept. of Revenue*
K	Average Value: Non-Residential Parcel	$2,615,000	*FI*
L	Average Value: All Parcels	$1,052,000	*G/J*
M	Ratio	2.49	*K/L*
N	Refinement Coefficient	0.686	*Consultant (Burchell)*
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P	Residential Expenditures	$185,015,200	*Consultant*

Average Cost Per Capita/Student, Adjusted

After establishing the approximate share of nonresidential expenditures under existing conditions, analysts can use a similar process to estimate the cost of services that will be used by new growth. For our 2019 study of Highway Commercial I, we applied the principles of proportional valuation to estimate the revenue and cost of services impact of new development under that plan. People familiar with that study may remember that a critical step in proportional valuation involves using a *refinement coefficient* to modify the average cost of nonresidential services in order to adjust for significant differences in scale between the proposed project and existing conditions in the tax base as a whole. We repeated the process for this report. However, since the new plan for the district includes options for mixed-use development with housing, the updated study is more complicated.

The development scenarios that could occur under the proposed zoning include multifamily units in mixed-use projects. This means the fiscal impact analysis must also consider the net new cost of residential demands on municipal services and schools. To estimate these costs, we used the following procedures.

The average cost of non-school services used by Needham residents is $2,130. This represents the total cost of residential non-school services, $65,821,000, divided by the Town's estimated 2019 population, 30,970.[1] When we prepare a fiscal impact analysis, our goal is to simulate as much as possible what the Town's *net new cost of services* will be – that is, the *incremental cost* of services associated with growth. Toward that end, we adjusted the average cost of municipal services per capita, just as we modified the average cost for the nonresidential portion of this study. For the residential analysis, we eliminated costs that would not necessarily change just because the Town attracts a modest number of new residents. For example, the Town would not hire more personnel in the Town Manager's office or the management/administrative tiers of other general government offices or the public safety and public works departments just because the Town gained 330-400 new residents. Still, population growth will impose some additional burdens on day-to-day service delivery, and those burdens come with some costs.

To account for these new demands, we assumed the *average variable cost* in municipal departments is approximately 18 percent, so we used 82 percent of the average municipal cost of services to estimate the cost of new growth:

Average cost of new municipal services =	Existing cost of municipal services	X 82%	/ Existing Population
$1,740 =	$65,821,000	$53,973,200	30,970

**Numbers may not total due to rounding.*

The cost of new services was multiplied by the new household population assumptions for each mixed-use scenario to arrive at the estimated cost of new demands on town services.

[1] U.S. Census Bureau, 2015-2019 American Community Survey (ACS) Five-Year Estimates).

The potential cost of new school services was estimated in a similar way. We consulted the detailed version of Needham's most recent Per Pupil Cost report from the Massachusetts Department of Elementary and Secondary Education (DESE) and identified what we assumed would be costs most directly affected by enrollment growth: teachers, instructional support personnel, instructional materials, and pupil services, including transportation. On a per-student basis, the sum of these expenditures is $7,530. Since the most recent report reflects FY 2019 conditions, we adjusted for inflation and non-inflation spending growth with a multiplier of 1.12. This explains how we arrived at the average cost per student for our study, $8,400.

We used the following procedures and data sources to estimate the new household population:

- The Town supplied us with the school enrollment counts for three existing Chapter 40B mixed-income developments: Charles River Landing, Modera Needham, and The Kendrick. The total number of units in these developments is 943 and total number of school students, 105 (October 1, 2020). Since 70 percent of the apartments at Charles River Landing are one-bedroom units, the number of school-age children is very low (18). We eliminated Charles River Landing from our analysis and focused on the other projects. The average number of students living at Modera Needham (136 units) and The Kendrick (390 units) is 87, or an average of 0.165 per unit. We used that number to estimate the school enrollment impact of the mixed-use options for the subject property: 28 students in 170 units or 38 students in 226 units.
- The household population estimate is based on the average household size of two-bedroom apartments per the U.S. Census Bureau, *American Housing Survey*: 1.945 persons per unit. For 170 units, the result is 331 new residents and for 226 units, 440.

The proportional valuation models for each of the development options the Town asked us to evaluate are presented on the following pages. They are:

1. A nonresidential project with a maximum floor area ratio (FAR) of 1.0., comprised of:
- Office: 280,305 sq. ft.
- Research Center/Lab: 280,305 sq. ft.
- Retail: 98,925 sq. ft.
- Total: 659,535 sq. ft.

2. A nonresidential project with a maximum floor area ratio (FAR) of 1.35., comprised of:
- Office: 368,200 sq. ft.
- Research Center/Lab: 368,200 sq. ft.
- Retail: 129,940 sq. ft.
- Total: 866,340 sq. ft.

3. A mixed-use project with a maximum floor area ratio (FAR) of 1.0, comprised of:
- Office: 197,860 sq. ft.
- Research Center/Lab: 197,860 sq. ft.
- Retail: 69,250 sq. ft.

- Apartments: 170
- Total: 659,535 sq. ft.

4. A mixed-use project with a maximum floor area ratio (FAR) of 1.35., comprised of:

- Office: 259,130 sq. ft.
- Research Center/Lab: 259,130 sq. ft.
- Retail: 91,460 sq. ft.
- Apartments: 226
- Total: 866,340 sq. ft.

5. A warehouse/distribution facility and television studio mix as of right:

- Warehouse: 158,900 sq. ft.
- TV studio: 90,002
- Total: 248,902 sq. ft.

Part II. Est. Impact of Five Development Scenarios
II.A. Office/Research/Retail Mix @ 1.0 FAR

	NEW PROJECT VALUE (Z)	$261,582,100	NOTES
A	New Value / Total Nonresidential Value	0.23	
B	Refinement Coefficient	0.321	
C	New Nonresidential Service Costs	$381,000	*(A*B*NonResTot)*
D	Est. Nonresidential Tax Revenue	$6,733,100	*Value/1000/*$25.74*
E	New Residential Service Costs		
F	Est. Residential Tax Revenue		
G	Net Revenue	$6,352,100	*D-C*
H	Cost/Revenue Ratio	0.060	*C/D*
	Project Use(s)		
I	Total Sq. Ft.	659,535	*From Town*
J	Office	280,305	*From Town*
K	Research Center	280,305	*From Town*
L	Retail	98,925	*From Town*
M	Warehouse	0	*From Town*
N	Residential (Units)	0	*From Town*
	Rent		
O	Office sq. ft.	$42.00	*CoStar*
P	Research Center sq. ft.	$60.00	*CoStar*
Q	Retail sq. ft.	$36.80	*CoStar*
R	Warehouse sq. ft.	$19.61	*Loopnet*
S	Residential (per unit)	$2,637	*CoStar*
	Income & Value		
T	Gross Nonresidential Income	$32,231,550	*Sq. ft.*rents*
U	Nonresidential Exp. Ratio 39.2%	$13,920,800	*CoStar*
V	Nonresidential NOI	$18,310,750	*T-U*
W	Residential Income	$0	
X	Residential Exp. Ratio 38%	$0	
Y	Residential NOI	$0	
Z	Submarket NonRes. Cap Rate 7%	$261,582,100	*Town; consultant modified*
AA	Submarket Res. Cap Rate 4.50%	$0	
AB	Total Value	$261,582,100	(Z+AA)

Part II. Est. Impact of Five Development Scenarios
II.B. Office/Research/Retail Mix @ 1.35 FAR

	NEW PROJECT VALUE (Z)	$343,604,200	NOTES
A	New Value / Total Nonresidential Value	0.30	
B	Refinement Coefficient	0.322	
C	New Nonresidential Service Costs	$502,000	*(A*B*NonResTot)*
D	Est. Nonresidential Tax Revenue	$8,844,400	*Value/1000/*$25.74*
E	New Residential Service Costs		
F	Est. Residential Tax Revenue		
G	Net Revenue	$8,342,400	*D-C*
H	Cost/Revenue Ratio	0.060	*C/D*
	Project Use(s)		
I	Total Sq. Ft.	866,340	*From Town*
J	Office	368,200	*From Town*
K	Research Center	368,200	*From Town*
L	Retail	129,940	*From Town*
M	Warehouse	0	*From Town*
N	Residential (Units)	0	*From Town*
	Rent		
O	Office	$42.00	*CoStar*
P	Research Center	$60.00	*CoStar*
Q	Retail	$36.80	*CoStar*
R	Warehouse	$19.61	*Loopnet*
S	Residential (Units)	$2,637	*CoStar*
	Income & Value		
T	Gross Nonresidential Income	$42,338,192	*Sq. ft.*rents*
U	Nonresidential Exp. Ratio 39.2%	$18,285,900	*CoStar*
V	Nonresidential NOI	$24,052,292	*T-U*
W	Residential Income	$0	
X	Residential Exp. Ratio 38%	$0	
Y	Residential NOI	$0	
Z	Submarket NonRes. Cap Rate 7%	$343,604,200	*Town; consultant modified*
AA	Submarket Res. Cap Rate 4.50%	$0	
AB	Total Value	$343,604,200	

Part II. Est. Impact of Five Development Scenarios
II.C. Office/Research/Retail/Residential Mix @ 1.0 FAR

	NEW PROJECT VALUE (Z)	$262,226,000	NOTES
A	New Value / Total Nonresidential Value	0.23	
B	Refinement Coefficient	0.289	
C	New Nonresidential Service Costs	$343,900	*(A*B*NonResTot)*
D	Est. Nonresidential Tax Revenue	$4,841,900	*Value/1000/*$25.74*
E	New Residential Service Costs[2]	$810,951	*See Assumptions*
F	Est. Residential Tax Revenue	$965,700	*Value/1000/*$13.03*
G	Net Revenue	$4,652,749	*(D+F)-(C+E)*
H	Cost/Revenue Ratio	0.199	*(C+E)/(D+F)*
	Project Use(s)		
I	Total Sq. Ft.*	659,535	*From Town*
J	Office	197,860	*From Town*
K	Research Center	197,860	*From Town*
L	Retail	69,250	*From Town*
M	Warehouse	0	*From Town*
N	Residential (Units)	170	*From Town*
	Rent		
O	Office	$42.00	*CoStar*
P	Research Center	$60.00	*CoStar*
Q	Retail	$36.80	*CoStar*
R	Warehouse	$19.61	*Loopnet*
S	Residential (Units)	$2,637	*CoStar*
	Income & Value		
T	Gross Nonresidential Income	$23,178,410	*Sq. ft.*rents*
U	Nonresidential Exp. Ratio 39.2%	$10,010,800	*CoStar for exp. ratio*
V	Nonresidential NOI	$13,167,610	*T-U*
W	Residential Income	$5,379,480	*Units * rents*
X	Residential Exp. Ratio 38%	$2,044,200	*CoStar for exp. ratio*
Y	Residential NOI	$3,335,280	W-X
Z	Submarket NonRes. Cap Rate 5.90%	$188,108,700	*CoStar for cap rate*
AA	Submarket Res. Cap Rate 4.50%	$74,117,300	*CoStar for cap rate*
AB	Total Value	$262,226,000	*Z+AA*

[2] 331 residents, 28 students

Part II. Est. Impact of Five Development Scenarios
II.D. Office/Research/Retail/Residential Mix @ 1.35 FAR

	NEW PROJECT VALUE (AB)	$340,356,200	NOTES
A	New Value / Total Nonresidential Value	0.30	
B	Refinement Coefficient	0.26	
C	New Nonresidential Service Costs	$401,500	*(A*B*NonResTot)*
D	Est. Nonresidential Tax Revenue	$6,224,600	*Value/1000/*$25.74*
E	New Residential Service Costs[3]	$1,078,100	*See Assumptions*
F	Est. Residential Tax Revenue	$1,283,900	*Value/1000/*$13.03*
G	Net Revenue	$6,028,900	*(D+F)-(C+E)*
H	Cost/Revenue Ratio	0.197	*(C+E)/(D+F)*
	Project Use(s)		
I	Total Sq. Ft.*	863,010	*From Town*
J	Office	259,130	*From Town*
K	Research Center	259,130	*From Town*
L	Retail	91,460	*From Town*
M	Warehouse	0	*From Town*
N	Residential (Units)	226	*From Town*
	Rent		
O	Office	$42.00	*CoStar*
P	Research Center	$60.00	*CoStar*
Q	Retail	$36.80	*CoStar*
R	Warehouse	$19.61	*Loopnet*
S	Residential (Units)	$2,637	*CoStar*
	Income & Value		
T	Gross Nonresidential Income	$29,796,988	*Sq. ft.*rents*
U	Nonresidential Exp. Ratio 39.2%	$12,869,300	*CoStar for exp. ratio*
V	Nonresidential NOI	$16,927,688	*T-U*
W	Residential Income	$7,151,544	*Units * rents*
X	Residential Exp. Ratio 38%	$2,717,600	*CoStar for exp. ratio*
Y	Residential NOI	$4,433,944	W-X
Z	NonRes Value: NonRes. Cap Rate 7%	$241,824,100	*Town; consultant modified*
AA	ResValue: Submarket Res. Cap Rate 4.50%	$98,532,100	*CoStar for cap rate*
AB	Total Value	$340,356,200	*Z+AA*

[3] 440 residents, 38 students.

Part II. Est. Impact of Five Development Scenarios
II.E. Warehouse/Distribution

	NEW PROJECT VALUE (AB)	$35,854,000	NOTES
A	New Value / Total Nonresidential Value	0.03	
B	Refinement Coefficient	0.55	
C	New Nonresidential Service Costs	$179,000	*(A*B*NonResTot)*
D	Est. Nonresidential Tax Revenue	$922,900	*Value/1000/*$25.74*
E	New Residential Service Costs	N/A	
F	Est. Residential Tax Revenue	N/A	
G	Net Revenue	$743,900	*D-C*
H	Cost/Revenue Ratio	0.241	*C/D*
	Project Use(s)		
I	Total Sq. Ft.	0	*From Town*
J	Office	0	*From Town*
K	Research Center	0	*From Town*
L	Retail	0	*From Town*
M	Warehouse	158,900	*From Town*
M.1	TV Studio (No Change)	90,002	*From Town*
N	Residential (Units)	0	*From Town*
	Rent		
O	Office	$42.00	*CoStar*
P	Research Center	$60.00	*CoStar*
Q	Retail	$36.80	*CoStar*
R	Warehouse	$19.61	*Loopnet*
S	Residential (Units)	$2,637	*CoStar*
	Income & Value		
T	Gross Nonresidential Income	$3,116,000	*Warehouse only*
U	Nonresidential Exp. Ratio 35%	$1,345,800	*CoStar for exp. ratio*
V	Nonresidential NOI	$1,770,200	*T-U*
W	Residential Income	$0	*Units * rents*
X	Residential Exp. Ratio 38%	$0	*CoStar for exp. ratio*
Y	Residential NOI	$0	W-X
Z	Submarket NonRes. Cap Rate 5.50%	$35,854,000	*Warehouse + TV Studio*
AA	Submarket Res. Cap Rate 4.50%		*CoStar for cap rate*
AB	Total Value	$35,854,000	*Z+AA*

TECHNICAL MEMORANDUM

REF: NEX-2020218.00

DATE: November 13, 2020

TO: Department of Planning and Community Development
c/o Ms. Lee Newman
500 Dedham Avenue
Needham, MA 02492

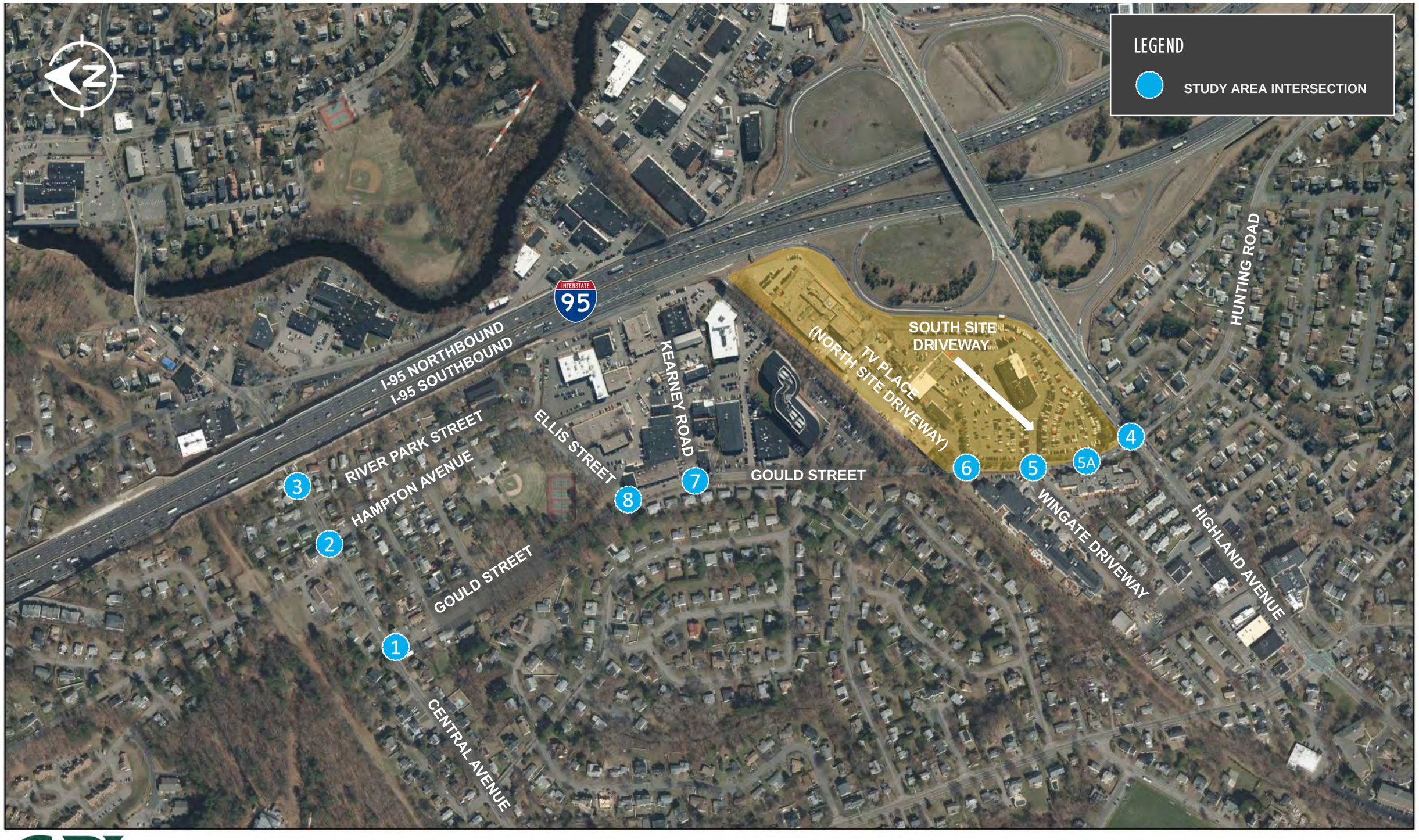
FROM: Ms. Rebecca L. Brown, P.E., Senior Project Manager
Mr. Douglas Halpert, P.E., Project Engineer

RE: Traffic Impact Study
Muzi Motors Redevelopment
Gould Street & Highland Avenue – Needham, Massachusetts

INTRODUCTION

Greenman-Pedersen, Inc. (GPI) has prepared this *Traffic Impact Study* (TIS) for a proposed rezoning and redevelopment of the Muzi Motors and Channel 5 properties on Highland Avenue and Gould Street in Needham, Massachusetts. The site is located on the northeast corner of the Highland Avenue / Gould Street intersection and is currently accessed via a right-in/right-out only driveway on Highland Avenue and two full-access/egress driveways on Gould Street. The property is currently zoned Industrial 1, and the Town of Needham Department of Planning and Community Development is currently evaluating the impacts associated with rezoning this property to Highway Commercial 1. This TIS examines the traffic impacts associated with one potential build-out of the site under the proposed zoning, which would provide a floor area ratio (FAR) of 1.35 and a total of ±866,350 square feet (SF) of development, consisting of approximately ±368,200 SF of corporate headquarter space, ±368,200 SF of research and development (R&D) space, and ±129,950 SF of ancillary retail space. In addition, this TIS identifies the transportation infrastructure improvements that would be required to accommodate the additional traffic generated by such a redevelopment.

The site is bounded by Interstate 95 (Yankee Division Highway) to the east, Highland Avenue to the south, Gould Street to the west, and commercial/office space to the north. The site location in relation to the surrounding roadways is shown on the map on Figure 1.



GPI

Greenman-Pedersen, Inc. || 181 Ballardvale Street, Suite 202, Wilmington, MA 01887

MUZI FORD REDEVELOPMENT – NEEDHAM, MASSACHUSETTS

FIGURE 1 – STUDY AREA

EXISTING CONDITIONS

Study Area

Evaluation of the traffic impacts associated with the proposed project requires an evaluation of existing and projected traffic volumes on the adjacent streets, the volume of traffic expected to be generated by the project, and the impact that this traffic will have on the adjacent streets and nearby intersections. In preparing the TIA for the proposed site, the following intersections have been analyzed and evaluated based on conversations with the Town of Needham Department of Planning and Community Development:

- Central Avenue / Gould Street
- Central Avenue / Hampton Avenue
- Central Avenue / River Park Street
- Highland Avenue / Gould Street / Hunting Road
- Gould Street / Wingate Needham Driveway / Muzi Motors Driveway (South Site Driveway)
- Gould Street / TV Place (North Site Driveway)
- Gould Street / Kearney Road
- Gould Street / Ellis Street

Central Avenue / Gould Street

Gould Street intersects Central Avenue from the south to create a three-way "T-shaped", unsignalized intersection. The Central Avenue eastbound and westbound approaches consist of a single general-purpose lane with directional traffic separated by a striped double-yellow centerline. The Gould Street northbound approach consists of a single general-purpose lane with directional traffic separated by a striped double-yellow centerline. The Central Avenue eastbound and westbound approaches operate under free-flow conditions while the Gould Street northbound approach operates under STOP sign control. Sidewalks are provided along both sides of all approaches with crosswalks provided across the Central Avenue westbound approach and the Gould Street northbound approach. No bicycle accommodations are provided at this intersection.

Central Avenue / Hampton Avenue

Hampton Avenue intersects Central Avenue from the south to create a three-way "T-shaped", unsignalized intersection. The Central Avenue eastbound and westbound approaches consist of a single general-purpose lane with directional traffic separated by a striped double-yellow centerline. The Hampton Avenue northbound approach consists of a single general-purpose lane with directional traffic not separated. The Central Avenue eastbound and westbound approaches operate under free-flow conditions while the Hampton Avenue northbound approach operates under STOP sign control. Sidewalks are provided along both sides of all approaches; however, no crosswalks are provided. No bicycle accommodations are provided at this intersection.

Central Avenue / River Park Street

River Park Street intersects Central Avenue from the south to create a three-way "T-shaped", unsignalized intersection. The Central Avenue eastbound and westbound approaches consist of a single general-purpose lane with directional traffic separated by a striped double-yellow centerline. The River Park Street northbound approach consists of a single general-purpose lane with directional traffic not separated. The Central Avenue eastbound and westbound approaches operate under free-flow conditions while the River Park Street northbound approach operates under STOP sign control. Sidewalks are provided along both sides of Central Avenue. No crosswalks or bicycle accommodations are provided at this intersection.

Highland Avenue / Gould Street / Hunting Road

Gould Street and Hunting Road intersect Highland Avenue from the north and south respectively to create a four-way, signalized intersection. The Highland Avenue eastbound and westbound approaches consist of an exclusive left-turn lane, an exclusive through lane, and a shared through/right-turn lane with directional travel separated by a raised concrete median. The Hunting Road northbound approach consists of a shared left-turn/through lane and an exclusive right-turn lane with directional travel separated by a striped double-yellow centerline. Heavy vehicle restriction signage is posted for Hunting Road. The Gould Street southbound approach consists of an exclusive left-turn lane and a shared left/through/right-turn lane with directional travel separated by a striped double-yellow centerline.

Sidewalks are provided along both sides of all approaches and crosswalks are provided on all approaches except the westbound approach. Bicycle detection with supplemental signage is provided at the Highland Avenue eastbound and westbound approaches.

Gould Street / Wingate Driveway / Site South Driveway

The Wingate Residences driveway and the Project site's southerly driveway (existing Muzi Ford driveway) intersect Gould Street from the east and west respectively to create a four-way, unsignalized intersection. The Wingate driveway eastbound approach consists of a single general-purpose lane with directional travel not separated. The site southerly driveway westbound approach consists of a shared left-turn/through lane and an exclusive right-turn lane with directional travel separated by a striped single-yellow centerline. The Gould Street northbound and southbound approaches consist of a single general-purpose lane with directional travel separated by a striped double-yellow centerline. The Gould Street northbound and southbound approaches operate under free-flowing conditions while the Wingate driveway eastbound approach and the site southerly driveway westbound approach are assumed to operate under STOP control though no signage or pavement markings are provided. Sidewalks are provided along the westerly side of Gould Street and along the northerly side of the Wingate driveway. No crosswalks or bicycle accommodations are provided at this intersection.

Gould Street / TV Place (Site North Driveway)

TV Place (the Project site's northerly driveway) intersects Gould Street from the east to create a three-way "Y-shaped", unsignalized intersection. The TV Place westbound approach consists of a single general-purpose lane with directional travel not separated. The Gould Street northbound and southbound approaches consist of a single general-purpose lane with directional travel separated by a striped double-yellow centerline. The Gould Street northbound and southbound approaches operate under free-flowing conditions while the TV Place westbound approach is assumed to operate under STOP control though no signage or pavement markings are provided. A sidewalk is provided along the westerly side of Gould Street. No crosswalks or bicycle accommodations are provided at this intersection.

Gould Street / Kearney Road

Kearney Road intersects Gould Street from the east to create a three-way "T-shaped", unsignalized intersection. The Kearney Road westbound approach consists of a single general-purpose lane with directional travel not separated. The Gould Street northbound and southbound approaches consist of a single general-purpose lane with directional travel separated by a striped double-yellow centerline. The Gould Street northbound and southbound approaches operate under free-flowing conditions while the Kearney Road westbound approach is assumed to operate under STOP control though no signage or pavement markings are provided. A sidewalk is provided along the westerly side of Gould Street. No crosswalks or bicycle accommodations are provided at this intersection.

Gould Street / Ellis Street / Driveway

The driveway at 99-151 Gould Street and Ellis Street intersect Gould Street from the west and east respectively to create a four-way, unsignalized intersection. The driveway eastbound approach consists of a single general-purpose lane with directional travel not separated. The Ellis Street approach consists of a single general-purpose lane with directional travel separated by a striped single-yellow centerline. The Gould Street northbound and southbound approaches consist of a single general-purpose lane with directional travel separated by a striped double-yellow centerline. The Gould Street northbound and southbound approaches operate under free-flowing conditions while the driveway eastbound approach and the Ellis Street westbound approach are assumed to operate under STOP control though no signage or pavement markings are provided. A sidewalk is provided along the westerly side of Gould Street. No crosswalks or bicycle accommodations are provided at this intersection.

Public Transportation

The Massachusetts Bay Transportation Authority (MBTA) provides public transportation services within the Greater Boston Metropolitan Area, which includes the Town of Needham. The Needham Heights train station is a stop for the MBTA's Needham Commuter Line located approximately 0.8 miles southwest of the proposed site location. The line provides service from South Station in Boston to Needham Heights. The average travel time between South Station / Needham Heights is 40-45 minutes. On a typical weekday, this service runs between 6:05 AM and 10:47 AM for inbound travel, and between 6:47 AM and midnight for outbound travel. On a typical Saturday, this service runs between 8:05 AM and 12:05 AM (Sunday) for inbound travel, and between 7:10 AM and 11:25 PM for outbound travel. No additional service is provided on Sundays.

The fare for the commuter line ranges from $2.40 to $13.25 for adults while seniors and persons with disabilities pay 50% off the regular fare. The range in fare prices is based by zone with the Needham Commuter Line residing between Zone 1A – Zone 2. Children 11 years of age and under ride for free.

The MBTA also provides public transportation services within the vicinity of the project through one of its bus lines. The Bus Line 59 connecting Watertown Square and Needham Junction passes through Highland Avenue and Central to the south and north of the proposed site location, respectively. On a typical weekday, this service runs from 6:20 AM to 8:22 PM, with the average travel time from one end to another of 35 minutes. The fare for MBTA buses ranges from $1.70 with CharlieCard to $2.00 for cash-on-board for adults while seniors, persons with disabilities, and students pay $0.85 per ride. Children 11 years of age and under ride for free. The closest stop to the site is located at Highland Avenue / Avery Square or at Central Avenue / Gould Street.

The Bus Line 59 also provides service to the Newton Heights train station which is approximately 2.5 miles from the Project site and on the MBTA Subway – Green Line D (Riverside). This line provides service from Government Center in Boston to Riverside in Newton. Because the Green Line D partially runs along the roadway with vehicles, the average travel time between Government Center / Riverside is variable. However, the MBTA notes that peak hour headways are 6 minutes and range from 8-11 minutes on off-peak hours. On a typical weekday and Saturday, this service runs between 4:56 AM and 12:49 AM. On a typical Sunday, this service runs between 5:25 AM and 12:49 AM.

The 128 Business Council provides shuttle service throughout the Town of Needham – Needham Shuttle Bus Route. The 128 Business Council provides service to numerous destinations in Needham, including Needham Street, Second Avenue, First Avenue, A Street, B Street, and Kendrick Street which are all located on the easterly side of Interstate 95. Weekday service operates from 7:30 AM to 5:50 PM. This service is offered when requested ahead of time and is available for persons with disabilities. The 128 Business Council is operating fare free until contract-free methods of fare payment is possible.

All public transportation information is provided in the Appendix.

Traffic Volumes

Due to the COVID-19 pandemic, current traffic volumes are lower than typical conditions, and therefore, MassDOT has a restriction on collecting new traffic count data. MassDOT has issued a directive, *Guidance of Traffic Count Data* dated April 2020 that allows for the use of counts collected as long ago as 2015, with application of appropriate adjustments to grow traffic volumes to current year conditions. Therefore, GPI researched previous studies in the area to obtain traffic counts data for the study area intersections.

A Traffic Impact Study[1] was previously prepared by BETA Group, Inc. in 2015 for the rezoning of property along Gould Street and Reservoir Street (herein referred to as *BETA 2015 TIS*). As part of the *BETA 2015 TIS*, manual turning movement counts (TMCs) were collected at the study area intersections in June, October, and December 2015 during the weekday AM peak period (7:00 to 9:00 AM) and weekday PM peak period (4:00 to 6:00 PM) peak periods, and were seasonally adjusted to reflect average-month conditions in accordance with MassDOT guidelines for traffic analysis. The 2015 seasonally adjusted traffic volumes from this study were used to estimate existing traffic-volume conditions at the majority of the study area intersections.

It should be noted that at the time that the traffic volumes were collected in 2015, a widening project was under construction along Route 128 (I-95) (MassDOT Project # 603711), which included reconstruction of the Exit 19 highway ramps. During this time, a significant volume of traffic was being detoured onto Hunting Road to travel to/from I-95. TMCs were collected at the Highland Avenue / Gould Street / Hunting Road intersection in February 2019 during the weekday AM and PM peak periods as part of the *Route 128 Add-a-Lane Post Construction Study*[2]. The volumes collected at this intersection in February 2019 were compared to those collected at the same intersection in 2015 as part of the *BETA 2015 TIS* and were found to be 14 to 15 percent lower in 2019 as compared to 2015. The majority of this reduction was experienced on the Highland Avenue westbound left-turn and Hunting Road northbound right-turn movements and is likely due a redistribution of traffic onto I-95 following completion of the Route 128 / I-95 roadway widening project. As the 2019 counts represent the most-recently collected traffic volumes and were collected after the construction along I-95 was completed, the February 2019 volumes were used to estimate existing traffic volume conditions at the Highland Avenue / Gould Street / Hunting Road intersection.

Annual Adjustment

The MassDOT directive, *Guidance of Traffic Count Data* provides specific annual adjustment factors to apply for each year of count data based on historic traffic growth trends along various classifications of roadways across the Commonwealth of Massachusetts. However, more local data is available to assess traffic growth specific to the study area. As described above, a comparison of the traffic volumes collected at the Highland Avenue / Gould Street / Hunting Road intersection in 2015 versus 2019 indicates that traffic volumes in the area have decreased by 14 to 15 percent since 2015.

In addition, supplemental Automatic Traffic Recorder (ATR) counts were collected at the Central Avenue / Gould Street and Gould Street / Ellis Street intersections in 2019. A comparison of these 2019 counts to the counts collected at the same locations as part of the *BETA 2015 TIS* indicate traffic volumes at the Central Avenue / Gould Street intersection have decreased by 13 to 14 percent. While volumes at the

[1] *Traffic Impact Study: Gould Street – Industrial 1 and Reservoir Street – Industrial Districts, Needham, Massachusetts, Contract No. 16GEN0110D;* prepared by BETA Group, Inc.; December 2015.

[2] *Route 128 Add-a-Lane Post Construction Study, Project File No. 603711, Contract #77875*; prepared by McMahon Associates; November 25, 2019.

Gould Street / Ellis Street intersection increased by 8 percent from 2015 to 2019 during the weekday PM peak hour, the volumes at this location decreased by 3 percent during the weekday AM peak hour.

As the comparison of 2015 to 2019 traffic volumes indicates traffic volumes have been decreasing in this area since 2015, the unadjusted 2015 traffic volumes were utilized to represent 2020 Existing traffic volume conditions in order to provide a conservative (worse case) analysis condition. The February 2019 traffic volumes from the *Route 128 Add-a-Lane Post Construction Study* were utilized to represent 2020 Existing traffic volumes at the Highland Avenue / Gould Street / Hunting Road intersection as these represent the most recently collected traffic volumes.

The traffic volume data and comparison calculations described above are provided in the Appendix. The resulting 2020 Existing traffic-flow networks for the weekday AM and PM peak hours are shown graphically on Figure 2.

FIGURE 2

2020 EXISTING TRAFFIC VOLUMES

Collisions

GPI reviewed collision history data from the Needham Police Department and MassDOT for the most recent five-year period available on file (2015-2019), plus the available data through October 21, 2020. Table 1 provides a summary of the collision patterns within the study area.

In addition to the collision summary, crash occurrence also should be compared to the volume of traffic through a particular intersection or on a particular classification of roadway to determine any significance. Accordingly, the crash rate was calculated for the study area intersections and compared with the statewide and district-wide averages. An intersection crash rate is a measure of the frequency of collisions compared to the volume of traffic through an intersection and is presented in crashes per million entering vehicles (c/mev). For signalized intersections, the statewide average is 0.78 c/mev and the district-wide (District 6) average is 0.71 c/mev. For unsignalized intersections, the statewide and district-wide average is 0.52 c/mev. A comparison of the calculated crash rate to these averages can be used to establish the significance of collision occurrence and whether or not potential safety problems exist. All crash rate worksheets are provided in the Appendix.

The intersection of Highland Avenue / Gould Street / Hunting Road experienced an average of nine collisions per year and a crash above the state and district-wide averages over the five-year analysis period. However, it should be noted that construction of roadway improvements was underway as part of the Route 128 Add-A-Lane project for the majority of the analysis time period and may have impacted the occurrence of collisions at this location.

The remaining study area intersections all experienced fewer than three collisions per year and crash rates lower than the state and district-wide averages, indicating a particular safety issue does not exist.

TABLE 1
Collision Summary

Location	Number of Collisions			Severity [a]				Collision Type [b]							Percent During	
	Total	Average per Year	Crash Rate [c]	PD	PI	F	NR	SS	RE	CM	HO	FO	SV	U	Commuter Peak [d]	Wet/Icy Conditions [e]
Central Avenue at Gould Street	14	2.8	0.47	11	2	--	1	--	2	12	--	--	--	--	43%	14%
Central Avenue at Hampton Avenue	1	0.2	0.04	--	1	--	--	--	1	--	--	--	--	--	0%	0%
Central Avenue at River Park Street	3	0.6	0.12	3	--	--	--	--	2	--	--	1	--	--	0%	67%
Highland Avenue / Gould Street / Hunting Road	46	9.2	0.93	37	7	--	2	15	16	7	--	3	3	2	32%	22%
Gould Street / Wingate Driveway / Muzi Motors Driveway	2	0.4	0.11	--	1	--	1	--	1	--	1	--	--	--	50%	0%
Gould Street / TV Place	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gould Street / Kearney Road	1	0.2	0.08	1	--	--	--	--	--	--	--	--	1	--	0%	0%
Gould Street / Ellis Street / Driveway	2	0.4	0.20	2	--	--	--	--	--	2	--	--	--	--	0%	50%

Source: MassDOT (2015-October 2020).

[a] PD = property damage only; PI = personal injury; F = fatality, NR = not reported.

[b] SS = sideswipe; RE = rear end; CM = cross movement/angle; HO = head-on; FO = fixed object; SV = single vehicle; U = unknown.

[c] Measured in crashes per million entering vehicles for intersections and in crashes per million vehicle miles traveled for roadway segments.

[d] Percent of vehicle incidents that occurred during the weekday AM (7:00 AM - 9:00 AM) and weekday PM (4:00 PM - 6:00 PM) commuter peak periods.

[e] Represents the percentage of only "known" collisions occurring during inclement weather conditions.

FUTURE CONDITIONS

To estimate the impact of site-generated traffic within the study area, existing traffic volumes were projected to the year 2030, representing a ten-year design horizon. The proposed redevelopment is expected to be completed and fully operational well within this time frame. Traffic volumes on the roadway network at that time will include existing traffic and new traffic due to normal traffic growth. Consideration of these factors resulted in the development of 2030 No-Build traffic volumes, which assume that the proposed redevelopment is not built. The incremental impacts of the proposed project may then be determined by adding site-generated traffic volumes (Build conditions) and making comparisons to the No-Build conditions.

Traffic Growth

To develop the 2030 No-Build forecast volumes, two components of traffic growth were considered. First, an annual growth percentage was determined. Based on correspondence with the Town of Needham Department of Planning and Community Development, a 1.0 percent compounded annual growth was assumed, which is consistent with other recent studies done in the area.

Second, any planned or approved specific developments in the area that would generate a significant volume of traffic on study area roadways within the next five years were considered. There were no significant projects identified and all smaller developments were considered to be included within the background annual growth rate.

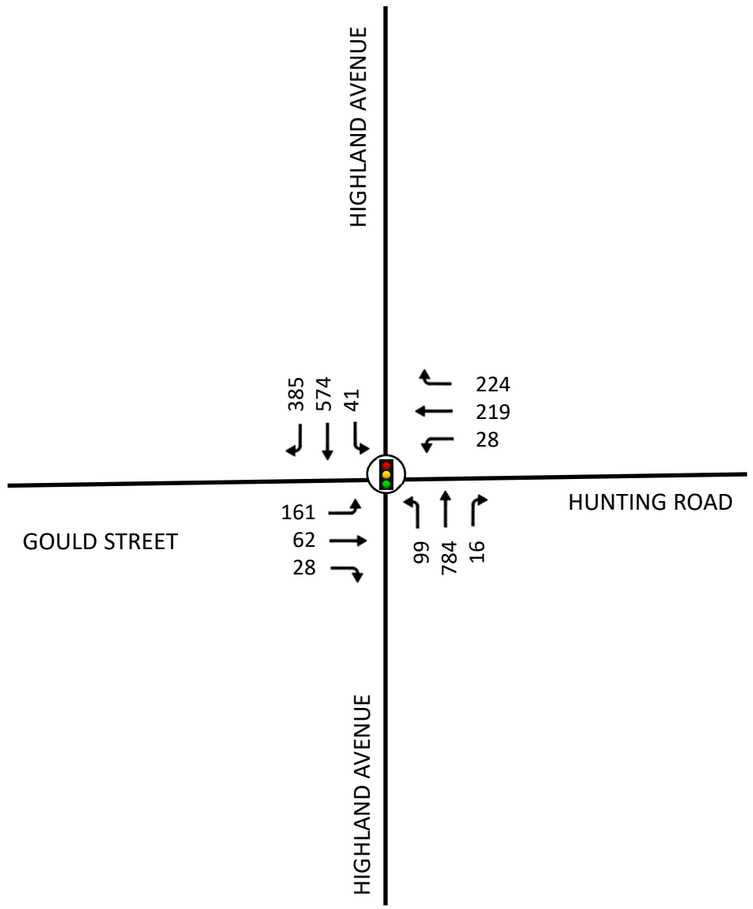
Planned Roadway Improvements

MassDOT issued a noticed to proceed in July 2020 for the Reconstruction of Highland Avenue, Needham Street, & Charles River Bridge (Project #606635), which includes roadway improvements at the Highland Avenue / Gould Street / Hunting Road intersection. This project includes upgrading the traffic control signal equipment, optimizing signal timing, constructing new crosswalks with pedestrian signals, installation of bicycle lanes in both directions along Highland Avenue, and implementation of bicycle detection at the signal. While the number and utilization of the travel lanes on all approaches to the intersection will remain consistent with the existing geometry of the intersection, the lane widths will be reduced to 11 feet to accommodate the bicycle lanes.

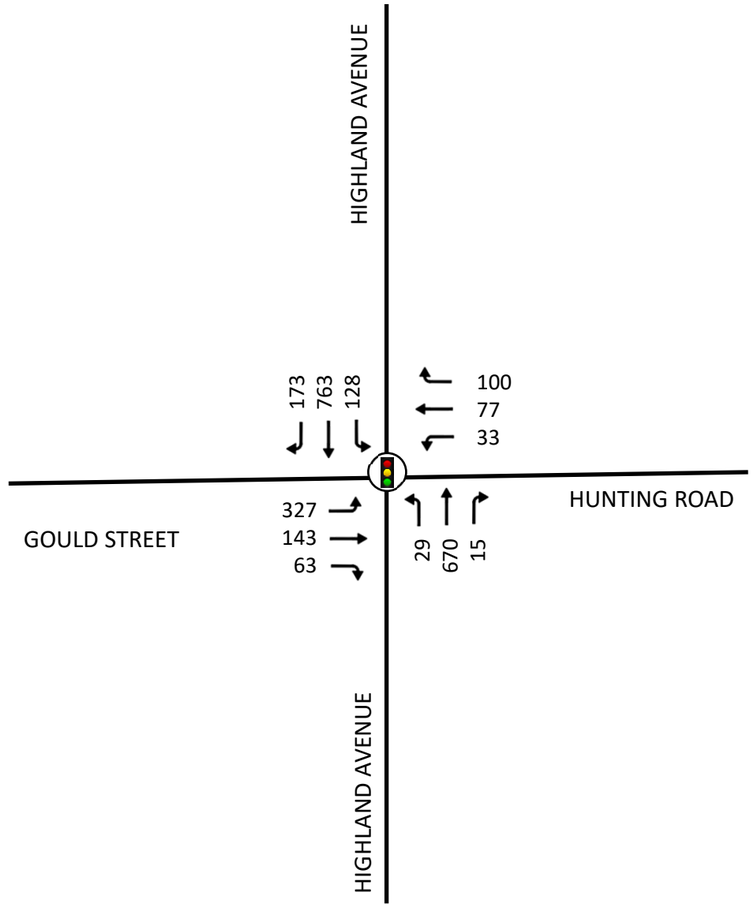
While these improvements are focused on traffic safety and multi-modal accommodations rather than increasing intersection capacity, the work will provide some minor improvements in traffic operations. Since, the construction of these improvements is anticipated to be completed within a three-year period (prior to any planned opening of a new development on the Muzi/Channel5 site), GPI has prepared a sensitivity analysis of the 2023 traffic conditions with the MassDOT improvements in place to evaluate the operational impacts these improvements would have on the intersection. For the purposes of analysis, the 2023 Opening Year for the MassDOT Improvements utilized the latest MassDOT timing plans compared to the 2020 Existing conditions. This analysis condition was analyzed for the Highland Avenue / Gould Street / Hunting Road intersection as it is the only study area intersection directly affected by the listed improvements. As these improvements are anticipated to be completed well within the ten-year design horizon with time for travel patterns to normalize post-construction, these improvements were included in the analysis of 2030 No-Build conditions.

Opening Year and No-Build Conditions

The 2023 Opening Year and 2030 No-Build peak-hour traffic volumes were accordingly developed by applying a 1.0 percent compounded annual traffic growth rate (3.0 percent over three years and 10.5 percent over ten years) to the 2020 Existing traffic volumes. The 2023 Opening Year traffic volumes are shown graphically on Figure 3 for the weekday AM and weekday PM peak hours. The 2030 No-Build traffic volumes are shown graphically on Figure 4 for the weekday AM and weekday PM peak hours.



WEEKDAY AM



WEEKDAY PM

FIGURE 3

2023 OPENING YEAR TRAFFIC VOLUMES

FIGURE 4

2030 NO-BUILD TRAFFIC VOLUMES

Trip Generation

This TIS examines the traffic impacts associated with one potential redevelopment scenario for the site that would consist of approximately 368,200 SF of corporate headquarters space, 368,200 SF of R&D space, and 129,950 SF of ancillary retail space. To estimate the volume of traffic to be generated by the proposed redevelopment, trip-generation rates published by the ITE *Trip Generation Manual* were utilized for Land Use Code (LUC) 714 (Corporate Headquarters), LUC 760 (Research & Development Center), and LUC 820 (Shopping Center), respectively. All trip-generation data are provided in the Appendix.

Existing Trips

Not all of the vehicle trips expected to be generated by the proposed redevelopment represent *new* trips on the study area roadway system. There are existing uses on the site that are currently generating traffic and would be removed as part of the redevelopment. GPI estimate the trips generated by the existing uses on the site based on the TMCs collected at the site driveways.

Internal Capture

Studies have shown that for developments of mixed-use or multi-use sites, it is realistic to assume that there will be some multi-use trips within the site itself. The proposed retail on site is anticipated to consist of a mix of service and retail space that will serve as ancillary uses to the proposed corporate office and R&D space. Therefore, a reduction in the overall trips experienced at the site driveways can be anticipated as a result of multi-use trips that include stops at more than one use on the site. Based on information published in the ITE *Trip Generation Handbook*, it is estimated that multi-use trips account for 24 to 29 percent of the trips generated by the site. The Multi-Use Development Trip Generation and Internal Capture Worksheets are provided in the Appendix.

Pass-by Trips

In addition, studies have shown that for retail developments, a substantial portion of the site-generated vehicle trips are already present in the adjacent passing stream of traffic or are diverted from another route to the proposed site. For example, some vehicles which are already on the roadways may decide to visit the site on their way to another destination. Based on information published in the ITE *Trip Generation Handbook*, the average *pass-by* trip percentage is 34 percent during the weekday PM peak hour and 26 percent during the Saturday midday peak hour for LUC 820 (Shopping Center).

Transit Trips

As described in the *Public Transportation* section of this TIS, both bus and commuter rail services are available in close proximity to the site. Therefore, it is reasonable to expect a reduction in the total number of trips generated by the proposed redevelopment due to the use of public transportation, particularly for employees of the corporate headquarters and R&D space. Based on U.S. Census information, approximately 11.7 percent of residents within the Town of Needham use public transportation to travel to work. In order to provide a conservative (worse case) analysis condition, no credit was applied for the use of public transportation when evaluating the potential traffic impacts associated with the proposed redevelopment. However, GPI encourages the developer and the Town to consider provision of a bus stop at or near the site, as well as other Transportation Demand Management (TDM) measures to reduce the number of single-occupant vehicle trips generated by the development.

Walking and Bicycling Trips

The site is also located in close proximity to multiple residential neighborhoods, as well as other commercial uses that may generate walking and bicycling trips. MassDOT is in the process of constructing bicycle

accommodations along Highland Avenue and sidewalks are provided along Gould Street and Highland Avenue in the area to provide walking and biking to the site. Based on U.S. Census information, approximately 3.5 percent of Needham residents walk or bike to get to work. Therefore, it is reasonable to expect a reduction in the number of trips generated by the redevelopment due to walking and biking. In order to provide a conservative (worse case) analysis condition, no credit has been applied for walking and biking trips. However, GPI recommends that the developer and the Town consider implementing a TDM program that includes measures to encourage walking and biking to the site.

The detailed site-generated trip calculations are included in the Appendix and the results are summarized in Table 2. As shown in Table 2, the proposed redevelopment is expected to generate 620 *additional new* vehicle trips (625 entering and -5 exiting) during the weekday AM peak hour, and 869 *additional new* vehicle trips (126 entering and 743 exiting) during the weekday PM peak hour. It should be noted that the volume of *pass-by* traffic does not reduce the total volume of traffic generated by the redevelopment and the external trips will still be realized as turning movements at the site driveways.

TABLE 2
Trip Generation Summary

Time Period / Direction	Total Trips				External Trips			
	Corporate Office Trips [a]	R&D Trips [b]	Retail Trips [c]	Total Trips [d]	Total External Trips [e]	Existing Trips [f]	Pass-by Trips [g]	New Primary Trips [h]
Weekday Daily	2,730	3,972	7,184	13,886	**10,402**	--	1,414	**8,988**[i]
Weekday AM Peak Hour:								
Enter	458	271	135	864	**766**	126	15	**625**
Exit	35	56	82	173	**75**	65	15	**-5**
Total	493	327	217	1,037	**841**	191	30	**620**
Weekday PM Peak Hour:								
Enter	49	63	317	429	**239**	33	80	**126**
Exit	440	333	343	1,116	**926**	103	80	**743**
Total	489	396	660	1,545	**1,165**	136	160	**869**

[a] ITE LUC 714 (Corporate Headquarters Building) for 368,200 SF.
[b] ITE LUC 760 (Research & Development Center) for 368,200 SF.
[c] ITE LUC 820 (Shopping Center) for 129,500 SF.
[d] Sum of Corporate Office, R&D, and Retail Trips.
[e] Reduction of 25% during the Weekday Daily and Weekday PM and 24% during the Weekday AM peak hours based on ITE *Trip Generation Handbook.*
[f] Based on counts collected at site driveways.
[g] 34 percent of retail trips during the Weekday PM peak hour and 26 percent of retail trips during all other time periods.
[h] External Trips minus Existing Trips and Pass-by Trips
[i] No credit applied for trips generated by the existing uses on site as no daily TMCs collected.

Trip Generation Comparison – Residential Component

The Town of Needham also requested that GPI prepare a trip generation estimate for an alternative development build-out that consists of approximately 226 residential apartment units, ±259,130 SF of corporate office space, ±259,130 SF of R&D space, and ±91,460 SF of ancillary retail space. GPI utilized ITE trip rates for LUC 221 (Multi-Family Housing (Mid-Rise)), LUC 714 (Corporate Headquarters Building), LUC 760 (Research & Development Center), and LUC 820 (Shopping Center). Similar adjustments were applied for internal capture and pass-by trips were applied to the residential alternative build-out as to the non-residential build-out described above. The detailed trip generation calculation worksheets are included in the Appendix and the resulting trip generation is summarized in Table 3. As shown in Table 3, the proposed residential alternative build-out is anticipated to generate 129 to 292 fewer external vehicle trips than the proposed office/R&D build-out.

TABLE 3
Trip Generation Comparison – Residential Build-Out

Time Period / Direction	Alternative 1 [a] (no Residential)			Alternative 2 [b] (226 units Residential)			Net Difference [c]		
	Total Trips	Pass-By Trips	New Primary Trips	Total Trips	Pass-By Trips	New Primary Trips	Total Trips	Pass-By Trips	New Primary Trips
Weekday Daily	10,402	1,414	8,988	8,064	988	7,066	**-2,338**	**-416**	**-1,922**
Weekday AM Peak Hour:									
Enter	766	15	751	597	15	582	**-169**	**0**	**-169**
Exit	75	15	60	115	15	100	**40**	**0**	**40**
Total	841	30	811	712	30	682	**-129**	**0**	**-129**
Weekday PM Peak Hour:									
Enter	239	80	159	200	56	144	**-39**	**-24**	**-15**
Exit	926	80	846	673	56	617	**-253**	**-24**	**-229**
Total	1,165	160	1,005	873	112	761	**-292**	**-48**	**-244**

[a] Total External Trips from Table 2.

[b] ITE LUC 221 (Multi-Family Housing (Mid-Rise)) for 226 units, LUC 714 (Corporate Headquarters Building) for 259,130 SF, LUC 760 (Research & Development Center) for 259,130 SF, and LUC 820 (Shopping Center) for 91,460 SF with reductions applied for internal capture.

[b] Alternative 2 trips minus Alternative 1 trips.

Trip Distribution

Having estimated project-generated vehicle trips, the next step is to determine the distribution of project traffic and assign these trips to the local roadway network. The directional distribution of site traffic is dependent on expected travel routes to and from the site and existing travel patterns. In addition, GPI prepared a Journey-to-Work model using U.S. Census data on the place of residency for employees working in the surrounding area in Needham to estimate the trip distribution for the proposed corporate headquarters and R&D space. GPI also developed a gravity based on building density within a 10-mile radius of the site to estimate the distribution of trips generated by the proposed retail uses. The detailed trip distribution models are included in the Appendix and all resulted in similar trip distribution patterns. Table 4 summarizes the resulting trip distribution percentages through the study area intersections.

TABLE 4
Trip Distribution Summary

Roadway	To/From Direction	Trip Distribution Percentage
Highland Avenue	East	40%
	West	10%
Central Avenue	East	15%
	West	15%
Hunting Road	South	20%
Total		**100%**

Removal of Existing Trips

As previously noted, there are existing uses on the site, including the Muzi Motors and Channel 5, which are currently generating traffic. These uses would be removed from the site as part of the redevelopment. Therefore, the trips generated by these uses will be removed from the existing roadway network as part of the redevelopment. GPI estimate the Removal of Existing Trips based on the TMCs collected at the existing driveways in 2015 and balancing through the adjacent intersections. The resulting Removal of Existing Trips traffic-flow network is graphically shown in Figure 5.

Build Traffic Volumes

Based on the traffic generation and distribution estimates for this project, the traffic volumes associated with the proposed redevelopment were assigned to the roadway network. The site-generated traffic networks are shown on Figures 6 and 7 for the weekday AM and PM peak hours, respectively. The 2030 Build peak-hour traffic-volume networks were then development by adding the site-generated traffic volumes to 2030 No-Build traffic volumes and removing the trips generated by the existing uses on site. The 2030 Build weekday AM and PM peak hour traffic volumes are illustrated on Figure 8. The 2030 Build With Mitigation weekday AM and PM peak hour traffic volumes are illustrated on Figure 9.

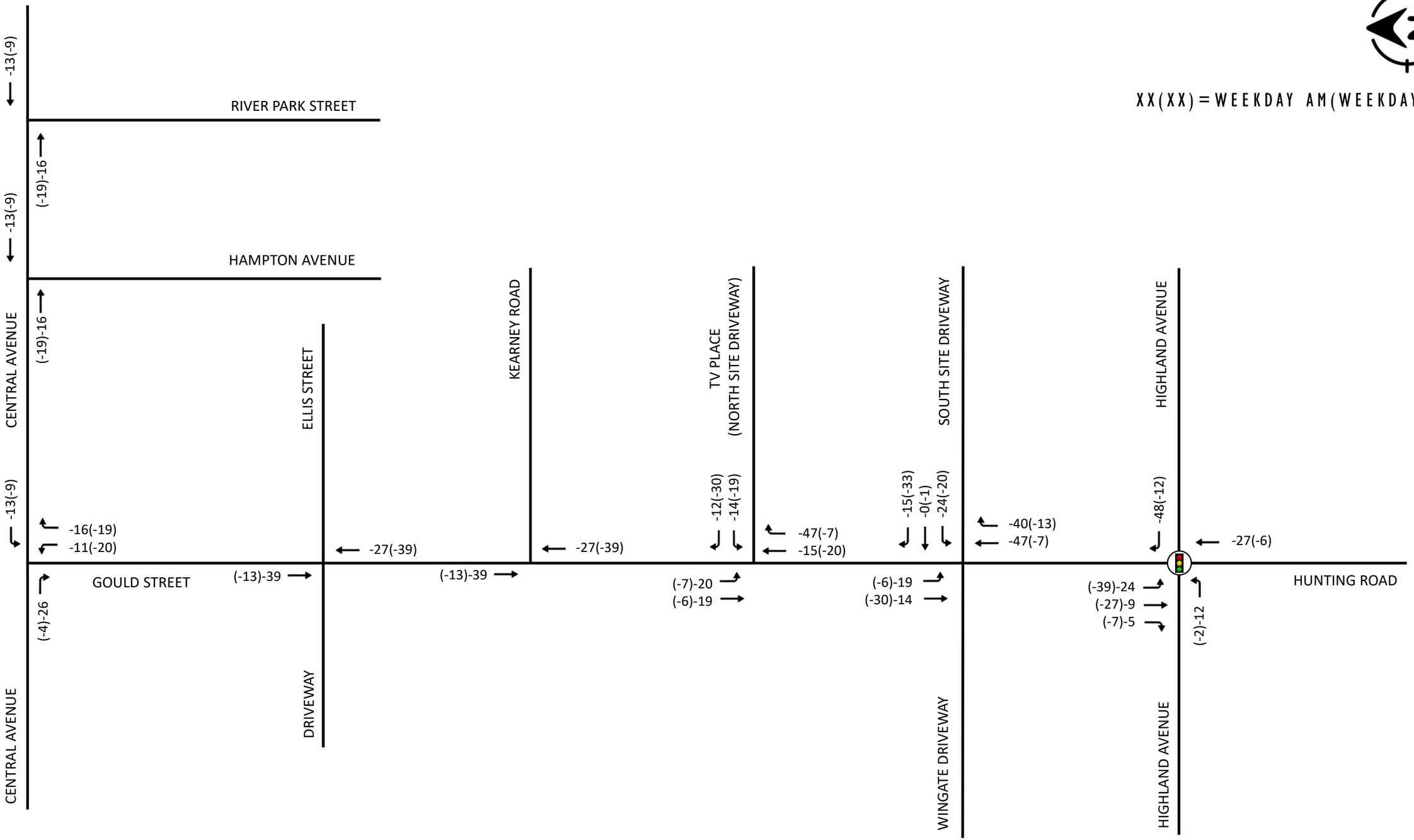


FIGURE 5

REMOVAL OF EXISTING TRIPS

XX(XX) = TOTAL PRIMARY TRIPS(RETAIL PASS-BY TRIPS)

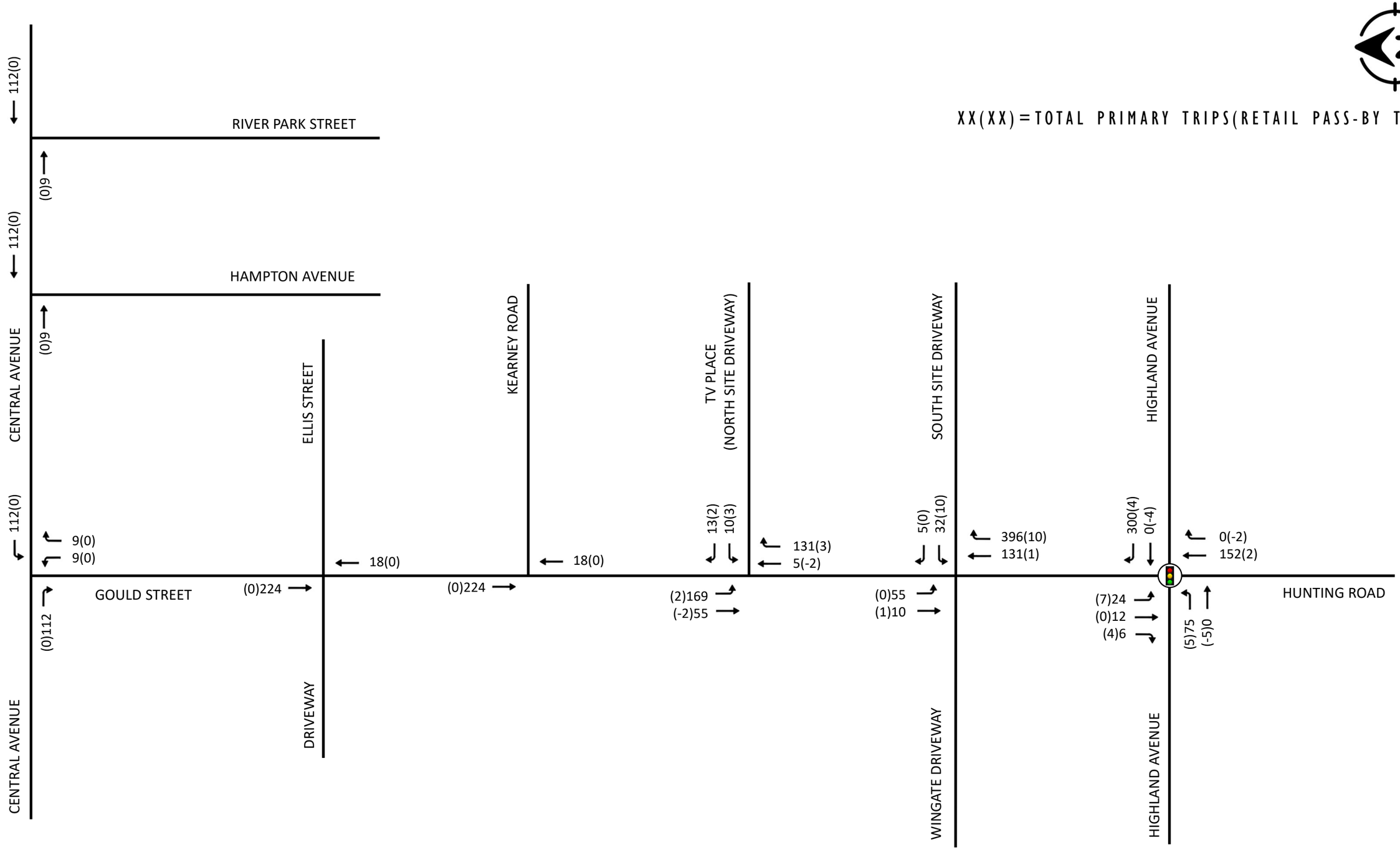


FIGURE 6

SITE-GENERATED VEHICLE TRIPS
WEEKDAY AM PEAK HOUR

XX(XX) = TOTAL PRIMARY TRIPS(RETAIL PASS-BY TRIPS)

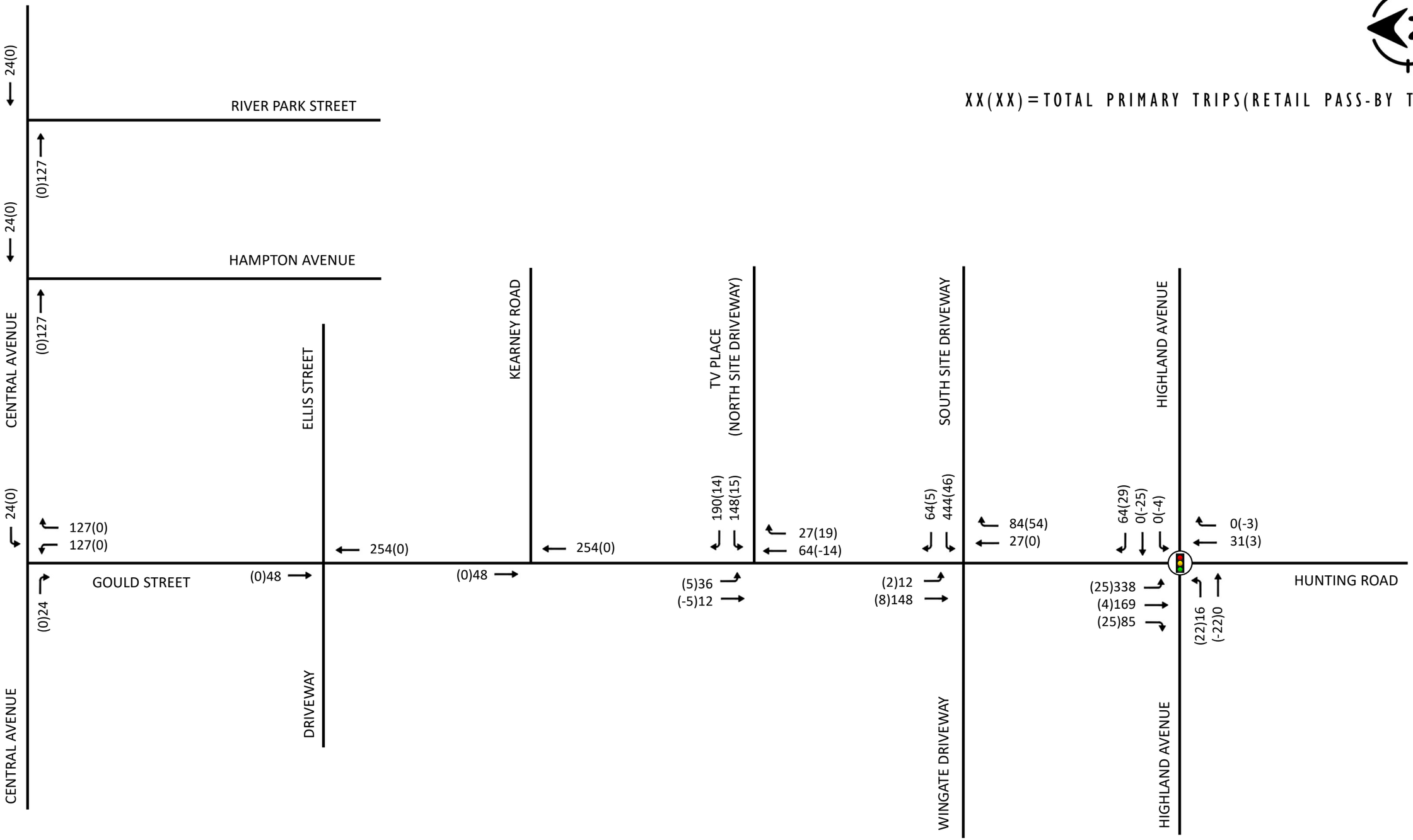


FIGURE 7

SITE-GENERATED VEHICLE TRIPS
WEEKDAY PM PEAK HOUR

FIGURE 8

2030 BUILD TRAFFIC VOLUMES

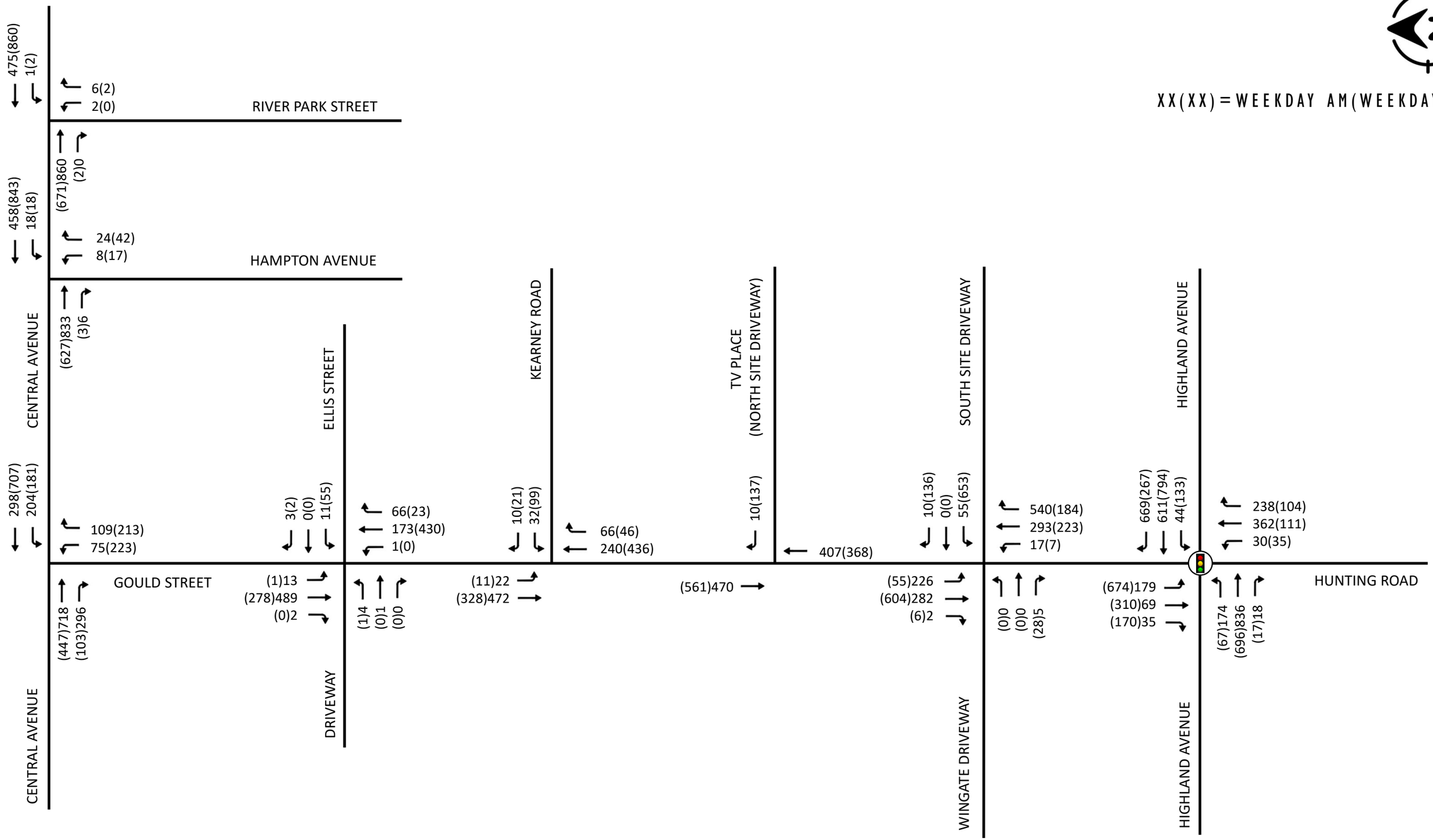


FIGURE 9

2030 BUILD WITH MITIGATION TRAFFIC VOLUMES – ALTERNATIVE 2 (CONSOLIDATED DRIVEWAYS)

CAPACITY AND QUEUE ANALYSIS

Capacity and queue analyses were conducted at all study area locations under 2020 Existing, 2030 No-Build, and 2030 Build traffic-volume conditions. The impact of site-generated traffic can be measured by comparing 2030 No-Build conditions to 2030 Build conditions.

An additional sensitivity analysis was performed for the Highland Avenue / Gould Street / Hunting Road intersection to evaluate the operations in the 2023 Opening Year for the MassDOT Improvements compared to the 2020 Existing conditions to assess what impact these improvements would have on the intersection.

Methodology

The capacity analysis methodology is based on the concepts and procedures in the *Highway Capacity Manual* (HCM)[3] and is described in the Appendix. The TIAS utilizes the HCM 2000 methodology at the signalized intersections due to the fact that *HCM 2010 methodology does not support exclusive ped or hold phases.* HCM 6 methodology was used at all unsignalized intersections as it represents the most recently approved analysis methodology.

For signalized intersections, the maximum back of queue during a typical (average) signal cycle and a 95th percentile signal cycle were calculated for each lane group during the peak periods studied. The back of queue is the length of a backup of vehicles from the stop line of a signalized intersection to the last vehicle in the queue that is required to stop, regardless of the signal indication. The length of this queue depends on a number of factors including signal timing, vehicle arrival patterns, and the saturation flow rate. For unsignalized intersections, the 95th percentile queue represents the length of queue of the critical minor-street movement that is not expected to be exceeded 95 percent of the time during the analysis period (typically one hour). In this case, the queue length is a function of the capacity of the movement and the movement's degree of saturation.

Analysis Results

The results of the level-of-service (LOS) and queue analyses are shown in Table 5 and are discussed below. Capacity and queue analyses were conducted at the study area intersections utilizing *Synchro* software.[4] The capacity and queue analysis worksheets for all conditions are provided in the Appendix.

Central Avenue / Gould Street

Traffic exiting Gould Street onto Central Avenue currently experiences long delays and queues that will be exacerbated as traffic volumes continue to grow in the area. This movement currently operates well over capacity, with a V/C ratio of 2.54 during the weekday PM peak hour.

Limited right-of-way exists to widen either Central Avenue or Gould Street to provide additional capacity. In addition, utilities, stone walls, and homes are located close to the roadway, further limiting the ability for widening. Since the potential developer of the Muzi/Channel 5 property would not have the power to acquire right-of-way, the following options could potentially be implemented to mitigate the project impacts, however, operations under the 2030 Build will still be worse than the 2030 No Build.

[3] *Highway Capacity Manual 2000*, Transportation Research Board; Washington, D.C.; 2000.

[4] *Synchro plus SimTraffic 10*; Trafficware LLC.; Sugar Land, TX; 2017.

- The traffic volumes through this intersection currently exceed the warranting conditions for installation of a traffic signal. Therefore, regardless of the Muzi/Channel 5 site redevelopment, the Town may wish to consider installation of a fully-actuated traffic-control signal at this intersection to reduce existing delay and mitigate the impacts of the proposed redevelopment. It is anticipated that the installation of traffic signal equipment at the intersection may require approximately 695 SF for signal easements from adjacent properties, approximately 250 SF for sidewalk easements, the relocation of a utility pole at the southeast corner of the intersection, and the potential acquisition of the #152 Central Avenue property. With the potential redevelopment of the site, this may present an opportunity to work with the site developer to share the costs of construction.

- In addition, GPI recommends minor roadway widening and restriping along Central Avenue to provide an 11-foot westbound left-turn lane, an 11-foot westbound through lane, and a 12-foot eastbound shared through/right-turn lane, with 5.5-foot sidewalks in either direction. Construction of these improvements will eliminate the existing 5-foot bicycle accommodating shoulders. However, any further widening to maintain the shoulders would require the acquisition of right-of-way and potential complete property takings that would be outside of the developer's capacity to construct.

With implementation of the improvements described above, all movements at this intersection will operate at acceptable levels of service (LOS D or better) during the weekday PM peak hour. Although traffic exiting Gould Street will continue to operate at LOS F during the weekday AM peak hour, the V/C ratio will be reduced below 1.00, indicating there will be adequate capacity to accommodate the anticipated traffic volumes. In addition, the volume of traffic on this movement is low during the weekday AM peak hour.

Additional widening to provide dedicated turning lanes on Gould Street or Central Avenue eastbound is required to further reduce the delay on this approach in the morning. This widening would necessitate acquisition of additional right-of-way, as well as significant relocation of utilities near the intersection. Therefore, the Town should consider developing a Town-funded project to implement additional turning lanes as a means of increasing capacity at this location to accommodate existing traffic volumes and future development in the surrounding area. The Town can request a fair-share contribution toward the design and/or construction of these improvements from the developer, proportional to the percentage increase in trips generated by the project through the intersection. The proposed conceptual improvements are illustrated in Figure 10.

Central Avenue / Hampton Avenue

All movements at the Central Avenue / Hampton Avenue intersection are anticipated to operate at acceptable levels of service (LOS D or better) under all analysis scenarios. In addition, all volume-to-capacity (V/C) ratios will be less than 1.00, indicating there will be adequate capacity to accommodate the anticipated traffic volumes, and queues are not expected to exceed two vehicles on any given approach. The additional traffic generated by the proposed redevelopment is not expected to increase delay on any given movement by more than 5 seconds per vehicle or increase queues by more than one vehicle.

Central Avenue / River Park Street

All movements at the Central Avenue / River Park Street intersection are anticipated to operate at acceptable levels of service (LOS C or better) under all analysis scenarios. In addition, all volume-to-capacity (V/C) ratios will be less than 1.00, indicating there will be adequate capacity to accommodate the anticipated traffic volumes, and queues are not expected to exceed one vehicle on any given approach. The additional traffic generated by the proposed redevelopment is not expected to increase delay on any given movement by more than one second per vehicle and will not measurably impact the queues on any approach.

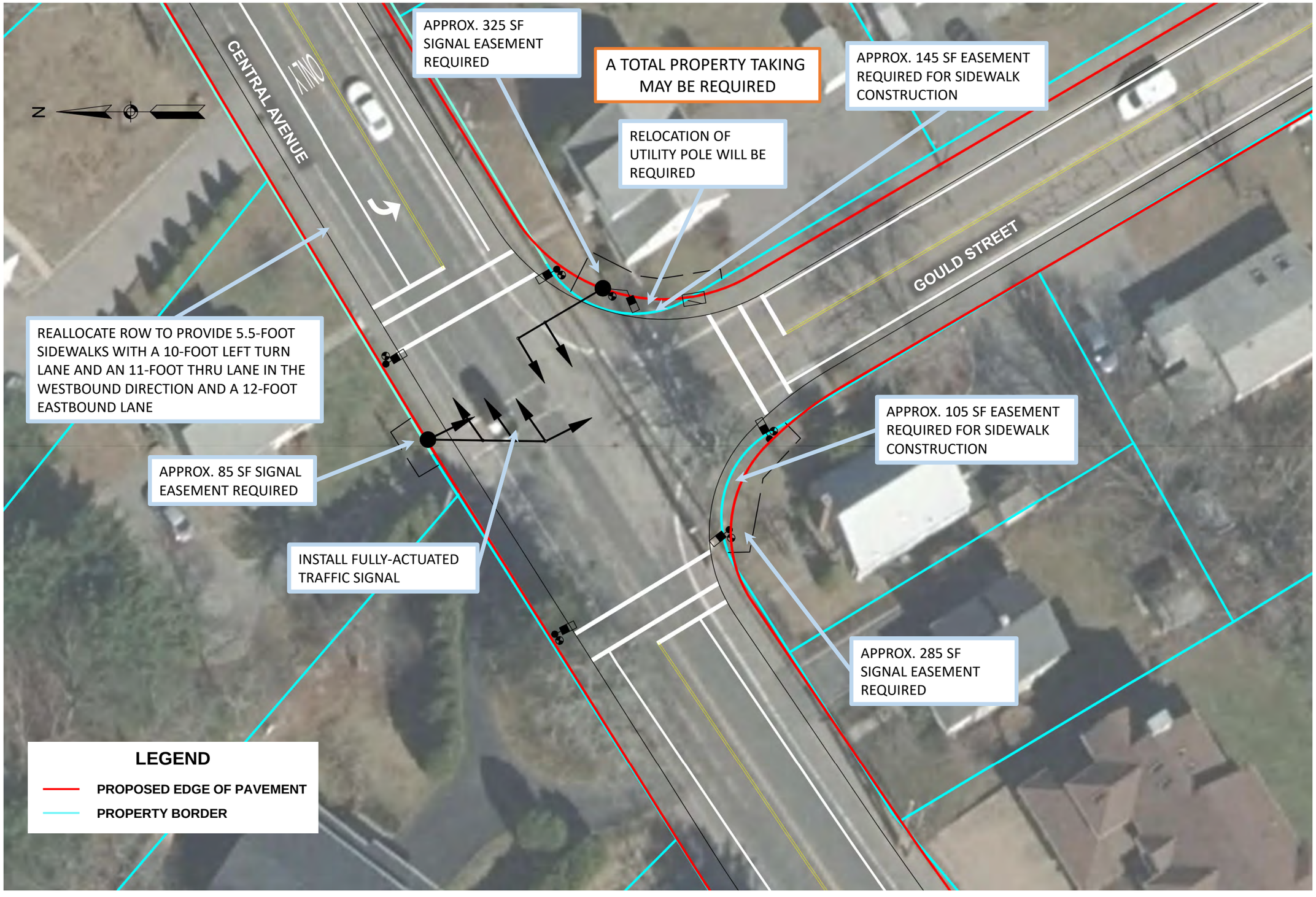


FIGURE 10

CONCEPT PLAN FOR GOULD STREET AT CENTRAL AVENUE

Highland Avenue / Gould Street / Hunting Road

All movements at the Highland Avenue / Gould Street / Hunting Road intersection currently operate under capacity (V/C less than 1.00) and at LOS E or better. A roadway improvement project is underway by MassDOT to enhance intersection safety and pedestrian and bicycle accommodations, and optimize the operation of the intersection. While this project is not expected to significantly increase the capacity of the intersection as no additional lanes are being added, the project will reallocate the green time at the traffic signal to optimize the intersection operations. As shown in the analysis of the 2023 with MassDOT Improvements conditions, the proposed improvements will result in slight decreases in the overall intersection delay and decreases in delay on individual movements of up to 21 seconds. MassDOT's project will also improve the level-of-service to LOS D or better for nearly all movements.

All movements at this intersection are anticipated to operate under capacity (V/C less than 1.00) and at LOS E or better under 2030 No-Build conditions. Although the MassDOT improvements have been included in the analysis of the 2020 No-Build condition, the 2030 No-Build conditions do not reflect any improvement in operations from the MassDOT improvements as the 1 percent background growth will utilize the limited additional capacity created by the signal timing optimization.

With the additional traffic generated by the proposed redevelopment, the overall intersection will operate over capacity at LOS F with several movements operating at LOS E or F. To mitigate the impacts of the proposed redevelopment, GPI recommends widening of Highland Avenue to provide a dedicated right-turn lane from Highland Avenue westbound onto Gould Street, which would be channelized and signalized as part of the intersection. Construction of this lane would go beyond the improvements currently proposed by MassDOT and will require the removal of the existing garden on the northeast corner of the intersection. This would require analysis of the weaving condition between the I-95 SB Off-Ramp and the channelized right-turn to ensure proper spacing exists between the intersections to provide an efficient and safe weaving condition. In addition, GPI recommends widening the Gould Street southbound approach to provide two dedicated left-turn lanes, a through lane, and a dedicated right-turn lane. Note that all widening along Gould Street and Highland Avenue would occur along the site-side of the roadway, which will likely require a significant donation of property from the developer and may impact the square footage of the areas used for trip generation.

As described in the following section of the TIS, installation of a traffic control signal is recommended at the Gould Street / Wingate Driveway / South Site Driveway intersection to facilitate traffic exiting the site. In order to manage queues and traffic flows between the intersections, GPI recommends implementing a coordinated signal system between these two intersections.

With implementation of the improvements described above, the operations of the Highland Avenue / Gould Street / Hunting Road intersection will be restored to nearly No-Build conditions during the weekday AM peak hour and better than No-Build conditions during the weekday PM peak hour. All movements will operate below capacity at LOS E or better.

Gould Street / Wingate Driveway / South Site Driveway

All movements at the Gould Street / Wingate Driveway / South Site Driveway intersection currently operate at acceptable levels of service (LOS D or better), with queues not exceeding two vehicles. With the additional traffic generated by the proposed redevelopment, traffic exiting the South Site Driveway is expected to operate at LOS F with a V/C ratio well over 1.00 and long queues, particularly during the weekday PM peak hour. GPI evaluated two options to mitigate the impacts of the proposed redevelopment at this location. Under both alternatives, the volume of traffic through the intersection is anticipated to exceed the warranting conditions for installation of a traffic control signal based on Warrant 1 – Eight Hour Volume Warrant, Warrant 2 – Four Hour Volume Warrant, and Warrant 3 – Peak Hour. Detail signal warrant analysis worksheets are provided in the Appendix. Therefore, GPI recommends installation of a fully-

actuated traffic control signal at this intersection at mitigation for the proposed redevelopment. Due to the proximity of this intersection to the existing signalized intersection of Highland Avenue / Gould Street / Hunting Road, GPI recommends implementation of a coordinated signal system. Additional improvements as part of each mitigation alternative are described below.

Alternative 1 consists of maintaining two full-access/egress driveways to the site at approximately the same locations as exist today. As part of this alternative, the South Site Driveway would be widened to provide an exclusive left-turn lane and a shared left/through/right-turn lane. Gould Street northbound would be widened to provide a shared left-turn/through lane and a dedicated right-turn lane entering the site. Gould Street southbound would also be widened to provide two general purpose travel lanes. The inside lane would transition of a left-turn lane at the Highland Avenue / Gould Street / Hunting Road intersection. With implementation of this alternative, all movements at the Gould Street / Wingate Driveway / South Site Driveway intersection would operate at acceptable levels of service (LOS D or better). GPI evaluated an option to maintain a single through lane on Gould Street southbound with Alternative 1. However, the queues on Gould Street southbound would extend over 650 feet, which would block traffic exiting the North Site Driveway and create additional back-ups into the site. With two southbound travel lanes, the queue on Gould Street will remain less than 250 feet, which is less than the distance between the two site driveways. It is anticipated that the installation of traffic signal equipment at the Highland Avenue / Gould Street / Hunting Road intersection and the need for roadway widening to provide additional turn lanes and sidewalk construction will require the acquisition of approximately 13,050 SF of the Muzi Motors property, which would reduce the total square footage available to be developed. In addition, a 725 SF signal easement will be required for the location of new traffic signal equipment on the site. The proposed conceptual improvements for Alternative 1 are illustrated in Figure 11.

Alternative 2 consists of consolidating the driveways into a single, signalized driveway at approximately the location of the Gould Street / Wingate Driveway / South Site Driveway intersection. A right-out-only movement would be maintained at northerly end of the site. As part of this alternative, the South Site Driveway would be widened to provide an exclusive left-turn lane and a shared left/through/right-turn lane. Gould Street northbound would be widened to provide a shared left-turn/through lane and a dedicated channelized right-turn lane entering the site. Gould Street southbound would also be widened to provide an exclusive left-turn lane and a shared through/right-turn lane. With implementation of this alternative, all movements at the Gould Street / Wingate Driveway / South Site Driveway intersection would operate at acceptable levels of service (LOS D or better). It is anticipated that the installation of traffic signal equipment at the Highland Avenue / Gould Street / Hunting Road intersection and the need for roadway widening to provide additional turn lanes and sidewalk construction will require the acquisition of approximately 9,250 SF of the Muzi Motors property, which would reduce the total square footage available to be developed. In addition, a 665 SF signal easement will be required for the location of new traffic signal equipment on the site. The proposed conceptual improvements for Alternative 2 are illustrated in Figure 12.

Gould Street / TV Place (North Site Driveway)

All movements at the Gould Street / TV Place (North Site Driveway) intersection currently operate at LOS C or better with queues not exceeding one vehicle. With the additional traffic generated by the proposed redevelopment, traffic exiting TV Place (North Site Driveway) is expected to operate at LOS F with long queues and delays, and V/C ratios exceeding 1.00, indicating there will be inadequate capacity to accommodate the anticipated traffic volumes generated by the proposed redevelopment. GPI evaluated two options to mitigate the impacts of the proposed redevelopment at this location.

Alternative 1 consists of maintaining full access and egress that the North Site Driveway while widening the driveway to provide separate left- and right-turn lanes, and widening Gould Street to provide dedicated left- and right-turn lanes entering the site. With this alternative, the North Site Driveway will still operate at LOS E during the weekday PM peak hour. However, the V/C ratio will be below 1.00, indicating there will be adequate capacity to accommodate the anticipated traffic volumes, and queues will be reduced to five

vehicles. All other movements through the intersection will operate at LOS B or better will implementation of this alternative. It is anticipated that the need for roadway widening will require the acquisition of approximately 3,750 SF of the Muzi Motors property which would reduce the total square footage available to be developed. The proposed conceptual improvements for Alternative 1 are illustrated in Figure 11.

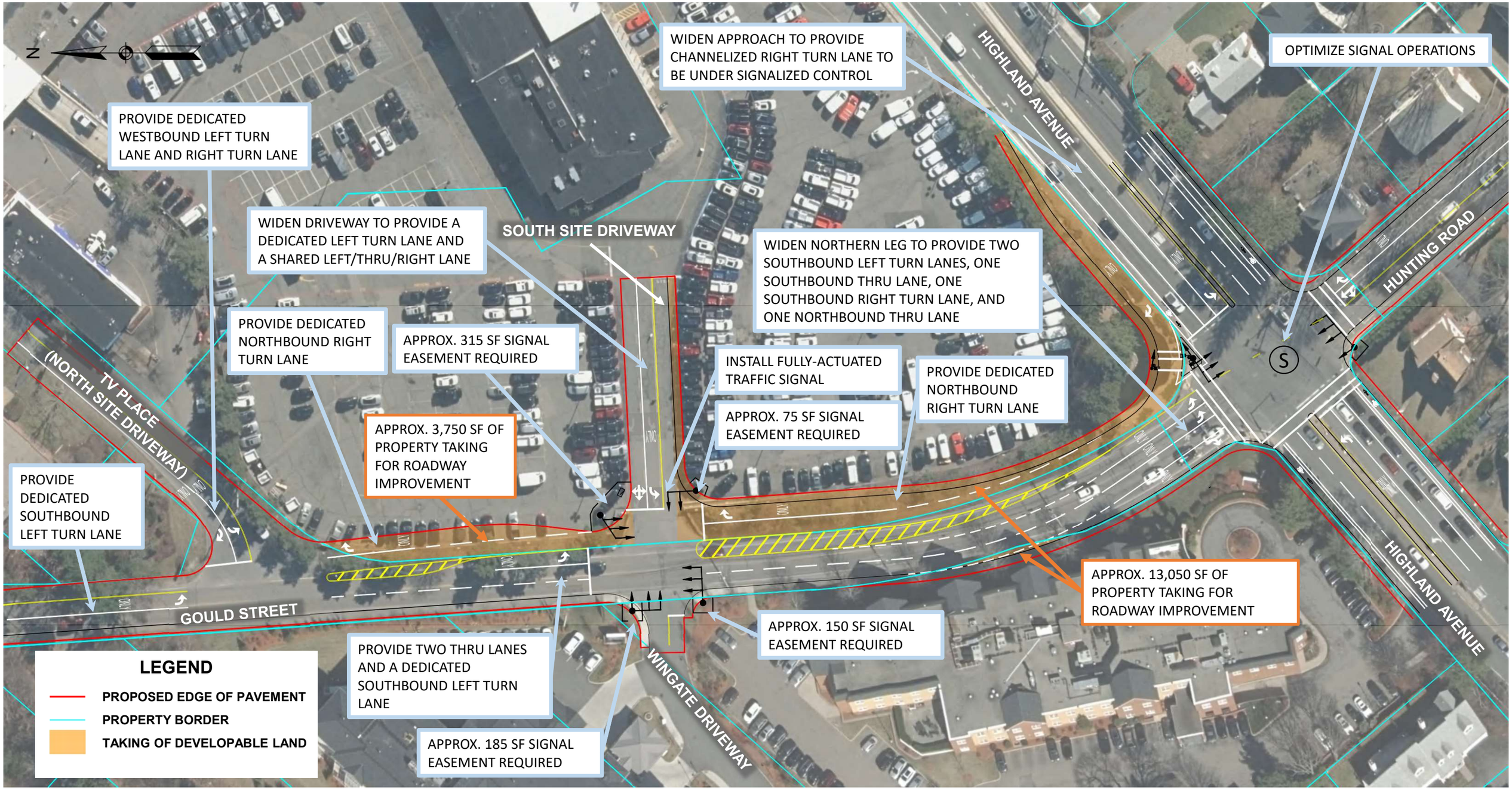
Alternative 2 consists of consolidating the site driveways to force all left-turn movements to occur a single signalized access point at the Gould Street / Wingate Driveway / South Site Driveway intersection. With this alternative, a right-out-only driveway would be provided at the northerly end of the site to alleviate some congestion at the Gould Street / Wingate Driveway / South Site Driveway intersection and allow a second means of egress. With this alternative, all movements at the Gould Street / North Site Driveway intersection would operate at LOS B or better with queues not exceeding two vehicles. It is not anticipated that property acquisition will be required at this intersection as part of Alternative 2. The proposed conceptual improvements for Alternative 2 are illustrated in Figure 12.

Gould Street / Kearney Road

All movements at the Gould Street / Kearney Road intersection are anticipated to operate at acceptable levels of service (LOS D or better) under all analysis scenarios. In addition, all volume-to-capacity (V/C) ratios will be less than 1.00, indicating there will be adequate capacity to accommodate the anticipated traffic volumes, and queues are not expected to exceed two vehicles on any given approach. The additional traffic generated by the proposed redevelopment is not expected to increase delay on any given movement by more than ten seconds per vehicle or increase queues on any given approach by more than one vehicle.

Gould Street / Ellis Street

All movements at the Gould Street / Kearney Road intersection are anticipated to operate at acceptable levels of service (LOS C or better) under all analysis scenarios. In addition, all volume-to-capacity (V/C) ratios will be less than 1.00, indicating there will be adequate capacity to accommodate the anticipated traffic volumes, and queues are not expected to exceed one vehicle on any given approach. The additional traffic generated by the proposed redevelopment is not expected to increase delay on any given movement by more than eight seconds per vehicle and will not measurably impact the queues on any approach.



GPI
Greenman-Pedersen, Inc. || 181 Ballardvale Street, Suite 202, Wilmington, MA 01887
MUZI FORD REDEVELOPMENT– NEEDHAM, MASSACHUSETTS

FIGURE 11

CONCEPT PLAN – ALTERNATIVE I

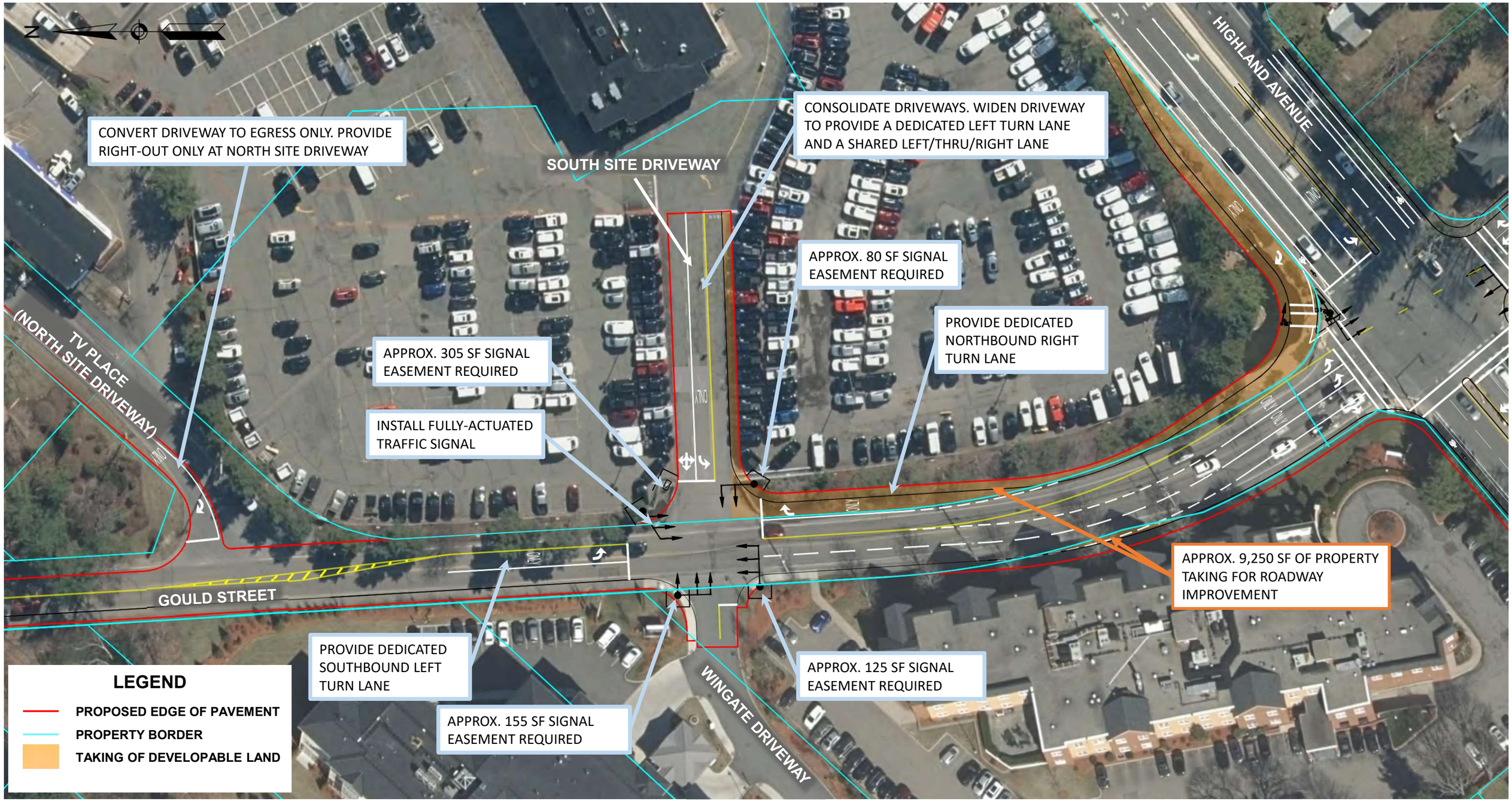


FIGURE 12

CONCEPT PLAN – ALTERNATIVE 2

TABLE 5
Intersection Capacity Analysis Summary

Intersection/Peak Hour/Lane Group	2020 Existing				2030 No-Build				2030 Build				2030 Build Mitigated Alt 1				2030 Build Mitigated Alt 2			
	V/C [a]	Del. [b]	LOS [c]	Queue [d]	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue
Central Avenue at Gould Street																				
Weekday AM:																				
Central Avenue EB approach	-	-	-	-	-	-	-	-	-	-	-	-	0.97	36.4	D	517/867				
Central Avenue WB approach	0.15	10.8	B	--/<25	0.17	11.5	B	--/<25	0.36	14.2	B	--/40	-	-	-	-				
Central Avenue WB left	-	-	-	-	-	-	-	-	-	-	-	-	0.92	65.7	E	78/215	Same as Alternative 1			
Central Avenue WB through	-	-	-	-	-	-	-	-	-	-	-	-	0.23	2.6	A	36/56				
Gould Street NB approach	1.02	110.7	F	--/240	1.12	151.7	F	--/258	1.85	484.0	F	--/403	0.86	73.6	E	78/208				
Overall Intersection	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.95**	**38.0**	**D**	**--/--**				
Weekday PM:																				
Central Avenue EB approach	-	-	-	-	-	-	-	-	-	-	-	-	0.83	29.6	C	261/422				
Central Avenue WB approach	0.18	9.5	A	--/<25	0.18	9.4	A	--/<25	0.20	9.6	A	--/<25	-	-	-	-				
Central Avenue WB left	-	-	-	-	-	-	-	-	-	-	-	-	0.66	18.8	B	48/132	Same as Alternative 1			
Central Avenue WB through	-	-	-	-	-	-	-	-	-	-	-	-	0.77	16.7	B	287/475				
Gould Street NB approach	2.54	769.9	F	--/728	1.94	509.1	F	--/480	>2.00	>999.9	F	--/>999	0.83	34.8	C	195/375				
Overall Intersection	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.85**	**24.9**	**C**	**--/--**				
Central Avenue at Hampton Avenue																				
Weekday AM:																				
Central Avenue WB approach	0.02	9.5	A	--/<25	0.03	10.0	A	--/<25	0.03	9.9	A	--/<25	N/A				N/A			
Hampton Avenue NB approach	0.13	18.6	C	--/<25	0.13	21.0	C	--/<25	0.14	22.0	C	--/<25								
Weekday PM:																				
Central Avenue WB approach	0.02	8.5	A	--/<25	0.02	8.7	A	--/<25	0.02	9.2	A	--/<25	N/A				N/A			
Hampton Avenue NB approach	0.25	19.9	C	--/25	0.23	21.9	C	--/<25	0.28	26.6	D	--/28								
Central Avenue at River Park Street																				
Weekday AM:																				
Central Avenue WB approach	0.00	9.5	A	--/<25	0.00	9.9	A	--/<25	0.00	9.9	A	--/<25	N/A				N/A			
River Park Street NB approach	0.04	18.4	C	--/<25	0.04	20.2	C	--/<25	0.04	20.9	C	--/<25								
Weekday PM:																				
Central Avenue WB approach	0.00	8.5	A	--/<25	0.00	8.7	A	--/<25	0.00	9.2	A	--/<25	N/A				N/A			
River Park Street NB approach	0.02	11.8	B	--/<25	0.00	12.3	B	--/<25	0.01	13.8	B	--/<25								

[a] Volume-to-capacity ratio.

[b] Average control delay in seconds per vehicle.

[c] Level of service.

[d] Average/95th percentile queue length in feet per lane (assuming 25 feet per vehicle).

TABLE 5 (continued)
Intersection Capacity Analysis Summary

Intersection/Peak Hour/Lane Group	2020 Existing				2023 With MassDOT Improvements				2030 No-Build				2030 Build				2030 Build Mitigated Alt 1				2030 Build Mitigated Alt 2			
	V/C [a]	Del. [b]	LOS [c]	Queue [d]	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue
Highland Avenue at Gould Street / Hunting Road																								
Weekday AM:																								
Highland Avenue EB left	0.73	65.4	E	75/183	0.69	56.3	E	70/216	0.76	65.7	E	80/233	1.43	288.9	F	206/400	0.89	71.8	E	107/227	0.89	71.8	E	107/227
Highland Avenue EB through/right	0.69	32.9	C	272/354	0.67	28.5	C	247/406	0.70	29.3	C	280/448	0.61	26.1	C	286/448	0.74	26.6	C	256/396	0.74	26.6	C	256/396
Highland Avenue WB left	0.38	51.9	D	30/71	0.36	47.0	D	29/80	0.39	49.0	D	33/84	0.42	56.1	E	38/83	0.73	71.1	E	27/63	0.73	71.1	E	27/63
Highland Avenue WB through/right	0.84	40.8	D	314/396	0.83	35.8	D	291/456	0.86	37.6	D	333/507	0.91	41.0	D	466/738	-	-	-	-	-	-	-	-
Highland Avenue WB through	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.70	31.1	C	184/291	0.70	31.1	C	184/291
Highland Avenue WB right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.94	50.1	D	161/627	0.97	57.9	E	172/638
Hunting Road NB left/through	0.78	54.0	D	193/354	0.76	48.6	D	170/433	0.86	61.5	E	197/476	1.44	269.7	F	469/757	0.96	66.3	E	240/425	0.96	66.3	E	240/425
Hunting Road NB right	0.30	30.7	C	49/125	0.33	31.0	C	32/96	0.40	33.7	C	46/115	0.48	41.5	D	70/126	0.31	25.4	C	<25/58	0.31	25.4	C	<25/58
Gould Street SB left	0.43	39.6	D	92/172	0.65	48.3	D	91/192	0.68	51.5	D	103/205	0.74	63.4	E	127/214	0.67	49.8	D	55/112	0.67	49.4	D	56/114
Gould Street SB left/through/right	0.38	39.1	D	85/164	0.59	45.5	D	84/183	0.62	48.1	D	95/195	0.68	57.6	E	117/204	-	-	-	-	-	-	-	-
Gould Street SB through	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.46	45.5	D	41/95	0.46	45.1	D	41/96
Gould Street SB right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	27.4	C	<25/<25	0.02	27.4	C	<25/<25
Overall Intersection	**0.74**	**39.7**	**D**	**--/--**	**0.80**	**36.4**	**D**	**--/--**	**0.85**	**39.4**	**D**	**--/--**	**1.08**	**79.7**	**F**	**--/--**	**1.00**	**41.6**	**D**	**--/--**	**1.02**	**43.2**	**D**	**--/--**
Weekday PM:																								
Highland Avenue EB left	0.62	73.5	E	<25/57	0.50	52.8	D	<25/64	0.53	57.4	E	27/67	0.74	81.6	F	60/132	0.70	57.4	E	41/96	0.70	57.4	E	41/96
Highland Avenue EB through/right	0.65	36.2	D	247/333	0.68	32.9	C	246/395	0.72	35.6	D	285/434	0.66	36.4	D	285/418	0.84	37.7	D	222/366	0.84	37.7	D	222/366
Highland Avenue WB left	0.70	59.8	E	109/175	0.65	50.0	D	100/190	0.70	55.0	D	116/205	0.74	65.7	E	118/200	0.76	53.7	D	80/167	0.76	53.7	D	80/167
Highland Avenue WB through/right	0.81	35.1	D	377/450	0.79	30.9	C	343/570	0.85	35.0	D	404/653	0.92	46.5	D	472/708	-	-	-	-	-	-	-	-
Highland Avenue WB through	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.86	36.2	D	248/400	0.86	36.2	D	248/400
Highland Avenue WB right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.17	9.4	A	<25/<25	0.19	9.4	A	<25/<25
Hunting Road NB left/through	0.72	64.2	E	96/184	0.59	47.9	D	86/168	0.63	52.0	D	99/178	0.75	66.1	E	130/216	0.77	53.7	D	88/180	0.77	53.7	D	88/180
Hunting Road NB right	0.07	33.9	C	<25/41	0.08	31.6	C	<25/26	0.12	33.5	C	<25/32	0.11	37.9	D	<25/31	0.07	27.3	C	<25/<25	0.07	27.3	C	<25/<25
Gould Street SB left	0.61	37.6	D	210/327	0.79	49.8	D	211/415	0.82	53.8	D	245/466	1.60	329.1	F	798/>999	0.89	44.3	D	141/357	0.89	43.6	D	194/349
Gould Street SB left/through/right	0.57	36.5	D	198/311	0.76	47.2	D	200/391	0.79	50.9	D	232/445	1.57	317.0	F	780/>999	-	-	-	-	-	-	-	-
Gould Street SB through	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.75	40.8	D	126/348	0.75	39.4	D	163/313
Gould Street SB right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10	36.2	D	<25/42	0.10	35.8	D	<25/39
Overall Intersection	**0.77**	**38.8**	**D**	**--/--**	**0.82**	**37.2**	**D**	**--/--**	**0.87**	**40.8**	**D**	**--/--**	**1.15**	**140.9**	**F**	**--/--**	**0.94**	**38.1**	**D**	**--/--**	**0.94**	**37.8**	**D**	**--/--**

[a] Volume-to-capacity ratio.
[b] Average control delay in seconds per vehicle.
[c] Level of service.
[d] Average/95th percentile queue length in feet per lane (assuming 25 feet per vehicle).

TABLE 5 (continued)
Intersection Capacity Analysis Summary

Intersection/Peak Hour/Lane Group	2020 Existing				2030 No-Build				2030 Build				2030 Build Mitigated Alt 1				2030 Build Mitigated Alt 2			
	V/C [a]	Del. [b]	LOS [c]	Queue [d]	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue
Gould Street at Wingate Driveway / Site South Driveway																				
Weekday AM:																				
Wingate Driveway EB	0.01	10.1	B	--/<25	0.01	10.1	B	--/<25	0.01	10.0	B	--/<25	0.00	43.9	D	<25/<25	0.00	43.9	D	<25/<25
Site Driveway WB left/through	0.08	17.9	C	--/<25	0.09	18.6	C	--/<25	0.30	38.2	E	--/30	-	-	-	-	-	-	-	-
Site Driveway WB right	0.02	10.4	B	--/<25	0.03	10.6	B	--/<25	0.01	13.1	B	--/<25	-	-	-	-	-	-	-	-
Site Driveway WB left	-	-	-	-	-	-	-	-	-	-	-	-	0.30	43.0	D	<25/41	0.30	41.1	D	<25/50
Site Driveway WB left/through/right	-	-	-	-	-	-	-	-	-	-	-	-	0.02	40.5	D	<25/<25	0.02	39.0	D	<25/<25
Gould Street NB approach	0.02	8.0	A	--/<25	0.02	8.0	A	--/<25	0.02	8.0	A	--/<25	-	-	-	-	-	-	-	-
Gould Street NB left/through	-	-	-	-	-	-	-	-	-	-	-	-	0.34	3.0	A	49/117	0.25	3.1	A	33/74
Gould Street NB right	-	-	-	-	-	-	-	-	-	-	-	-	0.28	3.9	A	<25/<25	0.37	6.3	A	<25/28
Gould Street SB approach	0.02	8.1	A	--/<25	0.02	8.2	A	--/<25	0.08	10.2	B	--/<25	0.17	3.0	A	<25/56	-	-	-	-
Gould Street SB left	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.332	4.8	A	25/99
Gould Street SB through/right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.22	3.8	A	29/101
Overall Intersection	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.34**	**4.9**	**A**	**--/--**	**0.36**	**6.5**	**A**	**--/--**
Weekday PM:																				
Wingate Driveway EB	0.08	13.7	B	--/<25	0.07	13.8	B	--/<25	0.08	15.7	C	--/<25	0.02	41.6	D	<25/<25	0.02	41.6	D	<25/<25
Site Driveway WB left/through	0.21	26.6	D	--/<25	0.19	27.4	D	--/<25	>2.00	>999.9	F	--/>999	-	-	-	-	-	-	-	-
Site Driveway WB right	0.03	9.7	A	--/<25	0.03	9.9	A	--/<25	0.11	11.0	B	--/<25	-	-	-	-	-	-	-	-
Site Driveway WB left	-	-	-	-	-	-	-	-	-	-	-	-	0.72	36.1	D	167/232	0.85	41.9	D	234/404
Site Driveway WB left/through/right	-	-	-	-	-	-	-	-	-	-	-	-	0.68	34.4	C	150/214	0.77	35.1	D	201/331
Gould Street NB approach	0.01	9.0	A	--/<25	0.01	9.1	A	--/<25	0.01	9.6	A	--/<25	-	-	-	-	-	-	-	-
Gould Street NB left/through	-	-	-	-	-	-	-	-	-	-	-	-	0.31	11.3	B	77/179	0.28	13.8	B	77/114
Gould Street NB right	-	-	-	-	-	-	-	-	-	-	-	-	0.09	9.1	A	<25/<25	0.13	18.0	B	<25/<25
Gould Street SB approach	0.00	7.8	A	--/<25	0.01	7.8	A	--/<25	0.01	8.3	A	--/<25	0.48	13.9	B	161/255	-	-	-	-
Gould Street SB left	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.12	13.1	B	<25/44
Gould Street SB through/right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.73	23.8	C	324/481
Overall Intersection	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.53**	**20.2**	**C**	**--/--**	**0.74**	**28.1**	**C**	**--/--**

[a] Volume-to-capacity ratio.
[b] Average control delay in seconds per vehicle.
[c] Level of service.
[d] Average/95th percentile queue length in feet per lane (assuming 25 feet per vehicle).

TABLE 5 (continued)
Intersection Capacity Analysis Summary

Intersection/Peak Hour/Lane Group	2020 Existing				2030 No-Build				2030 Build				2030 Build Mitigated Alt 1				2030 Build Mitigated Alt 2			
	V/C [a]	Del. [b]	LOS [c]	Queue [d]	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue
Gould Street at TV Place																				
Weekday AM:																				
TV Place WB approach	0.08	13.3	B	--/<25	0.07	14.0	B	--/<25	0.12	20.8	C	--/<25	-	-	-	-	-	-	-	-
TV Place WB left	-	-	-	-	-	-	-	-	-	-	-	-	0.08	26.2	D	--/<25	-	-	-	-
TV Place WB right	-	-	-	-	-	-	-	-	-	-	-	-	0.03	10.9	B	--/<25	0.02	10.9	B	--/<25
Gould Street SB approach	0.02	8.2	A	--/<25	0.02	8.4	A	--/<25	0.19	9.4	A	--/<25	0.19	9.4	A	--/<25	-	-	-	-
Weekday PM:																				
TV Place WB approach	0.15	16.8	C	--/<25	0.13	15.1	C	--/<25	1.02	82.3	F	--/315	-	-	-	-	-	-	-	-
TV Place WB left	-	-	-	-	-	-	-	-	-	-	-	-	0.66	41.2	E	--/108	-	-	-	-
TV Place WB right	-	-	-	-	-	-	-	-	-	-	-	-	0.31	12.2	B	--/33	0.23	12.1	B	--/<25
Gould Street SB approach	0.01	7.9	A	--/<25	0.01	7.9	A	--/<25	0.04	8.1	A	--/<25	0.04	8.1	A	--/<25	-	-	-	-
Gould Street at Kearney Road																				
Weekday AM:																				
Kearney Road WB approach	0.11	13.9	B	--/<25	0.10	14.0	B	--/<25	0.13	16.7	C	--/<25	N/A				N/A			
Gould Street SB approach	0.02	7.9	A	--/<25	0.02	8.0	A	--/<25	0.02	8.0	A	--/<25								
Weekday PM:																				
Kearney Road WB approach	0.30	16.5	C	--/33	0.27	15.0	C	--/28	0.38	22.0	D	--/45	N/A				N/A			
Gould Street SB approach	0.01	7.8	A	--/<25	0.01	7.8	A	--/<25	0.01	8.5	A	--/<25								
Gould Street at Ellis Street																				
Weekday AM:																				
Driveway EB approach	0.02	14.7	B	--/<25	0.01	14.4	B	--/<25	0.02	17.6	C	--/<25	N/A				N/A			
Ellis Street WB approach	0.05	13.8	B	--/<25	0.04	13.6	B	--/<25	0.05	16.3	C	--/<25								
Gould Street NB approach	0.00	8.0	A	--/<25	0.00	8.0	A	--/<25	0.00	8.6	A	--/<25								
Gould Street SB approach	0.01	7.8	A	--/<25	0.01	7.8	A	--/<25	0.01	7.8	A	--/<25								
Weekday PM:																				
Driveway EB approach	0.01	13.7	B	--/<25	0.00	12.7	B	--/<25	0.00	16.8	C	--/<25	N/A				N/A			
Ellis Street WB approach	0.16	15.0	C	--/<25	0.13	13.7	B	--/<25	0.22	19.3	C	--/<25								
Gould Street NB approach	0.00	0.0	A	--/<25	0.00	0.0	A	--/<25	0.00	0.0	A	--/<25								
Gould Street SB approach	0.00	7.8	A	--/<25	0.00	7.8	A	--/<25	0.00	8.3	A	--/<25								

[a] Volume-to-capacity ratio.
[b] Average control delay in seconds per vehicle.
[c] Level of service.
[d] Average/95th percentile queue length in feet per lane (assuming 25 feet per vehicle).

CONCLUSIONS

Existing and future conditions in the study area have been described, analyzed, and evaluated with respect to traffic operations and the impact of the proposed redevelopment. Conclusions of this effort are presented below.

- The existing site currently contains Muzi Motors and Channel 5. Access to the site is currently provided via a right-in/right-out driveway on Highland Avenue and two full-access/egress driveways on Gould Street. As part of the redevelopment, the existing uses on site would be razed to construct approximately 368,200 SF of corporate headquarters space, 368,200 SF of R&D space, and 129,950 SF of retail space. The right-in/right-out driveway on Highland Avenue would be closed as part of the redevelopment, and the two driveways on Gould Street would be maintained in some fashion or possibly combined to form a new signalized intersection.

- The proposed redevelopment is expected to generate 620 *additional new* vehicle trips (625 entering and -5 exiting) during the weekday AM peak hour, and 869 *additional new* vehicle trips (126 entering and 743 exiting) during the weekday PM peak hour.

- The Town of Needham also requested that GPI prepare a trip generation estimate for an alternative development build-out that consists of approximately 226 residential apartment units, ±259,130 SF of corporate office space, ±259,130 SF of R&D space, and ±91,460 SF of ancillary retail space. The proposed residential alternative build-out is anticipated to generate 129 to 292 fewer external vehicle trips than the proposed office/R&D build-out.

- While no credit was applied for public transit, walking, or biking trips to/from the site, GPI recommends that the developer implement a comprehensive Transportation Demand Management (TDM) program to encourage the use of public transit, walking and biking, and reduce single-occupancy vehicle trips to the site.

- ***Central Avenue / Gould Street –*** Traffic exiting Gould Street onto Central Avenue currently experiences long delays and queues that will be exacerbated as traffic volumes continue to grow in the area. This movement currently operates well over capacity, with a V/C ratio of 2.54 during the weekday PM peak hour. Limited right-of-way exists to widen either Central Avenue or Gould Street to provide additional capacity. In addition, utilities, stone walls, and homes are located close to the roadway, further limiting the ability for widening. Since the potential developer of the Muzi/Channel 5 property would not have the power to acquire right-of-way, the following options could potentially be implemented to mitigate the project impacts, however, operations under the 2030 Build will still be worse than the 2030 No Build.

    - The traffic volumes through this intersection currently exceed the warranting conditions for installation of a traffic signal. Therefore, regardless of the Muzi/Channel 5 site redevelopment, the Town may wish to consider installation of a fully-actuated traffic-control signal at this intersection to reduce existing delay and mitigate the impacts of the proposed redevelopment. The installation of traffic signal equipment at the intersection may require signal easements from adjacent properties. It is anticipated that the installation of traffic signal equipment at the intersection may require approximately 695 SF for signal easements from adjacent properties, approximately 250 SF for sidewalk easements, the relocation of a utility pole at the southeast corner of the intersection, and the potential acquisition of the #152 Central Avenue property. With the potential redevelopment of the site, this may present an opportunity to work with the site developer to share the costs of construction.

- In addition, GPI recommends minor roadway widening and restriping along Central Avenue to provide an 11-foot westbound left-turn lane, an 11-foot westbound through lane, and a 12-foot eastbound shared through/right-turn lane, with 5.5-foot sidewalks in either direction. Construction of these improvements will eliminate the existing 5-foot bicycle accommodating shoulders. However, any further widening to maintain the shoulders would require the acquisition of right-of-way and potential complete property takings that would be outside of the developer's capacity to construct.

With implementation of the improvements described above, all movements at this intersection will operate at acceptable levels of service (LOS D or better) during the weekday PM peak hour. Although traffic exiting Gould Street will continue to operate at LOS F during the weekday AM peak hour, the V/C ratio will be reduced below 1.00, indicating there will be adequate capacity to accommodate the anticipated traffic volumes. In addition, the volume of traffic on this movement is low during the weekday AM peak hour.

Additional widening to provide dedicated turning lanes on Gould Street or Central Avenue eastbound is required to further reduce the delay on this approach in the morning. This widening would necessitate acquisition of additional right-of-way, as well as significant relocation of utilities near the intersection. Therefore, the Town should consider developing a Town-funded project to implement additional turning lanes as a means of increasing capacity at this location to accommodate existing traffic volumes and future development in the surrounding area. The Town can request a fair-share contribution toward the design and/or construction of these improvements from the developer, proportional to the percentage increase in trips generated by the project through the intersection.

- ***Highland Avenue / Gould Street / Hunting Road*** – All movements at the Highland Avenue / Gould Street / Hunting Road intersection currently operate under capacity (V/C less than 1.00) and at LOS E or better. A roadway improvement project is underway by MassDOT to enhance intersection safety and pedestrian and bicycle accommodations, and optimize the operation of the intersection. While this project is not expected to significantly increase the capacity of the intersection as no additional lanes are being added, the project will reallocate the green time at the traffic signal to optimize the intersection operations. As shown in the analysis of the 2023 with MassDOT Improvements conditions, the proposed improvements will result in slight decreases in the overall intersection delay and decreases in delay on individual movements of up to 21 seconds. MassDOT's project will also improve the level-of-service to LOS D or better for nearly all movements.

  All movements at this intersection are anticipated to operate under capacity (V/C less than 1.00) and at LOS E or better under 2030 No-Build conditions. Although the MassDOT improvements have been included in the analysis of the 2020 No-Build condition, the 2030 No-Build conditions do not reflect any improvement in operations from the MassDOT improvements as the 1 percent background growth will utilize the limited additional capacity created by the signal timing optimization. With the additional traffic generated by the proposed redevelopment, the overall intersection will operate over capacity at LOS F with several movements operating at LOS E or F. To mitigate the impacts of the proposed redevelopment, GPI recommends widening of Highland Avenue to provide a dedicated right-turn lane from Highland Avenue westbound onto Gould Street, which would be channelized and signalized as part of the intersection. This would require analysis of the weaving condition between the I-95 SB Off-Ramp and the channelized right-turn to ensure proper spacing exists between the intersections to provide an efficient and safe weaving condition. In addition, GPI recommends widening the Gould Street southbound approach to provide two dedicated left-turn lanes, a through lane, and a dedicated right-turn lane. Note that all widening along Gould Street and Highland Avenue would occur along the site-side of the roadway, which will likely require a significant donation of property from the developer and may impact the square

footage of the areas used for trip generation. In order to manage queues and traffic flows between this intersection and the South Site Driveway, GPI recommends implementing a coordinated signal system between these two intersections. With implementation of the improvements described above, the operations of the Highland Avenue / Gould Street / Hunting Road intersection will be restored to nearly No-Build conditions during the weekday AM peak hour and better than No-Build conditions during the weekday PM peak hour. All movements will operate below capacity at LOS E or better.

- ***Gould Street / Site Driveway Intersections*** – Under the existing geometric configuration of the two site driveways, traffic exiting both site driveways is expected to operate over capacity at LOS F with long delays and queues, particularly during the weekday PM peak hour. GPI evaluated the impacts of implementing two alternative mitigation scenarios to reduce the delay and queues at the site driveways. Alternative 1 involves maintaining both full-access/egress driveways and providing enhancements at both driveways to improve traffic operations. Alternative 2 consists of consolidating the driveways into a single, signalized driveway at approximately the location of the South Site Driveway and providing a right-out-only driveway at the northerly end of the site. With either of these alternatives, the traffic volumes through the Gould Street / Wingate Driveway / South Site Driveway intersection would exceed the warranting conditions for installation of a traffic signal. Therefore, GPI recommends installation of a fully-actuated traffic-control signal, which would operate as part of a coordinated signal system with the existing signal at Highland Avenue / Gould Street / Hunting Road. The geometric enhancements included as part of each alternative are described below.

  - **Alternative 1 (Maintain Two Driveways):**
    - *Gould Street / Wingate Driveway / South Site Driveway*
      - Widen South Site Driveway to provide exclusive left-turn lane and shared left/through/right-lane;
      - Widen Gould Street northbound to provide a shared left-turn/through lane and an exclusive right-turn lane;
      - Widen Gould Street southbound to provide two general purpose travel lanes; and
      - It is anticipated that the installation of traffic signal equipment at the Highland Avenue / Gould Street / Hunting Road intersection and the need for roadway widening to provide additional turn lanes and sidewalk construction will require the acquisition of approximately 13,050 SF of the Muzi Motors property which inter would reduce the total square footage available to be developed.
      - A 725 SF signal easement will be required on the site for the placement of traffic signal equipment.
    - *Gould Street / TV Place (North Site Driveway)*
      - Widen North Site Driveway to provide exclusive left-turn lane and exclusive right-turn lane;
      - Widen Gould Street northbound to provide a through lane and an exclusive right-turn lane;
      - Widen Gould Street southbound to provide an exclusive left-turn lane and a through lane; and
      - It is anticipated that the need for roadway widening will require the acquisition of approximately 3,750 SF of the Muzi Motors property which inter would reduce the total square footage available to be developed.

- **Alternative 2 (Consolidate Driveways):**
  - *Gould Street / Wingate Driveway / South Site Driveway*
    - Widen South Site Driveway to provide exclusive left-turn lane and shared left/through/right-lane;
    - Widen Gould Street northbound to provide a shared left-turn/through lane and an exclusive channelized right-turn lane;
    - Widen Gould Street southbound to provide an exclusive left-turn lane and a shared through/right-turn lane; and
    - It is anticipated that the installation of traffic signal equipment at the Highland Avenue / Gould Street / Hunting Road intersection and the need for roadway widening to provide additional turn lanes and sidewalk construction will require the acquisition of approximately 9,250 SF of the Muzi Motors property which inter would reduce the total square footage available to be developed.
    - A 665 SF signal easement will be required on the site for the placement of traffic signal equipment.
  - *Gould Street / TV Place (North Site Driveway)*
    - Reconstruct the North Site Driveway to a right-out-only driveway with a single channelized lane to enforce the turn restriction; and
    - It is not anticipated that property acquisition will be required at this intersection as part of Alternative 2.

  With implementation of either Alternative 1 or 2, all movements at the Gould Street / Wingate Driveway / South Site Driveway will operate at acceptable levels of service (LOS D or better) during the weekday AM and PM peak hours. While all movements at the Gould Street / North Site Driveway intersection will operate at LOS B or better under Alternative 2 (Consolidated Driveways), traffic exiting the North Site Driveway will operate at LOS E during the weekday PM peak hour under Alternative 1 (Maintain Two Driveways). In addition, less than 250 feet of vehicle stacking separates the two intersections and queues on Gould Street southbound may occasionally extend from the signalized intersection of Gould Street / Wingate Driveway / South Site Driveway beyond the North Site Driveway, resulting in additional difficulty and delay exiting this driveway. Therefore, GPI recommends consolidation of the two driveways into a single, signalized location as described by Alternative 2.

- All movements at the remaining study area intersections are anticipated to operate at acceptable levels of service (LOS D or better) with queues not exceeding two vehicles under all analysis conditions. The additional traffic generated by the proposed redevelopment is not anticipated to increase delay on any movement through any of these intersections by more than ten seconds per vehicle or increase queues by more than one vehicle. This level of traffic impact does not warrant any project-specific mitigation.

- APPENDIX

- ***Public Transportation Information***
- ***Traffic Count Data***
- ***Crash Rate Worksheets***
- ***Trip Generation Calculations***
- ***Trip Generation Comparison – Residential Build-Out***
- ***Trip Distribution Calculations***
- ***Signal Warrant Analysis Worksheets***
- ***Capacity Analysis Methodology***
- ***Capacity and Queue Analysis Worksheets***

PUBLIC TRANSPORTATION INFORMATION

NEEDHAM LINE

Summer 2020 schedule, effective June 22, 2020

Monday to Friday

Inbound to Boston

ZONE	STATION	TRAIN #	AM						PM								
	Bikes Allowed		600	7602	7606	608	610	612	614	616	618	7620	7622	7624	626	628	630
2	Needham Heights	♿	6:05	7:00	7:53	8:45	10:05	11:05	12:50	2:50	3:55	5:08	5:58	6:47	7:50	8:37	10:02
2	Needham Center	♿	6:09	7:04	7:57	8:49	10:09	11:09	12:54	2:54	3:59	f 5:12	6:02	6:51	7:54	8:41	10:06
2	Needham Junction	♿	6:14	7:09	8:02	8:54	10:13	11:13	12:58	2:58	4:03	-	6:06	6:55	7:58	8:45	10:10
2	Hersey	♿	6:17	7:12	8:05	8:57	10:16	11:16	1:01	3:01	-	-	-	6:58	8:03	8:48	10:13
1	West Roxbury	♿	6:23	7:18	8:11	9:03	10:21	11:21	1:06	3:06	4:09	5:24	6:14	7:07	8:08	8:53	10:23
1	Highland	♿	6:26	7:21	8:14	9:06	10:23	11:23	1:08	3:08	-	5:26	-	7:09	8:10	8:55	10:25
1	Bellevue	♿	6:30	7:25	8:17	9:10	10:25	11:25	1:10	3:10	-	5:28	-	7:11	8:12	8:57	10:27
1	Roslindale Village	♿	6:33	7:28	8:20	9:13	10:28	11:28	1:13	3:13	-	5:31	-	7:14	8:15	9:00	10:30
1A	Forest Hills	♿	6:36	7:31	8:24	9:16	10:31	11:31	1:16	3:16	-	5:34	-	7:19	8:18	9:03	10:33
1A	Ruggles	♿	L 6:41	L 7:36	L 8:29	L 9:21	L 10:36	L 11:36	L 1:21	-	-	-	-	-	L 8:23	L 9:08	L 10:38
1A	Back Bay	♿	L 6:45	L 7:40	L 8:33	L 9:25	L 10:40	L 11:40	L 1:25	L 3:24	L 4:25	L 5:48	L 6:31	L 7:27	L 8:27	L 9:12	L 10:42
1A	South Station	♿	6:50	7:45	8:39	9:30	10:45	11:45	1:30	3:29	4:30	5:53	6:36	7:32	8:32	9:17	10:47

Trains in purple box indicate peak period trains.

Monday to Friday

Outbound from Boston

ZONE	STATION	TRAIN #	AM					PM									
	Bikes Allowed		7601	7603	605	607	609	611	613	615	7617	7619	623	625	627	629	631
1A	South Station	♿	6:47	7:42	9:05	9:53	11:50	1:52	3:00	4:05	4:53	5:42	6:36	7:30	8:50	9:50	11:20
1A	Back Bay	♿	6:52	7:47	9:10	9:58	11:55	1:57	3:05	4:10	4:58	5:47	6:41	7:35	8:55	9:55	11:25
1A	Ruggles	♿	-	-	-	10:02	11:59	2:01	3:09	4:14	5:02	5:51	6:45	7:39	8:59	9:59	11:29
1A	Forest Hills	♿	6:59	-	9:18	10:08	12:05	2:07	3:15	4:20	5:08	5:57	6:51	7:45	9:05	10:05	11:35
1	Roslindale Village	♿	7:02	-	9:21	10:11	12:08	2:10	3:18	4:25	5:13	6:02	6:56	7:48	9:08	10:08	11:38
1	Bellevue	♿	7:05	-	9:24	10:14	12:11	2:13	3:21	4:28	5:16	6:06	6:59	7:51	9:11	10:11	11:41
1	Highland	♿	7:07	-	9:26	10:16	12:13	2:15	3:23	4:30	5:18	6:08	7:01	7:53	9:13	10:13	11:43
1	West Roxbury	♿	7:09	8:01	9:29	10:18	12:15	2:17	3:25	4:32	5:20	6:10	7:03	7:55	9:15	10:15	11:45
2	Hersey	♿	7:19	-	9:34	10:25	12:20	2:22	3:30	4:37	5:26	6:16	7:08	8:00	9:20	10:20	11:50
2	Needham Junction	♿	7:22	8:17	9:36	10:28	12:23	2:25	3:34	4:41	5:30	6:20	7:12	8:03	9:23	10:23	11:53
2	Needham Center	♿	7:25	L 8:20	9:39	10:31	12:26	2:28	3:37	4:44	5:33	6:23	7:15	8:06	9:26	10:26	11:56
2	Needham Heights	♿	7:31	8:24	9:43	10:35	12:30	2:33	3:42	4:49	5:38	6:29	7:20	8:10	9:30	10:30	12:00

Trains in purple box indicate peak period trains.

Saturday (NO SERVICE ON SUNDAY)

Inbound to Boston

ZONE	STATION	TRAIN #	AM		PM						
	Bikes Allowed		1602	1604	1606	1608	1610	1612	1614	1616	1618
2	Needham Heights	♿	8:05	10:05	12:05	2:05	4:05	6:05	8:05	10:05	11:40
2	Needham Center	♿	8:10	10:10	12:10	2:10	4:10	6:10	8:10	10:10	-
2	Needham Junction	♿	8:13	10:13	12:13	2:13	4:13	6:13	8:13	10:13	-
2	Hersey	♿	8:16	10:16	12:16	2:16	4:16	6:16	8:16	10:16	-
1	West Roxbury	♿	8:21	10:21	12:21	2:21	4:21	6:21	8:21	10:21	-
1	Highland	♿	8:23	10:23	12:23	2:23	4:23	6:23	8:23	10:23	-
1	Bellevue	♿	8:25	10:25	12:25	2:25	4:25	6:25	8:25	10:25	-
1	Roslindale Village	♿	8:27	10:27	12:27	2:27	4:27	6:27	8:27	10:27	-
1A	Forest Hills	♿	8:31	10:31	12:31	2:31	4:31	6:31	8:31	10:31	-
1A	Ruggles	♿	L 8:35	L 10:35	L 12:35	L 2:35	L 4:35	L 6:35	L 8:35	L 10:35	-
1A	Back Bay	♿	L 8:39	L 10:39	L 12:39	L 2:39	L 4:39	L 6:39	L 8:39	L 10:39	L 12:00
1A	South Station	♿	8:44	10:44	12:44	2:44	4:44	6:44	8:44	10:44	12:05

Saturday (NO SERVICE ON SUNDAY)

Outbound from Boston

ZONE	STATION	TRAIN #	AM			PM					
	Bikes Allowed		1601	1603	1605	1607	1609	1611	1613	1615	1617
1A	South Station	♿	7:10	9:10	11:10	1:10	3:10	5:10	7:10	9:10	10:45
1A	Back Bay	♿	7:15	9:15	11:15	1:15	3:15	5:15	7:15	9:15	10:50
1A	Ruggles	♿	7:18	9:18	11:18	1:18	3:18	5:18	7:18	9:18	10:54
1A	Forest Hills	♿	7:24	9:24	11:24	1:24	3:24	5:24	7:24	9:24	11:00
1	Roslindale Village	♿	7:28	9:28	11:28	1:28	3:28	5:28	7:28	9:28	11:03
1	Bellevue	♿	7:30	9:30	11:30	1:30	3:30	5:30	7:30	9:30	11:06
1	Highland	♿	7:33	9:33	11:33	1:33	3:33	5:33	7:33	9:33	11:08
1	West Roxbury	♿	7:35	9:35	11:35	1:35	3:35	5:35	7:35	9:35	11:10
2	Hersey	♿	7:39	9:39	11:39	1:39	3:39	5:39	7:39	9:39	11:15
2	Needham Junction	♿	7:42	9:42	11:42	1:42	3:42	5:42	7:42	9:42	11:18
2	Needham Center	♿	7:46	9:46	11:46	1:46	3:46	5:46	7:46	9:46	11:21
2	Needham Heights	♿	7:50	9:50	11:50	1:50	3:50	5:50	7:50	9:50	11:25

Keep in Mind:

This schedule will be effective from June 22, 2020 and will replace the schedule of October 21, 2019

Presidents' Day and 4th of July operate on a **Saturday service schedule.**

New Year's Day, Memorial Day, Labor Day, Thanksgiving Day, and Christmas Day operate on a **Sunday service schedule**.

For all other holiday schedules, please check MBTA.com/holidays or call 617-222-3200.

For the latest information regarding weekend disruptions, visit MBTA.com/weekend.

For additional service to Ruggles Station, refer to the Providence and Franklin Line schedules for particular trains.

Times in purple with "f" indicate a flag stop: Passengers must tell the conductor that they wish to leave. Passengers waiting to board must be visible on the platform for the train to stop.

Times in blue indicate an early departure (L stop): The train may leave ahead of schedule at these stops.

Bikes: Bicycles are allowed on trains with the bicycle symbol shown below the train number.

High level platform and bridge plate available. Visit mbta.com/accessibility for more information.

mbta.com/ridesafer

Face coverings are required

Buy tickets with mTicket

Wash hands before and after riding

Socially distance whenever possible

Massachusetts Bay Transportation Authority

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AD062220V1

Needham

Connecting Newton Highlands Green Line station to the Needham Crossing area

Temporary Schedule Effective Date: 06-08-2020

Seating limited for physical distancing.

Follow protocols below to request an assigned seat.

This shuttle operates **Monday-Friday only**.

All times are approximate. **Arrive 5+ minutes early**.

For an accessible (lift-equipped) bus, contact us 24+ hours in advance.

AM

BUS NUMBER	001
DEPART CORNER OF LINCOLN & WALNUT Newton Highlands Pickup Location	**see below**
ARRIVE 320 NEEDHAM ST The Bulfinch Companies	**see below**
ARRIVE 152 SECOND AVE Atrius Health	**see below**
ARRIVE 254 SECOND AVE 254 Second Ave	**see below**
ARRIVE 75 SECOND AVE The Bulfinch Companies	**see below**
ARRIVE 50 CABOT ST Direct Federal Credit Union	**see below**
ARRIVE 200 FIRST AVE Homewood Suites	**see below**
ARRIVE 250 FIRST AVE The Bulfinch Companies	**see below**

BUS NUMBER	001
ARRIVE 189 B ST NBC Universal	**see below**
ARRIVE 89 A ST MCPF-Needham, LLC	**see below**
ARRIVE 110 A ST Intex	**see below**
ARRIVE 63 KENDRICK ST Charles River Place	**see below**
ARRIVE 117 KENDRICK ST The Bulfinch Companies	**see below**
ARRIVE 140 KENDRICK ST Boston Properties	**see below**

Needham

Connecting Newton Highlands Green Line station to the Needham Crossing area

Temporary Schedule Effective Date: 06-08-2020

Seating limited for physical distancing.

Follow protocols below to request an assigned seat.

This shuttle operates **Monday-Friday only**.

All times are approximate. **Arrive 5+ minutes early**.

For an accessible (lift-equipped) bus, contact us 24+ hours in advance.

PM

BUS NUMBER	001
DEPART 63 KENDRICK ST Charles River Place	**see below**
DEPART 117 KENDRICK ST The Bulfinch Companies	**see below**
DEPART 140 KENDRICK ST Boston Properties	**see below**
DEPART 89 A ST MCPF-Needham, LLC	**see below**
DEPART 189 B ST NBC Universal	**see below**
DEPART 110 A ST Intex	**see below**
DEPART 250 FIRST AVE The Bulfinch Companies	**see below**
DEPART 200 FIRST AVE Homewood Suites	**see below**

BUS NUMBER	001
DEPART 50 CABOT ST Direct Federal Credit Union	see below
DEPART 75 SECOND AVE The Bulfinch Companies	see below
DEPART 152 SECOND AVE Atrius Health	see below
DEPART 254 SECOND AVE 254 Second Ave	see below
DEPART 320 NEEDHAM ST The Bulfinch Companies	see below
ARRIVE NEWTON HIGHLANDS	see below

A.M. Departures

from Newton Highlands

7:30 AM	*last drop-off no later than*	**8:00 AM**
8:50 AM	*last drop-off no later than*	**9:25 AM**

Exact arrival times depend upon the stops needed by that day's riders.

No advance reservation needed for A.M. travel. The Shuttle Driver will assign you a seat immediately prior to departure from Newton Highlands.

P.M. Pickups

returning to Newton Highlands

trip begins	**4:00 PM**	*arrives at Alewife by approximately*	**4:30 PM**
trip begins	**5:15 PM**	*arrives at Alewife by approximately*	**5:50 PM**

Each afternoon/evening, shuttles will only stop at those sites for which riders have requested a pickup.

You can request pickup at one of these times between 5:00 AM EST and 12:00 PM (noon) EST.

In order to submit your request, fill out the form below. (This form is also available **here**.)

After you submit your request, you will receive an email from the 128BC team confirming your pickup time.

Download this temporary schedule and all Safe Shuttle Rider Protocols applicable to the Needham Shuttle (also listed below).

Request P.M. Pickup

Each afternoon/evening, 128 Business Council shuttles on multi-stop routes will only stop at those pickup sites for which riders have requested a pickup. **Evening pickup requests can only be made for the current day between 5:00 A.M. EST and 12:00 P.M. EST.** You do not need to use this form for A.M. travel.

How does the seat request process work?

What if I need to change my reservation?

Note: You cannot reserve more than one seat for a single evening. If you submit this request form multiple times in the same day, we will honor the last request submitted.

Shuttle Route (required)

Each shuttle is limited to eight riders to provide for safe physical distancing on board. If requests exceed this capacity, we will assign seats based on the order in which requests were received and may need to contact you about an alternate pickup time.

We need your contact information to follow up with you about your pickup request.

Rider Name (required)

Email (required)

Mobile Phone Number

Member Company

SUBMIT

COVID-19 Protocols

General Protocols

- **All 128BC/The Grid services will be fare-free until further notice.** We are working on developing contact-free methods of fare payment that will be safe for our riders and operators.
- **If telework is an option, consider staying home.** We can **work with your employer** to develop an office-wide telework plan, as well as other health & safety protocols.
- **If you are ill, definitely stay home.** Your Driver cannot assign a seat on the shuttle to anyone clearly displaying COVID-19 symptoms, including repeated coughing, difficulty breathing, blue lips or face, repeated shaking, or vomiting. You can find a complete list of symptoms associated with COVID-19 **here**.
- **Wear a mask to protect those around you**, including our drivers and other shuttle riders. You must wear a mask even if you feel healthy, as those with COVID-19 may experience little to no symptoms while still shedding infectious respiratory droplets.
- **Make sure your mask fits properly.** Your mask should fit snugly over the bridge of your nose and extend down under your chin, covering your mouth and nose completely. (**What does a properly fitting mask look like?**)
- **Do not let your mask hang below your nose, and do not wear it around your neck.** If you need to remove your mask, take it off completely and place it into a clean bag or container, isolated from other items. Improper use of a mask creates risk for cross-contamination.
- **Do not eat or drink in the waiting area or on the shuttle**, as this would require you to remove or compromise your mask.
- **Wash your hands frequently** throughout the day. Hand sanitizer is also available inside the entrance of each shuttle.

Morning Protocols

- **Needham Shuttle riders do not need to request a ride in the morning.** A seat will be assigned to you before you board the shuttle.
- **Head to the shuttle stop located on Walnut Street** after you arrive at Newton Highlands. The boarding area is curbside in front of a small park.
- **Find the bright green 6-foot distance sidewalk decals.** Feel feel to move around as needed to avoid foot traffic on Walnut Street, but return to one of these decals when you see your shuttle approaching.
- **Do not try to board early.** Your driver needs to exit the shuttle and assign each rider a seat prior to inviting each rider to board.
- **Remain standing on your green sidewalk decal as you check in with the driver.** The driver will ask for your destination and initials in order to create each trip's seat assignment list.
- **When invited by the Driver, go straight to your assigned seat.** If you are heading to the *last* stop, you will be asked to board first and assigned a seat at the back of the bus. If you are heading to the *first* stop, you will be asked to board last and assigned a seat at the front of the bus. (**What does the seating layout look like?**)
- **Do not stand up until it's your turn to exit.** We are working hard to maximize the space between riders and minimize riders having to pass one another in close quarters. Do your part by staying in your assigned seat and exercising patience when exiting the vehicle. (**Need help visualizing these boarding patterns?**)
- **Let the riders in front of you exit the bus first** when the shuttle pulls into your stop. The rider in the highest numbered seat (closest to the front) should exit first.
- **Allow more than 6 feet of space in the aisle** when following others off the vehicle. (**How far is 6 feet?**)

Evening Protocols

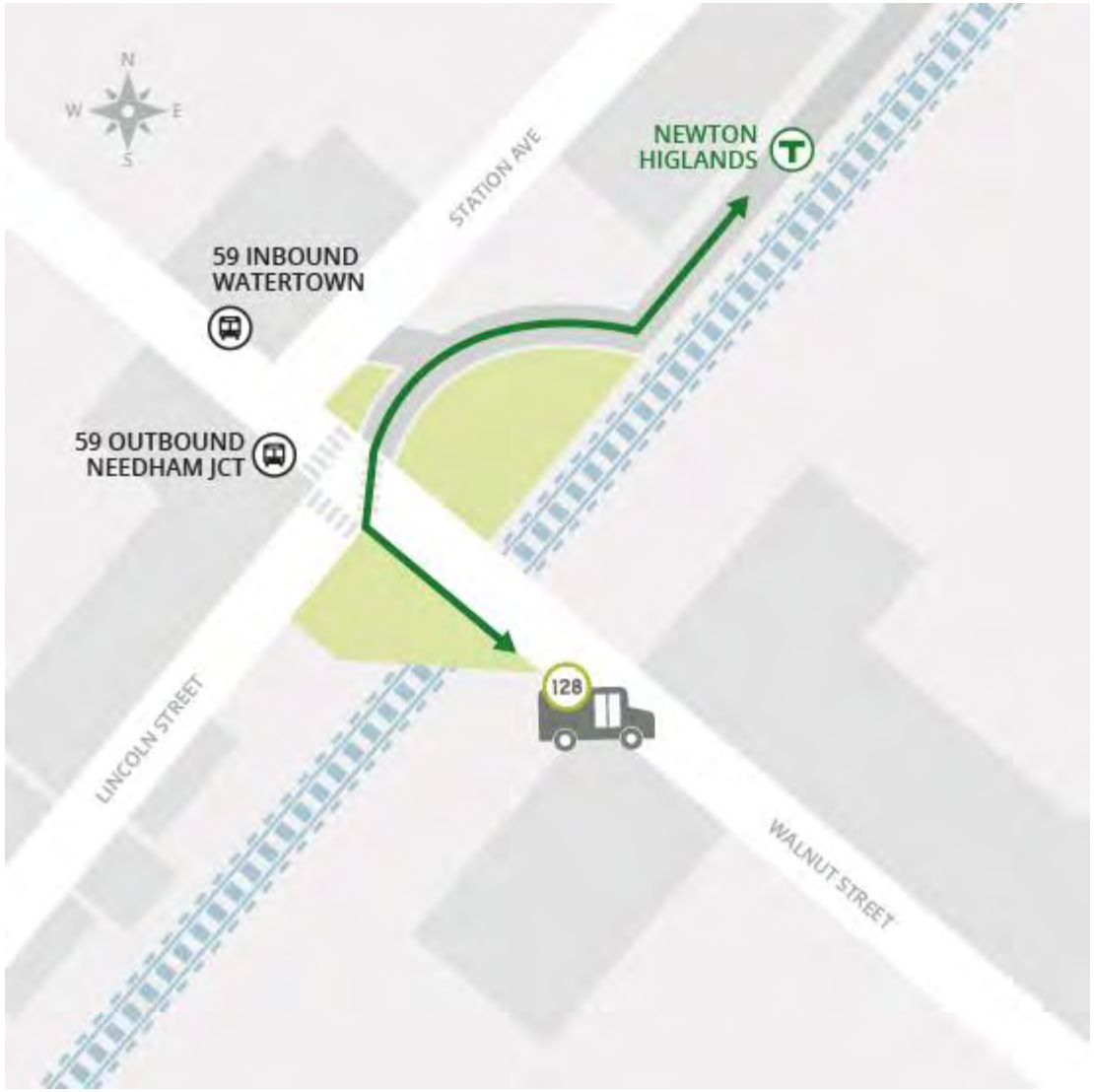
- **Do not forget to request a seat by 12:00 PM EST.** Each afternoon/evening, shuttles will

only stop at those sites for which riders have requested a pickup. **Afternoon/evening pickup requests** for the current day's pickups can be made beginning at 5:00 AM EST.

- **Arrive at least 5 minutes early** to the shuttle waiting area. Give yourself plenty of time so that you don't have to rush.
- **Maintain at least a 6-foot distance** from other waiting riders. For reference, six feet is a little more than the length of a bicycle and a little less than the length of a full-size bed. We can also work with your employer to demarcate 6-foot waiting areas as part of **creating a worksite health & safety plan**.
- **Do not approach the bus until the driver opens the door.** Once the driver opens the door, approach the bus one at a time, and exercise patience to avoid crowding other riders.
- **Go immediately to the lowest-numbered available seat**, as far to the back of the shuttle as possible. This will ensure that seats further forward are available to riders at later stops, eliminating the need for riders to pass one another in close quarters.
- **Do not stand up until it's your turn to exit.** We are working hard to maximize the space between riders and minimize riders having to pass one another in close quarters. Do your part by staying in your seat and exercising patience when exiting the vehicle.
- **Let the riders in front of you exit the bus first** when the shuttle pulls into the station. The rider in the highest numbered seat (closest to the front) should exit first.
- **Allow more than 6 feet of space in the aisle** when following others off the vehicle.

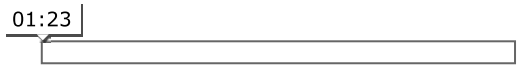
Learn more about all of our Safe Shuttle protocols.

Station Pickup Location



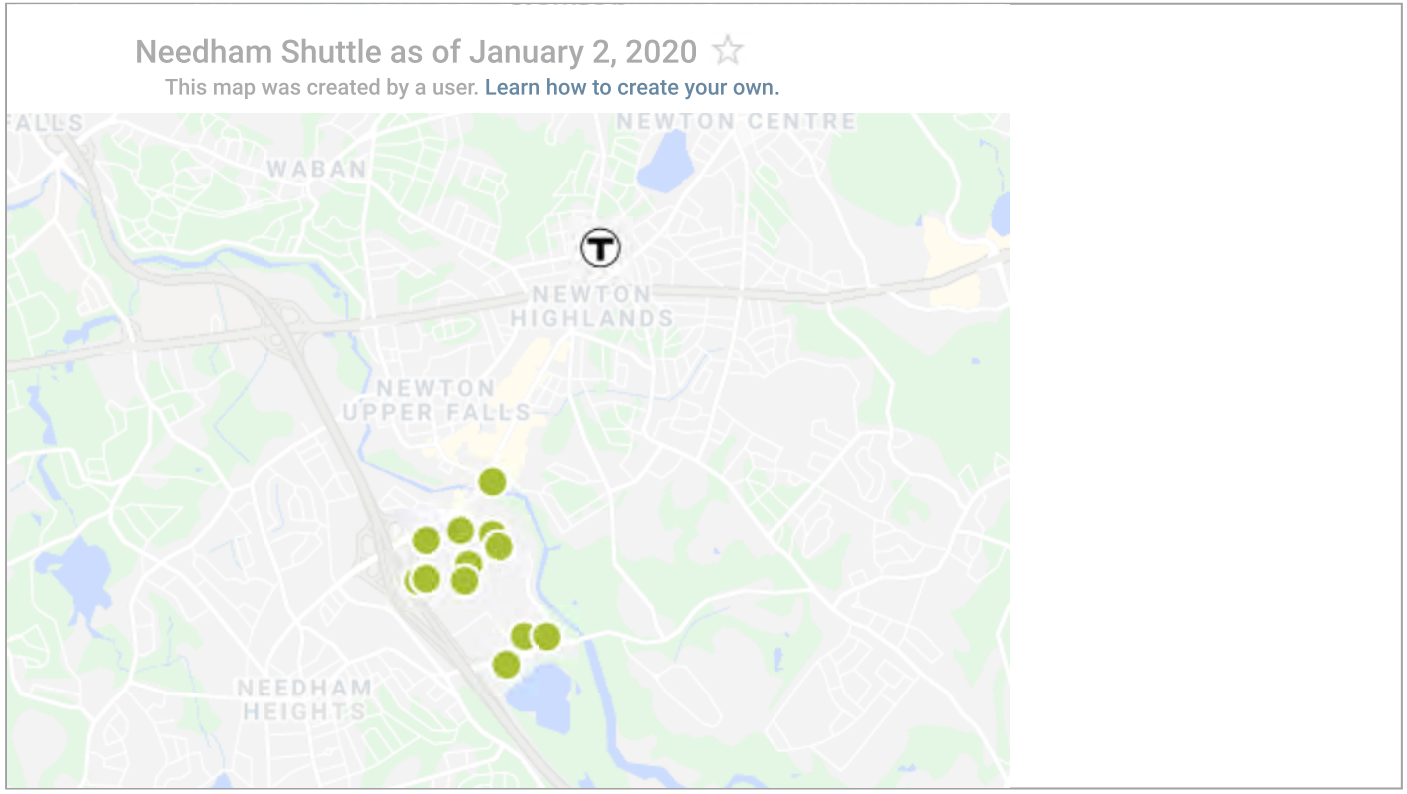
Newton Highlands Station Pickup Location – 128 Business Council

from **Unlock the Grid**

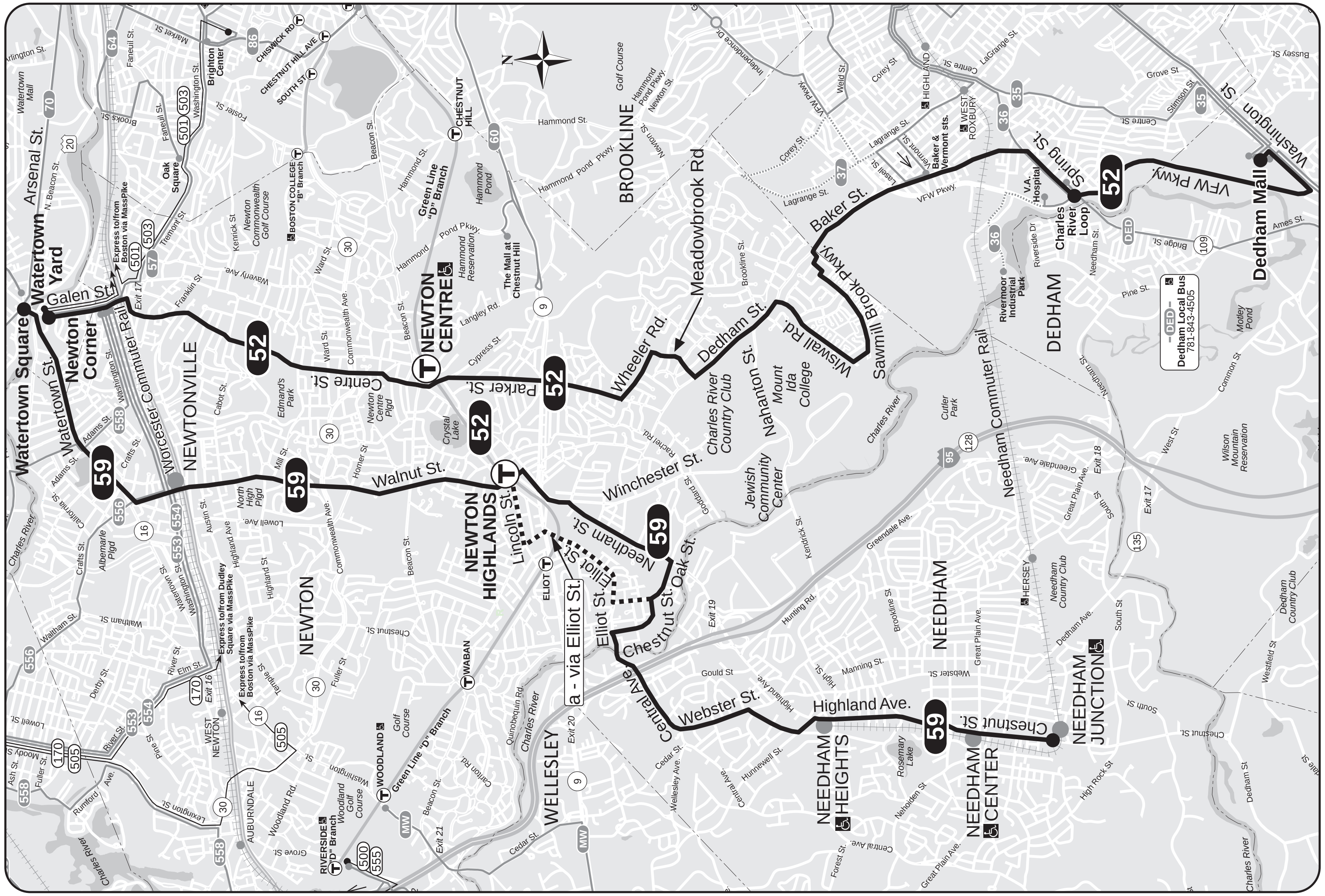


Service Area Map

All of the stops currently served by **Needham Shuttle** are shown in green below.
Click on any stop icon for address, member company, and route information.



Route 52 Dedham Mall - Watertown Yard
Route 59 Needham Junction - Watertown Square



Schedule Change

52•59

Effective August 30, 2020

52 Dedham Mall - Watertown Yard

59 Needham Junction-Watertown Square

Serving
- Newton Centre
- Oak Hill
- Newton Corner
- Jewish Community Center
- BC Law School
- Needham Center
- Needham Heights
- Newton Highlands
- Newtonville
- Green Line
- Needham Commuter Rail
- Worcester Commuter Rail

Massachusetts Bay Transportation Authority
massDOT Massachusetts Department of Transportation

Information 617-222-3200 • 1-800-392-6100
(TTY) 617-222-5146 • www.mbta.com

52 Weekday

Inbound				Outbound			
Leave Dedham Mall	Lv/Arrive Charles River	Arrive Newton Center	Arrive Watertown Yard	Leave Watertown Yard	Arrive Newton Center	Arrive Charles River	Arrive Dedham Mall
.....	6:15A	6:34A	6:45A	**7:00A**	**7:11A**	**7:38A**	**.....**
.....	6:45	7:08	7:22	**8:40**	**8:54**	**9:14**	**9:22A**
.....	7:45	8:12	8:29				
				s 2:57P	**3:11P**	**3:35P**	**3:45P**
.....	**2:36P**	**3:01P**	**3:18P**	**4:48**	**5:04**	**5:30**	**5:40**
4:00P	**4:04**	**4:28**	**4:41**	**6:35**	**6:44**	**7:06**	**.....**
5:50	**5:54**	**6:16**	**6:28**				

s - Does NOT run during school vacation

No Route 52 service on Saturday or Sunday

Route 52
Dedham Mall - Watertown Yard

59 Weekday

Inbound			Outbound		
Leave Needham Junction	Arrive Newton Highlands	Arrive Watertown Square	Leave Watertown Square	Arrive Newton Highlands	Arrive Needham Junction
6:20A	6:38A	6:55A	6:05A	6:18A	6:37A
6:50	7:09	7:30	6:35	6:48	7:07
a7:20	7:41	8:02	7:05	7:25	7:44
7:55	8:17	8:39	7:35	7:55	8:15
a 8:25	8:51	9:10	8:10	8:30	8:50
9:00	9:19	9:36	8:45	9:04	9:24
9:35	9:54	10:11	9:25	9:44	10:04
10:10	10:29	10:46	10:05	10:22	10:42
10:55	11:14	11:31	10:55	11:12	11:33
11:45	**12:04P**	**12:21P**	11:45	**12:02P**	**12:23P**
12:35P	**12:54**	**1:11**	**12:35P**	**12:52**	**1:13**
1:25	**1:44**	**2:01**	**1:25**	**1:42**	**2:03**
2:15	**2:34**	**2:51**	**2:10**	**2:27**	**2:52**
3:10	**3:33**	**3:56**	**3:00**	**3:20**	**3:45**
4:00	**4:22**	**4:44**	**3:50**	**4:10**	**4:35**
4:50	**5:13**	**5:33**	**a 4:30**	**4:50**	**5:14**
5:25	**5:48**	**6:08**	**5:05**	**5:28**	**5:53**
6:05	**6:28**	**6:46**	**a 5:45**	**6:08**	**6:32**
6:40	**6:58**	**7:16**	**6:25**	**6:42**	**7:05**
7:15	**7:31**	**7:46**	**7:00**	**7:16**	**7:39**
7:50	**8:07**	**8:22**			

a - Via Elliot St.

Route 59
Needham Junction- Watertown Square

59 Saturday

Inbound			Outbound		
Leave Needham Junction	Arrive Newton Highlands	Arrive Watertown Square	Leave Watertown Square	Arrive Newton Highlands	Arrive Needham Junction
7:05A	7:23A	7:36A	6:20A	6:35A	6:49A
8:35	8:55	9:10	7:50	8:05	8:22
10:05	10:28	10:45	9:20	9:35	9:56
11:36	**12:01P**	**12:18P**	10:50	11:05	11:30
1:10P	**1:35P**	**1:50P**	**12:22P**	**12:37P**	**1:02P**
2:40	**3:02**	**3:17**	**1:55**	**2:10**	**2:31**
4:10	**4:31**	**4:46**	**3:25**	**3:40**	**3:59**
5:40	**6:01**	**6:15**	**4:55**	**5:10**	**5:29**
7:05	**7:25**	**7:39**	**6:25**	**6:40**	**6:57**

59 Sunday

Inbound			Outbound		
Leave Needham Junction	Arrive Newton Highlands	Arrive Watertown Square	Leave Watertown Square	Arrive Newton Highlands	Arrive Needham Junction
7:50A	8:07A	8:20A	7:05A	7:17A	7:33A
9:20	9:39	9:53	8:35	8:47	9:05
10:50	11:09	11:23	10:05	10:18	10:38
			11:35	11:48	12:08
12:20P	**12:40P**	**12:56P**			
1:50	**2:08**	**2:24**	**1:05P**	**1:18P**	**1:38P**
3:20	**3:39**	**3:56**	**2:35**	**2:48**	**3:08**
4:50	**5:09**	**5:25**	**4:05**	**4:18**	**4:38**
6:20	**6:39**	**6:55**	**5:35**	**5:49**	**6:09**

All buses are accessible to persons with disabilities

Fare	Local Bus	Bus + Bus	Rapid Transit	Bus + Rapid Transit
CharlieCard	$1.70	$1.70	$2.40	$2.40
CharlieTicket	$2.00	$2.00	$2.90	$4.90
Cash-on-Board	$2.00	$4.00	$2.90	$4.90
Student/Youth*	$0.85	$0.85	$1.10	$1.10
Senior/TAP**	$0.85	$0.85	$1.10	$1.10

VALID PASSES: LinkPass ($90.00/mo.); Local Bus ($55/mo.); *Student/Youth LinkPass ($30.00/mo.); **Senior/TAP LinkPass ($30/mo.); and express bus, commuter rail, and boat passes.
FREE FARES: Children 11 and under ride free when accompanied by an adult; Blind Access CharlieCard holders ride free and if using a guide, the guide rides free.
* Requires Student CharlieCard or Youth CharlieCard. Student CharlieCards are available to students through participating middle schools and high schools. Youth CharlieCards are available through community partners in the Boston metro area. Visit www.mbta.com/youthpass for details.
** Requires Senior/TAP CharlieCard, available to Medicare cardholders, seniors 65+, and persons with disabilities.

Fall 2020 & Winter 2021 Holidays
9/7/20: Sunday; 10/12/20 & 11/11/20: Weekday
11/26/20, 12/25/20, & 1/1/21: Sun; 1/18/21 & 2/15/21: Sat

Fares

PRICE PER TRIP	Local Bus	Bus + Bus	Rapid Transit	Bus + Rapid Transit
CharlieCard	$1.70	$1.70	$2.40	$2.40
CharlieTicket	$2.00	$2.00	$2.90	$4.90***
Cash-on-Board	$2.00	$4.00	$2.90	$4.90***
Student/Youth*	$0.85	$0.85	$1.10	$1.10
Senior/TAP**	$0.85	$0.85	$1.10	$1.10
UNLIMITED TRIP PASSES				
1-Day	$12.75	$12.75	$12.75	$12.75
7-Day	$22.50	$22.50	$22.50	$22.50
Monthly	$55.00	$55.00	$90.00	$90.00
Senior/TAP Monthly	$30.00/month for unlimited travel on Local Bus and Rapid Transit			

VALID PASSES: LinkPass ($84.50/mo.); Student /Youth LinkPass* ($30/mo.) ; Senior/TAP LinkPass* ($30/mo.); and express bus, commuter rail, and boat passes.

FREE FARES: Children 11 and under ride free when accompanied by an adult; Blind Access CharlieCard holders ride free: if using a guide, the guide rides free

* Requires Student CharlieCard or Youth CharlieCard. Student CharlieCards are available to students through participating middle schools and high schools. Youth CharlieCards are available through community partners in the Boston metro area. Visit www.mbta.com/youthpass for details.

** Requires Senior/TAP CharlieCard, available to Medicare cardholders, seniors 65+, and persons with disabilities.

*** For Silver Line SL4 or SL5 pay $2.75. Also see "transfers."

TRANSFERS
If paying with a CharlieTicket or CharlieCard, discounted transfers that are available are automatic — just use the same ticket or card throughout your trip. If paying with cash onboard a vehicle, free transfers are only allowed between rapid transit lines and inside paid platform areas at gated stations.

SCHEDULES
Schedules are available at the following stations: Park Street, Airport, Malden, Harvard, Haymarket (Green Line Level), Back Bay and Downtown Crossing (Orange Line Level) or see station personnel. Schedules also available at the Transportation Building (10 Park Plaza), 45 High St, and online at mbta.com.

For real-time subway and bus tracking, download the Transit app on any smartphone.

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Rapid Transit

Effective August 30, 2020

Massachusetts Bay Transportation Authority
massDOT Massachusetts Department of Transportation

Information 617-222-3200 • 1-800-392-6100
(TTY) 617-222-5146 • www.mbta.com

Rapid Transit Line	Weekday				Saturday			Sunday		
	First Trip	Peak	Off Peak	Last Trip	First Trip	Arriving Every	Last Trip	First Trip	Arriving Every	Last Trip
Red Line										
Alewife	5:24 AM	9	12-16	12:20 AM	5:24 AM	12-16	12:20 AM	6:08AM	12-16	12:20 AM
Braintree	5:08 AM	mins	mins	12:17 AM	5:09 AM	mins	12:17 AM	6:00AM	mins	12:17 AM
Alewife	5:16 AM	9	12-16	w 12:27 AM	5:16 AM	12-16	w 12:27 AM	6:00AM	12-16	w 12:27 AM
Ashmont	5:16 AM	mins	mins	w 12:30 AM	5:16 AM	mins	w 12:30 AM	6:00AM	mins	w 12:30 AM
"M" Ashmont	5:17 AM	5	8-12 Day	w 1:05 AM	5:15 AM	8-12 Day	w 1:05 AM	6:03AM	8-12 Day	w 1:05 AM
Mattapan	5:05 AM	mins	26 Late	12:53 AM	5:05 AM	26 Early/Late	12:53 AM	5:51AM	26 Early/Late	12:53 AM
Blue Line										
Wonderland	5:13 AM	5	9-13	12:28 AM	5:25 AM	9-13	12:28 AM	5:58AM	9-13	12:28 AM
Orient Heights	5:14 AM	mins	mins	12:33 AM	5:13 AM	mins	12:33 AM	6:03AM	mins	12:33 AM
Bowdoin	5:30 AM			w 1:00 AM	5:29 AM		w 1:00 AM	6:21AM		w 1:00 AM
Orange Line										
Oak Grove	5:16 AM	6	9-11	w 12:30 AM	5:16 AM	9-11	w 12:30 AM	6:00AM	9-11	w 12:30 AM
Forest Hills	5:16 AM	mins	mins	w 12:28 AM	5:16 AM	mins	w 12:28 AM	6:00AM	mins	w 12:28 AM
Green Line*										
B Boston College	5:01 AM	5-6	7-9	12:10 AM	4:45 AM [2]	7-8	12:09 AM	5:20AM [2]	9	12:10 AM
Park Street	5:45 AM	mins	mins	w 12:52 AM	5:40 AM	mins	w 12:52 AM	6:12AM	mins	w 12:52 AM
C Cleveland Circle	4:57 AM [1]	6-8	9-11	12:07 AM	4:50 AM [2]	9-10	12:10 AM	5:30AM [2]	10	12:10 AM
North Station	5:48 AM	mins	mins	w 12:46 AM	5:30 AM	mins	w 12:46 AM	6:06AM	mins	w 12:46 AM
D Riverside	4:56 AM	6	8-11	12:05 AM	4:55 AM	8-9	12:02 AM	5:25AM	11-12	12:05 AM
Government Ctr.	5:45 AM	mins	mins	w 12:49 AM	5:38 AM	mins	w 12:49 AM	6:10AM	mins	w 12:49 AM
E Lechmere *	5:00 AM [4]	6-7	8-10	12:30 AM	5:01 AM	10	12:30 AM	5:35AM	12	12:30 AM
Heath Street	5:45 AM	mins	mins	12:47 AM [3]	5:39 AM	mins	12:47 AM [3]	6:15AM	mins	12:47 AM [3]
Silver Line										
SL1 Logan Airport	5:38 AM	7-12	10-12	f 1:03 AM	5:48 AM	10-12	1:15 AM	5:50AM	10-12	f 1:12 AM
South Station	5:40 AM	mins	mins	w 1:02 AM	5:45 AM	mins	w 12:59 AM	6:12AM	mins	w 1:00 AM
SL2 Design Center	6:07 AM	6	14-16	12:37 AM	6:03 AM	14-16	12:35 AM	6:51AM	14-16	12:51 AM
South Station	5:44 AM	mins	mins	12:50 AM	5:47 AM	mins	12:45 AM	6:35AM	mins	12:36 AM
	4:55 AM	6-11	8-13	f 1:05 AM	5:30 AM	8-13	1:22 AM	6:26AM	8-13	f 1:25 AM
SL3 Chelsea Station	4:20 AM	mins	mins	w 12:35 AM	4:56 AM	mins	w 12:55 AM	5:53AM	mins	w 12:55 AM
South Station										
SL4 Nubian Station	5:20 AM	6-11	6-11	12:20 AM	5:23 AM	13-20	12:20 AM	6:02AM	13-20	12:20 AM
South Station	5:38 AM	mins	mins	12:37 AM	5:40 AM	mins	12:40 AM	6:20AM	mins	12:40 AM
SL5 Nubian Station	5:15 AM	11-14	13-20	12:51 AM	5:19 AM	6-11	12:43 AM	6:00AM	6-11	12:25 AM
Downtown Xing	5:32 AM	mins	mins	w 1:07 AM	5:34 AM	mins	w 1:00 AM	6:16AM	mins	w 12:47 AM

Peak Service:
Weekdays 7 AM - 9 AM, 4 PM - 6:30 PM

Green Line Notes:

New and ongoing infrastucture projects may result in diversions on some branches at various times.

See GL service changes at mbta.com/GLwork

View service alerts at mbta.com/alerts

* E trains start/end at North Station for Green Line Extension work – shuttles provided between North Station and Lechmere.

More: mbta.com/GLEwork

1 - The first two C train AM northbound trips run through to Lechmere Station on weekdays.

2 - The first B and second C train AM northbound trips run through to Lechmere Station on weekends.

3 - On weekdays the 12:27 AM trip (weekends the 12:32 AM trip) from Heath St is the last connecting train to other lines downtown. The 12:37AM and 12:47AM trips (weekends the 12:47AM trip) from Heath St. runs in service to Lechmere with no guaranteed connections.

4 - Early morning service from Lechmere to Riverside departs Lechmere at 5:00 AM.

f - After exiting Ted Williams Tunnel bus will only service World Trade Center and South Station stops.

w - Last trips wait at some stations, primarily in the Downtown area, for connecting service. Departure times are approximate.

Fall 2020 & Winter 2021 Holidays
9/7/20: Sunday; 10/12/20 & 11/11/20: Weekday
11/26/20, 12/25/20, & 1/1/21: Sun; 1/18/21 & 2/15/21: Sat

TRAFFIC-COUNT DATA

Count Dates: Wednesday, October 21, 2015
Wednesday, December 9, 2015

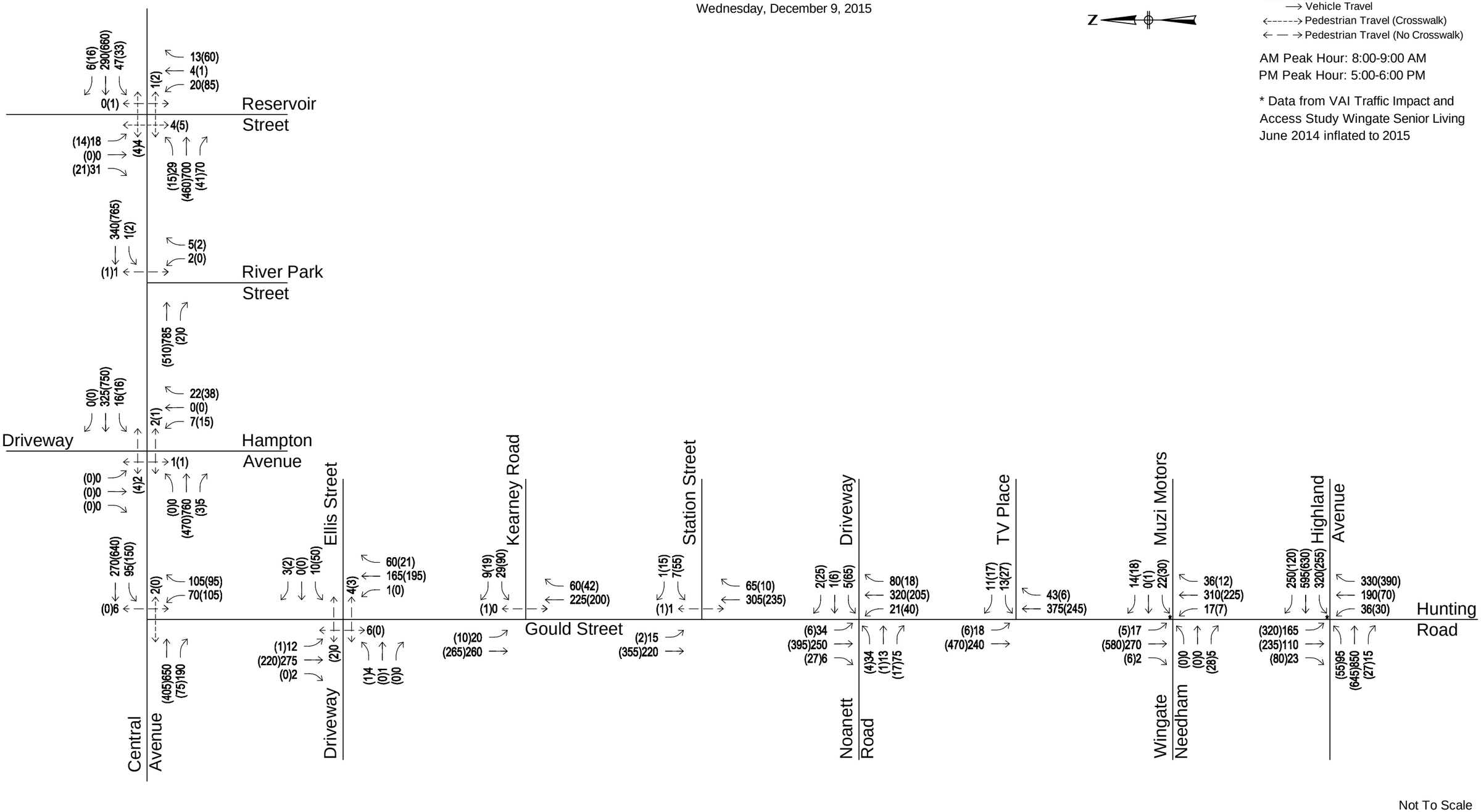
N

Legend:

⟶ Vehicle Travel
<------> Pedestrian Travel (Crosswalk)
← — → Pedestrian Travel (No Crosswalk)

AM Peak Hour: 8:00-9:00 AM
PM Peak Hour: 5:00-6:00 PM

* Data from VAI Traffic Impact and Access Study Wingate Senior Living June 2014 inflated to 2015



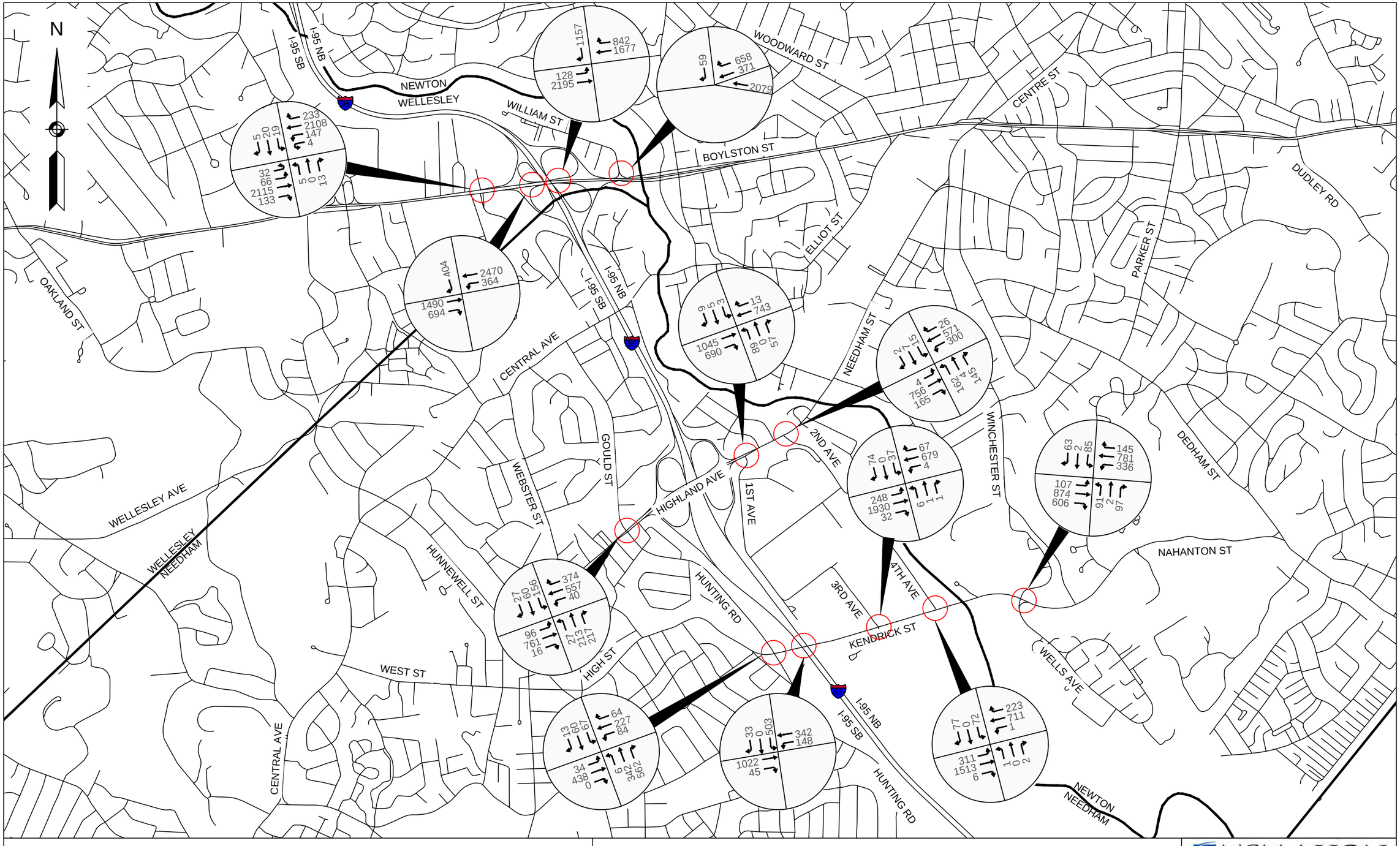
Not To Scale

BETA
www.BETA-Inc.com

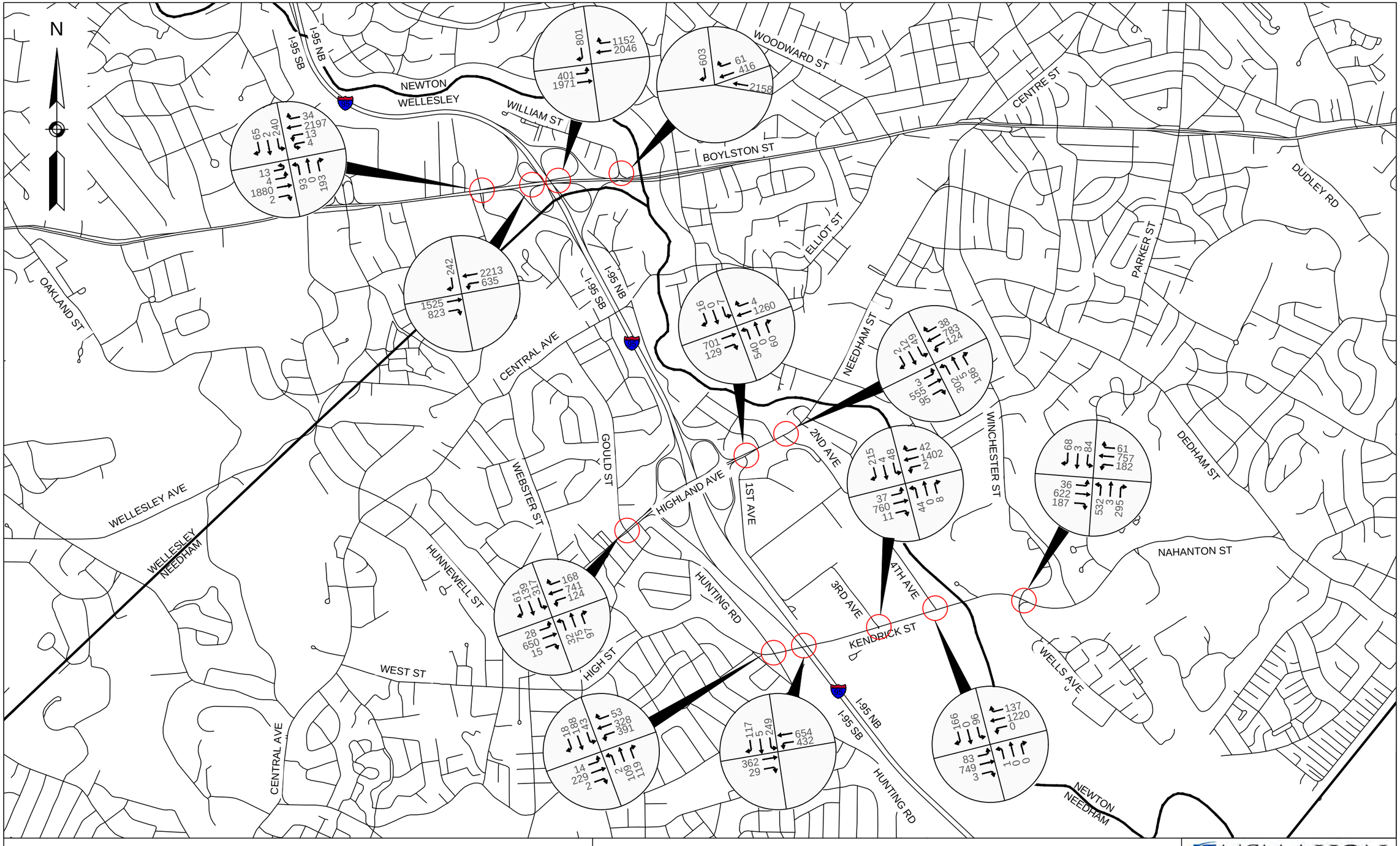
TRAFFIC IMPACT STUDY GOULD AND RESERVOIR INDUSTRIAL DISTRICT
Needham, MA

Figure 2
Study Area Intersection
AM(PM) Peak Hour Volumes
2015 Existing

O:\5100s\5178 - Needham - Gould St Traffic\Drawing Files\Miscellaneous\5178 TMC.dwg Dec 18,2015 8:32am



2019 POST CONSTRUCTION WEEKDAY MORNING PEAK HOUR TRAFFIC VOLUMES	ROUTE 128 ADD-A-LANE AFTER STUDY NEEDHAM, MASSACHUSETTS	McMAHON TRANSPORTATION ENGINEERS & PLANNERS

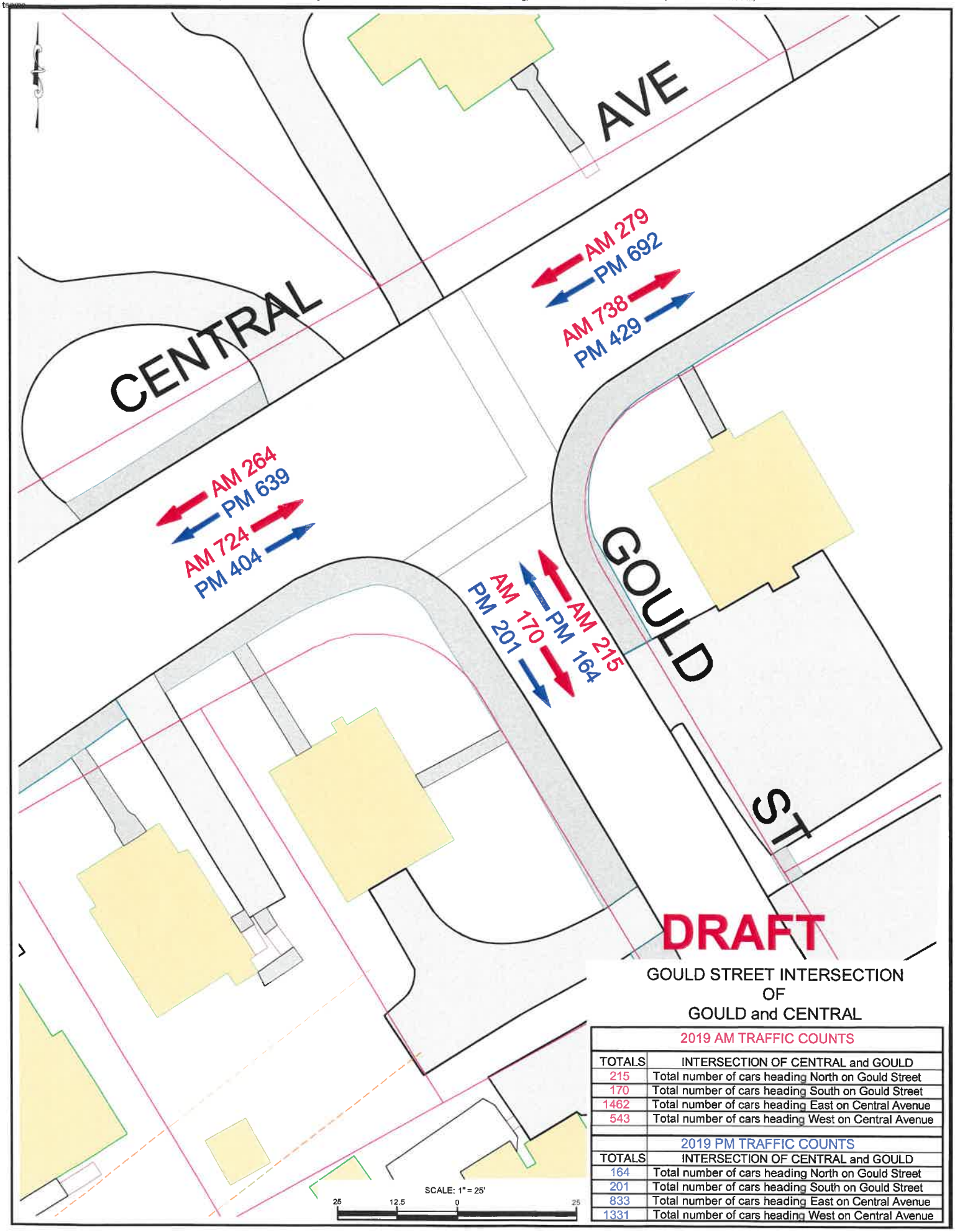


2019 POST CONSTRUCTION WEEKDAY AFTERNOON
PEAK HOUR TRAFFIC VOLUMES

ROUTE 128 ADD-A-LANE AFTER STUDY
NEEDHAM, MASSACHUSETTS

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

T:\Engineering\DPW Eng Branches\CAD-Drafting\CadProjects\Gould Street\Drafting\Gould St at Central Ave and Ellis St Traffic Counts.dwg, Central-AM-PM Traffic Count-8.5 x11, 2/24/2020 12:01:43 PM,

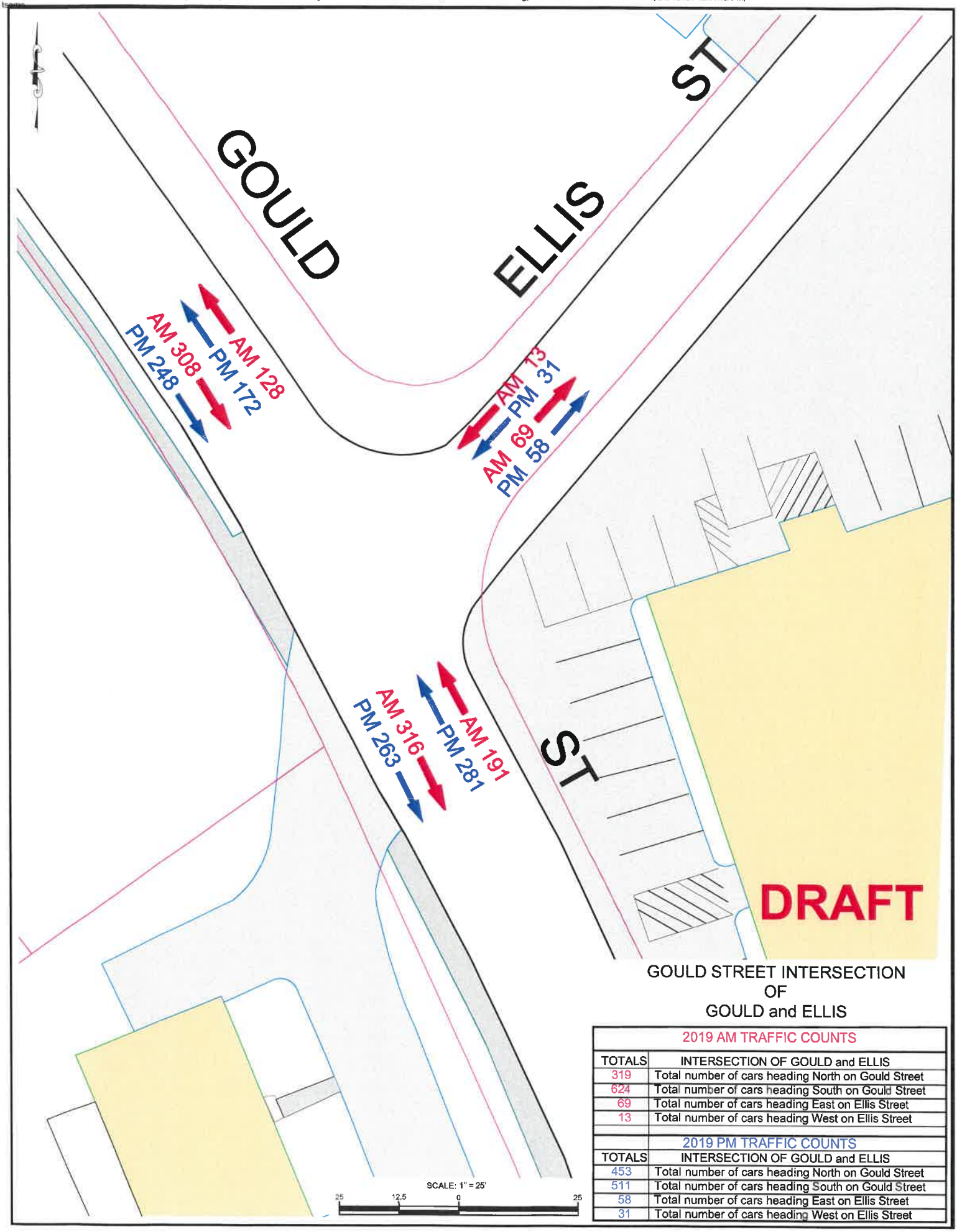


GOULD STREET INTERSECTION
OF
GOULD and CENTRAL

2019 AM TRAFFIC COUNTS	
TOTALS	INTERSECTION OF CENTRAL and GOULD
215	Total number of cars heading North on Gould Street
170	Total number of cars heading South on Gould Street
1462	Total number of cars heading East on Central Avenue
543	Total number of cars heading West on Central Avenue

	2019 PM TRAFFIC COUNTS
TOTALS	INTERSECTION OF CENTRAL and GOULD
164	Total number of cars heading North on Gould Street
201	Total number of cars heading South on Gould Street
833	Total number of cars heading East on Central Avenue
1331	Total number of cars heading West on Central Avenue

T:\Engineering\DPW Eng Branches\CAD-Drafting\CadProjects\Gould Street\Drafting\Gould St at Central Ave and Ellis St Traffic Counts.dwg, Ellis-AM-PM Traffic Count-8.5 x11, 2/24/2020 12:03:02 PM,



GOULD STREET INTERSECTION
OF
GOULD and ELLIS

2019 AM TRAFFIC COUNTS	
TOTALS	INTERSECTION OF GOULD and ELLIS
319	Total number of cars heading North on Gould Street
624	Total number of cars heading South on Gould Street
69	Total number of cars heading East on Ellis Street
13	Total number of cars heading West on Ellis Street

2019 PM TRAFFIC COUNTS	
TOTALS	INTERSECTION OF GOULD and ELLIS
453	Total number of cars heading North on Gould Street
511	Total number of cars heading South on Gould Street
58	Total number of cars heading East on Ellis Street
31	Total number of cars heading West on Ellis Street

CRASH RATE WORKSHEETS

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham COUNT DATE : 2015 grown to 2020

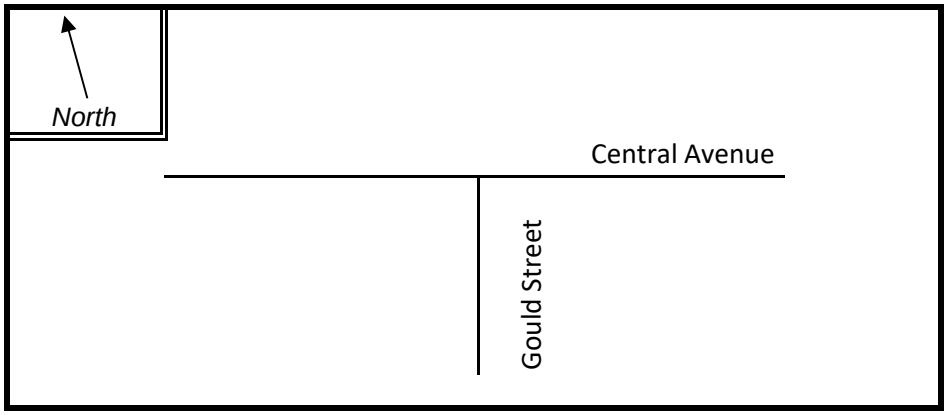
DISTRICT : 6 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Central Avenue

MINOR STREET(S) : Gould Street

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB	SB		
PEAK HOURLY VOLUMES (AM/PM) :	480	790	200			**1,470**

" K " FACTOR :	**0.090**	INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME :	**16,333**

TOTAL # OF CRASHES :	14	# OF YEARS :	5	AVERAGE # OF CRASHES PER YEAR (**A**) :	**2.80**

CRASH RATE CALCULATION : **0.47**

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

Comments : K-value based on MassDOT default value

Project Title & Date: NEX-2020218.00 - Muzi Motors Redevelopment - Needham, MA

MassDOT Crash Data
Central Avenue / Gould Street

Crash Date	Day of Week	Crash Severity	Crash Status	Crash Time	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	School Bus Related	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway	Near Intersection Roadway
02/05/2015	Thursday	Not Reported	Closed	7:29 AM	2	D1: (Unknown) / D2: (Unknown)		Daylight	Rear-end	Snow	0	0	No controls	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: W / V2: Not Reported	Snow/ Sleet, hail (freezing rain or drizzle)	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		CENTRAL AV / GOULD ST	
06/20/2015	Saturday	Property damage only (none injured)	Closed	8:59 AM	2	D1: (No improper driving) / D2: (Failed to yield right of way),(Distracted)	D1: External distraction (outside the vehicle)	Daylight	Angle	Dry	0	0	Stop signs	V1: Travelling straight ahead / V2: Turning right	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: N / V2: E	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	152	CENTRAL AVE	
09/03/2015	Thursday	Non-fatal injury	Closed	1:35 PM	2	D1: (No improper driving) / D2: (Failed to yield right of way)		Daylight	Angle	Dry	0	3	Stop signs	V1: Travelling straight ahead / V2: Turning left	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	152	CENTRAL AVENUE	
05/11/2017	Thursday	Property damage only (none injured)	Closed	10:42 AM	2	D1: (Failed to yield right of way) / D2: (No improper driving)		Daylight	Angle	Dry	0	0	Stop signs	V1: Turning left / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: W / V2: E	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		CENTRAL AVE / GOULD ST	
05/11/2017	Thursday	Property damage only (none injured)	Closed	12:59 PM	2	D1: (No improper driving) / D2: (No improper driving)		Daylight	Rear-end	Dry	0	0	Stop signs	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: W / V2: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		CENTRAL AVE / GOULD ST	
05/26/2017	Friday	Property damage only (none injured)	Closed	4:44 PM	2	D1: (Disregarded traffic signs, signals, road markings) / D2: (No improper driving)		Daylight	Angle	Wet	0	0	Stop signs	V1: Turning right / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: E	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	152	CENTRAL AVE	
05/27/2017	Saturday	Non-fatal injury	Closed	12:16 PM	2	D1: (Failed to yield right of way) / D2: (No improper driving)		Daylight	Angle	Dry	0	1	Stop signs	V1: Turning left / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: W / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		CENTRAL AVE / GOULD ST	
09/25/2017	Monday	Property damage only (none injured)	Closed	12:36 PM	2	D1: (Inattention) / D2: (No improper driving)		Daylight	Angle	Dry	0	0	Stop signs	V1: Turning left / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: N / V2: E	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		CENTRAL AVE / GOULD ST	

MassDOT Crash Data
Central Avenue / Gould Street

Crash Date	Day of Week	Crash Severity	Crash Status	Crash Time	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	School Bus Related	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway	Near Intersection Roadway
12/06/2017	Wednesday	Property damage only (none injured)	Closed	4:58 PM	2	D1: (Failed to yield right of way) / D2: (No improper driving)		Dark - lighted roadway	Angle	Dry	0	0	Stop signs	V1: Turning left / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: W / V2: S	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		CENTRAL AVE / GOULD ST	
07/11/2018	Wednesday	Property damage only (none injured)	Open	4:16 PM	2	D1: (No improper driving) / D2: (Failed to yield right of way),(Inattention)		Daylight	Angle	Dry	0	0	Stop signs	V1: Travelling straight ahead / V2: Turning left	V1:(Passenger car) / V2:(Passenger car)	V1: W / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		CENTRAL AVE / GOULD ST	
07/24/2018	Tuesday	Property damage only (none injured)	Open	4:15 PM	2	D1: (No improper driving) / D2: (Failed to yield right of way)		Daylight	Angle	Dry	0	0	Stop signs	V1: Travelling straight ahead / V2: Turning left	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		CENTRAL AVE / GOULD ST	
09/05/2018	Wednesday	Property damage only (none injured)	Open	5:21 PM	2	D1: (Unknown) / D2: (Failed to yield right of way)		Daylight	Angle	Dry	0	0	Stop signs	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	152	CENTRAL AVE	GOULD ST
06/07/2019	Friday	Property damage only (none injured)	Open	10:25 AM	2	D1: (No improper driving) / D2: (Failed to yield right of way)		Daylight	Angle		0	0	Stop signs	V1: Travelling straight ahead / V2: Turning left	V1:(Passenger car) / V2:(Unknown heavy truck, cannot classify)	V1: N / V2: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		CENTRAL AVENUE / GOULD STREET	
07/15/2019	Monday	Property damage only (none injured)	Open	12:45 PM	2	D1: (No improper driving) / D2: (Inattention)		Daylight	Angle	Dry	0	0	No controls	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: E / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		GOULD ST / CENTRAL AVE	

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham COUNT DATE : 2015 grown to 2020

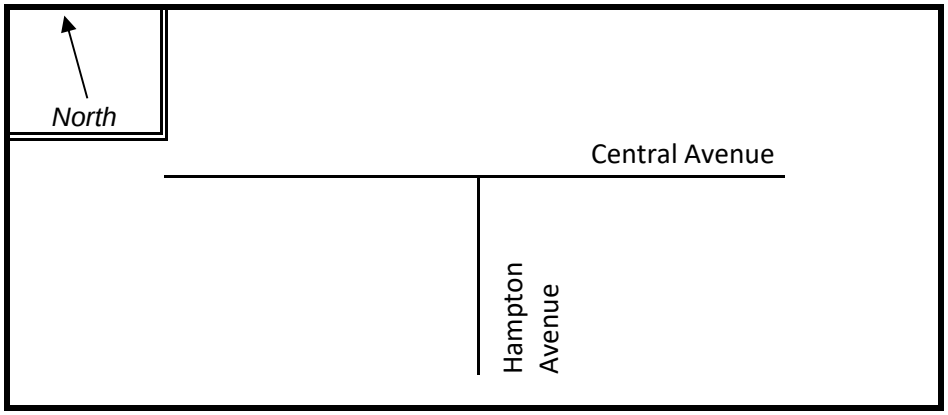
DISTRICT : 6 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Central Avenue

MINOR STREET(S) : Hampton Avenue

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB	SB		
PEAK HOURLY VOLUMES (AM/PM) :	473	766	53			**1,292**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **14,356**

TOTAL # OF CRASHES : 1 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.20**

CRASH RATE CALCULATION : **0.04** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : K-value based on MassDOT default value

Project Title & Date: NEX-2020218.00 - Muzi Motors Redevelopment - Needham, MA

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham COUNT DATE : 2015 grown to 2020

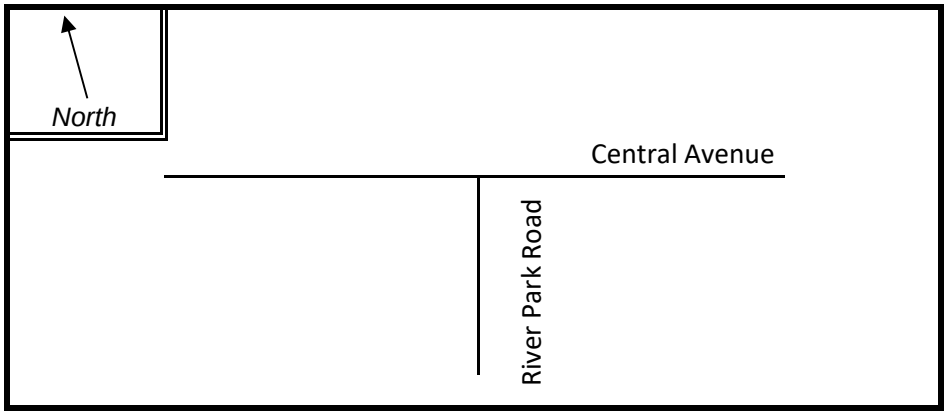
DISTRICT : 6 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Central Avenue

MINOR STREET(S) : River Park Road

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB	SB		
PEAK HOURLY VOLUMES (AM/PM) :	512	767	2			**1,281**

" K " FACTOR :	**0.090**	INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME :	**14,233**

TOTAL # OF CRASHES :	3	# OF YEARS :	5	AVERAGE # OF CRASHES PER YEAR (**A**) :	**0.60**

CRASH RATE CALCULATION : **0.12** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : K-value based on MassDOT default value

Project Title & Date: NEX-2020218.00 - Muzi Motors Redevelopment - Needham, MA

MassDOT Crash Data
Central Avenue / Hampton Avenue
Central Avenue / River Park Street

Crash Date	Day of Week	Crash Severity	Crash Status	Crash Time	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	School Bus Related	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway	Near Intersection Roadway
Central Avenue / Hampton Avenue																							
05/30/2019	Thursday	Non-fatal injury	Open	9:13 AM	2	D1: (Followed too closely) / D2: (No improper driving)		Daylight	Rear-end		0	2	No controls	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1: W / V2: W	Cloudy	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	110	CENTRAL AVE	HAMPTON AVE
Central Avenue / River Park Street																							
01/26/2015	Monday	Property damage only (none injured)	Closed	9:50 AM	2	D1: (Followed too closely) / D2: (No improper driving)		Daylight	Rear-end	Dry	0	0	No controls	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Cloudy/ Cloudy	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		CENTRAL AVE / RIVER PARK ST	
08/04/2015	Tuesday	Property damage only (none injured)	Closed	7:04 PM	3	D1: (No improper driving) / D2: (No improper driving) / D3: (No improper driving)		Other	Rear-end	Wet	0	0	No controls	V1: Travelling straight ahead / V2: Travelling straight ahead / V3: Travelling straight ahead	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility)) / V3:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: S / V3: S	Rain/ Severe crosswinds	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic) V3:(Collision with motor vehicle in traffic)	89	CENTRAL AVE	
04/04/2016	Monday	Property damage only (none injured)	Closed	1:12 PM	1	D1: (No improper driving)		Daylight	Single vehicle crash	Snow	0	0	No controls	V1: Travelling straight ahead	V1:(Passenger car)	V1: W	Snow/ Sleet, hail (freezing rain or drizzle)	No hit and run	No, school bus not involved	V1:(Collision with tree)	89	CENTRAL AVE	

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham COUNT DATE : 2015 grown to 2020

DISTRICT : 6 UNSIGNALIZED : SIGNALIZED : X

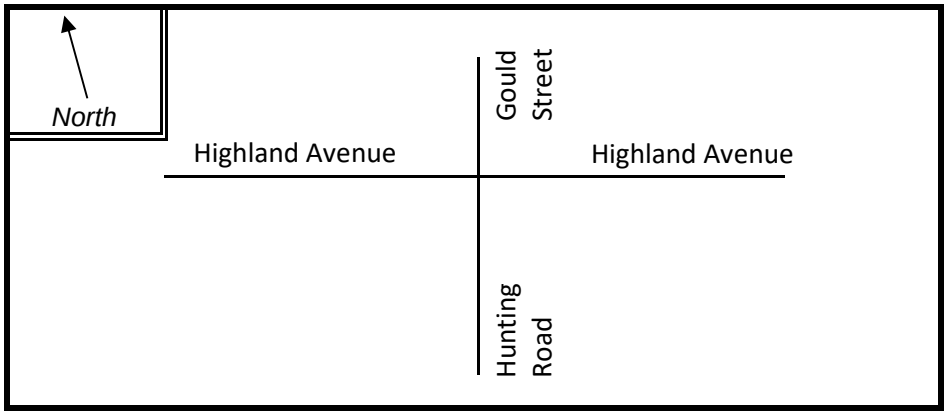
~ INTERSECTION DATA ~

MAJOR STREET : Highland Avenue

MINOR STREET(S) : Gould Street

Hunting Road

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB	SB		
PEAK HOURLY VOLUMES (AM/PM) :	693	1,033	204	517		**2,447**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **27,189**

TOTAL # OF CRASHES : 46 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **9.20**

CRASH RATE CALCULATION : **0.93** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : K-value based on MassDOT default value

Project Title & Date: NEX-2020218.00 - Muzi Motors Redevelopment - Needham, MA

MassDOT Crash Data
Highland Avenue / Gould Street / Hunting Road

Crash Date	Day of Week	Crash Severity	Crash Status	Crash Time	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	School Bus Related	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway	Near Intersection Roadway
01/10/2015	Saturday	Property damage only (none injured)	Closed	10:16 PM	3	D1: (Other improper action) / D2: (No improper driving) / D3: (No improper driving)		Dark - lighted roadway	Rear-end	Sand, mud, dirt, oil, gravel	0	0	Traffic control signal	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car) / V3:(Light truck(van, mini-van, pickup, sport utility))	V1: N / V2: N / V3: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic) V3:(Collision with motor vehicle in traffic)		HIGHLAND AVE / HUNTING RD	
02/16/2015	Monday	Property damage only (none injured)	Closed	2:01 PM	2	D1: (No improper driving) / D2: (Followed too closely)		Daylight	Rear-end	Wet	0	0	Traffic control signal	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: Not Reported	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / GOULD ST	
08/05/2015	Wednesday	Property damage only (none injured)	Closed	11:03 AM	2	D1: (Followed too closely) / D2: (No improper driving)		Daylight	Rear-end	Dry	0	0	No controls	V1: Entering traffic lane / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: W / V2: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with other movable object) V2:(Collision with other movable object)	557	HIGHLAND AVENUE	
08/18/2015	Tuesday	Property damage only (none injured)	Closed	12:02 PM	2	D1: (No improper driving) / D2: (Disregarded traffic signs, signals, road markings)		Daylight	Angle	Dry	0	0	Traffic control signal	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Bus (seats for 9-15 people, including driver))	V1: S / V2: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		GOULD STREET / HIGHLAND AVENUE	
10/28/2015	Wednesday	Property damage only (none injured)	Closed	1:15 PM	2	D1: (No improper driving) / D2: (Distracted),(Inattention)		Daylight	Rear-end	Dry	0	0	No controls	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	589	HIGHLAND AVE	
10/28/2015	Wednesday	Property damage only (none injured)	Closed	5:22 PM	2	D1: (Unknown) / D2: (No improper driving)		Dusk	Rear-end	Wet	0	0	No controls	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Rain/Other	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	501	HIGHLAND AVE	
11/05/2015	Thursday	Property damage only (none injured)	Closed	6:00 PM	2	D1: (Inattention),(Followed too closely) / D2: (No improper driving)	D1: Other activity (searching, eating, personal hygiene, etc.)	Dark - lighted roadway	Rear-end	Dry	0	0	No controls	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: E	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	580	HIGHLAND AVE	
12/09/2015	Wednesday	Property damage only (none injured)	Closed	8:41 AM	2	D1: (Unknown) / D2: (No improper driving)		Daylight	Sideswipe, same direction	Dry	0	0	No controls	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Single-unit truck (2-axle, 6-tires))	V1: W / V2: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	589	HIGHLAND AVENUE	

MassDOT Crash Data
Highland Avenue / Gould Street / Hunting Road

Crash Date	Day of Week	Crash Severity	Crash Status	Crash Time	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	School Bus Related	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway	Near Intersection Roadway
01/11/2016	Monday	Property damage only (none injured)	Closed	3:31 PM	2	D1: (No improper driving) / D2: (Other improper action)		Daylight	Unknown	Dry	0	0	No controls	V1: Travelling straight ahead / V2: Changing lanes	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: E	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	557	HIGHLAND AVENUE	
01/27/2016	Wednesday	Not Reported	Closed	6:42 PM	1	D1: (Failure to keep in proper lane or running off road),(Inattention)		Dark - lighted roadway	Single vehicle crash	Dry	0	0	No controls	V1: Changing lanes	V1:(Passenger car)	V1: S	Clear	No hit and run	No, school bus not involved	V1:(Collision with curb),(Collision with guardrail)	557	HIGHLAND AVE	
04/05/2016	Tuesday	Property damage only (none injured)	Closed	11:22 AM	2	D1: (No improper driving) / D2: (Inattention)		Daylight	Angle	Dry	0	0	Traffic control signal	V1: Turning left / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: S	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / GOULD ST	
07/13/2016	Wednesday	Non-fatal injury	Closed	9:09 PM	1	D1: (Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway, etc)		Dark - lighted roadway	Single vehicle crash	Dry	0	1	Traffic control signal	V1: Turning left	V1:(Passenger car)	V1: S	Clear	No hit and run	No, school bus not involved	V1:(Collision with utility pole)	580	HIGHLAND AVE	
08/24/2016	Wednesday	Property damage only (none injured)	Closed	4:14 PM	2	D1: (No improper driving) / D2: (No improper driving)		Daylight	Rear-end	Dry	0	0	Traffic control signal	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	589	HIGHLAND AVE	
09/24/2016	Saturday	Property damage only (none injured)	Closed	1:58 PM	1	D1: (No improper driving)		Unknown	Unknown	Dry	0	0	Unknown	V1: Unknown	V1:(Passenger car)	V1: E	Clear	No hit and run	No, school bus not involved		557	HIGHLAND AVE	
10/23/2016	Sunday	Property damage only (none injured)	Closed	3:34 PM	2	D1: (Disregarded traffic signs, signals, road markings) / D2: (No improper driving)		Daylight	Single vehicle crash	Dry	0	0	Traffic control signal	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: E / V2: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	589	HIGHLAND AVE	
11/11/2016	Friday	Property damage only (none injured)	Closed	1:49 PM	2	D1: (No improper driving) / D2: (No improper driving)		Daylight	Sideswipe, same direction	Dry	0	0	Traffic control signal	V1: Turning left / V2: Turning left	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: Not Reported	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / GOULD ST	

MassDOT Crash Data
Highland Avenue / Gould Street / Hunting Road

Crash Date	Day of Week	Crash Severity	Crash Status	Crash Time	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	School Bus Related	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway	Near Intersection Roadway
11/19/2016	Saturday	Property damage only (none injured)	Closed	3:55 PM	1	D1: (No improper driving)	D1: External distraction (outside the vehicle)	Daylight	Single vehicle crash	Dry	0	0	No controls	V1: Travelling straight ahead	V1:(Passenger car)	V1: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic)	589	HIGHLAND AVE	
11/30/2016	Wednesday	Non-fatal injury	Closed	12:46 PM	2	D1: (No improper driving) / D2: (Failed to yield right of way),(Disregarded traffic signs, signals, road markings)		Daylight	Angle	Dry	0	1	Yield signs	V1: Travelling straight ahead / V2: Entering traffic lane	V1:(Truck/trailer) / V2:(Passenger car)	V1: W / V2: S	Cloudy	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	501	HIGHLAND AVENUE	
03/01/2017	Wednesday	Property damage only (none injured)	Closed	1:31 PM	2	D1: (Disregarded traffic signs, signals, road markings) / D2: (No improper driving)		Daylight	Sideswipe, same direction	Dry	0	0	Traffic control signal	V1: Overtaking/ passing / V2: Turning right	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	580	HIGHLAND AVE	HUNTING RD
04/22/2017	Saturday	Property damage only (none injured)	Closed	4:01 PM	2	D1: (Inattention) / D2: (No improper driving)		Daylight	Rear-end	Dry	0	0	Stop signs	V1: Entering traffic lane / V2: Entering traffic lane	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: S	Cloudy	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	589	HIGHLAND AVE	HIGHLAND AVE
05/09/2017	Tuesday	Non-fatal injury	Closed	5:26 PM	2	D1: (Followed too closely) / D2: (No improper driving)		Daylight	Rear-end	Dry	0	1	No controls	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: E / V2: E	Cloudy	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	589	HIGHLAND AVENUE	
10/03/2017	Tuesday	Property damage only (none injured)	Closed	7:00 PM	2	D1: (Inattention) / D2: (No improper driving)		Dark - lighted roadway	Rear-end	Dry	0	0	Yield signs	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: W / V2: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	589	HIGHLAND AVE	
11/18/2017	Saturday	Property damage only (none injured)	Closed	10:55 PM	2	D1: (No improper driving) / D2: (Inattention)	D1: Manually operating an electronic device	Dark - lighted roadway	Angle	Wet	0	0	Traffic control signal	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: W / V2: S	Rain	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	589	HIGHLAND AVE	GOULD ST
11/22/2017	Wednesday	Property damage only (none injured)	Closed	5:32 PM	2	D1: (Other improper action) / D2: (No improper driving)	D1: Other activity (searching, eating, personal hygiene, etc.)	Dark - lighted roadway	Rear-end	Wet	0	0	Traffic control signal	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: S	Rain	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	557	HIGHLAND AVE	

MassDOT Crash Data
Highland Avenue / Gould Street / Hunting Road

Crash Date	Day of Week	Crash Severity	Crash Status	Crash Time	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	School Bus Related	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway	Near Intersection Roadway
03/22/2018	Thursday	Property damage only (none injured)	Open	4:40 PM	2	D1: (No improper driving) / D2: (Failed to yield right of way)		Daylight	Sideswipe, same direction	Wet	0	0	No controls	V1: Travelling straight ahead / V2: Turning right	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1: S / V2: S	Cloudy	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	589	HIGHLAND AVE	
05/04/2018	Friday	Property damage only (none injured)	Open	6:00 PM	2	D1: (No improper driving) / D2: (Distracted)	D1: External distraction (outside the vehicle)	Daylight	Rear-end	Dry	0	0	Traffic control signal	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: E	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	589	HIGHLAND AVE	
06/27/2018	Wednesday	Non-fatal injury	Open	7:23 AM	2	D1: (No improper driving) / D2: (Disregarded traffic signs, signals, road markings)		Daylight	Angle	Dry	0	1	Traffic control signal	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	580	HIGHLAND AVE	
07/13/2018	Friday	Non-fatal injury	Open	5:59 PM	2	D1: (Unknown) / D2: (No improper driving)		Dusk	Rear-end	Dry	0	1	Traffic control signal	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: N / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HUNTING RD / HIGHLAND AVE	
07/17/2018	Tuesday	Property damage only (none injured)	Open	2:03 AM	1	D1: (Inattention)		Dark - lighted roadway	Single vehicle crash	Dry	0	0	Traffic control signal	V1: Travelling straight ahead	V1:(Single-unit truck (3-or-more axles))	V1: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with overhead sign support),(Collision with highway traffic sign post)	589	HIGHLAND AVE	
07/26/2018	Thursday	Property damage only (none injured)	Open	8:20 AM	2	D1: (Failure to keep in proper lane or running off road) / D2: (No improper driving)		Daylight	Sideswipe, same direction	Dry	0	0	Traffic control signal	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: E	Cloudy	Yes, hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / GOULD ST	
08/15/2018	Wednesday	Property damage only (none injured)	Open	9:00 PM	2	D1: (No improper driving) / D2: (Inattention)		Dark - lighted roadway	Rear-end	Dry	0	0	Traffic control signal	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	596	HIGHLAND AVE	
12/12/2018	Wednesday	Property damage only (none injured)	Open	12:11 PM	1	D1: (No improper driving)		Daylight	Sideswipe, same direction	Dry	0	0	Traffic control signal	V1: Turning left	V1:(Passenger car)	V1: S	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic)		HIGHLAND AVE / GOULD ST	

MassDOT Crash Data
Highland Avenue / Gould Street / Hunting Road

Crash Date	Day of Week	Crash Severity	Crash Status	Crash Time	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	School Bus Related	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway	Near Intersection Roadway
02/05/2019	Tuesday	Property damage only (none injured)	Open	7:21 PM	1	D1: (No improper driving)		Dark - lighted roadway	Sideswipe, same direction		0	0	Traffic control signal	V1: Travelling straight ahead	V1:(Passenger car)	V1: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic)	589	HIGHLAND AVE	
03/23/2019	Saturday	Property damage only (none injured)	Open	11:04 AM	2	D1: (Unknown) / D2: (Unknown)		Daylight	Sideswipe, same direction	Dry	0	0	Traffic control signal	V1: Turning left / V2: Turning left	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1: S / V2: S	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / GOULD ST	
04/30/2019	Tuesday	Non-fatal injury	Open	4:49 AM	2	D1: (Unknown) / D2: (Unknown)		Dark - lighted roadway	Angle	Wet	0	1	Traffic control signal	V1: Turning right / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: W / V2: N	Rain	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / GOULD ST	
07/31/2019	Wednesday	Unknown	Open	4:35 PM	1	D1: (No improper driving)		Daylight	Sideswipe, same direction	Wet	0	0	Traffic control signal	V1: Travelling straight ahead	V1:(Passenger car)	V1: W	Clear	Yes, hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic)		HUNTING RD / HIGHLAND AVE	
08/03/2019	Saturday	Property damage only (none injured)	Open	2:55 PM	2	D1: (No improper driving) / D2: (Unknown)		Daylight	Angle	Dry	0	0	Traffic control signal	V1: Turning left / V2: Turning right	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		GOULD ST / HIGHLAND AVE	
12/09/2019	Monday	Property damage only (none injured)	Open	11:10 AM	2	D1: (Failure to keep in proper lane or running off road) / D2: (No improper driving)		Daylight	Sideswipe, same direction	Wet	0	0	Traffic control signal	V1: Turning left / V2: Turning left	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: E	Rain/ Cloudy	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)		HIGHLAND AVE / HUNTING RD	

MassDOT Crash Data
Highland Avenue / Gould Street / Hunting Road

Crash Date	Day of Week	Crash Severity	Crash Status	Crash Time	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	School Bus Related	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway	Near Intersection Roadway
06/12/2015	Friday	Non-fatal injury	Closed	11:00 AM	2	D1: (Failed to yield right of way) / D2: (No improper driving)		Daylight	Sideswipe, same direction	Dry	0	2	Not reported	V1: Turning right / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Tractor/ semi-trailer)	V1: W / V2: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	500	HIGHLAND AVENUE	
09/07/2016	Wednesday	Property damage only (none injured)	Closed	11:04 AM	2	D1: (Failure to keep in proper lane or running off road) / D2: (No improper driving)		Daylight	Sideswipe, same direction	Dry	0	0	No controls	V1: Changing lanes / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: S	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	500	HIGHLAND AVE	
11/08/2016	Tuesday	Property damage only (none injured)	Closed	4:12 PM	1	D1: (Glare)		Daylight	Single vehicle crash	Dry	0	0	No controls	V1: Travelling straight ahead	V1:(Passenger car)	V1: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with impact attenuator/ crash cushion)	500	HIGHLAND AVE	
01/03/2017	Tuesday	Property damage only (none injured)	Closed	5:30 PM	2	D1: (Failure to keep in proper lane or running off road),(Inattention) / D2: (No improper driving)		Dark - lighted roadway	Sideswipe, same direction	Wet	0	0	No controls	V1: Changing lanes / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: S	Rain	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	500	HIGHLAND AVE	
06/27/2017	Tuesday	Property damage only (none injured)	Closed	9:14 AM	2	D1: (Followed too closely) / D2: (No improper driving)		Daylight	Rear-end	Dry	0	0	No controls	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: S	Cloudy	No hit and run	No, school bus not involved	V1:(Collision with other movable object) V2:(Collision with other movable object)	500	HIGHLAND AVE	
12/07/2017	Thursday	Property damage only (none injured)	Closed	7:29 PM	2	D1: (No improper driving) / D2: (Failure to keep in proper lane or running off road)		Dark - lighted roadway	Sideswipe, same direction	Dry	0	0	Traffic control signal	V1: Turning left / V2: Turning left	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: S	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	500	HIGHLAND AVE	
03/09/2019	Saturday	Property damage only (none injured)	Open	4:23 PM	2	D1: (No improper driving) / D2: (Inattention),(Followed too closely)	D1: Other activity (searching, eating, personal hygiene, etc.)	Daylight	Rear-end	Dry	0	0	Yield signs	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: W / V2: W	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	500	HIGHLAND AVE	
09/04/2019	Wednesday	Property damage only (none injured)	Open	5:18 PM	2	D1: (Unknown) / D2: (Unknown)		Daylight	Sideswipe, same direction	Dry	0	0	Traffic control signal	V1: Turning left / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1: W / V2: W	Cloudy	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	500	HIGHLAND AVE	

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham COUNT DATE : 2015 grown to 2020

DISTRICT : 6 UNSIGNALIZED : X SIGNALIZED :

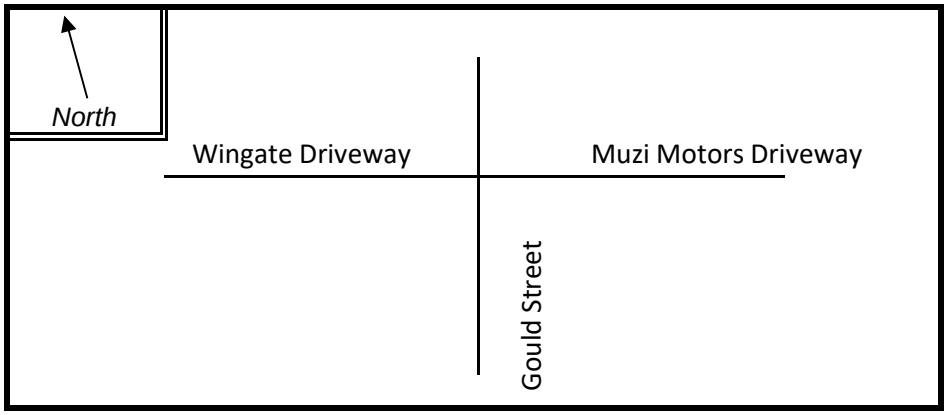
~ INTERSECTION DATA ~

MAJOR STREET : Gould Street

MINOR STREET(S) : Muzi Motors Driveway

Wingate Driveway

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB	SB		
PEAK HOURLY VOLUMES (AM/PM) :	28	49	244	591		**912**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **10,133**

TOTAL # OF CRASHES : 2 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.40**

CRASH RATE CALCULATION : **0.11** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : K-value based on MassDOT default value

Project Title & Date: NEX-2020218.00 - Muzi Motors Redevelopment - Needham, MA

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham COUNT DATE : 2015 grown to 2020

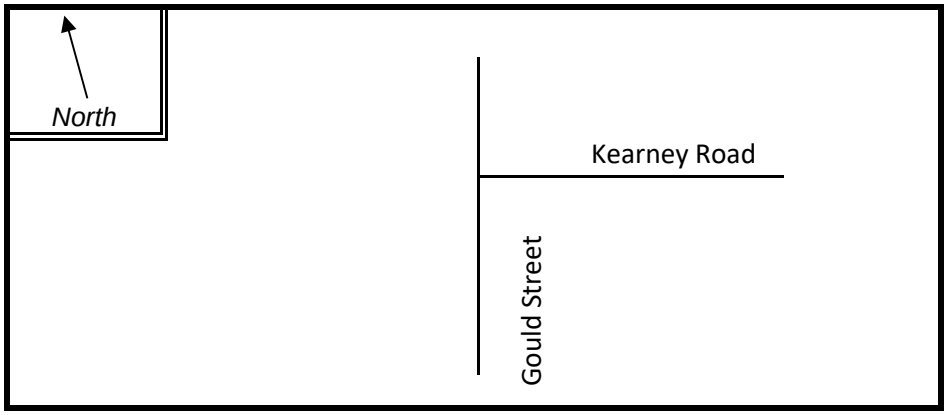
DISTRICT : 6 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Gould Street

MINOR STREET(S) : Kearney Road

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB	SB		
PEAK HOURLY VOLUMES (AM/PM) :		109	242	275		**626**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **6,956**

TOTAL # OF CRASHES : 1 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.20**

CRASH RATE CALCULATION : **0.08** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : K-value based on MassDOT default value

Project Title & Date: NEX-2020218.00 - Muzi Motors Redevelopment - Needham, MA

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Needham COUNT DATE : 2015 grown to 2020

DISTRICT : 6 UNSIGNALIZED : X SIGNALIZED :

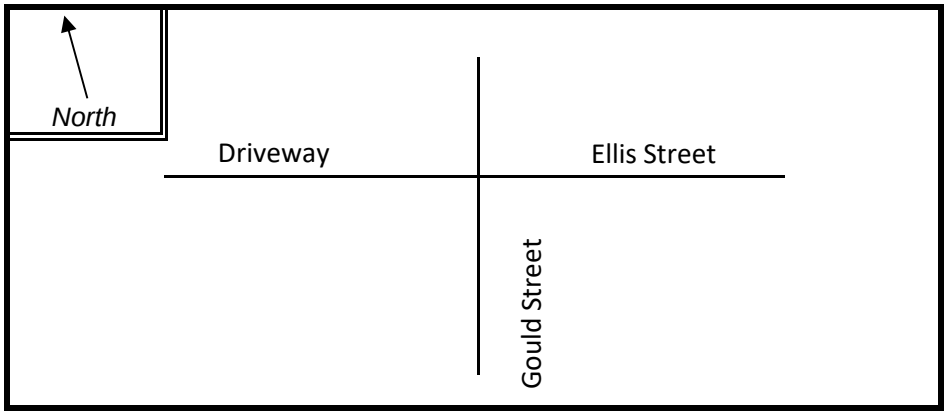
~ INTERSECTION DATA ~

MAJOR STREET : Gould Street

MINOR STREET(S) : Ellis Street

Driveway

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB	SB		
PEAK HOURLY VOLUMES (AM/PM) :	1	52	216	221		**490**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **5,444**

TOTAL # OF CRASHES : 2 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.40**

CRASH RATE CALCULATION : **0.20** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : K-value based on MassDOT default value

Project Title & Date: NEX-2020218.00 - Muzi Motors Redevelopment - Needham, MA

MassDOT Crash Data
Gould Street / Wingate Driveway / Muzi Motors Driveway
Gould Street / Kearney Road
Gould Street / Ellis Street / Driveway

Crash Date	Day of Week	Crash Severity	Crash Status	Crash Time	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	School Bus Related	Vehicle Sequence of Events (All Vehicles)	Street Number	Roadway
Gould Steet / Wingate Driveway / Muzi Motors Driveway																						
04/07/2018	Saturday	Unknown	Open	12:17 PM	2	D1: (No improper driving) / D2: (Unknown)		Daylight	Head-on	Dry	0	0	No controls	V1: Entering traffic lane / V2: Unknown	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: S	Clear/ Cloudy	No hit and run	No, school bus not involved	V1:(Collision with unknown movable object) V2:(Collision with motor vehicle in traffic)	235	GOULD ST
09/04/2018	Tuesday	Non-fatal injury	Open	8:49 AM	2	D1: (No improper driving) / D2: (No improper driving)		Daylight	Rear-end	Dry	0	1	No controls	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: N / V2: N	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	235	GOULD ST
No collisions at Gould Street / TV Place																						
Gould Steet / Kearney Road																						
03/05/2018	Monday	Property damage only (none injured)	Open	2:03 PM	3	D1: (Operating vehicle in erratic, reckless, careless, negligent or aggressive manner)		Daylight	Single vehicle crash	Dry	0	0	No controls	V1: Travelling straight ahead / V2: Parked / V3: Not reported	V1:(Passenger car) / V2:(Passenger car) / V3:(Passenger car)	V1: S / V2: Not Reported / V3: Not Reported	Cloudy	No hit and run	No, school bus not involved	V1:(Collision with parked motor vehicle)	110	GOULD ST
Gould Steet / Ellis Street / Driveway																						
02/05/2016	Friday	Property damage only (none injured)	Closed	12:14 PM	2	D1: (No improper driving) / D2: (Failed to yield right of way)		Daylight	Angle	Snow	0	0	No controls	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: W	Snow	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	99	GOULD ST
04/14/2018	Saturday	Property damage only (none injured)	Open	11:31 AM	2	D1: (Unknown) / D2: (Unknown)		Daylight	Angle	Dry	0	0	Stop signs	V1: Turning right / V2: Turning right	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: E	Clear	No hit and run	No, school bus not involved	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	99	GOULD ST

TRIP-GENERATION CALCULATIONS

Size	Units	Land Use
866,342	SF	-
	Units	LUC 221
368,195	SF	LUC 714
368,195	SF	LUC 760
129,951	SF	LUC 820

	Pass-By Rates				
	LUC 221	LUC 714	LUC 760	LUC 820	TOTAL
Weekday Daily	0%	0%	0%	26%	-
Weekday AM	0%	0%	0%	26%	-
Weekday PM	0%	0%	0%	34%	-
Saturday Daily	0%	0%	0%	26%	-
Saturday Midday	0%	0%	0%	26%	-

		Total Trips					External Trips					Pass-By Trips					New Primary Trips				
		LUC 221	LUC 714	LUC 760	LUC 820	TOTAL	LUC 221	LUC 714	LUC 760	LUC 820	TOTAL	LUC 221	LUC 714	LUC 760	LUC 820	TOTAL	LUC 221	LUC 714	LUC 760	LUC 820	TOTAL
Weekday Daily	Entering		1,365	1,986	3,592	6,943	0	956	1,390	2,855	5,201	0	0	0	707	707	0	956	1,390	2,148	4,494
	Exiting		1,365	1,986	3,592	6,943	0	1,065	1,549	2,587	5,201	0	0	0	707	707	0	1,065	1,549	1,880	4,494
	Total	0	2,730	3,972	7,184	13,886	0	2,021	2,939	5,442	10,402	0	0	0	1,414	1,414	0	2,021	2,939	4,028	8,988
Weekday AM Peak Hour	Entering		458	271	135	864	0	432	256	78	766	0	0	0	15	15	0	432	256	63	751
	Exiting		35	56	82	173	0	13	21	41	75	0	0	0	15	15	0	13	21	26	60
	Total	0	493	327	217	1,037	0	445	277	119	841	0	0	0	30	30	0	445	277	89	811
Weekday PM Peak Hour	Entering		49	63	317	429	0	34	43	162	239	0	0	0	80	80	0	34	43	82	159
	Exiting		440	333	343	1,116	0	352	266	308	926	0	0	0	80	80	0	352	266	228	846
	Total	0	489	396	660	1,545	0	386	309	470	1,165	0	0	0	160	160	0	386	309	310	1,005
Saturday Daily	Entering		331	286	5,242	5,859	0	258	223	5,106	5,587	0	0	0	1,328	1,328	0	258	223	3,778	4,259
	Exiting		331	286	5,242	5,859	0	258	223	5,106	5,587	0	0	0	1,328	1,328	0	258	223	3,778	4,259
	Total	0	662	572	10,484	11,718	0	516	446	10,212	11,174	0	0	0	2,656	2,656	0	516	446	7,556	8,518
Saturday Midday Peak Hour	Entering		16	44	396	456	0	10	27	383	420	0	0	0	94	94	0	10	27	289	326
	Exiting		21	44	365	430	0	17	35	342	394	0	0	0	94	94	0	17	35	248	300
	Total	0	37	88	761	886	0	27	62	725	814	0	0	0	188	188	0	27	62	537	626

Institute of Transportation Engineers (ITE)

Land Use Code (LUC) 714 - Corporate Headquarters Building

General Urban/Suburban

Average Vehicle Trips Ends vs: 1000 Sq. Feet Gross Floor Area
Independent Variable (X): 368.195

AVERAGE WEEKDAY DAILY

T = 6.16 * (X) + 462.50
T = 6.16 * 368.195 + 462.50
T = 2730.58
T = 2,730 vehicle trips
with 50% (1,365 vpd) entering and 14% (1,365 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF GENERATOR

Ln T = 0.88 Ln (X) + 1.00
Ln T = 0.88 Ln(368.195) + 1.00
Ln T = 6.20
T = 492.54
T = 493 vehicle trips
with 93% (458 vph) entering and 7% (35 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF GENERATOR

Ln T = 0.95 Ln (X) + 0.58
Ln T = 0.95 Ln(368.195) + 0.58
Ln T = 6.19
T = 489.40
T = 489 vehicle trips
with 10% (49 vph) entering and 90% (440 vph) exiting.

SATURDAY DAILY

$$\frac{\text{ITE LUC 710 Saturday Daily Trip Rate}}{\text{ITE LUC 710 Weekday Daily Trip Rate}} = \frac{\text{ITE LUC 714 Saturday Daily Trip Rate}}{\text{ITE LUC 714 Weekday Daily Trip Rate}}$$

$$\frac{2.21}{9.74} = \frac{(Y)}{7.95} = 1.80$$

T = Y * 368.195
T = 662.75
T = 662 vehicle trips
with 50% (331 vpd) entering and 50% (331 vpd) exiting.

(same distribution split as ITE LUC 710 during the Saturday Daily)

SATURDAY PEAK HOUR OF GENERATOR

T = 0.10 * (X)
T = 0.10 * 368.195
T = 36.82
T = 37 vehicle trips
with 44% (16 vph) entering and 56% (21 vph) exiting.

Institute of Transportation Engineers (ITE)

Land Use Code (LUC) 760 - Research and Development Center

General Urban/Suburban

Average Vehicle Trips Ends vs: 1000 Sq. Feet Gross Floor Area
Independent Variable (X): 368.195

AVERAGE WEEKDAY DAILY

T = 10.23 * (X) + 204.68
T = 10.23 * 368.195 + 204.68
T = 3971.31
T = 3,972 vehicle trips
with 50% (1,986 vpd) entering and 50% (1,986 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF GENERATOR

Ln T = 0.88 Ln (X) + 0.59
Ln T = 0.88 Ln(368.195) + 0.59
Ln T = 5.79
T = 326.88
T = 327 vehicle trips
with 83% (271 vph) entering and 17% (56 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF GENERATOR

T = 1.04 * (X) +12.86
T = 1.04 * 368.195 + 12.86
T = 395.78
T = 396 vehicle trips
with 16% (63 vph) entering and 84% (333 vph) exiting.

SATURDAY DAILY

T = 1.25 * (X) + 112.04
T = 1.25 * 368.195 + 112.04
T = 572.28
T = 572 vehicle trips
with 50% (286 vpd) entering and 50% (286 vpd) exiting.

SATURDAY PEAK HOUR OF GENERATOR

T = 0.24 * (X)
T = 0.24 * 368.195
T = 88.37
T = 88 vehicle trips
with 50% (44 vph) entering and % (44 vph) exiting.

(same distribution split as ITE LUC 760 during the Saturday Daily)

Institute of Transportation Engineers (ITE)

Land Use Code (LUC) 820 - Shopping Center

General Urban/Suburban

Average Vehicle Trips Ends vs: 1000 Sq. Ft. Gross Floor Area
Independent Variable (X): 129.951

AVERAGE WEEKDAY DAILY

Ln(T) = 0.68 Ln (X) + 5.57
Ln(T) = 0.68 Ln (129.951) + 5.57
Ln(T) = 8.88
T = 7184.40
T = 7,184 vehicle trips
with 50% (3,592 vph) entering and 50% (3,592 vph) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.50 * (X) + 151.78
T = 0.50 * (129.951) + 151.78
T = 216.76
T = 217 vehicle trips
with 62% (135 vph) entering and 38% (82 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

Ln T = 0.74 Ln (X) + 2.89
Ln T = 0.74 Ln(129.951) + 2.89
Ln T = 6.49
T = 659.64
T = 660 vehicle trips
with 48% (317 vph) entering and 52% (343 vph) exiting.

SATURDAY DAILY

Ln T = 0.62 Ln (X) + 6.24
Ln T = 0.62 Ln(129.951) + 6.24
Ln T = 9.26
T = 10484.34
T = 10,484 vehicle trips
with 50% (5,242 vpd) entering and 50% (5,242 vpd) exiting.

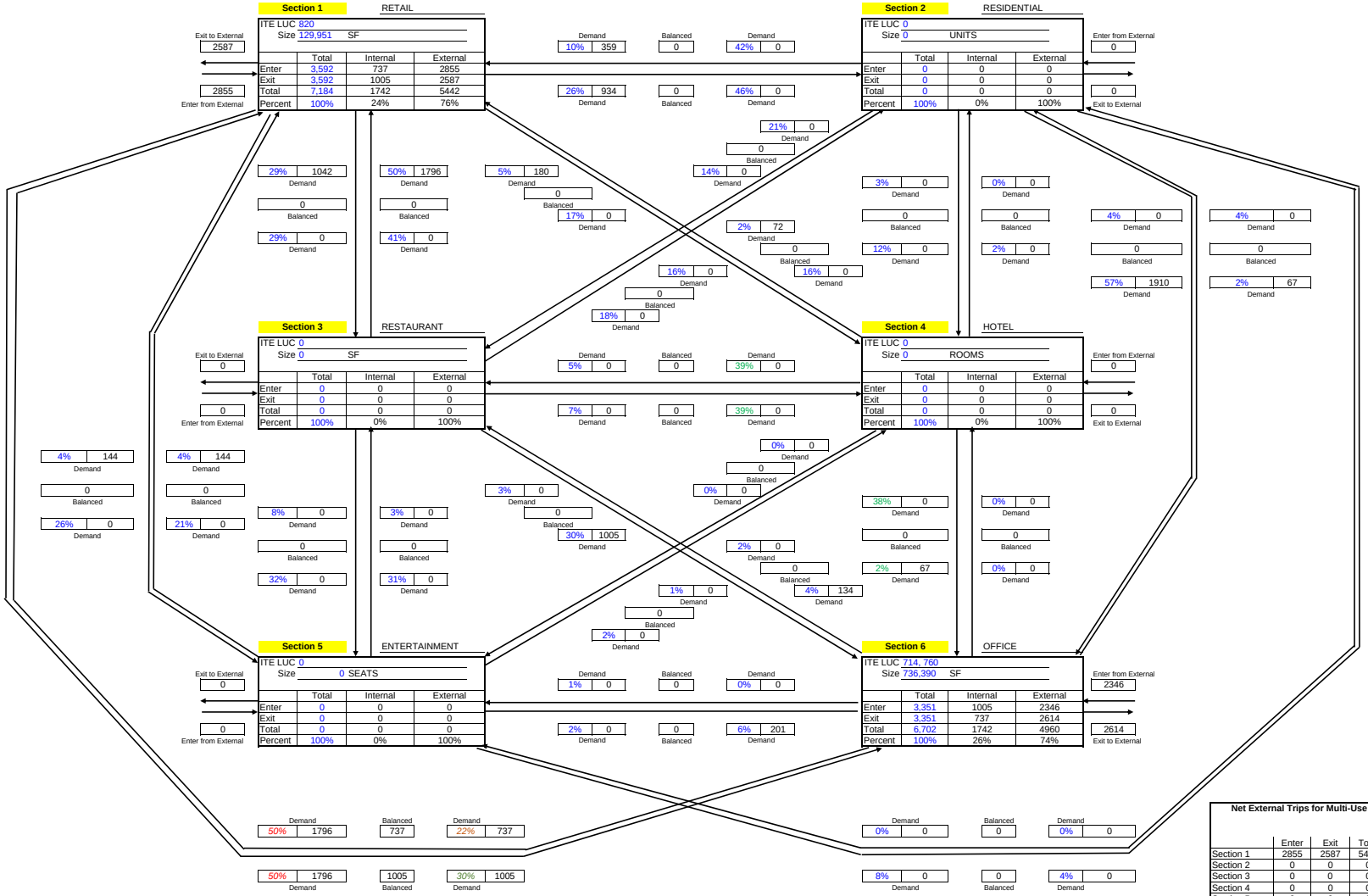
SATURDAY PEAK HOUR OF GENERATOR

Ln T = 0.79 Ln (X) + 2.79
Ln T = 0.79 Ln(129.951) + 2.79
Ln T = 6.64
T = 761.32
T = 761 vehicle trips
with 52% (396 vpd) entering and 48% (365 vpd) exiting.

Analyst: Douglas Halpert, P.E.
Date: September 22, 2020

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Name of Dvlpt: Muzi Ford Traffic Study - Needham, MA
Time Period: Weekday Daily



Net External Trips for Multi-Use Development

	Enter	Exit	Total	Single-Use Trip Gen Est.	
Section 1	2855	2587	5442	7184	
Section 2	0	0	0	0	
Section 3	0	0	0	0	
Section 4	0	0	0	0	
Section 5	0	0	0	0	
Section 6	2346	2614	4960	6702	*Internal Capture*
TOTAL	5201	5201	10402	13886	**25%**

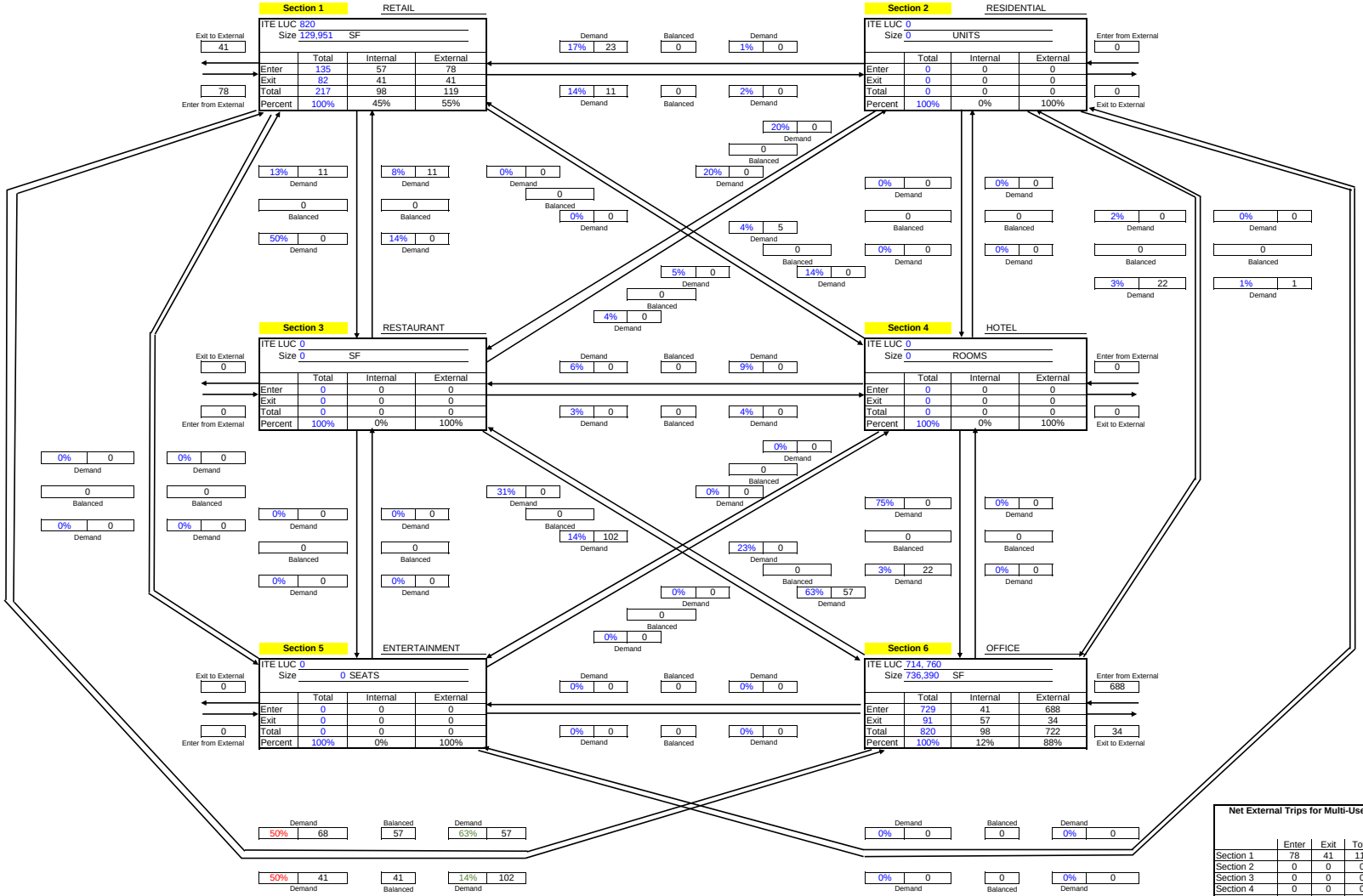
Based on Weekday PM from ITE Trip Generation Handbook, 3rd Edition, August 2014.
Based on an average of Weekday AM or PM from ITE Trip Generation Handbook, 3rd Edition, August 2014.

Retail will serve as ancillary use to other commercial/office uses on site. Internal Capture will be dependent upon demand to/from office uses and has been capped at 50% of retail.

Analyst: Douglas Halpert, P.E.
Date: September 22, 2020

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Name of Dvlpt: Muzi Ford Traffic Study - Needham, MA
Time Period: Weekday AM



Net External Trips for Multi-Use Development

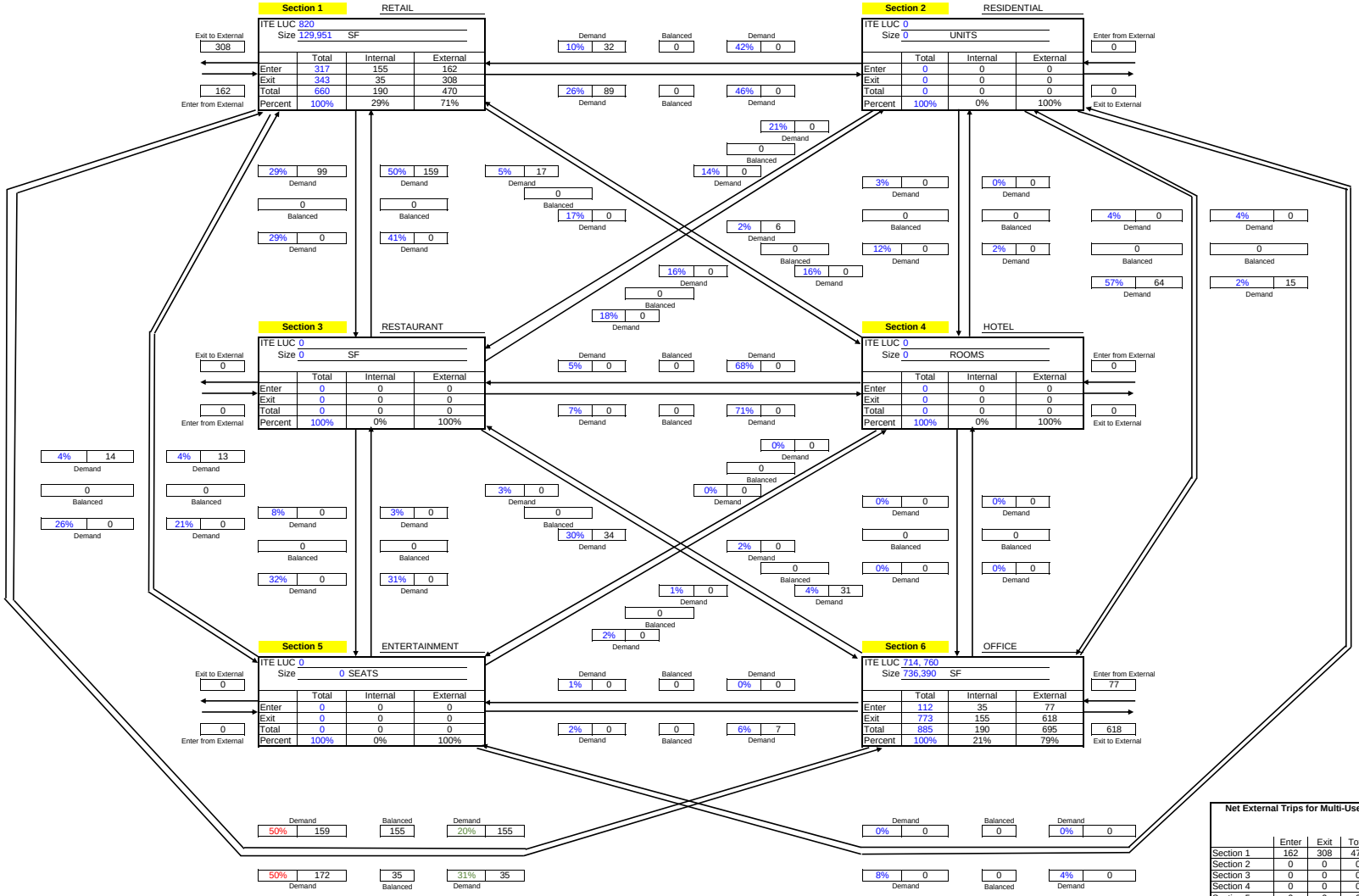
	Enter	Exit	Total	Single-Use Trip Gen Est.	
Section 1	78	41	119	217	
Section 2	0	0	0	0	
Section 3	0	0	0	0	
Section 4	0	0	0	0	
Section 5	0	0	0	0	
Section 6	688	34	722	820	*Internal Capture*
TOTAL	766	75	841	1037	**19%**

Based on ITE Trip Generation Handbook, 3rd Edition, August 2014.

Analyst: Douglas Halpert, P.E.
Date: September 22, 2020

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Name of Dvlpt: Muzi Ford Traffic Study - Needham, MA
Time Period: Weekday PM



Net External Trips for Multi-Use Development

	Enter	Exit	Total	Single-Use Trip Gen Est.	
Section 1	162	308	470	660	
Section 2	0	0	0	0	
Section 3	0	0	0	0	
Section 4	0	0	0	0	
Section 5	0	0	0	0	
Section 6	77	618	695	885	*Internal Capture*
TOTAL	239	926	1165	1545	**25%**

Based on ITE Trip Generation Handbook, 3rd Edition, August 2014.

Retail will serve as ancillary use to other commercial/office uses on site. Internal Capture will be dependent upon demand to/from office uses and has been capped at 50% of retail.

TRIP-GENERATION COMPARISON – RESIDENTIAL BUILD-OUT

Trip Generation Comparison Summary - Residential Alternative Build-Out

		Total External Trips		
		Alternative 1 (no Residential)	Alternative 2 (226 units Residential)	Net Difference
Weekday Daily	Entering	5,201	4,032	-1,169
	Exiting	5,201	4,032	-1,169
	Total	10,402	8,064	-2,338
Weekday AM Peak Hour	Entering	766	597	-169
	Exiting	75	115	40
	Total	841	712	-129
Weekday PM Peak Hour	Entering	239	200	-39
	Exiting	926	673	-253
	Total	1,165	873	-292
Saturday Daily	Entering	5,587	4,614	-973
	Exiting	5,587	4,614	-973
	Total	11,174	9,228	-1,946
Saturday Midday Peak Hour	Entering	420	329	-91
	Exiting	394	312	-82
	Total	814	641	-173

Size	Units	Land Use
866,342	SF	-
226	Units	LUC 221
259,132	SF	LUC 714
259,132	SF	LUC 760
91,458	SF	LUC 820

	Pass-By Rates				
	LUC 221	LUC 714	LUC 760	LUC 820	TOTAL
Weekday Daily	0%	0%	0%	26%	-
Weekday AM	0%	0%	0%	26%	-
Weekday PM	0%	0%	0%	34%	-
Saturday Daily	0%	0%	0%	26%	-
Saturday Midday	0%	0%	0%	26%	-

		Total Trips					External Trips					Pass-By Trips					New Primary Trips				
		LUC 221	LUC 714	LUC 760	LUC 820	TOTAL	LUC 221	LUC 714	LUC 760	LUC 820	TOTAL	LUC 221	LUC 714	LUC 760	LUC 820	TOTAL	LUC 221	LUC 714	LUC 760	LUC 820	TOTAL
Weekday Daily	Entering	615	1,029	1,428	2,829	5,901	307	710	985	2,030	4,032	0	0	0	499	499	307	710	985	1,531	3,533
	Exiting	615	1,029	1,428	2,829	5,901	332	792	1,099	1,809	4,032	0	0	0	499	499	332	792	1,099	1,310	3,533
	Total	1,230	2,058	2,856	5,658	11,802	639	1,502	2,084	3,839	8,064	0	0	0	998	998	639	1,502	2,084	2,841	7,066
Weekday AM Peak Hour	Entering	20	337	199	123	679	20	312	185	80	597	0	0	0	15	15	20	312	185	65	582
	Exiting	56	25	41	75	197	54	9	15	37	115	0	0	0	15	15	54	9	15	22	100
	Total	76	362	240	198	876	74	321	200	117	712	0	0	0	30	30	74	321	200	87	682
Weekday PM Peak Hour	Entering	59	35	45	244	383	30	23	30	117	200	0	0	0	56	56	30	23	30	61	144
	Exiting	38	316	237	265	856	20	251	189	213	673	0	0	0	56	56	20	251	189	157	617
	Total	97	351	282	509	1,239	50	274	219	330	873	0	0	0	112	112	50	274	219	218	761
Saturday Daily	Entering	555	233	218	4,216	5,222	367	176	165	3,906	4,614	0	0	0	1,019	1,019	367	176	165	2,887	3,595
	Exiting	555	233	218	4,216	5,222	333	179	168	3,934	4,614	0	0	0	1,019	1,019	333	179	168	2,915	3,595
	Total	1,110	466	436	8,432	10,444	700	355	333	7,840	9,228	0	0	0	2,038	2,038	700	355	333	5,802	7,190
Saturday Midday Peak Hour	Entering	50	11	31	300	392	31	7	18	273	329	0	0	0	67	67	31	7	18	206	262
	Exiting	52	15	31	277	375	33	12	25	242	312	0	0	0	67	67	33	12	25	175	245
	Total	102	26	62	577	767	64	19	43	515	641	0	0	0	134	134	64	19	43	381	507

Institute of Transportation Engineers (ITE)

Land Use Code (LUC) 221 - Multifamily Housing (Mid-Rise)

General Urban/Suburban

Average Vehicle Trips Ends vs: Dwelling Units
Independent Variable (X): 226

AVERAGE WEEKDAY DAILY

T = 5.45 * (X) - 1.75
T = 5.45 * 226 - 1.75
T = 1229.95
T = 1,230 vehicle trips
with 50% (615 vpd) entering and 50% (615 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

Ln(T) = 0.98 Ln (X) - 0.98
Ln(T) = 0.98 Ln (226) - 0.98
Ln(T) = 4.33
T = 76.11
T = 76 vehicle trips
with 26% (20 vph) entering and 74% (56 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

Ln T = 0.96 Ln (X) - 0.63
Ln T = 0.96 Ln(226) - 0.63
Ln T = 4.57
T = 96.90
T = 97 vehicle trips
with 61% (59 vph) entering and 39% (38 vph) exiting.

SATURDAY DAILY

T = 4.91 * (X)
T = 4.91 * 226
T = 1109.66
T = 1,110 vehicle trips
with 50% (555 vpd) entering and 50% (555 vpd) exiting.

SATURDAY PEAK HOUR OF GENERATOR

T = 0.42 * (X) + 6.73
T = 0.42 * 226 + 6.73
T = 101.65
T = 102 vehicle trips
with 49% (50 vpd) entering and 51% (52 vpd) exiting.

Institute of Transportation Engineers (ITE)

Land Use Code (LUC) 714 - Corporate Headquarters Building

General Urban/Suburban

Average Vehicle Trips Ends vs: 1000 Sq. Feet Gross Floor Area
Independent Variable (X): 259.132

AVERAGE WEEKDAY DAILY

T = 6.16 * (X) + 462.50
T = 6.16 * 259.132 + 462.50
T = 2058.75
T = 2,058 vehicle trips
with 50% (1,029 vpd) entering and 14% (1,029 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF GENERATOR

Ln T = 0.88 Ln (X) + 1.00
Ln T = 0.88 Ln(259.132) + 1.00
Ln T = 5.89
T = 361.57
T = 362 vehicle trips
with 93% (337 vph) entering and 7% (25 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF GENERATOR

Ln T = 0.95 Ln (X) + 0.58
Ln T = 0.95 Ln(259.132) + 0.58
Ln T = 5.86
T = 350.54
T = 351 vehicle trips
with 10% (35 vph) entering and 90% (316 vph) exiting.

SATURDAY DAILY

$$\frac{\text{ITE LUC 710 Saturday Daily Trip Rate}}{\text{ITE LUC 710 Weekday Daily Trip Rate}} = \frac{\text{ITE LUC 714 Saturday Daily Trip Rate}}{\text{ITE LUC 714 Weekday Daily Trip Rate}}$$

$$\frac{2.21}{9.74} = \frac{(Y)}{7.95} = 1.80$$

T = Y * 259.132
T = 466.44
T = 466 vehicle trips
with 50% (233 vpd) entering and 50% (233 vpd) exiting.

(same distribution split as ITE LUC 710 during the Saturday Daily)

SATURDAY PEAK HOUR OF GENERATOR

T = 0.10 * (X)
T = 0.10 * 259.132
T = 25.91
T = 26 vehicle trips
with 44% (11 vph) entering and 56% (15 vph) exiting.

Institute of Transportation Engineers (ITE)

Land Use Code (LUC) 760 - Research and Development Center

General Urban/Suburban

Average Vehicle Trips Ends vs: 1000 Sq. Feet Gross Floor Area
Independent Variable (X): 259.132

AVERAGE WEEKDAY DAILY

T = 10.23 * (X) + 204.68
T = 10.23 * 259.132 + 204.68
T = 2855.60
T = 2,856 vehicle trips
with 50% (1,428 vpd) entering and 50% (1,428 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF GENERATOR

Ln T = 0.88 Ln (X) + 0.59
Ln T = 0.88 Ln(259.132) + 0.59
Ln T = 5.48
T = 239.96
T = 240 vehicle trips
with 83% (199 vph) entering and 17% (41 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF GENERATOR

T = 1.04 * (X) +12.86
T = 1.04 * 259.132 + 12.86
T = 282.36
T = 282 vehicle trips
with 16% (45 vph) entering and 84% (237 vph) exiting.

SATURDAY DAILY

T = 1.25 * (X) + 112.04
T = 1.25 * 259.132 + 112.04
T = 435.96
T = 436 vehicle trips
with 50% (218 vpd) entering and 50% (218 vpd) exiting.

SATURDAY PEAK HOUR OF GENERATOR

T = 0.24 * (X)
T = 0.24 * 259.132
T = 62.19
T = 62 vehicle trips
with 50% (31 vph) entering and % (31 vph) exiting.

(same distribution split as ITE LUC 760 during the Saturday Daily)

Institute of Transportation Engineers (ITE)

Land Use Code (LUC) 820 - Shopping Center

General Urban/Suburban

Average Vehicle Trips Ends vs: 1000 Sq. Ft. Gross Floor Area
Independent Variable (X): 91.458

AVERAGE WEEKDAY DAILY

Ln(T) = 0.68 Ln (X) + 5.57
Ln(T) = 0.68 Ln (91.458) + 5.57
Ln(T) = 8.64
T = 5657.84
T = 5,658 vehicle trips
with 50% (2,829 vph) entering and 50% (2,829 vph) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.50 * (X) + 151.78
T = 0.50 * (91.458) + 151.78
T = 197.51
T = 198 vehicle trips
with 62% (123 vph) entering and 38% (75 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

Ln T = 0.74 Ln (X) + 2.89
Ln T = 0.74 Ln(91.458) + 2.89
Ln T = 6.23
T = 508.65
T = 509 vehicle trips
with 48% (244 vph) entering and 52% (265 vph) exiting.

SATURDAY DAILY

Ln T = 0.62 Ln (X) + 6.24
Ln T = 0.62 Ln(91.458) + 6.24
Ln T = 9.04
T = 8432.47
T = 8,432 vehicle trips
with 50% (4,216 vpd) entering and 50% (4,216 vpd) exiting.

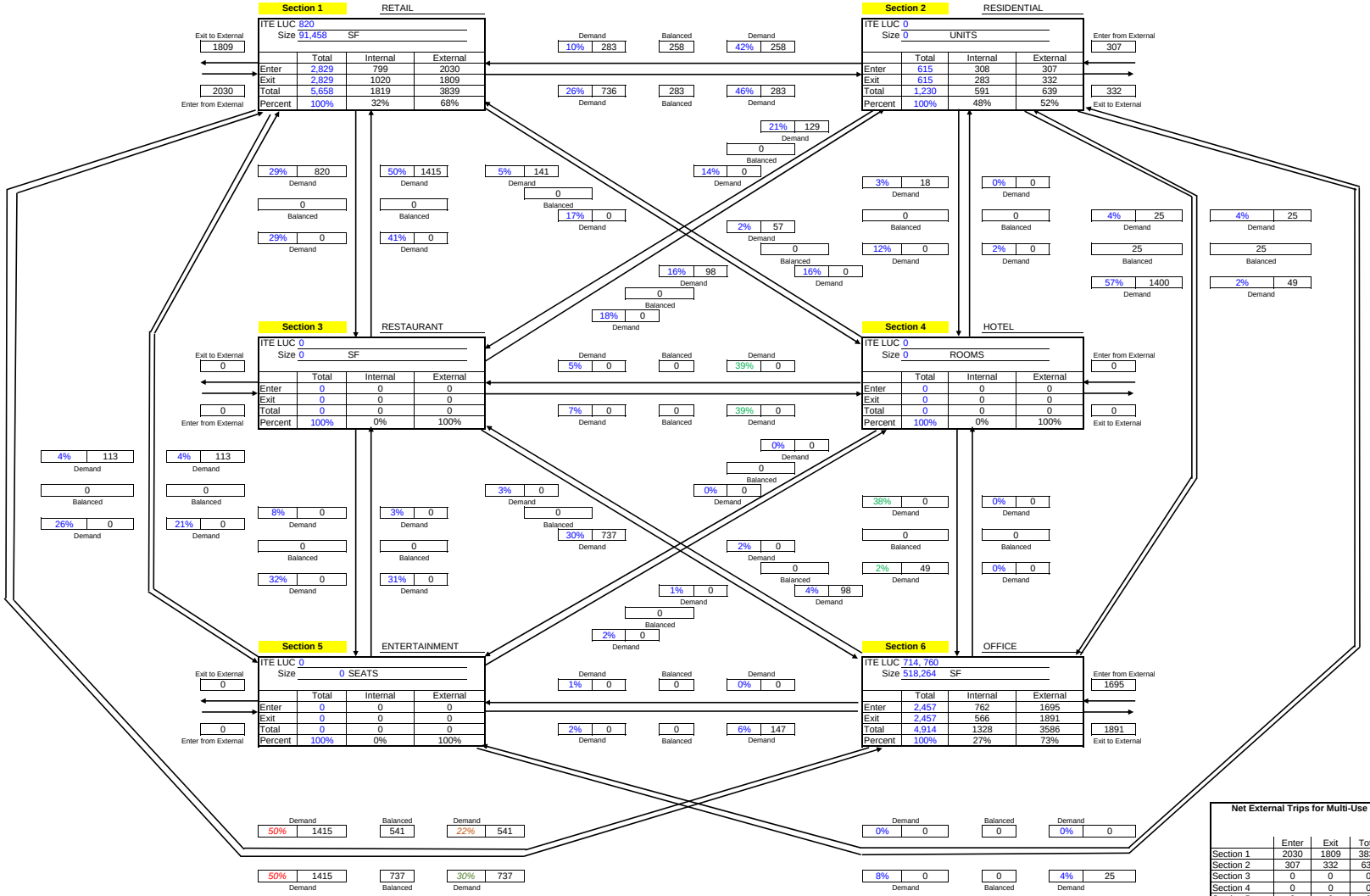
SATURDAY PEAK HOUR OF GENERATOR

Ln T = 0.79 Ln (X) + 2.79
Ln T = 0.79 Ln(91.458) + 2.79
Ln T = 6.36
T = 576.83
T = 577 vehicle trips
with 52% (300 vpd) entering and 48% (277 vpd) exiting.

Analyst: Douglas Halpert, P.E.
Date: September 22, 2020

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Name of Dvlpt: Muzi Ford Traffic Study - Needham, MA
Time Period: Weekday Daily



Net External Trips for Multi-Use Development

	Enter	Exit	Total	Single-Use Trip Gen Est.	
Section 1	2030	1809	3839	5658	
Section 2	307	332	639	1230	
Section 3	0	0	0	0	
Section 4	0	0	0	0	
Section 5	0	0	0	0	
Section 6	1695	1891	3586	4914	*Internal Capture*
TOTAL	4032	4032	8064	11802	**32%**

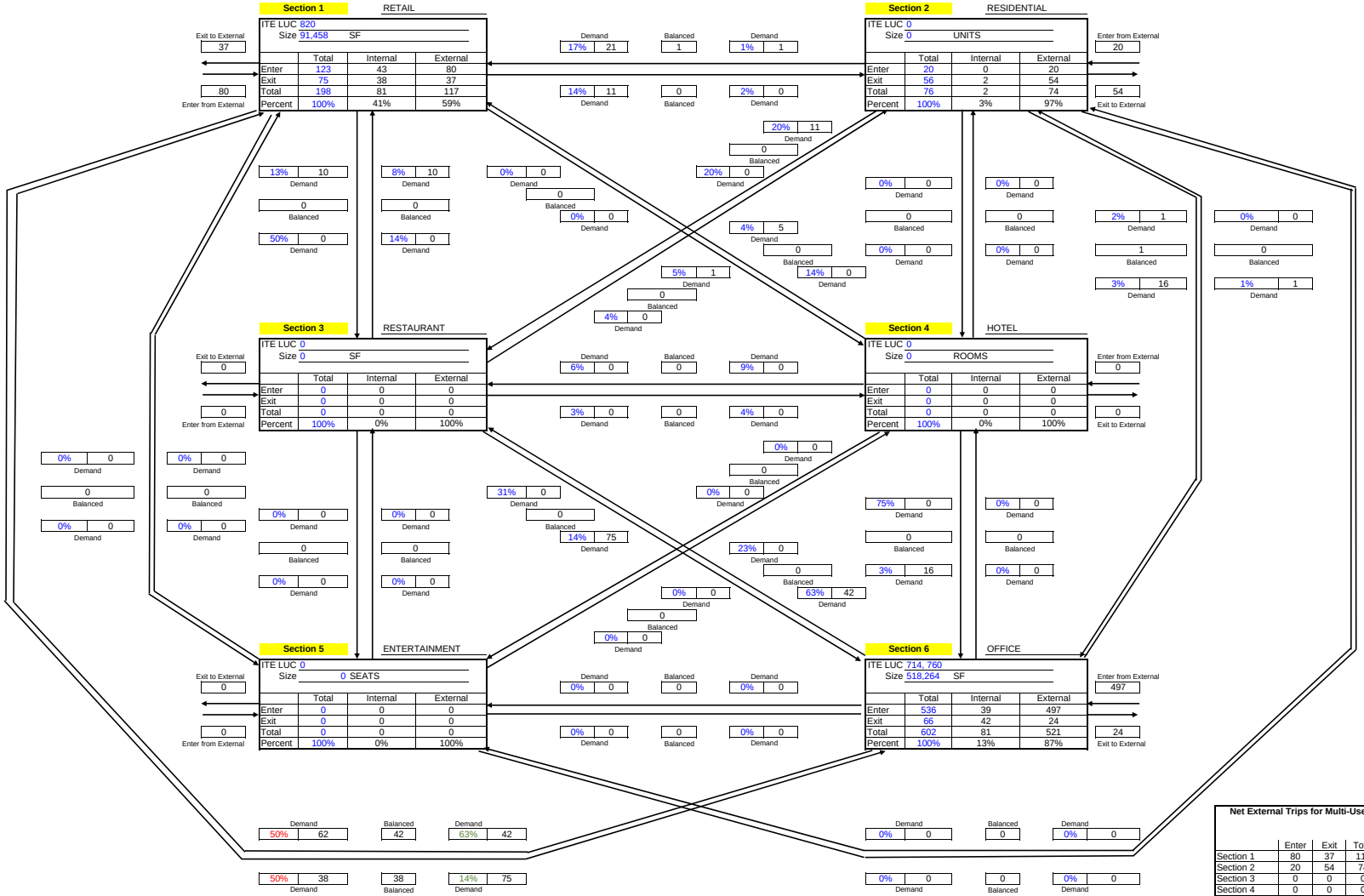
Based on Weekday PM from ITE Trip Generation Handbook, 3rd Edition, August 2014.
Based on an average of Weekday AM or PM from ITE Trip Generation Handbook, 3rd Edition, August 2014.

Retail will serve as ancillary use to other commercial/office uses on site. Internal Capture will be dependent upon demand to/from office uses and has been capped at 50% of retail.

Analyst: Douglas Halpert, P.E.
Date: September 22, 2020

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Name of Dvlpt: Muzi Ford Traffic Study - Needham, MA
Time Period: Weekday AM



Net External Trips for Multi-Use Development

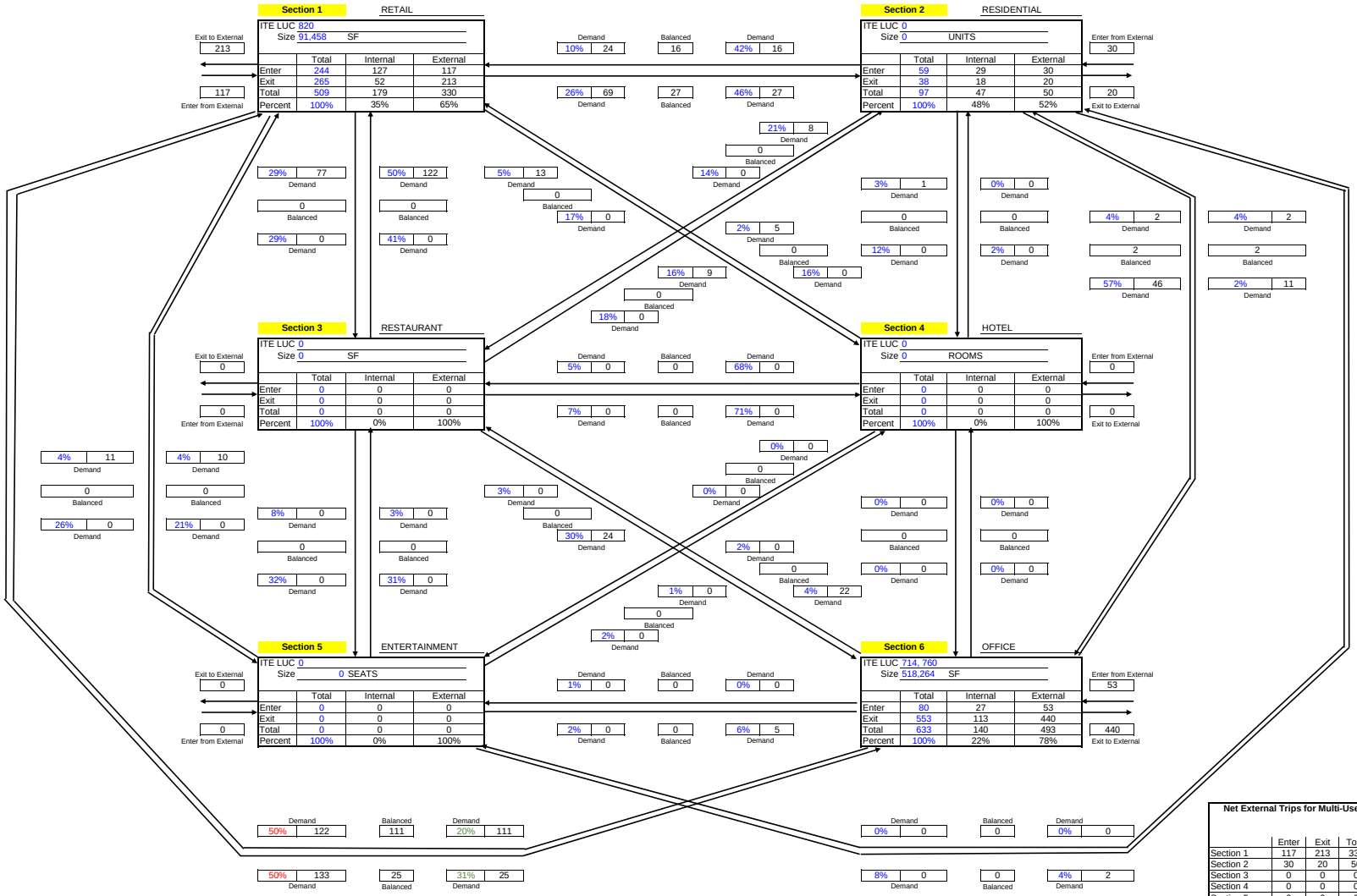
	Enter	Exit	Total	Single-Use Trip Gen Est.	
Section 1	80	37	117	198	
Section 2	20	54	74	76	
Section 3	0	0	0	0	
Section 4	0	0	0	0	
Section 5	0	0	0	0	
Section 6	497	24	521	602	*Internal Capture*
TOTAL	597	115	712	876	**19%**

Based on ITE Trip Generation Handbook, 3rd Edition, August 2014.

Analyst: Douglas Halpert, P.E.
Date: September 22, 2020

MULTI-USE DEVELOPMENT
TRIP GENERATION
AND INTERNAL CAPTURE SUMMARY

Name of Dvlpt: Muzi Ford Traffic Study - Needham, MA
Time Period: Weekday PM



Net External Trips for Multi-Use Development

	Enter	Exit	Total	Single-Use Trip Gen Est.	
Section 1	117	213	330	509	
Section 2	30	20	50	97	
Section 3	0	0	0	0	
Section 4	0	0	0	0	
Section 5	0	0	0	0	
Section 6	53	440	493	633	*Internal Capture*
TOTAL	200	673	873	1239	**30%**

Based on ITE Trip Generation Handbook, 3rd Edition, August 2014.

Retail will serve as ancillary use to other commercial/office uses on site. Internal Capture will be dependent upon demand to/from office uses and has been capped at 50% of retail.

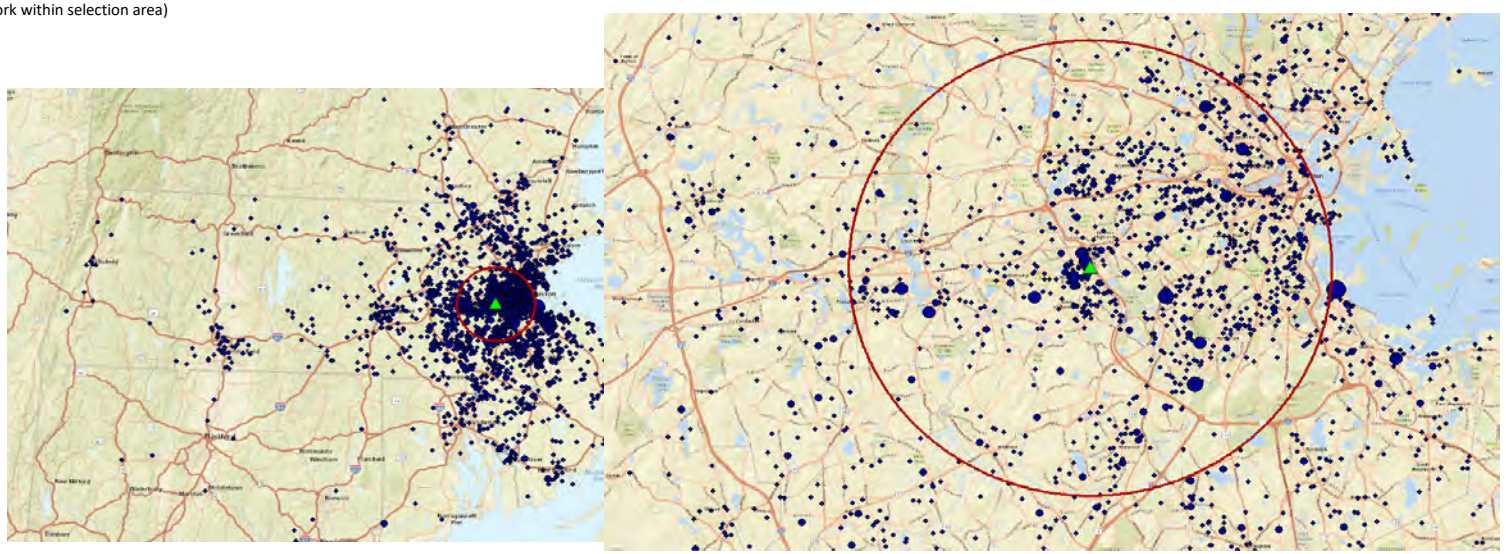
TRIP-DISTRIBUTION CALCULATIONS

	Existing Travel Patterns (Entering/Exiting Gould St)				BETA Gould Industrial Distribution				Building Density Model	Journey to Work (Office)	
	AM		PM		AM		PM		AM/PM	AM/PM	Use in TIAS++
Direction	Trips	% Distribution	Trips	% Distribution	Trips	% Distribution	Trips	% Distribution	% Distribution	% Distribution	% Distribution
Highland E	530	**38%**	485	**40%**	636	**32%**	580	**33%**	**48%**	**54%**	**40%**
Central E	200	**14%**	245	**20%**	280	**14%**	339	**19%**	**14%**	**9%**	**15%**
Central W	260	**19%**	180	**15%**	360	**18%**	260	**15%**	**15%**	**15%**	**15%**
Highland W	123	**9%**	89	**7%**	233	**12%**	151	**9%**	**2%**	**2%**	**10%**
Hunting S	273	**20%**	214	**18%**	492	**25%**	416	**24%**	**22%**	**21%**	**20%**
Total	1386	**100%**	1213	**100%**	2001	**100%**	1746	**100%**	**100%**	**100%**	**100%**

Work to Home Data

(Depicts home Locations of people who work within selection area)

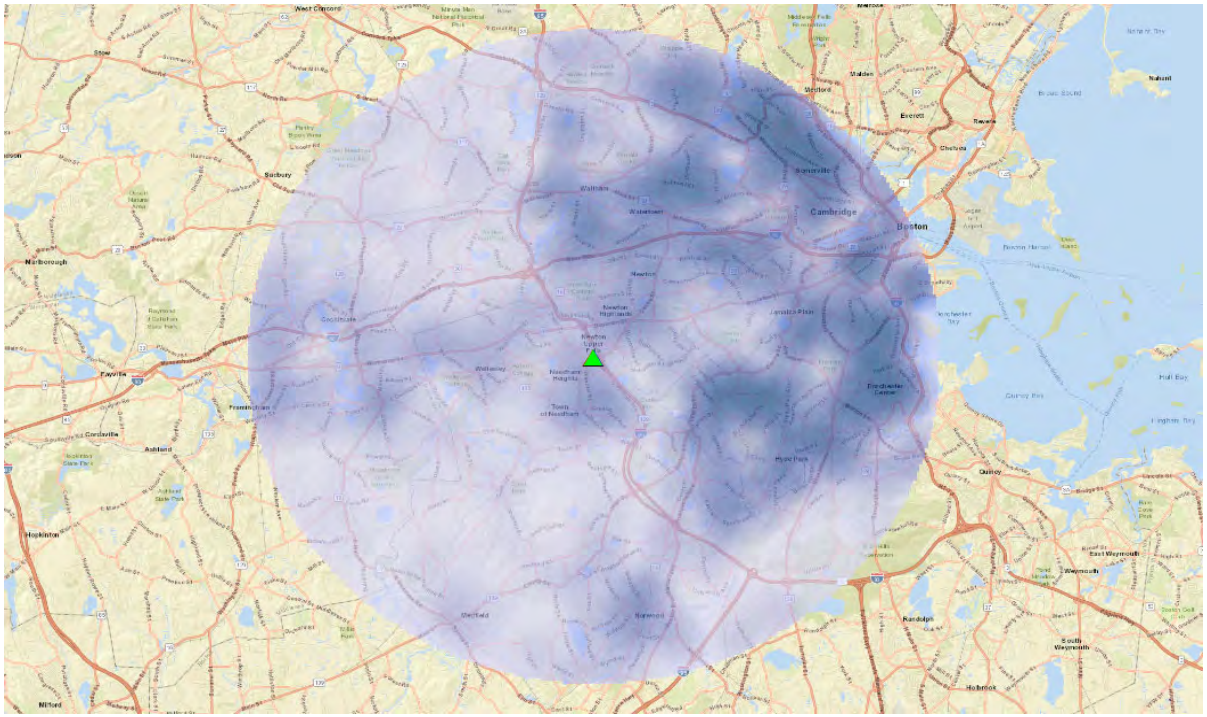
	# of Workers	Percentage
I-95 N	1446	51%
I -95 S	937	33%
Central E	98	3%
Central W	136	5%
Highland E	29	1%
Highland W	43	2%
Hunting S	122	4%
Total	**2811**	**100%**



Structures

(Depicts structures located within a 10 mile buffer of the site)

	# of Structi	Percentage
I-95 N	181265	52%
I -95 S	71236	20%
Central E	29578	8%
Central W	15355	4%
Highland E	7084	2%
Highland W	5360	2%
Hunting S	40054	11%
Total	**349932**	**100%**



SIGNAL WARRANT ANALYSIS WORKSHEETS

Raw Counts

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
6:00	0	343	67	42	111	0	25	0	40	0	0	0
7:00	**0**	**711**	**139**	**87**	**229**	**0**	**45**	**0**	**71**	**0**	**0**	**0**
8:00	0	650	190	93	272	0	72	0	104	0	0	0
9:00	0	539	105	66	174	0	42	0	66	0	0	0
10:00	0	480	94	59	155	0	47	0	75	0	0	0
11:00	0	458	89	56	147	0	71	0	65	0	0	0
12:00	0	475	90	176	752	0	71	0	65	0	0	0
13:00	0	461	88	171	730	0	74	0	68	0	0	0
14:00	0	477	91	177	754	0	71	0	65	0	0	0
15:00	0	583	111	216	923	0	68	0	62	0	0	0
16:00	0	369	77	197	614	0	135	0	122	0	0	0
17:00	**0**	**405**	**77**	**150**	**641**	**0**	**105**	**0**	**96**	**0**	**0**	**0**
18:00	0	407	77	151	643	0	90	0	82	0	0	0
19:00	0	345	66	128	546	0	63	0	58	0	0	0

From Raw 2015 TMCs in BETA Study
Ratio applied to AM Peak Hour counts on Highland Avenue
Ratio applied to PM Peak Hour counts on Highland Avenue

Highland Avenue Counts*

EB	WB	TOTAL
432	336	768
895	**600**	**1,495**
872	612	1,484
679	556	1,235
604	632	1,236
576	619	1,195
603	623	1,226
585	648	1,233
605	616	1,221
740	591	1,331
649	740	1,389
514	**916**	**1,430**
516	781	1,297
438	549	987

*Based on MassDOT Count Station 6697 for 3/8/2017

Seasonal Adjustment to Average Month Conditions (Percentage) = 0.0%

Seasonally Adjusted Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
7:00	0	711	139	87	229	0	45	0	71	0	0	0
8:00	0	650	190	93	272	0	72	0	104	0	0	0
9:00	0	539	105	66	174	0	42	0	66	0	0	0
10:00	0	480	94	59	155	0	47	0	75	0	0	0
11:00	0	458	89	56	147	0	71	0	65	0	0	0
12:00	0	475	90	176	752	0	71	0	65	0	0	0
13:00	0	461	88	171	730	0	74	0	68	0	0	0
14:00	0	477	91	177	754	0	71	0	65	0	0	0
15:00	0	583	111	216	923	0	68	0	62	0	0	0
16:00	0	369	77	197	614	0	135	0	122	0	0	0
17:00	0	405	77	150	641	0	105	0	96	0	0	0
18:00	0	407	77	151	643	0	90	0	82	0	0	0
19:00	0	345	66	128	546	0	63	0	58	0	0	0

Historical Growth Rate (Percentage) = 10.40%

Historic Growth Rate Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
7:00	0	785	153	96	253	0	50	0	78	0	0	0
8:00	0	718	210	103	300	0	79	0	115	0	0	0
9:00	0	595	116	73	192	0	46	0	73	0	0	0
10:00	0	530	104	65	171	0	52	0	83	0	0	0
11:00	0	506	98	62	162	0	78	0	72	0	0	0
12:00	0	524	99	194	830	0	78	0	72	0	0	0
13:00	0	509	97	189	806	0	82	0	75	0	0	0
14:00	0	527	100	195	832	0	78	0	72	0	0	0
15:00	0	644	123	238	1,019	0	75	0	68	0	0	0
16:00	0	407	85	217	678	0	149	0	135	0	0	0
17:00	0	447	85	166	708	0	116	0	106	0	0	0
18:00	0	449	85	167	710	0	99	0	91	0	0	0
19:00	0	381	73	141	603	0	70	0	64	0	0	0

No-Build Adjusted Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
7:00	0	785	153	96	253	0	50	0	78	0	0	0
8:00	0	718	210	103	300	0	79	0	115	0	0	0
9:00	0	595	116	73	192	0	46	0	73	0	0	0
10:00	0	530	104	65	171	0	52	0	83	0	0	0
11:00	0	506	98	62	162	0	78	0	72	0	0	0
12:00	0	524	99	194	830	0	78	0	72	0	0	0
13:00	0	509	97	189	806	0	82	0	75	0	0	0
14:00	0	527	100	195	832	0	78	0	72	0	0	0
15:00	0	644	123	238	1,019	0	75	0	68	0	0	0
16:00	0	407	85	217	678	0	149	0	135	0	0	0
17:00	0	447	85	166	708	0	116	0	106	0	0	0
18:00	0	449	85	167	710	0	99	0	91	0	0	0
19:00	0	381	73	141	603	0	70	0	64	0	0	0

Retail Site Generated Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT	% of Peak Hour Volumes Enter	% of Peak Hour Volumes Exit
7:00	0	0	2	2	0	0	3	0	3	0	0	0	1.4	0.9
8:00	0	0	9	9	0	0	4	0	4	0	0	0	2.6	1.5
9:00	0	0	6	6	0	0	9	0	9	0	0	0	4.7	2.5
10:00	0	0	9	9	0	0	15	0	15	0	0	0	7.1	4.1
11:00	0	0	13	13	0	0	25	0	25	0	0	0	9.7	6.8
12:00	0	0	14	14	0	0	34	0	34	0	0	0	10.6	9.4
13:00	0	0	12	12	0	0	34	0	34	0	0	0	9.2	9.5
14:00	0	0	12	12	0	0	33	0	33	0	0	0	8.9	9.2
15:00	0	0	11	11	0	0	33	0	33	0	0	0	8.5	9.0
16:00	0	0	12	12	0	0	34	0	34	0	0	0	8.9	9.4
17:00	0	0	12	12	0	0	34	0	34	0	0	0	9.2	9.4
18:00	0	0	10	10	0	0	31	0	31	0	0	0	7.6	8.5
19:00	0	0	7	7	0	0	25	0	25	0	0	0	5.3	6.9

Office / R&D Site Generated Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT	% of Peak Hour Volumes Enter	% of Peak Hour Volumes Exit
7:00	0	0	17	17	0	0	7	0	7	0	0	0	13.1	1.9
8:00	0	0	103	103	0	0	9	0	9	0	0	0	14.4	3.5
9:00	0	0	8	8	0	0	16	0	16	0	0	0	6.4	4.3
10:00	0	0	7	7	0	0	21	0	21	0	0	0	5.4	5.9
11:00	0	0	8	8	0	0	37	0	37	0	0	0	6.2	10.3
12:00	0	0	13	13	0	0	38	0	38	0	0	0	10.2	10.4
13:00	0	0	12	12	0	0	24	0	24	0	0	0	9.0	6.7
14:00	0	0	11	11	0	0	24	0	24	0	0	0	8.2	6.5
15:00	0	0	10	10	0	0	31	0	31	0	0	0	7.4	8.5
16:00	0	0	7	7	0	0	55	0	55	0	0	0	5.5	15.2
17:00	0	0	12	12	0	0	93	0	93	0	0	0	4.2	15.6
18:00	0	0	2	2	0	0	10	0	10	0	0	0	1.7	2.9
19:00	0	0	1	1	0	0	8	0	8	0	0	0	0.9	2.2

Build Adjusted Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
7:00	0	785	172	115	253	0	60	0	88	0	0	0
8:00	0	718	322	215	300	0	92	0	128	0	0	0
9:00	0	595	130	87	192	0	71	0	98	0	0	0
10:00	0	530	120	81	171	0	88	0	119	0	0	0
11:00	0	506	119	83	162	0	140	0	134	0	0	0
12:00	0	524	126	221	830	0	150	0	144	0	0	0
13:00	0	509	121	213	806	0	140	0	133	0	0	0
14:00	0	527	123	218	832	0	135	0	129	0	0	0
15:00	0	644	144	259	1,019	0	139	0	132	0	0	0
16:00	0	407	104	236	678	0	238	0	224	0	0	0
17:00	0	447	109	190	708	0	243	0	233	0	0	0
18:00	0	449	97	179	710	0	140	0	132	0	0	0
19:00	0	381	81	149	603	0	103	0	97	0	0	0

Traffic Control Signal Warrant Analyses

(Based on MUTCD-2009 Edition)

Intersection: Central Avenue at Gould Street

Pop. <10,000? (Y/N): N | Count Date: 10/21/2015 | Analysis Date: 10/04/20

Speed (in mph): 35 mph | Analysis Year: 2030 Build | Analyst: RLB

Adjustment Factor: 1 Raw counts

	Is Major?* (Y/N)	#Lanes* (one way)
EB	Y	1
WB	Y	1
NB	N	1
SB	N	1

Major Lanes: 1 Enter the higher number of lanes for the major street approach

Minor Lanes: 1 Enter the number of lanes for the minor street approach you want to analyze

*Note: If intersection is a "T" intersection, leave cells blank for the non-existent approach

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
7:00	0	785	172	115	253	0	60	0	88	0	0	0
8:00	0	718	322	215	300	0	92	0	128	0	0	0
9:00	0	595	130	87	192	0	71	0	98	0	0	0
10:00	0	530	120	81	171	0	88	0	119	0	0	0
11:00	0	506	119	83	162	0	140	0	134	0	0	0
12:00	0	524	126	221	830	0	150	0	144	0	0	0
13:00	0	509	121	213	806	0	140	0	133	0	0	0
14:00	0	527	123	218	832	0	135	0	129	0	0	0
15:00	0	644	144	259	1,019	0	139	0	132	0	0	0
16:00	0	407	104	236	678	0	238	0	224	0	0	0
17:00	0	447	109	190	708	0	243	0	233	0	0	0
18:00	0	449	97	179	710	0	140	0	132	0	0	0
19:00	0	381	81	149	603	0	103	0	97	0	0	0

Time	Σ EB	Σ WB	Σ NB	Σ SB	Σ Major	Σ Minor	Σ Max Minor	W1 A	W1 B	W1combo	W2	W3
7:00	957	368	148	0	1325	148	148	N	Y	Y	Y	Y
8:00	1039	515	220	0	1554	220	220	Y	Y	Y	Y	Y
9:00	725	279	169	0	1004	169	169	Y	Y	Y	Y	N
10:00	650	252	207	0	902	207	207	Y	Y	Y	Y	N
11:00	625	245	274	0	870	274	274	Y	Y	Y	Y	Y
12:00	651	1052	294	0	1702	294	294	Y	Y	Y	Y	Y
13:00	630	1019	273	0	1649	273	273	Y	Y	Y	Y	Y
14:00	650	1051	264	0	1701	264	264	Y	Y	Y	Y	Y
15:00	787	1278	272	0	2066	272	272	Y	Y	Y	Y	Y
16:00	511	914	462	0	1426	462	462	Y	Y	Y	Y	Y
17:00	556	897	476	0	1453	476	476	Y	Y	Y	Y	Y
18:00	546	889	272	0	1435	272	272	Y	Y	Y	Y	Y
19:00	462	752	200	0	1214	200	200	Y	Y	Y	Y	Y
								12 of 8	**13 of 8**	**13 of 8**	**13 of 4**	**11 of 1**

Warrant Analyses

Warrant 1: Condition A Minimum Vehicular Volume Warrant is Met

Warrant 1: Condition B Interruption of Continuous Traffic Warrant is Met

Warrant 1: Combination of Warrants 1A and 1B is Met

Warrant 2: Four-Hour Warrant is Met

Warrant 3: One-Hour Warrant is Met

Raw Counts

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
6:00	0	0	0	0	0	0	0	158	0	0	113	0
7:00	0	0	0	0	0	0	0	236	0	0	181	0
8:00	0	0	0	0	0	0	0	305	0	0	218	0
9:00	0	0	0	0	0	0	0	254	0	0	181	0
10:00	0	0	0	0	0	0	0	254	0	0	182	0
11:00	0	0	0	0	0	0	0	246	0	0	176	0
12:00	0	0	0	0	0	0	0	206	0	0	291	0
13:00	0	0	0	0	0	0	0	207	0	0	293	0
14:00	0	0	0	0	0	0	0	205	0	0	290	0
15:00	0	0	0	0	0	0	0	223	0	0	316	0
16:00	0	0	0	0	0	0	0	233	0	0	330	0
17:00	0	0	0	0	0	0	0	233	0	0	356	0
18:00	0	0	0	0	0	0	0	218	0	0	308	0
19:00	0	0	0	0	0	0	0	166	0	0	234	0

From Raw 2015 TMCs in BETA Study
Ratio applied to AM Peak Hour counts on Highland Avenue
Ratio applied to PM Peak Hour counts on Highland Avenue

Highland Avenue Counts*

EB	WB	TOTAL
432	336	768
895	600	1,495
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576	619	1,195
603	623	1,226
585	648	1,233
605	616	1,221
740	591	1,331
649	740	1,389
514	916	1,430
516	781	1,297
438	549	987

*Based on MassDOT Count Station 6697 for 3/8/2017

Seasonal Adjustment to Average Month Conditions (Percentage) = 0.0%

Seasonally Adjusted Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
7:00	0	0	0	0	0	0	0	236	0	0	181	0
8:00	0	0	0	0	0	0	0	305	0	0	218	0
9:00	0	0	0	0	0	0	0	254	0	0	181	0
10:00	0	0	0	0	0	0	0	254	0	0	182	0
11:00	0	0	0	0	0	0	0	246	0	0	176	0
12:00	0	0	0	0	0	0	0	206	0	0	291	0
13:00	0	0	0	0	0	0	0	207	0	0	293	0
14:00	0	0	0	0	0	0	0	205	0	0	290	0
15:00	0	0	0	0	0	0	0	223	0	0	316	0
16:00	0	0	0	0	0	0	0	233	0	0	330	0
17:00	0	0	0	0	0	0	0	233	0	0	356	0
18:00	0	0	0	0	0	0	0	218	0	0	308	0
19:00	0	0	0	0	0	0	0	166	0	0	234	0

Historical Growth Rate (Percentage) = 10.40%

Historic Growth Rate Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
7:00	0	0	0	0	0	0	0	261	0	0	200	0
8:00	0	0	0	0	0	0	0	337	0	0	241	0
9:00	0	0	0	0	0	0	0	280	0	0	200	0
10:00	0	0	0	0	0	0	0	280	0	0	201	0
11:00	0	0	0	0	0	0	0	272	0	0	194	0
12:00	0	0	0	0	0	0	0	227	0	0	321	0
13:00	0	0	0	0	0	0	0	229	0	0	323	0
14:00	0	0	0	0	0	0	0	226	0	0	320	0
15:00	0	0	0	0	0	0	0	246	0	0	349	0
16:00	0	0	0	0	0	0	0	257	0	0	364	0
17:00	0	0	0	0	0	0	0	257	0	0	393	0
18:00	0	0	0	0	0	0	0	241	0	0	340	0
19:00	0	0	0	0	0	0	0	183	0	0	258	0

No-Build Adjusted Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
7:00	0	0	0	0	0	0	0	261	0	0	200	0
8:00	0	0	0	0	0	0	0	337	0	0	241	0
9:00	0	0	0	0	0	0	0	280	0	0	200	0
10:00	0	0	0	0	0	0	0	280	0	0	201	0
11:00	0	0	0	0	0	0	0	272	0	0	194	0
12:00	0	0	0	0	0	0	0	227	0	0	321	0
13:00	0	0	0	0	0	0	0	229	0	0	323	0
14:00	0	0	0	0	0	0	0	226	0	0	320	0
15:00	0	0	0	0	0	0	0	246	0	0	349	0
16:00	0	0	0	0	0	0	0	257	0	0	364	0
17:00	0	0	0	0	0	0	0	257	0	0	393	0
18:00	0	0	0	0	0	0	0	241	0	0	340	0
19:00	0	0	0	0	0	0	0	183	0	0	258	0

Retail Site Generated Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT	% of Peak Hour Volumes Enter	% of Peak Hour Volumes Exit
7:00	0	0	0	16	0	2	0	2	15	1	5	0	1.4	0.9
8:00	0	0	0	24	0	2	0	12	44	4	5	0	2.6	1.5
9:00	0	0	0	44	0	6	0	7	50	4	13	0	4.7	2.5
10:00	0	0	0	72	0	10	0	11	76	6	21	0	7.1	4.1
11:00	0	0	0	120	0	16	0	15	103	8	35	0	9.7	6.8
12:00	0	0	0	166	0	22	0	16	113	9	48	0	10.6	9.4
13:00	0	0	0	168	0	22	0	14	98	8	49	0	9.2	9.5
14:00	0	0	0	162	0	22	0	14	95	8	47	0	8.9	9.2
15:00	0	0	0	159	0	21	0	13	91	7	46	0	8.5	9.0
16:00	0	0	0	166	0	22	0	14	95	8	48	0	8.9	9.4
17:00	0	0	0	166	0	22	0	14	98	8	48	0	9.2	9.4
18:00	0	0	0	150	0	20	0	12	81	7	43	0	7.6	8.5
19:00	0	0	0	122	0	16	0	8	56	5	35	0	5.3	6.9

Office / R&D Site Generated Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT	% of Peak Hour Volumes Enter	% of Peak Hour Volumes Exit
7:00	0	0	0	34	0	4	0	20	140	11	10	0	13.1	1.9
8:00	0	0	0	18	0	3	0	120	362	51	6	0	14.4	3.5
9:00	0	0	0	76	0	10	0	10	68	6	22	0	6.4	4.3
10:00	0	0	0	104	0	14	0	8	58	5	30	0	5.4	5.9
11:00	0	0	0	182	0	24	0	9	66	5	53	0	6.2	10.3
12:00	0	0	0	184	0	24	0	16	109	9	53	0	10.2	10.4
13:00	0	0	0	118	0	16	0	14	96	8	34	0	9.0	6.7
14:00	0	0	0	115	0	15	0	12	87	7	33	0	8.2	6.5
15:00	0	0	0	150	0	20	0	11	79	6	43	0	7.4	8.5
16:00	0	0	0	268	0	36	0	8	59	5	78	0	5.5	15.2
17:00	0	0	0	324	0	47	0	13	40	6	108	0	4.2	15.6
18:00	0	0	0	51	0	7	0	3	18	1	15	0	1.7	2.9
19:00	0	0	0	39	0	5	0	1	10	1	11	0	0.9	2.2

Build Adjusted Volumes

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
7:00	0	0	0	50	0	6	0	283	155	12	215	0
8:00	0	0	0	42	0	5	0	469	406	55	252	0
9:00	0	0	0	120	0	16	0	297	118	10	235	0
10:00	0	0	0	176	0	24	0	299	134	11	252	0
11:00	0	0	0	302	0	40	0	296	169	13	282	0
12:00	0	0	0	350	0	46	0	259	222	18	422	0
13:00	0	0	0	286	0	38	0	257	194	16	406	0
14:00	0	0	0	277	0	37	0	252	182	15	400	0
15:00	0	0	0	309	0	41	0	270	170	13	438	0
16:00	0	0	0	434	0	58	0	279	154	13	490	0
17:00	0	0	0	490	0	69	0	284	138	14	549	0
18:00	0	0	0	201	0	27	0	256	99	8	398	0
19:00	0	0	0	161	0	21	0	192	66	6	304	0

Traffic Control Signal Warrant Analyses

(Based on MUTCD-2009 Edition)

Intersection:	Gould Street at South Site Driveway				
Pop. <10,000? (Y/N)	N	Count Date:	12/1/2015	Analysis Date:	10/04/20
Speed (in mph):	35 mph	Analysis Year:	2030 Build	Analyst:	RLB
		Adjustment Factor:	1	Raw counts	

	Is Major?* (Y/N)	#Lanes* (one way)
EB	N	1
WB	N	2
NB	Y	2
SB	Y	1

Major Lanes: 2 — Enter the higher number of lanes for the major street approach

Minor Lanes: 2 — Enter the number of lanes for the minor street approach you want to analyze

*Note: If intersection is a "T" intersection, leave cells blank for the non-existent approach

Time	EB LT	EB TH	EB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	SB LT	SB TH	SB RT
7:00	0	0	0	50	0	6	0	283	155	12	215	0
8:00	0	0	0	42	0	5	0	469	406	55	252	0
9:00	0	0	0	120	0	16	0	297	118	10	235	0
10:00	0	0	0	176	0	24	0	299	134	11	252	0
11:00	0	0	0	302	0	40	0	296	169	13	282	0
12:00	0	0	0	350	0	46	0	259	222	18	422	0
13:00	0	0	0	286	0	38	0	257	194	16	406	0
14:00	0	0	0	277	0	37	0	252	182	15	400	0
15:00	0	0	0	309	0	41	0	270	170	13	438	0
16:00	0	0	0	434	0	58	0	279	154	13	490	0
17:00	0	0	0	490	0	69	0	284	138	14	549	0
18:00	0	0	0	201	0	27	0	256	99	8	398	0
19:00	0	0	0	161	0	21	0	192	66	6	304	0

Time	Σ EB	Σ WB	Σ NB	Σ SB	Σ Major	Σ Minor	Σ Max Minor	W1 A	W1 B	W1combo	W2	W3
7:00	0	56	438	227	664	56	56	N	N	N	N	N
8:00	0	47	875	307	1181	47	47	N	N	N	N	N
9:00	0	136	415	245	660	136	136	N	N	N	N	N
10:00	0	200	433	263	696	200	200	Y	N	N	N	N
11:00	0	342	465	295	760	342	342	Y	N	Y	Y	N
12:00	0	396	481	440	922	396	396	Y	Y	Y	Y	N
13:00	0	324	451	422	873	324	324	Y	N	Y	Y	N
14:00	0	314	434	415	849	314	314	Y	N	Y	Y	N
15:00	0	350	440	451	891	350	350	Y	N	Y	Y	N
16:00	0	492	433	503	937	492	492	Y	Y	Y	Y	Y
17:00	0	559	422	563	985	559	559	Y	Y	Y	Y	Y
18:00	0	228	355	406	761	228	228	Y	N	Y	N	N
19:00	0	182	258	310	569	182	182	N	N	N	N	N
								9 of 8	**3 of 8**	**8 of 8**	**7 of 4**	**2 of 1**

Warrant Analyses

Warrant 1: Condition A Minimum Vehicular Volume Warrant is Met
Warrant 1: Condition B Interruption of Continuous Traffic Warrant is Not Met
Warrant 1: Combination of Warrants 1A and 1B is Met
Warrant 2: Four-Hour Warrant is Met
Warrant 3: One-Hour Warrant is Met

CAPACITY ANALYSIS METHODOLOGY

CAPACITY ANALYSIS METHODOLOGY

A primary result of capacity analysis is the assignment of levels of service to traffic facilities under various traffic flow conditions. The capacity analysis methodology is based on the concepts and procedures in the *Highway Capacity Manual* (HCM).[5] The concept of level of service (LOS) is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with LOS A representing the best operating conditions and LOS F the worst. Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year. A description of the operating condition under each level of service is provided below:

- *LOS A* describes conditions with little to no delay to motorists.
- *LOS B* represents a desirable level with relatively low delay to motorists.
- *LOS C* describes conditions with average delays to motorists.
- *LOS D* describes operations where the influence of congestion becomes more noticeable. Delays are still within an acceptable range.
- *LOS E* represents operating conditions with high delay values. This level is considered by many agencies to be the limit of acceptable delay.
- *LOS F* is considered to be unacceptable to most drivers with high delay values that often occur, when arrival flow rates exceed the capacity of the intersection.

Unsignalized Intersections

Levels of service for unsignalized intersections are calculated using the operational analysis methodology of the HCM. The procedure accounts for lane configuration on both the minor and major street approaches, conflicting traffic stream volumes, and the type of intersection control (STOP, YIELD, or all-way STOP control). The definition of level of service for unsignalized intersections is a function of average *control* delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The level-of-service criteria for unsignalized intersections are shown in Table A-1.

Signalized Intersections

Levels of service for signalized intersections are also calculated using the operational analysis methodology of the HCM. The methodology for signalized intersections assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on average *control* delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Table A-1 summarizes the relationship between level of service and average control delay.

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[5] *Highway Capacity Manual 2000*, Transportation Research Board; Washington, D.C.; 2000.

TABLE A-1
Level-of-Service Criteria for Intersections

Level of Service	Unsignalized Intersection Criteria Average Control Delay (Seconds per Vehicle)	Signalized Intersection Criteria Average Control Delay (Seconds per Vehicle)
A	≤10	≤10
B	>10 and ≤15	>10 and ≤20
C	>15 and ≤25	>20 and ≤35
D	>25 and ≤35	>35 and ≤55
E	>35 and ≤50	>55 and ≤80
F	>50	>80

Source *Highway Capacity Manual 2000*, Transportation Research Board; Washington, D.C.; 2000. Pages 10-16 and 17-2.

For signalized intersections, this delay criterion may be applied in assigning level-of-service designations to individual lane groups, to individual intersection approaches, or to the entire intersection. For unsignalized intersections, this delay criterion may be applied in assigning level-of-service designations to individual lane groups or to individual intersection approaches.

CAPACITY AND QUEUE ANALYSIS WORKSHEETS

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	650	190	95	270	70	105
Future Volume (vph)	650	190	95	270	70	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.970				0.919	
Flt Protected				0.987	0.980	
Satd. Flow (prot)	1807	0	0	1802	1652	0
Flt Permitted				0.987	0.980	
Satd. Flow (perm)	1807	0	0	1802	1652	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	1354			549	1225	
Travel Time (s)	30.8			12.5	27.8	
Confl. Peds. (#/hr)		2	2		2	2
Peak Hour Factor	0.93	0.93	0.89	0.89	0.76	0.76
Heavy Vehicles (%)	2%	2%	7%	3%	3%	4%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	17.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	650	190	95	270	70	105
Future Vol, veh/h	650	190	95	270	70	105
Conflicting Peds, #/hr	0	2	2	0	2	2
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	89	89	76	76
Heavy Vehicles, %	2	2	7	3	3	4
Mvmt Flow	699	204	107	303	92	138

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	905	0	1322	805
Stage 1	-	-	-	-	803	-
Stage 2	-	-	-	-	519	-
Critical Hdwy	-	-	4.17	-	6.43	6.24
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.263	-	3.527	3.336
Pot Cap-1 Maneuver	-	-	731	-	172	379
Stage 1	-	-	-	-	439	-
Stage 2	-	-	-	-	595	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	730	-	141	378
Mov Cap-2 Maneuver	-	-	-	-	141	-
Stage 1	-	-	-	-	438	-
Stage 2	-	-	-	-	489	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.8	110.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	226	-	-	730	-
HCM Lane V/C Ratio	1.019	-	-	0.146	-
HCM Control Delay (s)	110.7	-	-	10.8	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	9.6	-	-	0.5	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	760	5	16	325	7	22
Future Volume (vph)	760	5	16	325	7	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.999				0.899	
Flt Protected				0.998	0.988	
Satd. Flow (prot)	1859	0	0	1810	1688	0
Flt Permitted				0.998	0.988	
Satd. Flow (perm)	1859	0	0	1810	1688	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	549			284	522	
Travel Time (s)	12.5			6.5	17.8	
Confl. Peds. (#/hr)		3	2		3	2
Peak Hour Factor	0.93	0.93	0.89	0.89	0.73	0.73
Heavy Vehicles (%)	2%	20%	0%	5%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	760	5	16	325	7	22
Future Vol, veh/h	760	5	16	325	7	22
Conflicting Peds, #/hr	0	3	2	0	3	2
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	89	89	73	73
Heavy Vehicles, %	2	20	0	5	0	0
Mvmt Flow	817	5	18	365	10	30

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	825	0	1227	825
Stage 1	-	-	-	-	823	-
Stage 2	-	-	-	-	404	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	814	-	199	376
Stage 1	-	-	-	-	435	-
Stage 2	-	-	-	-	679	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	812	-	192	374
Mov Cap-2 Maneuver	-	-	-	-	192	-
Stage 1	-	-	-	-	434	-
Stage 2	-	-	-	-	658	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	18.6
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	304	-	-	812	-
HCM Lane V/C Ratio	0.131	-	-	0.022	-
HCM Control Delay (s)	18.6	-	-	9.5	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0.1	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	785	0	1	340	2	5
Future Volume (vph)	785	0	1	340	2	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt					0.899	
Flt Protected					0.988	
Satd. Flow (prot)	1863	0	0	1827	1467	0
Flt Permitted					0.988	
Satd. Flow (perm)	1863	0	0	1827	1467	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	284			471	517	
Travel Time (s)	6.5			10.7	17.6	
Confl. Peds. (#/hr)			1			1
Peak Hour Factor	0.93	0.93	0.91	0.91	0.58	0.58
Heavy Vehicles (%)	2%	0%	0%	4%	0%	20%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	785	0	1	340	2	5
Future Vol, veh/h	785	0	1	340	2	5
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	91	91	58	58
Heavy Vehicles, %	2	0	0	4	0	20
Mvmt Flow	844	0	1	374	3	9

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	845	0	1221	846
Stage 1	-	-	-	-	845	-
Stage 2	-	-	-	-	376	-
Critical Hdwy	-	-	4.1	-	6.4	6.4
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.48
Pot Cap-1 Maneuver	-	-	800	-	200	337
Stage 1	-	-	-	-	425	-
Stage 2	-	-	-	-	699	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	799	-	199	336
Mov Cap-2 Maneuver	-	-	-	-	199	-
Stage 1	-	-	-	-	425	-
Stage 2	-	-	-	-	698	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	18.4
HCM LOS			C

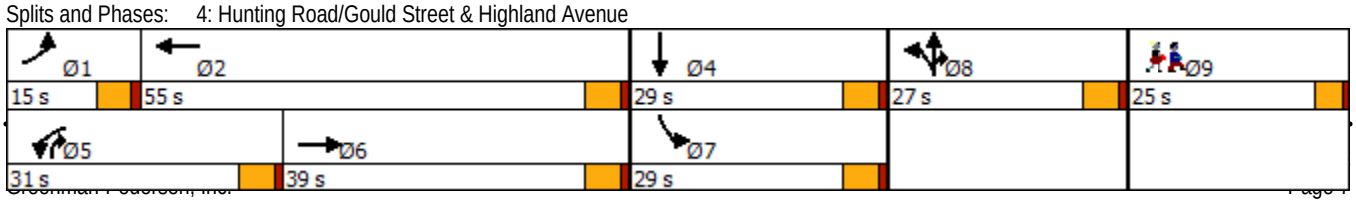
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	281	-	-	799	-
HCM Lane V/C Ratio	0.043	-	-	0.001	-
HCM Control Delay (s)	18.4	-	-	9.5	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	761	16	40	557	374	27	213	217	156	60	27
Future Volume (vph)	96	761	16	40	557	374	27	213	217	156	60	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	11	11	10	10	11	11
Storage Length (ft)	200		250	250		0	0		100	100		0
Storage Lanes	1		1	1		0	0		1	1		0
Taper Length (ft)	150			75			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Frt		0.997			0.940				0.850		0.967	
Flt Protected	0.950			0.950				0.994		0.950	0.986	
Satd. Flow (prot)	1636	3411	0	1668	3222	0	0	1810	1492	1510	1620	0
Flt Permitted	0.950			0.950				0.994		0.950	0.000	
Satd. Flow (perm)	1636	3411	0	1668	3222	0	0	1810	1492	1510	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1			115				158		8	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1352			1324			681			463	
Travel Time (s)		30.7			30.1			15.5			10.5	
Peak Hour Factor	0.93	0.93	0.93	0.95	0.95	0.95	0.88	0.88	0.88	0.89	0.89	0.89
Heavy Vehicles (%)	3%	2%	2%	1%	3%	0%	0%	1%	1%	6%	2%	0%
Shared Lane Traffic (%)										22%		
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Prot	NA	
Protected Phases	1	6		5	2		8	8	5 8	7	4	
Permitted Phases												
Detector Phase	1	6		5	2		8	8	5 8	7	4	
Switch Phase												
Minimum Initial (s)	4.0	10.0		6.0	20.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	9.0	15.0		11.0	25.0		11.0	11.0		11.0	11.0	
Total Split (s)	15.0	39.0		31.0	55.0		27.0	27.0		29.0	29.0	
Total Split (%)	9.9%	25.8%		20.5%	36.4%		17.9%	17.9%		19.2%	19.2%	
Maximum Green (s)	10.0	34.0		26.0	50.0		22.0	22.0		24.0	24.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0			5.0		5.0	5.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	Min		None	Min		None	None		None	None	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												

Intersection Summary

Area Type: Other
Cycle Length: 151
Actuated Cycle Length: 114.7
Natural Cycle: 105
Control Type: Actuated-Uncoordinated

Splits and Phases: 4: Hunting Road/Gould Street & Highland Avenue



Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	6.0
Minimum Split (s)	25.0
Total Split (s)	25.0
Total Split (%)	17%
Maximum Green (s)	21.0
Yellow Time (s)	3.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	2.0
Recall Mode	None
Walk Time (s)	6.0
Flash Dont Walk (s)	15.0
Pedestrian Calls (#/hr)	0

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	103	835	42	980	273	247	136	136
v/c Ratio	0.72	0.69	0.38	0.85	0.78	0.44	0.43	0.39
Control Delay	80.1	34.9	62.4	38.7	62.0	14.9	45.9	42.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.1	34.9	62.4	38.7	62.0	14.9	45.9	42.2
Queue Length 50th (ft)	75	272	30	314	193	49	92	85
Queue Length 95th (ft)	#183	354	71	396	#354	125	172	164
Internal Link Dist (ft)		1272		1244	601			383
Turn Bay Length (ft)	200		250			100	100	
Base Capacity (vph)	143	1210	379	1474	348	776	317	346
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.69	0.11	0.66	0.78	0.32	0.43	0.39

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	761	16	40	557	374	27	213	217	156	60	27
Future Volume (vph)	96	761	16	40	557	374	27	213	217	156	60	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	11	11	10	10	11	11
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00	0.95	0.95	
Frt	1.00	1.00		1.00	0.94			1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.99	
Satd. Flow (prot)	1636	3411		1668	3221			1810	1492	1510	1619	
Flt Permitted	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.00	
Satd. Flow (perm)	1636	3411		1668	3221			1810	1492	1510	0	
Peak-hour factor, PHF	0.93	0.93	0.93	0.95	0.95	0.95	0.88	0.88	0.88	0.89	0.89	0.89
Adj. Flow (vph)	103	818	17	42	586	394	31	242	247	175	67	30
RTOR Reduction (vph)	0	1	0	0	76	0	0	0	110	0	6	0
Lane Group Flow (vph)	103	834	0	42	904	0	0	273	137	136	130	0
Heavy Vehicles (%)	3%	2%	2%	1%	3%	0%	0%	1%	1%	6%	2%	0%
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Prot	NA	
Protected Phases	1	6		5	2		8	8	5 8	7	4	
Permitted Phases												
Actuated Green, G (s)	10.0	40.7		7.7	38.4			22.1	34.8	24.1	24.1	
Effective Green, g (s)	10.0	40.7		7.7	38.4			22.1	34.8	24.1	24.1	
Actuated g/C Ratio	0.09	0.36		0.07	0.34			0.19	0.30	0.21	0.21	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0		5.0	5.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0		2.0	2.0	
Lane Grp Cap (vph)	142	1211		112	1079			349	453	317	340	
v/s Ratio Prot	c0.06	0.24		0.03	c0.28			c0.15	0.09	c0.09	0.08	
v/s Ratio Perm												
v/c Ratio	0.73	0.69		0.38	0.84			0.78	0.30	0.43	0.38	
Uniform Delay, d1	51.0	31.5		51.1	35.2			44.0	30.6	39.3	38.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	14.4	1.3		0.8	5.5			10.1	0.1	0.3	0.3	
Delay (s)	65.4	32.9		51.9	40.8			54.0	30.7	39.6	39.1	
Level of Service	E	C		D	D			D	C	D	D	
Approach Delay (s)		36.4			41.2			43.0			39.4	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	39.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	114.6	Sum of lost time (s)	24.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	5	22	0	14	17	310	36	17	270	2
Future Volume (vph)	0	0	5	22	0	14	17	310	36	17	270	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865				0.850		0.987			0.999	
Flt Protected					0.950			0.998			0.997	
Satd. Flow (prot)	0	1611	0	0	1770	1583	0	1835	0	0	1855	0
Flt Permitted					0.950			0.998			0.997	
Satd. Flow (perm)	0	1611	0	0	1770	1583	0	1835	0	0	1855	0
Link Speed (mph)		20			20			30			30	
Link Distance (ft)		431			469			463			307	
Travel Time (s)		14.7			16.0			10.5			7.0	
Peak Hour Factor	0.63	0.63	0.63	0.90	0.90	0.90	0.90	0.90	0.90	0.83	0.83	0.83
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	5	22	0	14	17	310	36	17	270	2
Future Vol, veh/h	0	0	5	22	0	14	17	310	36	17	270	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	63	63	63	90	90	90	90	90	90	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	8	24	0	16	19	344	40	20	325	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	776	788	326	772	769	364	327	0	0	384	0	0
Stage 1	366	366	-	402	402	-	-	-	-	-	-	-
Stage 2	410	422	-	370	367	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	315	323	715	317	332	681	1233	-	-	1174	-	-
Stage 1	653	623	-	625	600	-	-	-	-	-	-	-
Stage 2	619	588	-	650	622	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	298	310	715	304	318	681	1233	-	-	1174	-	-
Mov Cap-2 Maneuver	298	310	-	304	318	-	-	-	-	-	-	-
Stage 1	640	610	-	613	588	-	-	-	-	-	-	-
Stage 2	593	576	-	629	609	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.1	15	0.4	0.5
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1233	-	-	715	304	681	1174	-	-
HCM Lane V/C Ratio	0.015	-	-	0.011	0.08	0.023	0.017	-	-
HCM Control Delay (s)	8	0	-	10.1	17.9	10.4	8.1	0	-
HCM Lane LOS	A	A	-	B	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.3	0.1	0.1	-	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	13	11	375	43	18	240
Future Volume (vph)	13	11	375	43	18	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.939		0.986			
Flt Protected	0.973					0.996
Satd. Flow (prot)	1736	0	1837	0	0	1841
Flt Permitted	0.973					0.996
Satd. Flow (perm)	1736	0	1837	0	0	1841
Link Speed (mph)	20		30			30
Link Distance (ft)	474		307			641
Travel Time (s)	16.2		7.0			14.6
Peak Hour Factor	0.60	0.60	0.95	0.95	0.91	0.91
Heavy Vehicles (%)	0%	0%	2%	2%	0%	3%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	11	375	43	18	240
Future Vol, veh/h	13	11	375	43	18	240
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	60	60	95	95	91	91
Heavy Vehicles, %	0	0	2	2	0	3
Mvmt Flow	22	18	395	45	20	264

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	722	418	0	0	440	0
Stage 1	418	-	-	-	-	-
Stage 2	304	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	397	639	-	-	1131	-
Stage 1	669	-	-	-	-	-
Stage 2	753	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	389	639	-	-	1131	-
Mov Cap-2 Maneuver	389	-	-	-	-	-
Stage 1	669	-	-	-	-	-
Stage 2	737	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.3	0	0.6
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	474	1131	-
HCM Lane V/C Ratio	-	-	0.084	0.017	-
HCM Control Delay (s)	-	-	13.3	8.2	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	29	9	225	60	20	260
Future Volume (vph)	29	9	225	60	20	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.969		0.971			
Flt Protected	0.963					0.996
Satd. Flow (prot)	1600	0	1805	0	0	1808
Flt Permitted	0.963					0.996
Satd. Flow (perm)	1600	0	1805	0	0	1808
Link Speed (mph)	25		30			30
Link Distance (ft)	562		255			293
Travel Time (s)	15.3		5.8			6.7
Peak Hour Factor	0.79	0.79	0.90	0.90	0.80	0.80
Heavy Vehicles (%)	14%	0%	2%	3%	0%	5%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	1.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	29	9	225	60	20	260
Future Vol, veh/h	29	9	225	60	20	260
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	79	79	90	90	80	80
Heavy Vehicles, %	14	0	2	3	0	5
Mvmt Flow	37	11	250	67	25	325

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	659	284	0	0	317	0
Stage 1	284	-	-	-	-	-
Stage 2	375	-	-	-	-	-
Critical Hdwy	6.54	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.54	-	-	-	-	-
Critical Hdwy Stg 2	5.54	-	-	-	-	-
Follow-up Hdwy	3.626	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	410	760	-	-	1255	-
Stage 1	737	-	-	-	-	-
Stage 2	669	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	400	760	-	-	1255	-
Mov Cap-2 Maneuver	400	-	-	-	-	-
Stage 1	737	-	-	-	-	-
Stage 2	653	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.9	0	0.6
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	451	1255	-
HCM Lane V/C Ratio	-	-	0.107	0.02	-
HCM Control Delay (s)	-	-	13.9	7.9	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	1	0	10	0	3	1	165	60	12	275	2
Future Volume (vph)	4	1	0	10	0	3	1	165	60	12	275	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt					0.966			0.964			0.999	
Flt Protected		0.964			0.964						0.998	
Satd. Flow (prot)	0	1832	0	0	1646	0	0	1783	0	0	1825	0
Flt Permitted		0.964			0.964						0.998	
Satd. Flow (perm)	0	1832	0	0	1646	0	0	1783	0	0	1825	0
Link Speed (mph)		20			25			30			30	
Link Distance (ft)		246			436			293			1225	
Travel Time (s)		8.4			11.9			6.7			27.8	
Confl. Peds. (#/hr)	10		6			4	10		4			6
Peak Hour Factor	0.63	0.63	0.63	0.65	0.65	0.65	0.82	0.82	0.82	0.81	0.81	0.81
Heavy Vehicles (%)	0%	0%	0%	10%	2%	0%	2%	3%	2%	0%	4%	2%
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	0.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	4	1	0	10	0	3	1	165	60	12	275	2
Future Vol, veh/h	4	1	0	10	0	3	1	165	60	12	275	2
Conflicting Peds, #/hr	10	0	6	0	0	4	10	0	4	0	0	6
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	63	63	63	65	65	65	82	82	82	81	81	81
Heavy Vehicles, %	0	0	0	10	2	0	2	3	2	0	4	2
Mvmt Flow	6	2	0	15	0	5	1	201	73	15	340	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	633	661	357	622	626	252	352	0	0	278	0	0
Stage 1	381	381	-	244	244	-	-	-	-	-	-	-
Stage 2	252	280	-	378	382	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.2	6.52	6.2	4.12	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.2	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.2	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.59	4.018	3.3	2.218	-	-	2.2	-	-
Pot Cap-1 Maneuver	395	385	692	388	401	792	1207	-	-	1296	-	-
Stage 1	645	617	-	742	704	-	-	-	-	-	-	-
Stage 2	757	683	-	628	613	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	381	374	681	379	389	781	1196	-	-	1291	-	-
Mov Cap-2 Maneuver	381	374	-	379	389	-	-	-	-	-	-	-
Stage 1	638	602	-	738	700	-	-	-	-	-	-	-
Stage 2	745	680	-	614	598	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.7	13.8	0	0.3
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1196	-	-	380	430	1291	-	-
HCM Lane V/C Ratio	0.001	-	-	0.021	0.047	0.011	-	-
HCM Control Delay (s)	8	0	-	14.7	13.8	7.8	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0	-	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	405	75	150	640	105	95
Future Volume (vph)	405	75	150	640	105	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.979				0.936	
Flt Protected				0.991	0.974	
Satd. Flow (prot)	1845	0	0	1849	1700	0
Flt Permitted				0.991	0.974	
Satd. Flow (perm)	1845	0	0	1849	1700	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	1354			549	1225	
Travel Time (s)	30.8			12.5	27.8	
Confl. Peds. (#/hr)			6			6
Peak Hour Factor	0.90	0.90	0.82	0.82	0.61	0.61
Heavy Vehicles (%)	1%	0%	1%	2%	0%	4%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	139.3					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	405	75	150	640	105	95
Future Vol, veh/h	405	75	150	640	105	95
Conflicting Peds, #/hr	0	0	6	0	0	6
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	82	82	61	61
Heavy Vehicles, %	1	0	1	2	0	4
Mvmt Flow	450	83	183	780	172	156

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	539	0	1644	504
Stage 1	-	-	-	-	498	-
Stage 2	-	-	-	-	1146	-
Critical Hdwy	-	-	4.11	-	6.4	6.24
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.209	-	3.5	3.336
Pot Cap-1 Maneuver	-	-	1034	-	~ 111	564
Stage 1	-	-	-	-	615	-
Stage 2	-	-	-	-	306	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1028	-	~ 76	558
Mov Cap-2 Maneuver	-	-	-	-	~ 76	-
Stage 1	-	-	-	-	611	-
Stage 2	-	-	-	-	210	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	$ 769.9
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	129	-	-	1028	-
HCM Lane V/C Ratio	2.542	-	-	0.178	-
HCM Control Delay (s)	$ 769.9	-	-	9.3	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	29.1	-	-	0.6	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	470	3	16	750	15	38
Future Volume (vph)	470	3	16	750	15	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.999				0.903	
Flt Protected				0.999	0.986	
Satd. Flow (prot)	1861	0	0	1877	1656	0
Flt Permitted				0.999	0.986	
Satd. Flow (perm)	1861	0	0	1877	1656	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	549			284	522	
Travel Time (s)	12.5			6.5	17.8	
Confl. Peds. (#/hr)		2	1		2	1
Peak Hour Factor	0.96	0.96	0.87	0.87	0.66	0.66
Heavy Vehicles (%)	2%	0%	6%	1%	0%	3%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	1.2					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	470	3	16	750	15	38
Future Vol, veh/h	470	3	16	750	15	38
Conflicting Peds, #/hr	0	2	1	0	2	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	87	87	66	66
Heavy Vehicles, %	2	0	6	1	0	3
Mvmt Flow	490	3	18	862	23	58

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	495	0	1394	495
Stage 1	-	-	-	-	494	-
Stage 2	-	-	-	-	900	-
Critical Hdwy	-	-	4.16	-	6.4	6.23
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.254	-	3.5	3.327
Pot Cap-1 Maneuver	-	-	1048	-	158	573
Stage 1	-	-	-	-	617	-
Stage 2	-	-	-	-	400	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1046	-	152	571
Mov Cap-2 Maneuver	-	-	-	-	152	-
Stage 1	-	-	-	-	616	-
Stage 2	-	-	-	-	386	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	19.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	321	-	-	1046	-
HCM Lane V/C Ratio	0.25	-	-	0.018	-
HCM Control Delay (s)	19.9	-	-	8.5	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1	-	-	0.1	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	510	2	2	765	0	2
Future Volume (vph)	510	2	2	765	0	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt					0.865	
Flt Protected						
Satd. Flow (prot)	1863	0	0	1881	1644	0
Flt Permitted						
Satd. Flow (perm)	1863	0	0	1881	1644	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	284			471	517	
Travel Time (s)	6.5			10.7	17.6	
Confl. Peds. (#/hr)			1			1
Peak Hour Factor	0.94	0.94	0.87	0.87	0.25	0.25
Heavy Vehicles (%)	2%	0%	0%	1%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	510	2	2	765	0	2
Future Vol, veh/h	510	2	2	765	0	2
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	87	87	25	25
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	543	2	2	879	0	8

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	546	0	1428	546
Stage 1	-	-	-	-	545	-
Stage 2	-	-	-	-	883	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1033	-	150	541
Stage 1	-	-	-	-	585	-
Stage 2	-	-	-	-	408	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1032	-	149	540
Mov Cap-2 Maneuver	-	-	-	-	149	-
Stage 1	-	-	-	-	584	-
Stage 2	-	-	-	-	406	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	11.8
HCM LOS			B

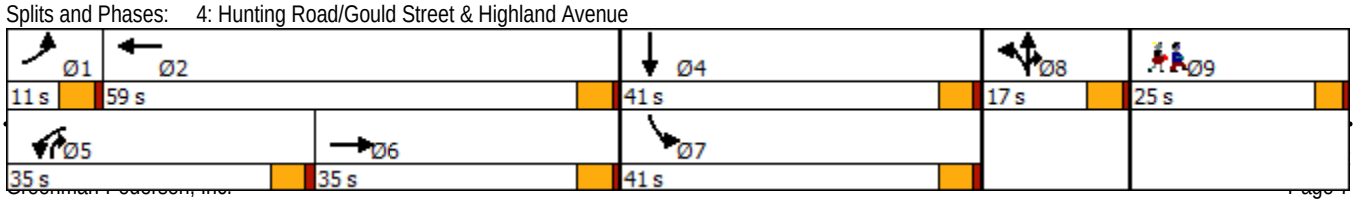
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	540	-	-	1032	-
HCM Lane V/C Ratio	0.015	-	-	0.002	-
HCM Control Delay (s)	11.8	-	-	8.5	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	650	15	124	741	168	32	75	97	317	139	61
Future Volume (vph)	28	650	15	124	741	168	32	75	97	317	139	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	11	11	10	10	11	11
Storage Length (ft)	200		250	250		0	0		100	100		0
Storage Lanes	1		1	1		0	0		1	1		0
Taper Length (ft)	150			75			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Frt		0.997			0.972				0.850		0.964	
Flt Protected	0.950			0.950				0.985		0.950	0.989	
Satd. Flow (prot)	1685	3413	0	1685	3090	0	0	1797	1492	1585	1639	0
Flt Permitted	0.950			0.950				0.985		0.950	0.000	
Satd. Flow (perm)	1685	3413	0	1685	3090	0	0	1797	1492	1585	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1			20				111		10	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1352			1324			681			463	
Travel Time (s)		30.7			30.1			15.5			10.5	
Peak Hour Factor	0.95	0.95	0.95	0.88	0.88	0.88	0.87	0.87	0.87	0.89	0.89	0.89
Heavy Vehicles (%)	0%	2%	0%	0%	12%	0%	0%	1%	1%	1%	1%	3%
Shared Lane Traffic (%)										18%		
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Prot	NA	
Protected Phases	1	6		5	2		8	8	5 8	7	4	
Permitted Phases												
Detector Phase	1	6		5	2		8	8	5 8	7	4	
Switch Phase												
Minimum Initial (s)	4.0	10.0		6.0	20.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	9.0	15.0		11.0	25.0		11.0	11.0		11.0	11.0	
Total Split (s)	11.0	35.0		35.0	59.0		17.0	17.0		41.0	41.0	
Total Split (%)	7.2%	22.9%		22.9%	38.6%		11.1%	11.1%		26.8%	26.8%	
Maximum Green (s)	6.0	30.0		30.0	54.0		12.0	12.0		36.0	36.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0			5.0		5.0	5.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	Min		None	Min		None	None		None	None	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												

Intersection Summary

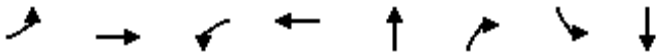
Area Type: Other
Cycle Length: 153
Actuated Cycle Length: 118.2
Natural Cycle: 105
Control Type: Actuated-Uncoordinated

Splits and Phases: 4: Hunting Road/Gould Street & Highland Avenue



Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	6.0
Minimum Split (s)	25.0
Total Split (s)	25.0
Total Split (%)	16%
Maximum Green (s)	21.0
Yellow Time (s)	3.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	2.0
Recall Mode	None
Walk Time (s)	6.0
Flash Dont Walk (s)	15.0
Pedestrian Calls (#/hr)	0

Intersection Summary



Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	29	700	141	1033	123	111	292	289
v/c Ratio	0.37	0.67	0.69	0.80	0.70	0.24	0.60	0.57
Control Delay	71.0	39.9	68.6	35.7	75.2	7.5	43.0	40.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.0	39.9	68.6	35.7	75.2	7.5	43.0	40.2
Queue Length 50th (ft)	23	247	109	377	96	0	210	198
Queue Length 95th (ft)	57	333	175	450	#184	41	327	311
Internal Link Dist (ft)		1272		1244	601			383
Turn Bay Length (ft)	200		250			100	100	
Base Capacity (vph)	85	1039	430	1431	183	650	485	509
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.67	0.33	0.72	0.67	0.17	0.60	0.57

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	650	15	124	741	168	32	75	97	317	139	61
Future Volume (vph)	28	650	15	124	741	168	32	75	97	317	139	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	11	11	10	10	11	11
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00	0.95	0.95	
Frt	1.00	1.00		1.00	0.97			1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.99	
Satd. Flow (prot)	1685	3411		1685	3091			1797	1492	1585	1640	
Flt Permitted	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.00	
Satd. Flow (perm)	1685	3411		1685	3091			1797	1492	1585	0	
Peak-hour factor, PHF	0.95	0.95	0.95	0.88	0.88	0.88	0.87	0.87	0.87	0.89	0.89	0.89
Adj. Flow (vph)	29	684	16	141	842	191	37	86	111	356	156	69
RTOR Reduction (vph)	0	1	0	0	12	0	0	0	83	0	7	0
Lane Group Flow (vph)	29	699	0	141	1021	0	0	123	28	292	282	0
Heavy Vehicles (%)	0%	2%	0%	0%	12%	0%	0%	1%	1%	1%	1%	3%
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Prot	NA	
Protected Phases	1	6		5	2		8	8	5 8	7	4	
Permitted Phases												
Actuated Green, G (s)	3.4	38.2		14.3	49.1			11.5	30.8	36.2	36.2	
Effective Green, g (s)	3.4	38.2		14.3	49.1			11.5	30.8	36.2	36.2	
Actuated g/C Ratio	0.03	0.32		0.12	0.41			0.10	0.26	0.30	0.30	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0		5.0	5.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0		2.0	2.0	
Lane Grp Cap (vph)	47	1084		200	1262			171	382	477	493	
v/s Ratio Prot	0.02	0.21		c0.08	c0.33			c0.07	0.02	c0.18	0.17	
v/s Ratio Perm												
v/c Ratio	0.62	0.65		0.70	0.81			0.72	0.07	0.61	0.57	
Uniform Delay, d1	57.8	35.2		50.9	31.4			52.8	33.9	36.0	35.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	15.7	1.0		8.9	3.7			11.4	0.0	1.6	1.0	
Delay (s)	73.5	36.2		59.8	35.1			64.2	33.9	37.6	36.5	
Level of Service	E	D		E	D			E	C	D	D	
Approach Delay (s)		37.7			38.1			49.8			37.0	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	38.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.2	Sum of lost time (s)	24.0
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	28	30	1	18	7	225	12	5	580	6
Future Volume (vph)	0	0	28	30	1	18	7	225	12	5	580	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865				0.850		0.993			0.999	
Flt Protected					0.953			0.998				
Satd. Flow (prot)	0	1611	0	0	1775	1583	0	1846	0	0	1861	0
Flt Permitted					0.953			0.998				
Satd. Flow (perm)	0	1611	0	0	1775	1583	0	1846	0	0	1861	0
Link Speed (mph)		20			20			30			30	
Link Distance (ft)		431			469			463			307	
Travel Time (s)		14.7			16.0			10.5			7.0	
Peak Hour Factor	0.75	0.75	0.75	0.72	0.72	0.72	0.92	0.92	0.92	0.86	0.86	0.86
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	1.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	28	30	1	18	7	225	12	5	580	6
Future Vol, veh/h	0	0	28	30	1	18	7	225	12	5	580	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	72	72	72	92	92	92	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	37	42	1	25	8	245	13	6	674	7

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	971	964	678	976	961	252	681	0	0	258	0	0
Stage 1	690	690	-	268	268	-	-	-	-	-	-	-
Stage 2	281	274	-	708	693	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	232	255	452	230	256	787	912	-	-	1307	-	-
Stage 1	435	446	-	738	687	-	-	-	-	-	-	-
Stage 2	726	683	-	426	445	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	221	251	452	208	252	787	912	-	-	1307	-	-
Mov Cap-2 Maneuver	221	251	-	208	252	-	-	-	-	-	-	-
Stage 1	431	443	-	731	680	-	-	-	-	-	-	-
Stage 2	694	676	-	388	442	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.7	20.4	0.3	0.1
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	912	-	-	452	209	787	1307	-	-
HCM Lane V/C Ratio	0.008	-	-	0.083	0.206	0.032	0.004	-	-
HCM Control Delay (s)	9	0	-	13.7	26.6	9.7	7.8	0	-
HCM Lane LOS	A	A	-	B	D	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.8	0.1	0	-	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	27	17	245	6	6	470
Future Volume (vph)	27	17	245	6	6	470
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.947		0.997			
Flt Protected	0.970					0.999
Satd. Flow (prot)	1745	0	1894	0	0	1792
Flt Permitted	0.970					0.999
Satd. Flow (perm)	1745	0	1894	0	0	1792
Link Speed (mph)	20		30			30
Link Distance (ft)	474		307			641
Travel Time (s)	16.2		7.0			14.6
Peak Hour Factor	0.81	0.81	0.75	0.75	0.73	0.73
Heavy Vehicles (%)	0%	0%	0%	0%	0%	6%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	27	17	245	6	6	470
Future Vol, veh/h	27	17	245	6	6	470
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	81	81	75	75	73	73
Heavy Vehicles, %	0	0	0	0	0	6
Mvmt Flow	33	21	327	8	8	644

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	991	331	0	0	335	0
Stage 1	331	-	-	-	-	-
Stage 2	660	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	275	715	-	-	1236	-
Stage 1	732	-	-	-	-	-
Stage 2	518	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	272	715	-	-	1236	-
Mov Cap-2 Maneuver	272	-	-	-	-	-
Stage 1	732	-	-	-	-	-
Stage 2	513	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.8	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	358	1236	-
HCM Lane V/C Ratio	-	-	0.152	0.007	-
HCM Control Delay (s)	-	-	16.8	7.9	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	90	19	200	42	10	265
Future Volume (vph)	90	19	200	42	10	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.976		0.976			
Flt Protected	0.960					0.998
Satd. Flow (prot)	1766	0	1818	0	0	1896
Flt Permitted	0.960					0.998
Satd. Flow (perm)	1766	0	1818	0	0	1896
Link Speed (mph)	25		30			30
Link Distance (ft)	562		255			293
Travel Time (s)	15.3		5.8			6.7
Confl. Peds. (#/hr)	1	1		1	1	
Peak Hour Factor	0.80	0.80	0.90	0.90	0.66	0.66
Heavy Vehicles (%)	1%	0%	2%	2%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	2.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	90	19	200	42	10	265
Future Vol, veh/h	90	19	200	42	10	265
Conflicting Peds, #/hr	1	1	0	1	1	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	80	80	90	90	66	66
Heavy Vehicles, %	1	0	2	2	0	0
Mvmt Flow	113	24	222	47	15	402

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	680	248	0	0	270	0
Stage 1	247	-	-	-	-	-
Stage 2	433	-	-	-	-	-
Critical Hdwy	6.41	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	418	796	-	-	1305	-
Stage 1	796	-	-	-	-	-
Stage 2	656	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	411	794	-	-	1304	-
Mov Cap-2 Maneuver	411	-	-	-	-	-
Stage 1	795	-	-	-	-	-
Stage 2	646	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.5	0	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	449	1304	-
HCM Lane V/C Ratio	-	-	0.303	0.012	-
HCM Control Delay (s)	-	-	16.5	7.8	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.3	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	50	0	2	0	195	21	1	220	0
Future Volume (vph)	1	0	0	50	0	2	0	195	21	1	220	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt					0.994			0.987				
Flt Protected		0.950			0.954							
Satd. Flow (prot)	0	1805	0	0	1802	0	0	1842	0	0	1827	0
Flt Permitted		0.950			0.954							
Satd. Flow (perm)	0	1805	0	0	1802	0	0	1842	0	0	1827	0
Link Speed (mph)		20			25			30			30	
Link Distance (ft)		246			436			293			1225	
Travel Time (s)		8.4			11.9			6.7			27.8	
Confl. Peds. (#/hr)	2		3	3		2	3		3	2		2
Peak Hour Factor	0.25	0.25	0.25	0.76	0.76	0.76	0.83	0.83	0.83	0.66	0.66	0.66
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	4%	0%
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	1.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	0	50	0	2	0	195	21	1	220	0
Future Vol, veh/h	1	0	0	50	0	2	0	195	21	1	220	0
Conflicting Peds, #/hr	2	0	3	3	0	2	3	0	3	2	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	25	25	25	76	76	76	83	83	83	66	66	66
Heavy Vehicles, %	0	0	0	0	0	0	0	2	0	0	4	0
Mvmt Flow	4	0	0	66	0	3	0	235	25	2	333	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	591	603	339	591	591	253	336	0	0	263	0	0
Stage 1	340	340	-	251	251	-	-	-	-	-	-	-
Stage 2	251	263	-	340	340	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	422	416	708	422	422	791	1235	-	-	1313	-	-
Stage 1	679	643	-	758	703	-	-	-	-	-	-	-
Stage 2	758	694	-	679	643	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	418	413	704	419	419	787	1231	-	-	1309	-	-
Mov Cap-2 Maneuver	418	413	-	419	419	-	-	-	-	-	-	-
Stage 1	677	640	-	756	701	-	-	-	-	-	-	-
Stage 2	754	692	-	676	640	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.7	15	0	0
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1231	-	-	418	427	1309	-	-
HCM Lane V/C Ratio	-	-	-	0.01	0.16	0.001	-	-
HCM Control Delay (s)	0	-	-	13.7	15	7.8	0	-
HCM Lane LOS	A	-	-	B	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.6	0	-	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	718	210	105	298	77	116
Future Volume (vph)	718	210	105	298	77	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.969				0.919	
Flt Protected				0.987	0.980	
Satd. Flow (prot)	1805	0	0	1802	1652	0
Flt Permitted				0.987	0.980	
Satd. Flow (perm)	1805	0	0	1802	1652	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	1354			549	1225	
Travel Time (s)	30.8			12.5	27.8	
Confl. Peds. (#/hr)		2	2		2	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	7%	3%	3%	4%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	20					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	718	210	105	298	77	116
Future Vol, veh/h	718	210	105	298	77	116
Conflicting Peds, #/hr	0	2	2	0	2	2
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	7	3	3	4
Mvmt Flow	780	228	114	324	84	126

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1010	0	1450	898
Stage 1	-	-	-	-	896	-
Stage 2	-	-	-	-	554	-
Critical Hdwy	-	-	4.17	-	6.43	6.24
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.263	-	3.527	3.336
Pot Cap-1 Maneuver	-	-	667	-	143	335
Stage 1	-	-	-	-	397	-
Stage 2	-	-	-	-	574	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	666	-	113	334
Mov Cap-2 Maneuver	-	-	-	-	113	-
Stage 1	-	-	-	-	396	-
Stage 2	-	-	-	-	453	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3	151.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	188	-	-	666	-
HCM Lane V/C Ratio	1.116	-	-	0.171	-
HCM Control Delay (s)	151.7	-	-	11.5	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	10.3	-	-	0.6	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	840	6	18	359	8	24
Future Volume (vph)	840	6	18	359	8	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.999				0.900	
Flt Protected				0.998	0.987	
Satd. Flow (prot)	1858	0	0	1810	1688	0
Flt Permitted				0.998	0.987	
Satd. Flow (perm)	1858	0	0	1810	1688	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	549			284	522	
Travel Time (s)	12.5			6.5	17.8	
Confl. Peds. (#/hr)		3	2		3	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	20%	0%	5%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	840	6	18	359	8	24
Future Vol, veh/h	840	6	18	359	8	24
Conflicting Peds, #/hr	0	3	2	0	3	2
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	20	0	5	0	0
Mvmt Flow	913	7	20	390	9	26

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	923	0	1353	922
Stage 1	-	-	-	-	920	-
Stage 2	-	-	-	-	433	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	748	-	167	330
Stage 1	-	-	-	-	392	-
Stage 2	-	-	-	-	658	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	746	-	160	328
Mov Cap-2 Maneuver	-	-	-	-	160	-
Stage 1	-	-	-	-	391	-
Stage 2	-	-	-	-	634	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	21
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	260	-	-	746	-
HCM Lane V/C Ratio	0.134	-	-	0.026	-
HCM Control Delay (s)	21	-	-	10	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0.1	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	867	0	1	376	2	6
Future Volume (vph)	867	0	1	376	2	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt					0.895	
Flt Protected					0.989	
Satd. Flow (prot)	1863	0	0	1827	1455	0
Flt Permitted					0.989	
Satd. Flow (perm)	1863	0	0	1827	1455	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	284			471	517	
Travel Time (s)	6.5			10.7	17.6	
Confl. Peds. (#/hr)			1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	0%	0%	4%	0%	20%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	867	0	1	376	2	6
Future Vol, veh/h	867	0	1	376	2	6
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	0	0	4	0	20
Mvmt Flow	942	0	1	409	2	7

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	943	0	1354	944
Stage 1	-	-	-	-	943	-
Stage 2	-	-	-	-	411	-
Critical Hdwy	-	-	4.1	-	6.4	6.4
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.48
Pot Cap-1 Maneuver	-	-	736	-	167	294
Stage 1	-	-	-	-	382	-
Stage 2	-	-	-	-	674	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	735	-	166	293
Mov Cap-2 Maneuver	-	-	-	-	166	-
Stage 1	-	-	-	-	382	-
Stage 2	-	-	-	-	673	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	20.2
HCM LOS			C

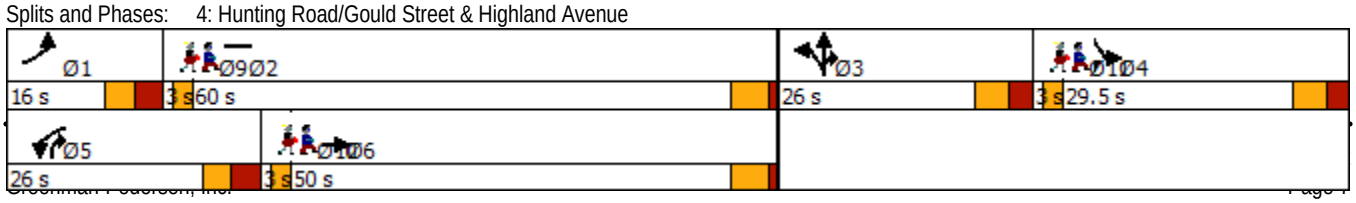
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	246	-	-	735	-
HCM Lane V/C Ratio	0.035	-	-	0.001	-
HCM Control Delay (s)	20.2	-	-	9.9	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	106	841	18	44	615	413	30	235	240	172	66	30
Future Volume (vph)	106	841	18	44	615	413	30	235	240	172	66	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	11	11	11	11	11	11
Storage Length (ft)	175		0	165		0	0		100	100		0
Storage Lanes	1		0	1		0	0		1	1		0
Taper Length (ft)	150			75			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Frt		0.997			0.940				0.850		0.966	
Flt Protected	0.950			0.950				0.994		0.950	0.986	
Satd. Flow (prot)	1636	3411	0	1668	3222	0	0	1810	1546	1564	1619	0
Flt Permitted	0.950			0.950				0.994		0.950	0.986	
Satd. Flow (perm)	1636	3411	0	1668	3222	0	0	1810	1546	1564	1619	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			141				134		9	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1352			1324			681			463	
Travel Time (s)		30.7			30.1			15.5			10.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	2%	1%	3%	0%	0%	1%	1%	6%	2%	0%
Shared Lane Traffic (%)										22%		
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Split	NA	
Protected Phases	1	6		5	2		3	3	3 5	4	4	
Permitted Phases												
Detector Phase	1	6		5	2		3	3	3 5	4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	12.0	15.0		12.0	15.0		12.0	12.0		12.0	12.0	
Total Split (s)	16.0	50.0		26.0	60.0		26.0	26.0		29.5	29.5	
Total Split (%)	11.6%	36.4%		18.9%	43.6%		18.9%	18.9%		21.5%	21.5%	
Maximum Green (s)	10.0	45.0		20.0	55.0		20.0	20.0		23.5	23.5	
Yellow Time (s)	3.0	4.0		3.0	4.0		3.5	3.5		3.5	3.5	
All-Red Time (s)	3.0	1.0		3.0	1.0		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Lost Time (s)	6.0	5.0		6.0	5.0			6.0		6.0	6.0	
Lead/Lag	Lead			Lead			Lead	Lead				
Lead-Lag Optimize?	Yes			Yes			Yes	Yes				
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	Min		None	Min		None	None		None	None	
Walk Time (s)		4.0			4.0					4.0	4.0	
Flash Dont Walk (s)		11.0			12.0					19.5	19.5	
Pedestrian Calls (#/hr)		1			1					1	1	

Intersection Summary

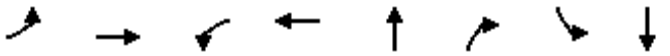
Area Type: Other
Cycle Length: 137.5
Actuated Cycle Length: 111.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated

Splits and Phases: 4: Hunting Road/Gould Street & Highland Avenue



Lane Group	Ø9	Ø10	Ø11
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Peak Hour Factor			
Heavy Vehicles (%)			
Shared Lane Traffic (%)			
Turn Type			
Protected Phases	9	10	11
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	3.0	3.0	3.0
Total Split (s)	3.0	3.0	3.0
Total Split (%)	2%	2%	2%
Maximum Green (s)	1.0	1.0	1.0
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0	2.0
Recall Mode	None	None	None
Walk Time (s)	0.0	0.0	0.0
Flash Dont Walk (s)	0.0	0.0	0.0
Pedestrian Calls (#/hr)	1	1	1

Intersection Summary



Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	115	934	48	1117	288	261	146	146
v/c Ratio	0.77	0.71	0.39	0.88	0.87	0.53	0.69	0.64
Control Delay	84.0	32.9	63.3	37.4	71.8	14.4	64.8	57.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	84.0	32.9	63.3	37.4	71.8	14.4	64.8	57.9
Queue Length 50th (ft)	80	280	33	333	197	46	103	95
Queue Length 95th (ft)	#233	448	84	507	#476	115	205	195
Internal Link Dist (ft)		1272		1244	601			383
Turn Bay Length (ft)	175		165			100	100	
Base Capacity (vph)	150	1473	306	1700	332	653	338	357
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.63	0.16	0.66	0.87	0.40	0.43	0.41

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	106	841	18	44	615	413	30	235	240	172	66	30
Future Volume (vph)	106	841	18	44	615	413	30	235	240	172	66	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	11	11	11	11	11	11
Total Lost time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00	0.95	0.95	
Frt	1.00	1.00		1.00	0.94			1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.99	
Satd. Flow (prot)	1636	3410		1668	3221			1810	1546	1564	1619	
Flt Permitted	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.99	
Satd. Flow (perm)	1636	3410		1668	3221			1810	1546	1564	1619	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	115	914	20	48	668	449	33	255	261	187	72	33
RTOR Reduction (vph)	0	1	0	0	88	0	0	0	99	0	8	0
Lane Group Flow (vph)	115	933	0	48	1029	0	0	288	162	146	138	0
Heavy Vehicles (%)	3%	2%	2%	1%	3%	0%	0%	1%	1%	6%	2%	0%
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Split	NA	
Protected Phases	1	6		5	2		3	3	3 5	4	4	
Permitted Phases												
Actuated Green, G (s)	10.2	42.9		8.2	40.9			20.4	28.6	15.1	15.1	
Effective Green, g (s)	10.2	42.9		8.2	40.9			20.4	28.6	15.1	15.1	
Actuated g/C Ratio	0.09	0.39		0.07	0.37			0.19	0.26	0.14	0.14	
Clearance Time (s)	6.0	5.0		6.0	5.0			6.0		6.0	6.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0		2.0	2.0	
Lane Grp Cap (vph)	152	1334		124	1201			336	403	215	223	
v/s Ratio Prot	c0.07	0.27		0.03	c0.32			c0.16	0.10	c0.09	0.09	
v/s Ratio Perm												
v/c Ratio	0.76	0.70		0.39	0.86			0.86	0.40	0.68	0.62	
Uniform Delay, d1	48.5	27.9		48.3	31.6			43.2	33.4	44.9	44.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	17.2	1.3		0.7	6.0			18.3	0.2	6.5	3.6	
Delay (s)	65.7	29.3		49.0	37.6			61.5	33.7	51.5	48.1	
Level of Service	E	C		D	D			E	C	D	D	
Approach Delay (s)		33.2			38.1			48.3			49.8	
Approach LOS		C			D			D			D	

Intersection Summary

HCM 2000 Control Delay	39.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	109.6	Sum of lost time (s)	27.0
Intersection Capacity Utilization	76.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	5	24	0	15	17	342	40	19	298	2
Future Volume (vph)	0	0	5	24	0	15	17	342	40	19	298	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865				0.850		0.987			0.999	
Flt Protected					0.950			0.998			0.997	
Satd. Flow (prot)	0	1611	0	0	1770	1583	0	1835	0	0	1855	0
Flt Permitted					0.950			0.998			0.997	
Satd. Flow (perm)	0	1611	0	0	1770	1583	0	1835	0	0	1855	0
Link Speed (mph)		20			20			30			30	
Link Distance (ft)		431			469			463			307	
Travel Time (s)		14.7			16.0			10.5			7.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	1.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↰	↱		↔			↔	
Traffic Vol, veh/h	0	0	5	24	0	15	17	342	40	19	298	2
Future Vol, veh/h	0	0	5	24	0	15	17	342	40	19	298	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	5	26	0	16	18	372	43	21	324	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	805	818	325	800	798	394	326	0	0	415	0	0
Stage 1	367	367	-	430	430	-	-	-	-	-	-	-
Stage 2	438	451	-	370	368	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	301	311	716	303	319	655	1234	-	-	1144	-	-
Stage 1	653	622	-	603	583	-	-	-	-	-	-	-
Stage 2	597	571	-	650	621	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	284	298	716	291	306	655	1234	-	-	1144	-	-
Mov Cap-2 Maneuver	284	298	-	291	306	-	-	-	-	-	-	-
Stage 1	641	608	-	592	572	-	-	-	-	-	-	-
Stage 2	571	560	-	631	607	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.1	15.5	0.3	0.5
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1234	-	-	716	291	655	1144	-	-
HCM Lane V/C Ratio	0.015	-	-	0.008	0.09	0.025	0.018	-	-
HCM Control Delay (s)	8	0	-	10.1	18.6	10.6	8.2	0	-
HCM Lane LOS	A	A	-	B	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.3	0.1	0.1	-	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	14	12	414	47	20	265
Future Volume (vph)	14	12	414	47	20	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.937		0.986			
Flt Protected	0.974					0.996
Satd. Flow (prot)	1734	0	1837	0	0	1841
Flt Permitted	0.974					0.996
Satd. Flow (perm)	1734	0	1837	0	0	1841
Link Speed (mph)	20		30			30
Link Distance (ft)	474		307			641
Travel Time (s)	16.2		7.0			14.6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	2%	2%	0%	3%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	14	12	414	47	20	265
Future Vol, veh/h	14	12	414	47	20	265
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	2	0	3
Mvmt Flow	15	13	450	51	22	288

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	808	476	0	0	501	0
Stage 1	476	-	-	-	-	-
Stage 2	332	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	353	593	-	-	1074	-
Stage 1	629	-	-	-	-	-
Stage 2	731	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	345	593	-	-	1074	-
Mov Cap-2 Maneuver	345	-	-	-	-	-
Stage 1	629	-	-	-	-	-
Stage 2	713	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14	0	0.6
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	428	1074	-
HCM Lane V/C Ratio	-	-	0.066	0.02	-
HCM Control Delay (s)	-	-	14	8.4	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	32	10	249	66	22	287
Future Volume (vph)	32	10	249	66	22	287
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.968		0.972			
Flt Protected	0.963					0.996
Satd. Flow (prot)	1601	0	1807	0	0	1808
Flt Permitted	0.963					0.996
Satd. Flow (perm)	1601	0	1807	0	0	1808
Link Speed (mph)	25		30			30
Link Distance (ft)	562		255			293
Travel Time (s)	15.3		5.8			6.7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	14%	0%	2%	3%	0%	5%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	1.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	32	10	249	66	22	287
Future Vol, veh/h	32	10	249	66	22	287
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	14	0	2	3	0	5
Mvmt Flow	35	11	271	72	24	312

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	667	307	0	0	343	0
Stage 1	307	-	-	-	-	-
Stage 2	360	-	-	-	-	-
Critical Hdwy	6.54	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.54	-	-	-	-	-
Critical Hdwy Stg 2	5.54	-	-	-	-	-
Follow-up Hdwy	3.626	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	406	738	-	-	1227	-
Stage 1	720	-	-	-	-	-
Stage 2	680	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	396	738	-	-	1227	-
Mov Cap-2 Maneuver	396	-	-	-	-	-
Stage 1	720	-	-	-	-	-
Stage 2	664	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14	0	0.6
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	445	1227	-
HCM Lane V/C Ratio	-	-	0.103	0.019	-
HCM Control Delay (s)	-	-	14	8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	1	0	11	0	3	1	182	66	13	304	2
Future Volume (vph)	4	1	0	11	0	3	1	182	66	13	304	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt					0.973			0.964			0.999	
Flt Protected		0.962			0.962						0.998	
Satd. Flow (prot)	0	1828	0	0	1647	0	0	1783	0	0	1824	0
Flt Permitted		0.962			0.962						0.998	
Satd. Flow (perm)	0	1828	0	0	1647	0	0	1783	0	0	1824	0
Link Speed (mph)		20			25			30			30	
Link Distance (ft)		246			436			293			1225	
Travel Time (s)		8.4			11.9			6.7			27.8	
Confl. Peds. (#/hr)	10		6			4	10		4			6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	10%	2%	0%	2%	3%	2%	0%	4%	2%
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	0.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	1	0	11	0	3	1	182	66	13	304	2
Future Vol, veh/h	4	1	0	11	0	3	1	182	66	13	304	2
Conflicting Peds, #/hr	10	0	6	0	0	4	10	0	4	0	0	6
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	10	2	0	2	3	2	0	4	2
Mvmt Flow	4	1	0	12	0	3	1	198	72	14	330	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	617	645	347	606	610	248	342	0	0	274	0	0
Stage 1	369	369	-	240	240	-	-	-	-	-	-	-
Stage 2	248	276	-	366	370	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.2	6.52	6.2	4.12	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.2	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.2	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.59	4.018	3.3	2.218	-	-	2.2	-	-
Pot Cap-1 Maneuver	405	393	701	398	409	796	1217	-	-	1301	-	-
Stage 1	655	624	-	746	707	-	-	-	-	-	-	-
Stage 2	760	685	-	637	620	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	392	382	690	389	398	785	1205	-	-	1296	-	-
Mov Cap-2 Maneuver	392	382	-	389	398	-	-	-	-	-	-	-
Stage 1	648	610	-	742	703	-	-	-	-	-	-	-
Stage 2	749	682	-	624	606	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.4	13.6	0	0.3
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1205	-	-	390	436	1296	-	-
HCM Lane V/C Ratio	0.001	-	-	0.014	0.035	0.011	-	-
HCM Control Delay (s)	8	0	-	14.4	13.6	7.8	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.1	0	-	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	447	83	166	707	116	105
Future Volume (vph)	447	83	166	707	116	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.979				0.936	
Flt Protected				0.991	0.974	
Satd. Flow (prot)	1845	0	0	1849	1700	0
Flt Permitted				0.991	0.974	
Satd. Flow (perm)	1845	0	0	1849	1700	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	1354			549	1225	
Travel Time (s)	30.8			12.5	27.8	
Confl. Peds. (#/hr)			6			6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	1%	2%	0%	4%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	70.2					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	447	83	166	707	116	105
Future Vol, veh/h	447	83	166	707	116	105
Conflicting Peds, #/hr	0	0	6	0	0	6
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	1	0	1	2	0	4
Mvmt Flow	486	90	180	768	126	114

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	582	0	1665	543
Stage 1	-	-	-	-	537	-
Stage 2	-	-	-	-	1128	-
Critical Hdwy	-	-	4.11	-	6.4	6.24
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.209	-	3.5	3.336
Pot Cap-1 Maneuver	-	-	997	-	~ 108	536
Stage 1	-	-	-	-	590	-
Stage 2	-	-	-	-	312	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	991	-	~ 73	530
Mov Cap-2 Maneuver	-	-	-	-	~ 73	-
Stage 1	-	-	-	-	586	-
Stage 2	-	-	-	-	213	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	$ 509.1
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	124	-	-	991	-
HCM Lane V/C Ratio	1.937	-	-	0.182	-
HCM Control Delay (s)	$ 509.1	-	-	9.4	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	19.2	-	-	0.7	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	519	3	18	828	17	42
Future Volume (vph)	519	3	18	828	17	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.999				0.903	
Flt Protected				0.999	0.986	
Satd. Flow (prot)	1861	0	0	1877	1656	0
Flt Permitted				0.999	0.986	
Satd. Flow (perm)	1861	0	0	1877	1656	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	549			284	522	
Travel Time (s)	12.5			6.5	17.8	
Confl. Peds. (#/hr)		2	1		2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	0%	6%	1%	0%	3%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	1					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	519	3	18	828	17	42
Future Vol, veh/h	519	3	18	828	17	42
Conflicting Peds, #/hr	0	2	1	0	2	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	0	6	1	0	3
Mvmt Flow	564	3	20	900	18	46

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	569	0	1510	569
Stage 1	-	-	-	-	568	-
Stage 2	-	-	-	-	942	-
Critical Hdwy	-	-	4.16	-	6.4	6.23
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.254	-	3.5	3.327
Pot Cap-1 Maneuver	-	-	984	-	134	520
Stage 1	-	-	-	-	571	-
Stage 2	-	-	-	-	382	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	982	-	128	519
Mov Cap-2 Maneuver	-	-	-	-	128	-
Stage 1	-	-	-	-	570	-
Stage 2	-	-	-	-	366	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	21.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	276	-	-	982	-
HCM Lane V/C Ratio	0.232	-	-	0.02	-
HCM Control Delay (s)	21.9	-	-	8.7	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.9	-	-	0.1	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	563	2	2	845	0	2
Future Volume (vph)	563	2	2	845	0	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt					0.865	
Flt Protected						
Satd. Flow (prot)	1863	0	0	1881	1644	0
Flt Permitted						
Satd. Flow (perm)	1863	0	0	1881	1644	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	284			471	517	
Travel Time (s)	6.5			10.7	17.6	
Confl. Peds. (#/hr)			1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	0%	0%	1%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	563	2	2	845	0	2
Future Vol, veh/h	563	2	2	845	0	2
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	612	2	2	918	0	2

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	615	0	1536	615
Stage 1	-	-	-	-	614	-
Stage 2	-	-	-	-	922	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	974	-	129	495
Stage 1	-	-	-	-	544	-
Stage 2	-	-	-	-	391	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	973	-	128	494
Mov Cap-2 Maneuver	-	-	-	-	128	-
Stage 1	-	-	-	-	543	-
Stage 2	-	-	-	-	389	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	12.3
HCM LOS			B

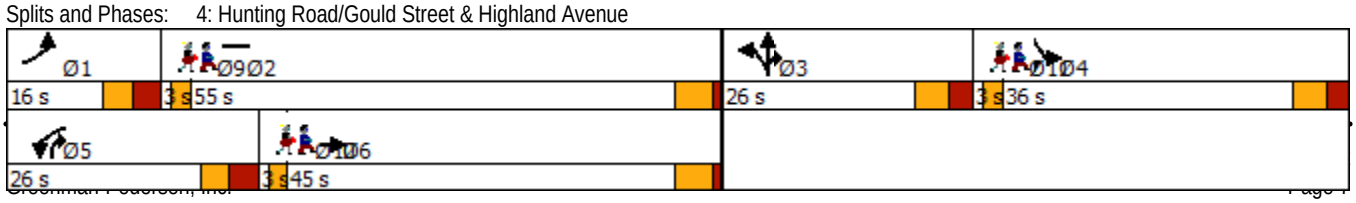
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	494	-	-	973	-
HCM Lane V/C Ratio	0.004	-	-	0.002	-
HCM Control Delay (s)	12.3	-	-	8.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	718	17	137	819	186	35	83	107	350	154	67
Future Volume (vph)	31	718	17	137	819	186	35	83	107	350	154	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	11	11	11	11	11	11
Storage Length (ft)	175		0	165		0	0		100	100		0
Storage Lanes	1		0	1		0	0		1	1		0
Taper Length (ft)	150			75			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Frt		0.997			0.972				0.850		0.964	
Flt Protected	0.950			0.950				0.985		0.950	0.989	
Satd. Flow (prot)	1685	3412	0	1685	3090	0	0	1796	1546	1641	1639	0
Flt Permitted	0.950			0.950				0.985		0.950	0.989	
Satd. Flow (perm)	1685	3412	0	1685	3090	0	0	1796	1546	1641	1639	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			22				94		10	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1352			1324			681			463	
Travel Time (s)		30.7			30.1			15.5			10.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	12%	0%	0%	1%	1%	1%	1%	3%
Shared Lane Traffic (%)										18%		
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Split	NA	
Protected Phases	1	6		5	2		3	3	3 5	4	4	
Permitted Phases												
Detector Phase	1	6		5	2		3	3	3 5	4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	12.0	15.0		12.0	15.0		12.0	12.0		12.0	12.0	
Total Split (s)	16.0	45.0		26.0	55.0		26.0	26.0		36.0	36.0	
Total Split (%)	11.5%	32.4%		18.7%	39.6%		18.7%	18.7%		25.9%	25.9%	
Maximum Green (s)	10.0	40.0		20.0	50.0		20.0	20.0		30.0	30.0	
Yellow Time (s)	3.0	4.0		3.0	4.0		3.5	3.5		3.5	3.5	
All-Red Time (s)	3.0	1.0		3.0	1.0		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Lost Time (s)	6.0	5.0		6.0	5.0			6.0		6.0	6.0	
Lead/Lag	Lead			Lead			Lead	Lead				
Lead-Lag Optimize?	Yes			Yes			Yes	Yes				
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	Min		None	Min		None	None		None	None	
Walk Time (s)		4.0			4.0					4.0	4.0	
Flash Dont Walk (s)		11.0			12.0					19.5	19.5	
Pedestrian Calls (#/hr)		1			1					1	1	

Intersection Summary

Area Type: Other
Cycle Length: 139
Actuated Cycle Length: 111.7
Natural Cycle: 90
Control Type: Actuated-Uncoordinated

Splits and Phases: 4: Hunting Road/Gould Street & Highland Avenue



Lane Group	Ø9	Ø10	Ø11
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Peak Hour Factor			
Heavy Vehicles (%)			
Shared Lane Traffic (%)			
Turn Type			
Protected Phases	9	10	11
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	3.0	3.0	3.0
Total Split (s)	3.0	3.0	3.0
Total Split (%)	2%	2%	2%
Maximum Green (s)	1.0	1.0	1.0
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0	2.0
Recall Mode	None	None	None
Walk Time (s)	0.0	0.0	0.0
Flash Dont Walk (s)	0.0	0.0	0.0
Pedestrian Calls (#/hr)	1	1	1

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	34	798	149	1092	128	116	312	308
v/c Ratio	0.30	0.78	0.69	0.84	0.62	0.26	0.81	0.79
Control Delay	64.5	43.4	67.7	38.3	64.9	7.0	60.9	57.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.5	43.4	67.7	38.3	64.9	7.0	60.9	57.1
Queue Length 50th (ft)	27	285	116	404	99	7	245	232
Queue Length 95th (ft)	67	434	205	#653	178	32	#466	#445
Internal Link Dist (ft)		1272		1244	601			383
Turn Bay Length (ft)	175		165			100	100	
Base Capacity (vph)	158	1296	316	1465	337	640	463	469
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.62	0.47	0.75	0.38	0.18	0.67	0.66

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	718	17	137	819	186	35	83	107	350	154	67
Future Volume (vph)	31	718	17	137	819	186	35	83	107	350	154	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	11	11	11	11	11	11
Total Lost time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00	0.95	0.95	
Frt	1.00	1.00		1.00	0.97			1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.99	
Satd. Flow (prot)	1685	3411		1685	3091			1797	1546	1641	1640	
Flt Permitted	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.99	
Satd. Flow (perm)	1685	3411		1685	3091			1797	1546	1641	1640	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	780	18	149	890	202	38	90	116	380	167	73
RTOR Reduction (vph)	0	1	0	0	13	0	0	0	71	0	8	0
Lane Group Flow (vph)	34	797	0	149	1079	0	0	128	45	312	300	0
Heavy Vehicles (%)	0%	2%	0%	0%	12%	0%	0%	1%	1%	1%	1%	3%
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Split	NA	
Protected Phases	1	6		5	2		3	3	3 5	4	4	
Permitted Phases												
Actuated Green, G (s)	4.3	36.5		14.3	46.5			12.8	27.1	26.1	26.1	
Effective Green, g (s)	4.3	36.5		14.3	46.5			12.8	27.1	26.1	26.1	
Actuated g/C Ratio	0.04	0.32		0.13	0.41			0.11	0.24	0.23	0.23	
Clearance Time (s)	6.0	5.0		6.0	5.0			6.0		6.0	6.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0		2.0	2.0	
Lane Grp Cap (vph)	64	1104		213	1275			204	371	380	379	
v/s Ratio Prot	0.02	0.23		c0.09	c0.35			c0.07	0.03	c0.19	0.18	
v/s Ratio Perm												
v/c Ratio	0.53	0.72		0.70	0.85			0.63	0.12	0.82	0.79	
Uniform Delay, d1	53.2	33.6		47.1	29.9			47.7	33.5	41.1	40.8	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.2	2.0		7.8	5.2			4.3	0.1	12.7	10.1	
Delay (s)	57.4	35.6		55.0	35.0			52.0	33.5	53.8	50.9	
Level of Service	E	D		D	D			D	C	D	D	
Approach Delay (s)		36.5			37.4			43.2			52.3	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	40.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	112.7	Sum of lost time (s)	27.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	28	33	1	20	7	249	13	6	641	6
Future Volume (vph)	0	0	28	33	1	20	7	249	13	6	641	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865				0.850		0.994			0.999	
Flt Protected					0.954			0.999				
Satd. Flow (prot)	0	1611	0	0	1777	1583	0	1850	0	0	1861	0
Flt Permitted					0.954			0.999				
Satd. Flow (perm)	0	1611	0	0	1777	1583	0	1850	0	0	1861	0
Link Speed (mph)		20			20			30			30	
Link Distance (ft)		431			469			463			307	
Travel Time (s)		14.7			16.0			10.5			7.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	1.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	28	33	1	20	7	249	13	6	641	6
Future Vol, veh/h	0	0	28	33	1	20	7	249	13	6	641	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	30	36	1	22	8	271	14	7	697	7

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1021	1016	701	1024	1012	278	704	0	0	285	0	0
Stage 1	715	715	-	294	294	-	-	-	-	-	-	-
Stage 2	306	301	-	730	718	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	215	238	439	214	239	761	894	-	-	1277	-	-
Stage 1	422	434	-	714	670	-	-	-	-	-	-	-
Stage 2	704	665	-	414	433	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	205	233	439	196	234	761	894	-	-	1277	-	-
Mov Cap-2 Maneuver	205	233	-	196	234	-	-	-	-	-	-	-
Stage 1	417	430	-	706	663	-	-	-	-	-	-	-
Stage 2	675	658	-	382	429	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.8	20.9	0.2	0.1
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	894	-	-	439	197	761	1277	-	-
HCM Lane V/C Ratio	0.009	-	-	0.069	0.188	0.029	0.005	-	-
HCM Control Delay (s)	9.1	0	-	13.8	27.4	9.9	7.8	0	-
HCM Lane LOS	A	A	-	B	D	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.7	0.1	0	-	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	30	19	271	7	7	519
Future Volume (vph)	30	19	271	7	7	519
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.947		0.996			
Flt Protected	0.970					0.999
Satd. Flow (prot)	1745	0	1892	0	0	1792
Flt Permitted	0.970					0.999
Satd. Flow (perm)	1745	0	1892	0	0	1792
Link Speed (mph)	20		30			30
Link Distance (ft)	474		307			641
Travel Time (s)	16.2		7.0			14.6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	6%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	30	19	271	7	7	519
Future Vol, veh/h	30	19	271	7	7	519
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	6
Mvmt Flow	33	21	295	8	8	564

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	879	299	0	0	303	0
Stage 1	299	-	-	-	-	-
Stage 2	580	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	321	745	-	-	1269	-
Stage 1	757	-	-	-	-	-
Stage 2	564	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	318	745	-	-	1269	-
Mov Cap-2 Maneuver	318	-	-	-	-	-
Stage 1	757	-	-	-	-	-
Stage 2	559	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.1	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	409	1269	-
HCM Lane V/C Ratio	-	-	0.13	0.006	-
HCM Control Delay (s)	-	-	15.1	7.9	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	99	21	221	46	11	293
Future Volume (vph)	99	21	221	46	11	293
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.976		0.977			
Flt Protected	0.960					0.998
Satd. Flow (prot)	1766	0	1820	0	0	1896
Flt Permitted	0.960					0.998
Satd. Flow (perm)	1766	0	1820	0	0	1896
Link Speed (mph)	25		30			30
Link Distance (ft)	562		255			293
Travel Time (s)	15.3		5.8			6.7
Confl. Peds. (#/hr)	1	1		1	1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	2%	2%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	2.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	99	21	221	46	11	293
Future Vol, veh/h	99	21	221	46	11	293
Conflicting Peds, #/hr	1	1	0	1	1	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	1	0	2	2	0	0
Mvmt Flow	108	23	240	50	12	318

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	609	267	0	0	291	0
Stage 1	266	-	-	-	-	-
Stage 2	343	-	-	-	-	-
Critical Hdwy	6.41	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	460	777	-	-	1282	-
Stage 1	781	-	-	-	-	-
Stage 2	721	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	454	776	-	-	1281	-
Mov Cap-2 Maneuver	454	-	-	-	-	-
Stage 1	780	-	-	-	-	-
Stage 2	712	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15	0	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	490	1281	-
HCM Lane V/C Ratio	-	-	0.266	0.009	-
HCM Control Delay (s)	-	-	15	7.8	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.1	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	55	0	2	0	215	23	1	243	0
Future Volume (vph)	1	0	0	55	0	2	0	215	23	1	243	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt					0.996			0.987				
Flt Protected		0.950			0.954							
Satd. Flow (prot)	0	1805	0	0	1805	0	0	1842	0	0	1827	0
Flt Permitted		0.950			0.954							
Satd. Flow (perm)	0	1805	0	0	1805	0	0	1842	0	0	1827	0
Link Speed (mph)		20			25			30			30	
Link Distance (ft)		246			436			293			1225	
Travel Time (s)		8.4			11.9			6.7			27.8	
Confl. Peds. (#/hr)	2		3	3		2	3		3	2		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	4%	0%
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	1.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	0	55	0	2	0	215	23	1	243	0
Future Vol, veh/h	1	0	0	55	0	2	0	215	23	1	243	0
Conflicting Peds, #/hr	2	0	3	3	0	2	3	0	3	2	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	2	0	0	4	0
Mvmt Flow	1	0	0	60	0	2	0	234	25	1	264	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	519	531	270	519	519	252	267	0	0	262	0	0
Stage 1	269	269	-	250	250	-	-	-	-	-	-	-
Stage 2	250	262	-	269	269	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	471	457	774	471	464	792	1308	-	-	1314	-	-
Stage 1	741	690	-	759	704	-	-	-	-	-	-	-
Stage 2	759	695	-	741	690	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	467	454	770	468	461	788	1304	-	-	1310	-	-
Mov Cap-2 Maneuver	467	454	-	468	461	-	-	-	-	-	-	-
Stage 1	739	687	-	757	702	-	-	-	-	-	-	-
Stage 2	755	693	-	738	687	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.7	13.7	0	0
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1304	-	-	467	475	1310	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.13	0.001	-	-
HCM Control Delay (s)	0	-	-	12.7	13.7	7.8	0	-
HCM Lane LOS	A	-	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.4	0	-	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	718	296	204	298	75	109
Future Volume (vph)	718	296	204	298	75	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.961				0.920	
Flt Protected				0.980	0.980	
Satd. Flow (prot)	1790	0	0	1780	1654	0
Flt Permitted				0.980	0.980	
Satd. Flow (perm)	1790	0	0	1780	1654	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	1354			549	1225	
Travel Time (s)	30.8			12.5	27.8	
Confl. Peds. (#/hr)		2	2		2	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	7%	3%	3%	4%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	54.1					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	718	296	204	298	75	109
Future Vol, veh/h	718	296	204	298	75	109
Conflicting Peds, #/hr	0	2	2	0	2	2
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	7	3	3	4
Mvmt Flow	780	322	222	324	82	118

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1104	0	1713	945
Stage 1	-	-	-	-	943	-
Stage 2	-	-	-	-	770	-
Critical Hdwy	-	-	4.17	-	6.43	6.24
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.263	-	3.527	3.336
Pot Cap-1 Maneuver	-	-	614	-	99	315
Stage 1	-	-	-	-	377	-
Stage 2	-	-	-	-	455	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	613	-	~ 55	314
Mov Cap-2 Maneuver	-	-	-	-	~ 55	-
Stage 1	-	-	-	-	376	-
Stage 2	-	-	-	-	253	-

Approach	EB	WB	NB
HCM Control Delay, s	0	5.8	$ 484
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	108	-	-	613	-
HCM Lane V/C Ratio	1.852	-	-	0.362	-
HCM Control Delay (s)	$ 484	-	-	14.2	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	16.1	-	-	1.6	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	833	6	18	458	8	24
Future Volume (vph)	833	6	18	458	8	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.999				0.900	
Flt Protected				0.998	0.987	
Satd. Flow (prot)	1858	0	0	1809	1688	0
Flt Permitted				0.998	0.987	
Satd. Flow (perm)	1858	0	0	1809	1688	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	549			284	522	
Travel Time (s)	12.5			6.5	17.8	
Confl. Peds. (#/hr)		3	2		3	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	20%	0%	5%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	833	6	18	458	8	24
Future Vol, veh/h	833	6	18	458	8	24
Conflicting Peds, #/hr	0	3	2	0	3	2
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	20	0	5	0	0
Mvmt Flow	905	7	20	498	9	26

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	915	0	1453	914
Stage 1	-	-	-	-	912	-
Stage 2	-	-	-	-	541	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	754	-	145	334
Stage 1	-	-	-	-	395	-
Stage 2	-	-	-	-	588	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	752	-	139	332
Mov Cap-2 Maneuver	-	-	-	-	139	-
Stage 1	-	-	-	-	394	-
Stage 2	-	-	-	-	564	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	22
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	246	-	-	752	-
HCM Lane V/C Ratio	0.141	-	-	0.026	-
HCM Control Delay (s)	22	-	-	9.9	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0.1	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	860	0	1	475	2	6
Future Volume (vph)	860	0	1	475	2	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt					0.895	
Flt Protected					0.989	
Satd. Flow (prot)	1863	0	0	1827	1455	0
Flt Permitted					0.989	
Satd. Flow (perm)	1863	0	0	1827	1455	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	284			471	517	
Travel Time (s)	6.5			10.7	17.6	
Confl. Peds. (#/hr)			1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	0%	0%	4%	0%	20%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	860	0	1	475	2	6
Future Vol, veh/h	860	0	1	475	2	6
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	0	0	4	0	20
Mvmt Flow	935	0	1	516	2	7

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	936	0	1454	937
Stage 1	-	-	-	-	936	-
Stage 2	-	-	-	-	518	-
Critical Hdwy	-	-	4.1	-	6.4	6.4
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.48
Pot Cap-1 Maneuver	-	-	740	-	145	297
Stage 1	-	-	-	-	385	-
Stage 2	-	-	-	-	602	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	739	-	145	296
Mov Cap-2 Maneuver	-	-	-	-	145	-
Stage 1	-	-	-	-	385	-
Stage 2	-	-	-	-	601	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	20.9
HCM LOS			C

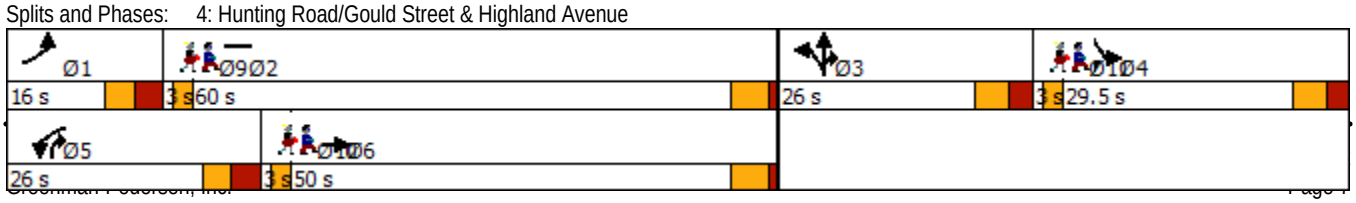
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	235	-	-	739	-
HCM Lane V/C Ratio	0.037	-	-	0.001	-
HCM Control Delay (s)	20.9	-	-	9.9	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Future Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	11	11	11	11	11	11
Storage Length (ft)	175		0	165		0	0		100	100		0
Storage Lanes	1		0	1		0	0		1	1		0
Taper Length (ft)	150			75			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Frt		0.997			0.922				0.850		0.963	
Flt Protected	0.950			0.950				0.996		0.950	0.987	
Satd. Flow (prot)	1636	3411	0	1668	3172	0	0	1813	1546	1564	1617	0
Flt Permitted	0.950			0.950				0.996		0.950	0.987	
Satd. Flow (perm)	1636	3411	0	1668	3172	0	0	1813	1546	1564	1617	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			240				112		10	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1352			1324			681			463	
Travel Time (s)		30.7			30.1			15.5			10.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	2%	1%	3%	0%	0%	1%	1%	6%	2%	0%
Shared Lane Traffic (%)										21%		
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Split	NA	
Protected Phases	1	6		5	2		3	3	3 5	4	4	
Permitted Phases												
Detector Phase	1	6		5	2		3	3	3 5	4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	12.0	15.0		12.0	15.0		12.0	12.0		12.0	12.0	
Total Split (s)	16.0	50.0		26.0	60.0		26.0	26.0		29.5	29.5	
Total Split (%)	11.6%	36.4%		18.9%	43.6%		18.9%	18.9%		21.5%	21.5%	
Maximum Green (s)	10.0	45.0		20.0	55.0		20.0	20.0		23.5	23.5	
Yellow Time (s)	3.0	4.0		3.0	4.0		3.5	3.5		3.5	3.5	
All-Red Time (s)	3.0	1.0		3.0	1.0		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Lost Time (s)	6.0	5.0		6.0	5.0			6.0		6.0	6.0	
Lead/Lag	Lead			Lead			Lead	Lead				
Lead-Lag Optimize?	Yes			Yes			Yes	Yes				
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	Min		None	Min		None	None		None	None	
Walk Time (s)		4.0			4.0					4.0	4.0	
Flash Dont Walk (s)		11.0			12.0					19.5	19.5	
Pedestrian Calls (#/hr)		1			1					1	1	

Intersection Summary

Area Type: Other
Cycle Length: 137.5
Actuated Cycle Length: 124.6
Natural Cycle: 140
Control Type: Actuated-Uncoordinated

Splits and Phases: 4: Hunting Road/Gould Street & Highland Avenue



Lane Group	Ø9	Ø10	Ø11
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Peak Hour Factor			
Heavy Vehicles (%)			
Shared Lane Traffic (%)			
Turn Type			
Protected Phases	9	10	11
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	3.0	3.0	3.0
Total Split (s)	3.0	3.0	3.0
Total Split (%)	2%	2%	2%
Maximum Green (s)	1.0	1.0	1.0
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0	2.0
Recall Mode	None	None	None
Walk Time (s)	0.0	0.0	0.0
Flash Dont Walk (s)	0.0	0.0	0.0
Pedestrian Calls (#/hr)	1	1	1

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	189	929	48	1391	426	259	154	154
v/c Ratio	1.44	0.61	0.42	0.92	1.46	0.59	0.75	0.70
Control Delay	275.5	29.8	69.1	39.1	262.4	19.6	74.7	65.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	275.5	29.8	69.1	39.1	262.4	19.6	74.7	65.6
Queue Length 50th (ft)	~206	286	38	466	~469	70	127	117
Queue Length 95th (ft)	#400	448	83	#738	#757	126	214	204
Internal Link Dist (ft)		1272		1244	601			383
Turn Bay Length (ft)	175		165			100	100	
Base Capacity (vph)	131	1520	268	1540	292	574	296	314
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.44	0.61	0.18	0.90	1.46	0.45	0.52	0.49

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Future Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	11	11	11	11	11	11
Total Lost time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00	0.95	0.95	
Frt	1.00	1.00		1.00	0.92			1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	0.99	
Satd. Flow (prot)	1636	3410		1668	3171			1813	1546	1564	1617	
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	0.99	
Satd. Flow (perm)	1636	3410		1668	3171			1813	1546	1564	1617	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	189	909	20	48	664	727	33	393	259	195	75	38
RTOR Reduction (vph)	0	1	0	0	135	0	0	0	86	0	9	0
Lane Group Flow (vph)	189	928	0	48	1256	0	0	426	173	154	145	0
Heavy Vehicles (%)	3%	2%	2%	1%	3%	0%	0%	1%	1%	6%	2%	0%
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Split	NA	
Protected Phases	1	6		5	2		3	3	3 5	4	4	
Permitted Phases												
Actuated Green, G (s)	10.0	55.5		8.4	53.9			20.1	28.5	16.4	16.4	
Effective Green, g (s)	10.0	55.5		8.4	53.9			20.1	28.5	16.4	16.4	
Actuated g/C Ratio	0.08	0.45		0.07	0.44			0.16	0.23	0.13	0.13	
Clearance Time (s)	6.0	5.0		6.0	5.0			6.0		6.0	6.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0		2.0	2.0	
Lane Grp Cap (vph)	132	1533		113	1385			295	357	207	214	
v/s Ratio Prot	c0.12	0.27		0.03	c0.40			c0.23	0.11	c0.10	0.09	
v/s Ratio Perm												
v/c Ratio	1.43	0.61		0.42	0.91			1.44	0.48	0.74	0.68	
Uniform Delay, d1	56.7	25.7		55.2	32.4			51.6	41.1	51.5	51.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	232.2	0.5		0.9	8.6			218.0	0.4	11.9	6.6	
Delay (s)	288.9	26.1		56.1	41.0			269.7	41.5	63.4	57.6	
Level of Service	F	C		E	D			F	D	E	E	
Approach Delay (s)		70.5			41.5			183.4			60.5	
Approach LOS		E			D			F			E	

Intersection Summary

HCM 2000 Control Delay	79.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	123.4	Sum of lost time (s)	27.0
Intersection Capacity Utilization	95.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	5	42	0	5	17	427	406	55	295	2
Future Volume (vph)	0	0	5	42	0	5	17	427	406	55	295	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865				0.850		0.935			0.999	
Flt Protected					0.950			0.999			0.992	
Satd. Flow (prot)	0	1611	0	0	1770	1583	0	1740	0	0	1846	0
Flt Permitted					0.950			0.999			0.992	
Satd. Flow (perm)	0	1611	0	0	1770	1583	0	1740	0	0	1846	0
Link Speed (mph)		20			20			30			30	
Link Distance (ft)		431			469			463			307	
Travel Time (s)		14.7			16.0			10.5			7.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	5	42	0	5	17	427	406	55	295	2
Future Vol, veh/h	0	0	5	42	0	5	17	427	406	55	295	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	5	46	0	5	18	464	441	60	321	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1165	1383	322	1166	1164	685	323	0	0	905	0	0
Stage 1	442	442	-	721	721	-	-	-	-	-	-	-
Stage 2	723	941	-	445	443	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	171	144	719	171	194	448	1237	-	-	752	-	-
Stage 1	594	576	-	419	432	-	-	-	-	-	-	-
Stage 2	417	342	-	592	576	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	153	126	719	153	170	448	1237	-	-	752	-	-
Mov Cap-2 Maneuver	153	126	-	153	170	-	-	-	-	-	-	-
Stage 1	575	520	-	406	418	-	-	-	-	-	-	-
Stage 2	399	331	-	531	520	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10	35.5	0.2	1.6
HCM LOS	B	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1237	-	-	719	153	448	752	-	-
HCM Lane V/C Ratio	0.015	-	-	0.008	0.298	0.012	0.079	-	-
HCM Control Delay (s)	8	0	-	10	38.2	13.1	10.2	0	-
HCM Lane LOS	A	A	-	B	E	B	B	A	-
HCM 95th %tile Q(veh)	0	-	-	0	1.2	0	0.3	-	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	13	15	402	134	171	299
Future Volume (vph)	13	15	402	134	171	299
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.928		0.966			
Flt Protected	0.977					0.982
Satd. Flow (prot)	1723	0	1799	0	0	1831
Flt Permitted	0.977					0.982
Satd. Flow (perm)	1723	0	1799	0	0	1831
Link Speed (mph)	20		30			30
Link Distance (ft)	474		307			641
Travel Time (s)	16.2		7.0			14.6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	2%	2%	0%	3%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	15	402	134	171	299
Future Vol, veh/h	13	15	402	134	171	299
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	2	0	3
Mvmt Flow	14	16	437	146	186	325

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1207	510	0	0	583	0
Stage 1	510	-	-	-	-	-
Stage 2	697	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	204	567	-	-	1001	-
Stage 1	607	-	-	-	-	-
Stage 2	498	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	158	567	-	-	1001	-
Mov Cap-2 Maneuver	158	-	-	-	-	-
Stage 1	607	-	-	-	-	-
Stage 2	385	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	20.8	0	3.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	258	1001	-
HCM Lane V/C Ratio	-	-	0.118	0.186	-
HCM Control Delay (s)	-	-	20.8	9.4	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.7	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	32	10	240	66	22	472
Future Volume (vph)	32	10	240	66	22	472
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.968		0.971			
Flt Protected	0.963					0.998
Satd. Flow (prot)	1601	0	1805	0	0	1810
Flt Permitted	0.963					0.998
Satd. Flow (perm)	1601	0	1805	0	0	1810
Link Speed (mph)	25		30			30
Link Distance (ft)	562		255			293
Travel Time (s)	15.3		5.8			6.7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	14%	0%	2%	3%	0%	5%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	32	10	240	66	22	472
Future Vol, veh/h	32	10	240	66	22	472
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	14	0	2	3	0	5
Mvmt Flow	35	11	261	72	24	513

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	858	297	0	0	333	0
Stage 1	297	-	-	-	-	-
Stage 2	561	-	-	-	-	-
Critical Hdwy	6.54	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.54	-	-	-	-	-
Critical Hdwy Stg 2	5.54	-	-	-	-	-
Follow-up Hdwy	3.626	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	312	747	-	-	1238	-
Stage 1	727	-	-	-	-	-
Stage 2	548	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	304	747	-	-	1238	-
Mov Cap-2 Maneuver	304	-	-	-	-	-
Stage 1	727	-	-	-	-	-
Stage 2	533	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.7	0	0.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	354	1238	-
HCM Lane V/C Ratio	-	-	0.129	0.019	-
HCM Control Delay (s)	-	-	16.7	8	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	1	0	11	0	3	1	173	66	13	489	2
Future Volume (vph)	4	1	0	11	0	3	1	173	66	13	489	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt					0.973			0.963				
Flt Protected		0.962			0.962						0.999	
Satd. Flow (prot)	0	1828	0	0	1647	0	0	1781	0	0	1827	0
Flt Permitted		0.962			0.962						0.999	
Satd. Flow (perm)	0	1828	0	0	1647	0	0	1781	0	0	1827	0
Link Speed (mph)		20			25			30			30	
Link Distance (ft)		246			436			293			1225	
Travel Time (s)		8.4			11.9			6.7			27.8	
Confl. Peds. (#/hr)	10		6			4	10		4			6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	10%	2%	0%	2%	3%	2%	0%	4%	2%
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	0.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	4	1	0	11	0	3	1	173	66	13	489	2
Future Vol, veh/h	4	1	0	11	0	3	1	173	66	13	489	2
Conflicting Peds, #/hr	10	0	6	0	0	4	10	0	4	0	0	6
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	10	2	0	2	3	2	0	4	2
Mvmt Flow	4	1	0	12	0	3	1	188	72	14	532	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	809	837	549	798	802	238	544	0	0	264	0	0
Stage 1	571	571	-	230	230	-	-	-	-	-	-	-
Stage 2	238	266	-	568	572	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.2	6.52	6.2	4.12	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.2	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.2	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.59	4.018	3.3	2.218	-	-	2.2	-	-
Pot Cap-1 Maneuver	301	305	539	295	317	806	1025	-	-	1312	-	-
Stage 1	509	508	-	755	714	-	-	-	-	-	-	-
Stage 2	770	692	-	494	504	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	290	296	531	288	307	795	1015	-	-	1307	-	-
Mov Cap-2 Maneuver	290	296	-	288	307	-	-	-	-	-	-	-
Stage 1	503	495	-	751	710	-	-	-	-	-	-	-
Stage 2	759	689	-	483	491	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	17.6	16.3	0	0.2
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1015	-	-	291	334	1307	-	-
HCM Lane V/C Ratio	0.001	-	-	0.019	0.046	0.011	-	-
HCM Control Delay (s)	8.6	0	-	17.6	16.3	7.8	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0	-	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	447	103	181	707	223	213
Future Volume (vph)	447	103	181	707	223	213
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.975				0.934	
Flt Protected				0.990	0.975	
Satd. Flow (prot)	1838	0	0	1848	1697	0
Flt Permitted				0.990	0.975	
Satd. Flow (perm)	1838	0	0	1848	1697	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	1354			549	1225	
Travel Time (s)	30.8			12.5	27.8	
Confl. Peds. (#/hr)			6			6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	1%	2%	0%	4%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	349.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	447	103	181	707	223	213
Future Vol, veh/h	447	103	181	707	223	213
Conflicting Peds, #/hr	0	0	6	0	0	6
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	1	0	1	2	0	4
Mvmt Flow	486	112	197	768	242	232

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	604	0	1710	554
Stage 1	-	-	-	-	548	-
Stage 2	-	-	-	-	1162	-
Critical Hdwy	-	-	4.11	-	6.4	6.24
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.209	-	3.5	3.336
Pot Cap-1 Maneuver	-	-	979	-	~ 101	528
Stage 1	-	-	-	-	583	-
Stage 2	-	-	-	-	300	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	973	-	~ 65	522
Mov Cap-2 Maneuver	-	-	-	-	~ 65	-
Stage 1	-	-	-	-	580	-
Stage 2	-	-	-	-	~ 194	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2	$ 1497.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	114	-	-	973	-
HCM Lane V/C Ratio	4.157	-	-	0.202	-
HCM Control Delay (s)	$ 1497.7	-	-	9.6	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	48.6	-	-	0.8	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	627	3	18	843	17	42
Future Volume (vph)	627	3	18	843	17	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.999				0.903	
Flt Protected				0.999	0.986	
Satd. Flow (prot)	1861	0	0	1877	1656	0
Flt Permitted				0.999	0.986	
Satd. Flow (perm)	1861	0	0	1877	1656	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	549			284	522	
Travel Time (s)	12.5			6.5	17.8	
Confl. Peds. (#/hr)		2	1		2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	0%	6%	1%	0%	3%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	1.1					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	627	3	18	843	17	42
Future Vol, veh/h	627	3	18	843	17	42
Conflicting Peds, #/hr	0	2	1	0	2	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	0	6	1	0	3
Mvmt Flow	682	3	20	916	18	46

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	687	0	1644	687
Stage 1	-	-	-	-	686	-
Stage 2	-	-	-	-	958	-
Critical Hdwy	-	-	4.16	-	6.4	6.23
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.254	-	3.5	3.327
Pot Cap-1 Maneuver	-	-	888	-	111	445
Stage 1	-	-	-	-	504	-
Stage 2	-	-	-	-	376	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	886	-	105	444
Mov Cap-2 Maneuver	-	-	-	-	105	-
Stage 1	-	-	-	-	503	-
Stage 2	-	-	-	-	358	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	26.6
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	230	-	-	886	-
HCM Lane V/C Ratio	0.279	-	-	0.022	-
HCM Control Delay (s)	26.6	-	-	9.2	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	1.1	-	-	0.1	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	690	2	2	880	0	2
Future Volume (vph)	690	2	2	880	0	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt					0.865	
Flt Protected						
Satd. Flow (prot)	1863	0	0	1881	1644	0
Flt Permitted						
Satd. Flow (perm)	1863	0	0	1881	1644	0
Link Speed (mph)	30			30	20	
Link Distance (ft)	284			471	517	
Travel Time (s)	6.5			10.7	17.6	
Confl. Peds. (#/hr)			1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	0%	0%	1%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	690	2	2	880	0	2
Future Vol, veh/h	690	2	2	880	0	2
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	750	2	2	957	0	2

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	753	0	1713	753
Stage 1	-	-	-	-	752	-
Stage 2	-	-	-	-	961	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	866	-	101	413
Stage 1	-	-	-	-	469	-
Stage 2	-	-	-	-	374	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	865	-	100	412
Mov Cap-2 Maneuver	-	-	-	-	100	-
Stage 1	-	-	-	-	469	-
Stage 2	-	-	-	-	372	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	13.8
HCM LOS			B

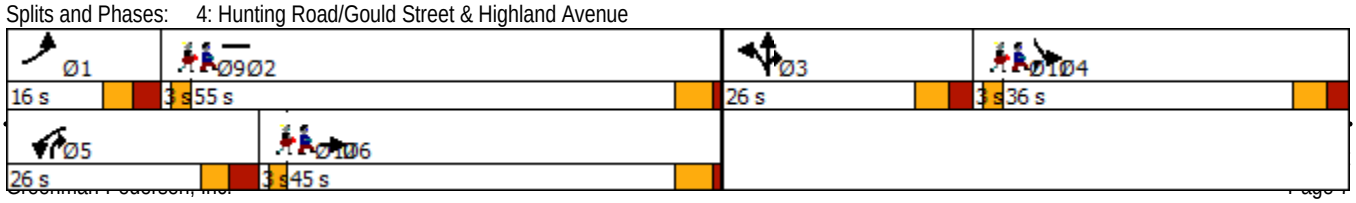
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	412	-	-	865	-
HCM Lane V/C Ratio	0.005	-	-	0.003	-
HCM Control Delay (s)	13.8	-	-	9.2	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Future Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	11	11	11	11	11	11
Storage Length (ft)	175		0	165		0	0		100	100		0
Storage Lanes	1		0	1		0	0		1	1		0
Taper Length (ft)	150			75			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Frt		0.997			0.962				0.850		0.956	
Flt Protected	0.950			0.950				0.988		0.950	0.992	
Satd. Flow (prot)	1685	3413	0	1685	3080	0	0	1801	1546	1641	1629	0
Flt Permitted	0.950			0.950				0.988		0.950	0.992	
Satd. Flow (perm)	1685	3413	0	1685	3080	0	0	1801	1546	1641	1629	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			37				94		14	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1352			1324			681			463	
Travel Time (s)		30.7			30.1			15.5			10.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	12%	0%	0%	1%	1%	1%	1%	3%
Shared Lane Traffic (%)										14%		
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Split	NA	
Protected Phases	1	6		5	2		3	3	3 5	4	4	
Permitted Phases												
Detector Phase	1	6		5	2		3	3	3 5	4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	12.0	15.0		12.0	15.0		12.0	12.0		12.0	12.0	
Total Split (s)	16.0	45.0		26.0	55.0		26.0	26.0		36.0	36.0	
Total Split (%)	11.5%	32.4%		18.7%	39.6%		18.7%	18.7%		25.9%	25.9%	
Maximum Green (s)	10.0	40.0		20.0	50.0		20.0	20.0		30.0	30.0	
Yellow Time (s)	3.0	4.0		3.0	4.0		3.5	3.5		3.5	3.5	
All-Red Time (s)	3.0	1.0		3.0	1.0		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Lost Time (s)	6.0	5.0		6.0	5.0			6.0		6.0	6.0	
Lead/Lag	Lead			Lead			Lead	Lead				
Lead-Lag Optimize?	Yes			Yes			Yes	Yes				
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	Min		None	Min		None	None		None	None	
Walk Time (s)		4.0			4.0					4.0	4.0	
Flash Dont Walk (s)		11.0			12.0					19.5	19.5	
Pedestrian Calls (#/hr)		1			1					1	1	

Intersection Summary

Area Type: Other
Cycle Length: 139
Actuated Cycle Length: 125.8
Natural Cycle: 140
Control Type: Actuated-Uncoordinated

Splits and Phases: 4: Hunting Road/Gould Street & Highland Avenue



Lane Group	Ø9	Ø10	Ø11
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Peak Hour Factor			
Heavy Vehicles (%)			
Shared Lane Traffic (%)			
Turn Type			
Protected Phases	9	10	11
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	3.0	3.0	3.0
Total Split (s)	3.0	3.0	3.0
Total Split (%)	2%	2%	2%
Maximum Green (s)	1.0	1.0	1.0
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0	2.0
Recall Mode	None	None	None
Walk Time (s)	0.0	0.0	0.0
Flash Dont Walk (s)	0.0	0.0	0.0
Pedestrian Calls (#/hr)	1	1	1

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	73	775	145	1153	159	113	630	625
v/c Ratio	0.62	0.68	0.74	0.92	0.75	0.26	1.60	1.55
Control Delay	82.1	41.3	77.1	48.3	75.8	6.7	313.8	294.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	82.1	41.3	77.1	48.3	75.8	6.7	313.8	294.6
Queue Length 50th (ft)	60	285	118	472	130	7	~798	~780
Queue Length 95th (ft)	#132	418	200	#708	216	31	#1143	#1125
Internal Link Dist (ft)		1272		1244	601			383
Turn Bay Length (ft)	175		165			100	100	
Base Capacity (vph)	135	1161	270	1256	288	559	394	402
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.67	0.54	0.92	0.55	0.20	1.60	1.55

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Future Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	11	11	11	11	11	11
Total Lost time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00	0.95	0.95	
Frt	1.00	1.00		1.00	0.96			1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.99	
Satd. Flow (prot)	1685	3411		1685	3081			1801	1546	1641	1628	
Flt Permitted	0.95	1.00		0.95	1.00			0.99	1.00	0.95	0.99	
Satd. Flow (perm)	1685	3411		1685	3081			1801	1546	1641	1628	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	73	757	18	145	863	290	38	121	113	733	337	185
RTOR Reduction (vph)	0	1	0	0	22	0	0	0	72	0	11	0
Lane Group Flow (vph)	73	774	0	145	1131	0	0	159	41	630	614	0
Heavy Vehicles (%)	0%	2%	0%	0%	12%	0%	0%	1%	1%	1%	1%	3%
Turn Type	Prot	NA		Prot	NA		Split	NA	pt+ov	Split	NA	
Protected Phases	1	6		5	2		3	3	3 5	4	4	
Permitted Phases												
Actuated Green, G (s)	7.4	43.1		14.7	50.4			14.9	29.6	30.3	30.3	
Effective Green, g (s)	7.4	43.1		14.7	50.4			14.9	29.6	30.3	30.3	
Actuated g/C Ratio	0.06	0.34		0.12	0.40			0.12	0.23	0.24	0.24	
Clearance Time (s)	6.0	5.0		6.0	5.0			6.0		6.0	6.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0		2.0	2.0	
Lane Grp Cap (vph)	98	1166		196	1232			212	363	394	391	
v/s Ratio Prot	0.04	0.23		c0.09	c0.37			c0.09	0.03	c0.38	0.38	
v/s Ratio Perm												
v/c Ratio	0.74	0.66		0.74	0.92			0.75	0.11	1.60	1.57	
Uniform Delay, d1	58.4	35.3		53.8	35.8			53.7	37.9	47.9	47.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	23.2	1.1		11.9	10.6			12.4	0.1	281.2	269.2	
Delay (s)	81.6	36.4		65.7	46.5			66.1	37.9	329.1	317.0	
Level of Service	F	D		E	D			E	D	F	F	
Approach Delay (s)		40.3			48.6			54.4			323.1	
Approach LOS		D			D			D			F	

Intersection Summary

HCM 2000 Control Delay	140.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	126.0	Sum of lost time (s)	27.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	28	490	1	69	7	269	138	14	767	6
Future Volume (vph)	0	0	28	490	1	69	7	269	138	14	767	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865				0.850		0.955			0.999	
Flt Protected					0.952			0.999			0.999	
Satd. Flow (prot)	0	1611	0	0	1773	1583	0	1777	0	0	1859	0
Flt Permitted					0.952			0.999			0.999	
Satd. Flow (perm)	0	1611	0	0	1773	1583	0	1777	0	0	1859	0
Link Speed (mph)		20			20			30			30	
Link Distance (ft)		431			469			463			307	
Travel Time (s)		14.7			16.0			10.5			7.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	403											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	28	490	1	69	7	269	138	14	767	6
Future Vol, veh/h	0	0	28	490	1	69	7	269	138	14	767	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	30	533	1	75	8	292	150	15	834	7

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1289	1326	838	1266	1254	367	841	0	0	442	0	0
Stage 1	868	868	-	383	383	-	-	-	-	-	-	-
Stage 2	421	458	-	883	871	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	141	156	366	~ 146	172	678	794	-	-	1118	-	-
Stage 1	347	370	-	640	612	-	-	-	-	-	-	-
Stage 2	610	567	-	~ 340	368	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	121	150	366	~ 130	165	678	794	-	-	1118	-	-
Mov Cap-2 Maneuver	121	150	-	~ 130	165	-	-	-	-	-	-	-
Stage 1	342	361	-	631	603	-	-	-	-	-	-	-
Stage 2	534	559	-	~ 304	359	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	15.7	$ 1286.5	0.2	0.1
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	794	-	-	366	130	678	1118	-	-
HCM Lane V/C Ratio	0.01	-	-	0.083	4.105	0.111	0.014	-	-
HCM Control Delay (s)	9.6	0	-	15.7	$ 1465.8	11	8.3	0	-
HCM Lane LOS	A	A	-	C	F	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	54.2	0.4	0	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	163	204	301	46	41	520
Future Volume (vph)	163	204	301	46	41	520
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.925		0.982			
Flt Protected	0.978					0.996
Satd. Flow (prot)	1719	0	1866	0	0	1793
Flt Permitted	0.978					0.996
Satd. Flow (perm)	1719	0	1866	0	0	1793
Link Speed (mph)	20		30			30
Link Distance (ft)	474		307			641
Travel Time (s)	16.2		7.0			14.6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	6%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	24

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	163	204	301	46	41	520
Future Vol, veh/h	163	204	301	46	41	520
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	6
Mvmt Flow	177	222	327	50	45	565

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1007	352	0	0	377	0
Stage 1	352	-	-	-	-	-
Stage 2	655	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	269	696	-	-	1193	-
Stage 1	716	-	-	-	-	-
Stage 2	521	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	254	696	-	-	1193	-
Mov Cap-2 Maneuver	254	-	-	-	-	-
Stage 1	716	-	-	-	-	-
Stage 2	492	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	82.3	0	0.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	393	1193	-
HCM Lane V/C Ratio	-	-	1.015	0.037	-
HCM Control Delay (s)	-	-	82.3	8.1	0
HCM Lane LOS	-	-	F	A	A
HCM 95th %tile Q(veh)	-	-	12.6	0.1	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	99	21	436	46	11	328
Future Volume (vph)	99	21	436	46	11	328
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.976		0.987			
Flt Protected	0.960					0.998
Satd. Flow (prot)	1766	0	1839	0	0	1896
Flt Permitted	0.960					0.998
Satd. Flow (perm)	1766	0	1839	0	0	1896
Link Speed (mph)	25		30			30
Link Distance (ft)	562		255			293
Travel Time (s)	15.3		5.8			6.7
Confl. Peds. (#/hr)	1	1		1	1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	2%	2%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	2.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	99	21	436	46	11	328
Future Vol, veh/h	99	21	436	46	11	328
Conflicting Peds, #/hr	1	1	0	1	1	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	1	0	2	2	0	0
Mvmt Flow	108	23	474	50	12	357

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	882	501	0	0	525	0
Stage 1	500	-	-	-	-	-
Stage 2	382	-	-	-	-	-
Critical Hdwy	6.41	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	318	574	-	-	1052	-
Stage 1	611	-	-	-	-	-
Stage 2	692	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	313	573	-	-	1051	-
Mov Cap-2 Maneuver	313	-	-	-	-	-
Stage 1	610	-	-	-	-	-
Stage 2	682	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	22	0	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	340	1051	-
HCM Lane V/C Ratio	-	-	0.384	0.011	-
HCM Control Delay (s)	-	-	22	8.5	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.8	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	55	0	2	0	430	23	1	278	0
Future Volume (vph)	1	0	0	55	0	2	0	430	23	1	278	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt					0.996			0.993				
Flt Protected		0.950			0.954							
Satd. Flow (prot)	0	1805	0	0	1805	0	0	1852	0	0	1827	0
Flt Permitted		0.950			0.954							
Satd. Flow (perm)	0	1805	0	0	1805	0	0	1852	0	0	1827	0
Link Speed (mph)		20			25			30			30	
Link Distance (ft)		246			436			293			1225	
Travel Time (s)		8.4			11.9			6.7			27.8	
Confl. Peds. (#/hr)	2		3	3		2	3		3	2		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	4%	0%
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	1.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	0	55	0	2	0	430	23	1	278	0
Future Vol, veh/h	1	0	0	55	0	2	0	430	23	1	278	0
Conflicting Peds, #/hr	2	0	3	3	0	2	3	0	3	2	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	2	0	0	4	0
Mvmt Flow	1	0	0	60	0	2	0	467	25	1	302	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	790	802	308	790	790	485	305	0	0	495	0	0
Stage 1	307	307	-	483	483	-	-	-	-	-	-	-
Stage 2	483	495	-	307	307	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	310	320	737	310	325	586	1267	-	-	1079	-	-
Stage 1	707	665	-	569	556	-	-	-	-	-	-	-
Stage 2	569	549	-	707	665	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	307	318	733	308	323	583	1263	-	-	1076	-	-
Mov Cap-2 Maneuver	307	318	-	308	323	-	-	-	-	-	-	-
Stage 1	705	662	-	567	554	-	-	-	-	-	-	-
Stage 2	566	547	-	704	662	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	16.8	19.3	0	0
HCM LOS	C	C		

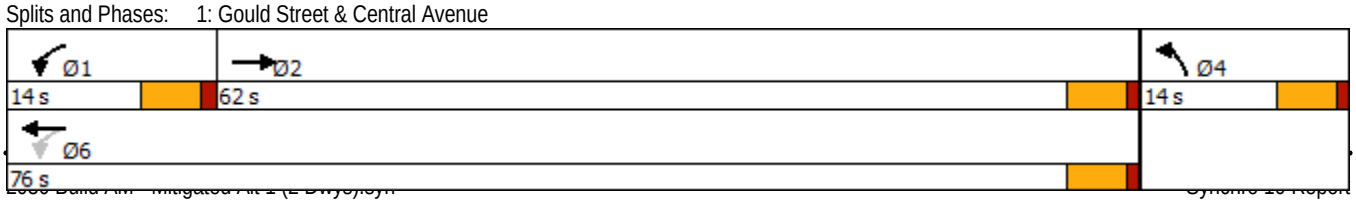
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1263	-	-	307	313	1076	-	-
HCM Lane V/C Ratio	-	-	-	0.004	0.198	0.001	-	-
HCM Control Delay (s)	0	-	-	16.8	19.3	8.3	0	-
HCM Lane LOS	A	-	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.7	0	-	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	718	296	204	298	75	109
Future Volume (vph)	718	296	204	298	75	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	11	12	12
Storage Length (ft)		0	100		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		1.00		0.98	
Frt	0.961				0.920	
Flt Protected			0.950		0.980	
Satd. Flow (prot)	1779	0	1631	1783	1625	0
Flt Permitted			0.066		0.980	
Satd. Flow (perm)	1779	0	113	1783	1618	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	45				64	
Link Speed (mph)	30			30	30	
Link Distance (ft)	1354			549	1225	
Travel Time (s)	30.8			12.5	27.8	
Confl. Peds. (#/hr)		2	2		2	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	7%	3%	3%	4%
Shared Lane Traffic (%)						
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Detector Phase	2		1	6	4	
Switch Phase						
Minimum Initial (s)	10.0		6.0	10.0	6.0	
Minimum Split (s)	15.0		11.0	15.0	11.0	
Total Split (s)	62.0		14.0	76.0	14.0	
Total Split (%)	68.9%		15.6%	84.4%	15.6%	
Maximum Green (s)	57.0		9.0	71.0	9.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	
Total Lost Time (s)	5.0		5.0	5.0	5.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	Min		None	Min	None	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 88.6
Natural Cycle: 90
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Gould Street & Central Avenue



Lane Group	EBT	WBL	WBT	NBL
Lane Group Flow (vph)	1102	222	324	200
v/c Ratio	0.97	0.92	0.23	0.90
Control Delay	37.8	63.7	2.9	68.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	37.8	63.7	2.9	68.4
Queue Length 50th (ft)	517	78	36	78
Queue Length 95th (ft)	#867	#215	56	#208
Internal Link Dist (ft)	1274		469	1145
Turn Bay Length (ft)		100		
Base Capacity (vph)	1161	242	1429	222
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.95	0.92	0.23	0.90

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	718	296	204	298	75	109
Future Volume (vph)	718	296	204	298	75	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0		5.0	5.0	5.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frpb, ped/bikes	0.99		1.00	1.00	0.98	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.96		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1778		1631	1783	1625	
Flt Permitted	1.00		0.07	1.00	0.98	
Satd. Flow (perm)	1778		113	1783	1625	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	780	322	222	324	82	118
RTOR Reduction (vph)	17	0	0	0	57	0
Lane Group Flow (vph)	1085	0	222	324	143	0
Confl. Peds. (#/hr)		2	2		2	2
Heavy Vehicles (%)	2%	2%	7%	3%	3%	4%
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.6		69.6	69.6	9.0	
Effective Green, g (s)	55.6		69.6	69.6	9.0	
Actuated g/C Ratio	0.63		0.79	0.79	0.10	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1115		242	1400	165	
v/s Ratio Prot	c0.61		c0.09	0.18	c0.09	
v/s Ratio Perm			0.62			
v/c Ratio	0.97		0.92	0.23	0.86	
Uniform Delay, d1	15.8		29.7	2.5	39.2	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	20.6		35.9	0.1	34.4	
Delay (s)	36.4		65.7	2.6	73.6	
Level of Service	D		E	A	E	
Approach Delay (s)	36.4			28.2	73.6	
Approach LOS	D			C	E	

Intersection Summary

HCM 2000 Control Delay	38.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		

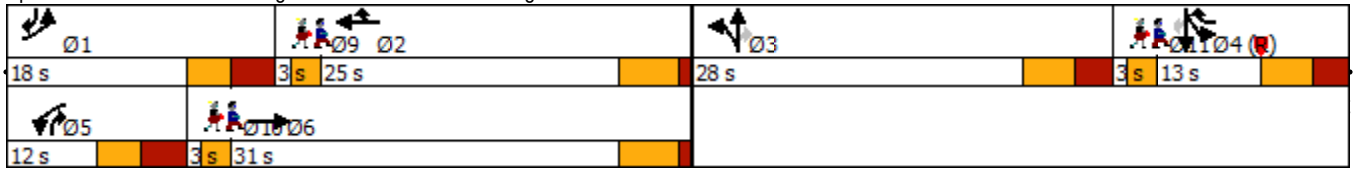
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Future Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	13	11	11	11	11	11	11
Storage Length (ft)	175		0	165		400	0		150	200		200
Storage Lanes	1		0	1		1	0		1	1		1
Taper Length (ft)	150			75			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frt		0.997				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.996		0.950		
Satd. Flow (prot)	1636	3411	0	1668	3388	1669	0	1813	1546	3193	1801	1561
Flt Permitted	0.950			0.950				0.996		0.950		
Satd. Flow (perm)	1636	3411	0	1668	3388	1669	0	1813	1546	3193	1801	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				231			170			170
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1352			1324			681			465	
Travel Time (s)		30.7			30.1			15.5			10.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	2%	1%	3%	0%	0%	1%	1%	6%	2%	0%
Shared Lane Traffic (%)												
Turn Type	Prot	NA		Prot	NA	pt+ov	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2	2 4	3	3	5	4	4	1
Permitted Phases									3			4
Detector Phase	1	6		5	2	2	3	3	3	4	4	4
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	12.0	15.0		12.0	15.0		12.0	12.0	12.0	12.0	12.0	12.0
Total Split (s)	18.0	31.0		12.0	25.0		28.0	28.0	12.0	13.0	13.0	18.0
Total Split (%)	20.0%	34.4%		13.3%	27.8%		31.1%	31.1%	13.3%	14.4%	14.4%	20.0%
Maximum Green (s)	12.0	26.0		6.0	20.0		22.0	22.0	6.0	7.0	7.0	12.0
Yellow Time (s)	3.0	4.0		3.0	4.0		3.5	3.5	3.0	3.5	3.5	3.0
All-Red Time (s)	3.0	1.0		3.0	1.0		2.5	2.5	3.0	2.5	2.5	3.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead			Lead			Lead	Lead	Lead			Lead
Lead-Lag Optimize?	Yes			Yes			Yes	Yes	Yes			Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None	None	C-Min	C-Min	None
Walk Time (s)		4.0			4.0					4.0	4.0	
Flash Dont Walk (s)		11.0			12.0					19.5	19.5	
Pedestrian Calls (#/hr)		1			1					1	1	

Intersection Summary

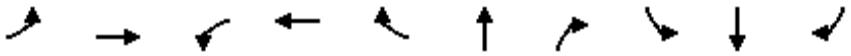
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:SBTL, Start of Yellow, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 4: Huntington Road/Gould Street & Highland Avenue



Lane Group	Ø9	Ø10	Ø11
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Peak Hour Factor			
Heavy Vehicles (%)			
Shared Lane Traffic (%)			
Turn Type			
Protected Phases	9	10	11
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	3.0	3.0	3.0
Total Split (s)	3.0	3.0	3.0
Total Split (%)	3%	3%	3%
Maximum Green (s)	1.0	1.0	1.0
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0	2.0
Recall Mode	None	None	None
Walk Time (s)	0.0	0.0	0.0
Flash Dont Walk (s)	0.0	0.0	0.0
Pedestrian Calls (#/hr)	1	1	1

Intersection Summary



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	189	929	48	664	727	426	259	195	75	38
v/c Ratio	0.89	0.74	0.43	0.78	0.96	0.96	0.46	0.59	0.40	0.06
Control Delay	78.7	30.9	52.9	39.5	39.8	69.7	8.0	46.0	43.2	1.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	78.7	30.9	52.9	39.5	39.8	69.7	8.0	46.0	43.2	1.3
Queue Length 50th (ft)	107	256	27	184	161	240	22	55	41	0
Queue Length 95th (ft)	#227	#396	63	#291	#627	#425	58	#112	#95	2
Internal Link Dist (ft)		1272		1244		601			385	
Turn Bay Length (ft)	175		165		400		150	200		200
Base Capacity (vph)	218	1259	111	853	759	443	561	333	188	589
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.87	0.74	0.43	0.78	0.96	0.96	0.46	0.59	0.40	0.06

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Future Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	13	11	11	11	11	11	11
Total Lost time (s)	6.0	5.0		6.0	5.0	5.0		6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.97	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1636	3410		1668	3388	1669		1813	1546	3193	1801	1561
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1636	3410		1668	3388	1669		1813	1546	3193	1801	1561
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	189	909	20	48	664	727	33	393	259	195	75	38
RTOR Reduction (vph)	0	1	0	0	0	146	0	0	122	0	0	30
Lane Group Flow (vph)	189	928	0	48	664	581	0	426	137	195	75	8
Heavy Vehicles (%)	3%	2%	2%	1%	3%	0%	0%	1%	1%	6%	2%	0%
Turn Type	Prot	NA		Prot	NA	pt+ov	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2	2 4	3	3	5	4	4	1
Permitted Phases									3			4
Actuated Green, G (s)	11.7	33.2		3.6	25.1	33.3		22.0	25.6	8.2	8.2	19.9
Effective Green, g (s)	11.7	33.2		3.6	25.1	33.3		22.0	25.6	8.2	8.2	19.9
Actuated g/C Ratio	0.13	0.37		0.04	0.28	0.37		0.24	0.28	0.09	0.09	0.22
Clearance Time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	212	1257		66	944	617		443	439	290	164	449
v/s Ratio Prot	c0.12	c0.27		0.03	0.20	c0.35		c0.23	0.01	0.06	0.04	0.00
v/s Ratio Perm									0.08			0.00
v/c Ratio	0.89	0.74		0.73	0.70	0.94		0.96	0.31	0.67	0.46	0.02
Uniform Delay, d1	38.5	24.6		42.7	29.1	27.4		33.6	25.3	39.6	38.8	27.4
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	0.96	0.94	1.00
Incremental Delay, d2	33.3	2.0		28.4	2.0	22.7		32.7	0.1	11.8	8.9	0.0
Delay (s)	71.8	26.6		71.1	31.1	50.1		66.3	25.4	49.8	45.5	27.4
Level of Service	E	C		E	C	D		E	C	D	D	C
Approach Delay (s)		34.3			42.0			50.8			46.0	
Approach LOS		C			D			D			D	

Intersection Summary

HCM 2000 Control Delay	41.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	27.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		

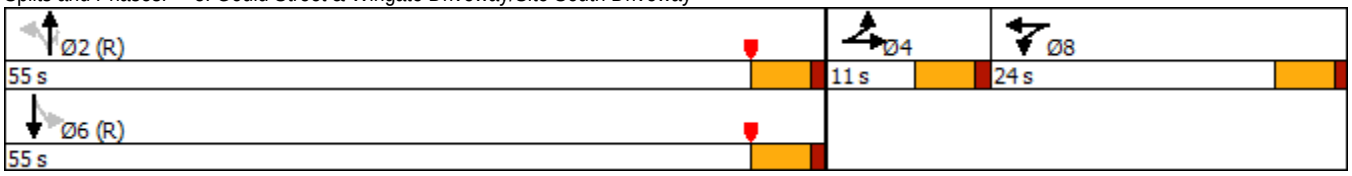
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	5	42	0	5	17	427	406	55	295	2
Future Volume (vph)	0	0	5	42	0	5	17	427	406	55	295	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	0.95	0.95	0.95
Frt		0.865			0.970				0.850		0.999	
Flt Protected				0.950	0.962			0.998			0.992	
Satd. Flow (prot)	0	1611	0	1681	1651	0	0	1859	1583	0	3507	0
Flt Permitted				0.950	0.962			0.981			0.826	
Satd. Flow (perm)	0	1611	0	1681	1651	0	0	1827	1583	0	2920	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		604			85				441		1	
Link Speed (mph)		20			20			30			30	
Link Distance (ft)		431			469			465			307	
Travel Time (s)		14.7			16.0			10.6			7.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)				44%								
Turn Type		NA		Split	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	11.0	11.0		23.0	23.0		15.0	15.0	15.0	23.0	23.0	
Total Split (s)	11.0	11.0		24.0	24.0		55.0	55.0	55.0	55.0	55.0	
Total Split (%)	12.2%	12.2%		26.7%	26.7%		61.1%	61.1%	61.1%	61.1%	61.1%	
Maximum Green (s)	6.0	6.0		19.0	19.0		50.0	50.0	50.0	50.0	50.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0		0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)		5.0		5.0	5.0			5.0	5.0		5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None		C-Min	C-Min	C-Min	C-Min	C-Min	
Walk Time (s)				7.0	7.0					7.0	7.0	
Flash Dont Walk (s)				11.0	11.0					11.0	11.0	
Pedestrian Calls (#/hr)				0	0					0	0	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 44 (49%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 5: Gould Street & Wingate Driveway/Site South Driveway



Lane Group	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	5	26	25	482	441	383
v/c Ratio	0.01	0.20	0.12	0.31	0.31	0.15
Control Delay	0.0	41.8	1.2	2.8	0.8	2.7
Queue Delay	0.0	0.0	0.0	0.4	0.3	0.0
Total Delay	0.0	41.8	1.2	3.2	1.1	2.7
Queue Length 50th (ft)	0	14	0	49	6	17
Queue Length 95th (ft)	0	41	0	m117	m19	56
Internal Link Dist (ft)	351		389	385		227
Turn Bay Length (ft)						
Base Capacity (vph)	671	354	415	1565	1419	2502
Starvation Cap Reductn	0	0	0	583	448	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.07	0.06	0.49	0.45	0.15

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	5	42	0	5	17	427	406	55	295	2
Future Volume (vph)	0	0	5	42	0	5	17	427	406	55	295	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0			5.0	5.0		5.0	
Lane Util. Factor		1.00		0.95	0.95			1.00	1.00		0.95	
Frt		0.86		1.00	0.97			1.00	0.85		1.00	
Flt Protected		1.00		0.95	0.96			1.00	1.00		0.99	
Satd. Flow (prot)		1611		1681	1650			1859	1583		3509	
Flt Permitted		1.00		0.95	0.96			0.98	1.00		0.83	
Satd. Flow (perm)		1611		1681	1650			1828	1583		2922	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	5	46	0	5	18	464	441	60	321	2
RTOR Reduction (vph)	0	5	0	0	24	0	0	0	102	0	0	0
Lane Group Flow (vph)	0	0	0	26	1	0	0	482	339	0	383	0
Turn Type		NA		Split	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2		2	6		
Actuated Green, G (s)		1.2		4.7	4.7			69.1	69.1		69.1	
Effective Green, g (s)		1.2		4.7	4.7			69.1	69.1		69.1	
Actuated g/C Ratio		0.01		0.05	0.05			0.77	0.77		0.77	
Clearance Time (s)		5.0		5.0	5.0			5.0	5.0		5.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		21		87	86			1403	1215		2243	
v/s Ratio Prot		c0.00		c0.02	0.00							
v/s Ratio Perm								c0.26	0.21		0.13	
v/c Ratio		0.00		0.30	0.02			0.34	0.28		0.17	
Uniform Delay, d1		43.8		41.1	40.5			3.3	3.1		2.8	
Progression Factor		1.00		1.00	1.00			0.84	1.20		1.00	
Incremental Delay, d2		0.1		1.9	0.1			0.2	0.2		0.2	
Delay (s)		43.9		43.0	40.5			3.0	3.9		3.0	
Level of Service		D		D	D			A	A		A	
Approach Delay (s)		43.9			41.8			3.4			3.0	
Approach LOS		D			D			A			A	

Intersection Summary

HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	13	15	402	134	171	299
Future Volume (vph)	13	15	402	134	171	299
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		100	100	
Storage Lanes	1	1		1	1	
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1805	1615	1863	1583	1805	1845
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1805	1615	1863	1583	1805	1845
Link Speed (mph)	20		30			30
Link Distance (ft)	474		307			641
Travel Time (s)	16.2		7.0			14.6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	2%	2%	0%	3%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	15	402	134	171	299
Future Vol, veh/h	13	15	402	134	171	299
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	100	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	2	0	3
Mvmt Flow	14	16	437	146	186	325

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1134	437	0	0	583	0
Stage 1	437	-	-	-	-	-
Stage 2	697	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	226	624	-	-	1001	-
Stage 1	655	-	-	-	-	-
Stage 2	498	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	184	624	-	-	1001	-
Mov Cap-2 Maneuver	184	-	-	-	-	-
Stage 1	655	-	-	-	-	-
Stage 2	405	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18	0	3.4
HCM LOS	C		

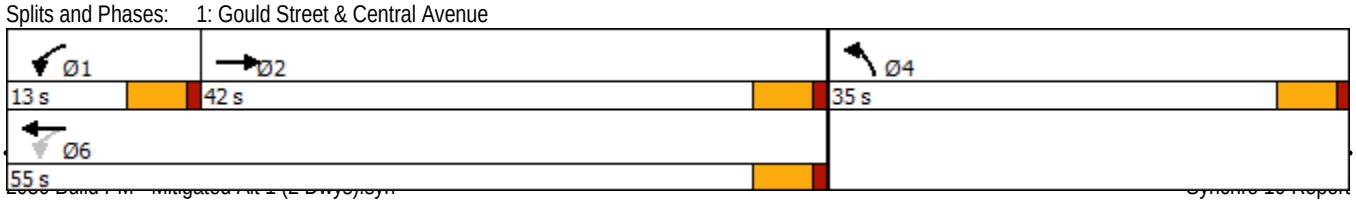
Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	184	624	1001	-
HCM Lane V/C Ratio	-	-	0.077	0.026	0.186	-
HCM Control Delay (s)	-	-	26.2	10.9	9.4	-
HCM Lane LOS	-	-	D	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0.1	0.7	-

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	447	103	181	707	223	213
Future Volume (vph)	447	103	181	707	223	213
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	11	12	12
Storage Length (ft)		0	100		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor			1.00		0.99	
Frt	0.975				0.934	
Flt Protected			0.950		0.975	
Satd. Flow (prot)	1838	0	1728	1801	1673	0
Flt Permitted			0.141		0.975	
Satd. Flow (perm)	1838	0	256	1801	1673	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	16				58	
Link Speed (mph)	30			30	30	
Link Distance (ft)	1354			549	1225	
Travel Time (s)	30.8			12.5	27.8	
Confl. Peds. (#/hr)			6			6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	1%	2%	0%	4%
Shared Lane Traffic (%)						
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Detector Phase	2		1	6	4	
Switch Phase						
Minimum Initial (s)	10.0		6.0	10.0	6.0	
Minimum Split (s)	15.0		11.0	15.0	11.0	
Total Split (s)	42.0		13.0	55.0	35.0	
Total Split (%)	46.7%		14.4%	61.1%	38.9%	
Maximum Green (s)	37.0		8.0	50.0	30.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	
Total Lost Time (s)	5.0		5.0	5.0	5.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	Min		None	Min	None	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 77
Natural Cycle: 65
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Gould Street & Central Avenue



Lane Group	EBT	WBL	WBT	NBL
Lane Group Flow (vph)	598	197	768	474
v/c Ratio	0.84	0.67	0.77	0.84
Control Delay	33.9	23.5	20.7	37.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	33.9	23.5	20.7	37.8
Queue Length 50th (ft)	261	48	287	195
Queue Length 95th (ft)	#422	#132	475	#375
Internal Link Dist (ft)	1274		469	1145
Turn Bay Length (ft)		100		
Base Capacity (vph)	925	300	1214	711
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.65	0.66	0.63	0.67

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	447	103	181	707	223	213
Future Volume (vph)	447	103	181	707	223	213
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0		5.0	5.0	5.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.99	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.97		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1837		1727	1801	1673	
Flt Permitted	1.00		0.14	1.00	0.98	
Satd. Flow (perm)	1837		256	1801	1673	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	486	112	197	768	242	232
RTOR Reduction (vph)	10	0	0	0	40	0
Lane Group Flow (vph)	588	0	197	768	434	0
Confl. Peds. (#/hr)			6			6
Heavy Vehicles (%)	1%	0%	1%	2%	0%	4%
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Actuated Green, G (s)	29.5		42.6	42.6	24.0	
Effective Green, g (s)	29.5		42.6	42.6	24.0	
Actuated g/C Ratio	0.39		0.56	0.56	0.31	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	707		297	1001	524	
v/s Ratio Prot	0.32		0.07	c0.43	c0.26	
v/s Ratio Perm			0.30			
v/c Ratio	0.83		0.66	0.77	0.83	
Uniform Delay, d1	21.3		13.3	13.2	24.4	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	8.3		5.5	3.6	10.4	
Delay (s)	29.6		18.8	16.7	34.8	
Level of Service	C		B	B	C	
Approach Delay (s)	29.6			17.2	34.8	
Approach LOS	C			B	C	

Intersection Summary			
HCM 2000 Control Delay	24.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	76.6	Sum of lost time (s)	15.0
Intersection Capacity Utilization	78.0%	ICU Level of Service	D
Analysis Period (min)	15		

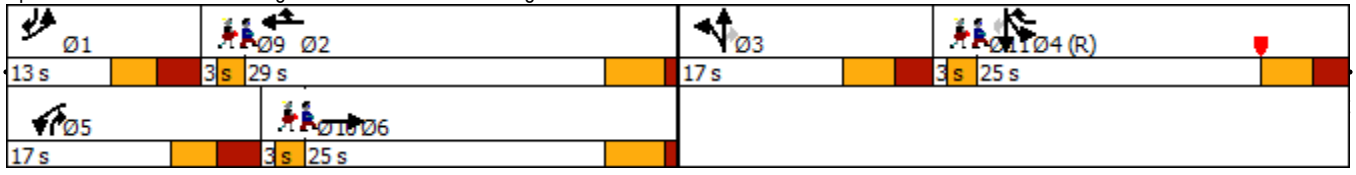
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Future Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	13	11	11	11	11	11	11
Storage Length (ft)	175		0	165		400	0		150	200		200
Storage Lanes	1		0	1		1	0		1	1		1
Taper Length (ft)	150			75			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frt		0.997				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.988		0.950		
Satd. Flow (prot)	1685	3413	0	1685	3116	1669	0	1801	1546	3351	1818	1516
Flt Permitted	0.950			0.950				0.988		0.950		
Satd. Flow (perm)	1685	3413	0	1685	3116	1669	0	1801	1546	3351	1818	1516
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				290			170			185
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1352			1324			681			463	
Travel Time (s)		30.7			30.1			15.5			10.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	12%	0%	0%	1%	1%	1%	1%	3%
Shared Lane Traffic (%)												
Turn Type	Prot	NA		Prot	NA	pt+ov	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2	2 4	3	3	5	4	4	1
Permitted Phases									3			4
Detector Phase	1	6		5	2	2	3	3	3	4	4	4
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	12.0	15.0		12.0	15.0		12.0	12.0	12.0	12.0	12.0	12.0
Total Split (s)	13.0	25.0		17.0	29.0		17.0	17.0	17.0	25.0	25.0	13.0
Total Split (%)	14.4%	27.8%		18.9%	32.2%		18.9%	18.9%	18.9%	27.8%	27.8%	14.4%
Maximum Green (s)	7.0	20.0		11.0	24.0		11.0	11.0	11.0	19.0	19.0	7.0
Yellow Time (s)	3.0	4.0		3.0	4.0		3.5	3.5	3.0	3.5	3.5	3.0
All-Red Time (s)	3.0	1.0		3.0	1.0		2.5	2.5	3.0	2.5	2.5	3.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead			Lead			Lead	Lead	Lead			Lead
Lead-Lag Optimize?	Yes			Yes			Yes	Yes	Yes			Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None	None	C-Min	C-Min	None
Walk Time (s)		4.0			4.0					4.0	4.0	
Flash Dont Walk (s)		11.0			12.0					19.5	19.5	
Pedestrian Calls (#/hr)		1			1					1	1	

Intersection Summary

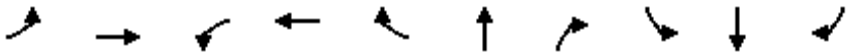
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:SBTL, Start of Yellow, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 4: Huntington Road/Gould Street & Highland Avenue



Lane Group	Ø9	Ø10	Ø11
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Peak Hour Factor			
Heavy Vehicles (%)			
Shared Lane Traffic (%)			
Turn Type			
Protected Phases	9	10	11
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	3.0	3.0	3.0
Total Split (s)	3.0	3.0	3.0
Total Split (%)	3%	3%	3%
Maximum Green (s)	1.0	1.0	1.0
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0	2.0
Recall Mode	None	None	None
Walk Time (s)	0.0	0.0	0.0
Flash Dont Walk (s)	0.0	0.0	0.0
Pedestrian Calls (#/hr)	1	1	1

Intersection Summary



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	73	775	145	863	290	159	113	733	337	185
v/c Ratio	0.57	0.88	0.77	0.86	0.26	0.77	0.23	0.89	0.75	0.28
Control Delay	58.9	46.2	64.8	40.9	1.4	63.7	1.8	46.0	43.0	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	58.9	46.2	64.8	40.9	1.4	63.7	1.8	46.0	43.0	6.2
Queue Length 50th (ft)	41	222	80	248	0	88	0	141	126	15
Queue Length 95th (ft)	#96	#366	#167	#400	19	#180	6	#357	#348	42
Internal Link Dist (ft)		1272		1244		601			383	
Turn Bay Length (ft)	175		165		400		150	200		200
Base Capacity (vph)	131	878	205	1000	1104	220	493	827	448	667
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.88	0.71	0.86	0.26	0.72	0.23	0.89	0.75	0.28

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Future Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	13	11	11	11	11	11	11
Total Lost time (s)	6.0	5.0		6.0	5.0	5.0		6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.97	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1685	3411		1685	3116	1669		1801	1546	3351	1818	1516
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.99	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1685	3411		1685	3116	1669		1801	1546	3351	1818	1516
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	73	757	18	145	863	290	38	121	113	733	337	185
RTOR Reduction (vph)	0	1	0	0	0	125	0	0	87	0	0	128
Lane Group Flow (vph)	73	774	0	145	863	165	0	159	26	733	337	57
Heavy Vehicles (%)	0%	2%	0%	0%	12%	0%	0%	1%	1%	1%	1%	3%
Turn Type	Prot	NA		Prot	NA	pt+ov	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2	2 4	3	3	5	4	4	1
Permitted Phases									3			4
Actuated Green, G (s)	5.6	24.3		10.2	28.9	51.1		10.3	20.5	22.2	22.2	27.8
Effective Green, g (s)	5.6	24.3		10.2	28.9	51.1		10.3	20.5	22.2	22.2	27.8
Actuated g/C Ratio	0.06	0.27		0.11	0.32	0.57		0.11	0.23	0.25	0.25	0.31
Clearance Time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	104	920		190	1000	947		206	352	826	448	569
v/s Ratio Prot	0.04	0.23		c0.09	c0.28	0.10		c0.09	0.01	c0.22	0.19	0.01
v/s Ratio Perm									0.01			0.03
v/c Ratio	0.70	0.84		0.76	0.86	0.17		0.77	0.07	0.89	0.75	0.10
Uniform Delay, d1	41.4	31.0		38.7	28.7	9.3		38.7	27.3	32.7	31.4	22.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	0.98	0.98	1.63
Incremental Delay, d2	16.0	6.7		15.0	7.6	0.0		15.0	0.0	12.3	10.0	0.0
Delay (s)	57.4	37.7		53.7	36.2	9.4		53.7	27.3	44.3	40.8	36.2
Level of Service	E	D		D	D	A		D	C	D	D	D
Approach Delay (s)		39.4			32.2			42.7			42.2	
Approach LOS		D			C			D			D	

Intersection Summary

HCM 2000 Control Delay	38.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	27.0
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

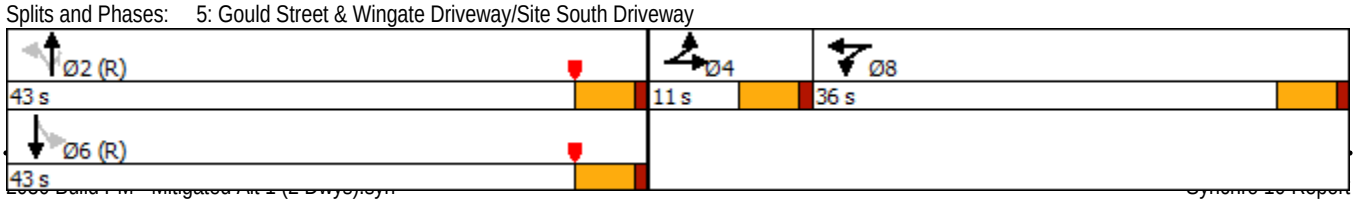
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	28	490	1	69	7	269	138	14	767	6
Future Volume (vph)	0	0	28	490	1	69	7	269	138	14	767	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	100		0
Storage Lanes	0		0	1		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	0.95	0.95	0.95
Frt		0.865			0.962				0.850		0.999	
Flt Protected				0.950	0.964			0.999			0.999	
Satd. Flow (prot)	0	1611	0	1681	1641	0	0	1861	1583	0	3532	0
Flt Permitted				0.950	0.964			0.978			0.948	
Satd. Flow (perm)	0	1611	0	1681	1641	0	0	1822	1583	0	3352	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		107			20				150		1	
Link Speed (mph)		20			20			30			30	
Link Distance (ft)		431			469			463			307	
Travel Time (s)		14.7			16.0			10.5			7.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)				42%								
Turn Type		NA		Split	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	11.0	11.0		23.0	23.0		15.0	15.0	15.0	23.0	23.0	
Total Split (s)	11.0	11.0		36.0	36.0		43.0	43.0	43.0	43.0	43.0	
Total Split (%)	12.2%	12.2%		40.0%	40.0%		47.8%	47.8%	47.8%	47.8%	47.8%	
Maximum Green (s)	6.0	6.0		31.0	31.0		38.0	38.0	38.0	38.0	38.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0		0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)		5.0		5.0	5.0			5.0	5.0		5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None		C-Min	C-Min	C-Min	C-Min	C-Min	
Walk Time (s)				7.0	7.0					7.0	7.0	
Flash Dont Walk (s)				11.0	11.0					11.0	11.0	
Pedestrian Calls (#/hr)				0	0					0	0	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 34 (38%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 5: Gould Street & Wingate Driveway/Site South Driveway



Lane Group	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	30	309	300	300	150	856
v/c Ratio	0.14	0.72	0.69	0.29	0.16	0.46
Control Delay	1.5	39.2	35.6	13.0	2.8	15.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.5	39.2	35.6	13.0	2.8	15.1
Queue Length 50th (ft)	0	167	150	77	0	161
Queue Length 95th (ft)	0	232	214	m179	m21	255
Internal Link Dist (ft)	351		389	383		227
Turn Bay Length (ft)						
Base Capacity (vph)	207	579	578	1018	951	1873
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.53	0.52	0.29	0.16	0.46

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	28	490	1	69	7	269	138	14	767	6
Future Volume (vph)	0	0	28	490	1	69	7	269	138	14	767	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0			5.0	5.0		5.0	
Lane Util. Factor		1.00		0.95	0.95			1.00	1.00		0.95	
Frt		0.86		1.00	0.96			1.00	0.85		1.00	
Flt Protected		1.00		0.95	0.96			1.00	1.00		1.00	
Satd. Flow (prot)		1611		1681	1642			1860	1583		3532	
Flt Permitted		1.00		0.95	0.96			0.98	1.00		0.95	
Satd. Flow (perm)		1611		1681	1642			1821	1583		3350	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	30	533	1	75	8	292	150	15	834	7
RTOR Reduction (vph)	0	29	0	0	15	0	0	0	70	0	0	0
Lane Group Flow (vph)	0	1	0	309	285	0	0	300	81	0	856	0
Turn Type		NA		Split	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2		2	6		
Actuated Green, G (s)		3.6		23.1	23.1			48.3	48.3		48.3	
Effective Green, g (s)		3.6		23.1	23.1			48.3	48.3		48.3	
Actuated g/C Ratio		0.04		0.26	0.26			0.54	0.54		0.54	
Clearance Time (s)		5.0		5.0	5.0			5.0	5.0		5.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		64		431	421			977	849		1797	
v/s Ratio Prot		c0.00		c0.18	0.17							
v/s Ratio Perm								0.16	0.05		c0.26	
v/c Ratio		0.02		0.72	0.68			0.31	0.09		0.48	
Uniform Delay, d1		41.5		30.5	30.1			11.6	10.2		13.0	
Progression Factor		1.00		1.00	1.00			0.91	0.87		1.00	
Incremental Delay, d2		0.1		5.6	4.3			0.8	0.2		0.9	
Delay (s)		41.6		36.1	34.4			11.3	9.1		13.9	
Level of Service		D		D	C			B	A		B	
Approach Delay (s)		41.6			35.2			10.5			13.9	
Approach LOS		D			D			B			B	

Intersection Summary

HCM 2000 Control Delay	20.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	163	204	301	46	41	520
Future Volume (vph)	163	204	301	46	41	520
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		100	100	
Storage Lanes	1	1		1	1	
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1805	1615	1900	1615	1805	1792
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1805	1615	1900	1615	1805	1792
Link Speed (mph)	20		30			30
Link Distance (ft)	474		307			641
Travel Time (s)	16.2		7.0			14.6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	6%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	7.5					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	163	204	301	46	41	520
Future Vol, veh/h	163	204	301	46	41	520
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	100	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	6
Mvmt Flow	177	222	327	50	45	565

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	982	327	0	0	377	0
Stage 1	327	-	-	-	-	-
Stage 2	655	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	279	719	-	-	1193	-
Stage 1	735	-	-	-	-	-
Stage 2	521	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	268	719	-	-	1193	-
Mov Cap-2 Maneuver	268	-	-	-	-	-
Stage 1	735	-	-	-	-	-
Stage 2	501	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	25.1	0	0.6
HCM LOS	D		

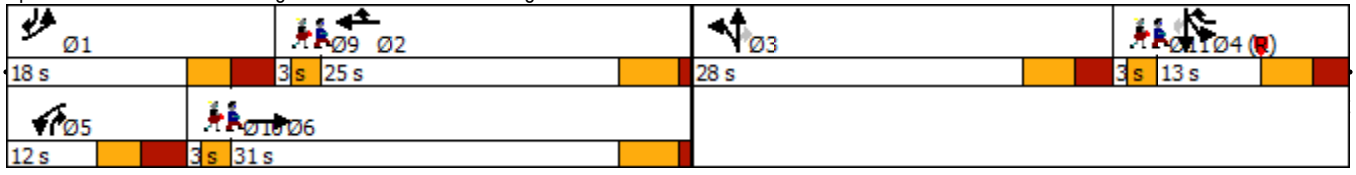
Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	268	719	1193	-
HCM Lane V/C Ratio	-	-	0.661	0.308	0.037	-
HCM Control Delay (s)	-	-	41.2	12.2	8.1	-
HCM Lane LOS	-	-	E	B	A	-
HCM 95th %tile Q(veh)	-	-	4.3	1.3	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Future Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	12	11	11	11	11	11	11
Storage Length (ft)	175		0	165		400	0		150	200		200
Storage Lanes	1		0	1		1	0		1	1		1
Taper Length (ft)	150			75			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frt		0.997				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.996		0.950		
Satd. Flow (prot)	1636	3411	0	1668	3388	1615	0	1813	1546	3193	1801	1561
Flt Permitted	0.950			0.950				0.996		0.950		
Satd. Flow (perm)	1636	3411	0	1668	3388	1615	0	1813	1546	3193	1801	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				231			170			170
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1352			1324			681			462	
Travel Time (s)		30.7			30.1			15.5			10.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	2%	1%	3%	0%	0%	1%	1%	6%	2%	0%
Shared Lane Traffic (%)												
Turn Type	Prot	NA		Prot	NA	pt+ov	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2	2 4	3	3	5	4	4	1
Permitted Phases									3			4
Detector Phase	1	6		5	2	2	3	3	3	4	4	4
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	12.0	15.0		12.0	15.0		12.0	12.0	12.0	12.0	12.0	12.0
Total Split (s)	18.0	31.0		12.0	25.0		28.0	28.0	12.0	13.0	13.0	18.0
Total Split (%)	20.0%	34.4%		13.3%	27.8%		31.1%	31.1%	13.3%	14.4%	14.4%	20.0%
Maximum Green (s)	12.0	26.0		6.0	20.0		22.0	22.0	6.0	7.0	7.0	12.0
Yellow Time (s)	3.0	4.0		3.0	4.0		3.5	3.5	3.0	3.5	3.5	3.0
All-Red Time (s)	3.0	1.0		3.0	1.0		2.5	2.5	3.0	2.5	2.5	3.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead			Lead			Lead	Lead	Lead			Lead
Lead-Lag Optimize?	Yes			Yes			Yes	Yes	Yes			Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None	None	C-Min	C-Min	None
Walk Time (s)		4.0			4.0					4.0	4.0	
Flash Dont Walk (s)		11.0			12.0					19.5	19.5	
Pedestrian Calls (#/hr)		1			1					1	1	

Intersection Summary

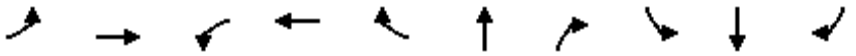
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:SBTL, Start of Yellow, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 4: Huntington Road/Gould Street & Highland Avenue



Lane Group	Ø9	Ø10	Ø11
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Peak Hour Factor			
Heavy Vehicles (%)			
Shared Lane Traffic (%)			
Turn Type			
Protected Phases	9	10	11
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	3.0	3.0	3.0
Total Split (s)	3.0	3.0	3.0
Total Split (%)	3%	3%	3%
Maximum Green (s)	1.0	1.0	1.0
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0	2.0
Recall Mode	None	None	None
Walk Time (s)	0.0	0.0	0.0
Flash Dont Walk (s)	0.0	0.0	0.0
Pedestrian Calls (#/hr)	1	1	1

Intersection Summary



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	189	929	48	664	727	426	259	195	75	38
v/c Ratio	0.89	0.74	0.43	0.78	0.98	0.96	0.46	0.59	0.40	0.06
Control Delay	78.7	30.9	52.9	39.5	46.0	69.7	8.0	45.7	42.7	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	78.7	30.9	52.9	39.5	46.0	69.7	8.0	45.7	42.7	1.0
Queue Length 50th (ft)	107	256	27	184	172	240	22	56	41	1
Queue Length 95th (ft)	#227	#396	63	#291	#638	#425	58	#114	#96	4
Internal Link Dist (ft)		1272		1244		601			382	
Turn Bay Length (ft)	175		165		400		150	200		200
Base Capacity (vph)	218	1259	111	853	739	443	561	333	188	589
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.87	0.74	0.43	0.78	0.98	0.96	0.46	0.59	0.40	0.06

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Future Volume (vph)	174	836	18	44	611	669	30	362	238	179	69	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	12	11	11	11	11	11	11
Total Lost time (s)	6.0	5.0		6.0	5.0	5.0		6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.97	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1636	3410		1668	3388	1615		1813	1546	3193	1801	1561
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1636	3410		1668	3388	1615		1813	1546	3193	1801	1561
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	189	909	20	48	664	727	33	393	259	195	75	38
RTOR Reduction (vph)	0	1	0	0	0	146	0	0	122	0	0	30
Lane Group Flow (vph)	189	928	0	48	664	581	0	426	137	195	75	8
Heavy Vehicles (%)	3%	2%	2%	1%	3%	0%	0%	1%	1%	6%	2%	0%
Turn Type	Prot	NA		Prot	NA	pt+ov	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2	2 4	3	3	5	4	4	1
Permitted Phases									3			4
Actuated Green, G (s)	11.7	33.2		3.6	25.1	33.3		22.0	25.6	8.2	8.2	19.9
Effective Green, g (s)	11.7	33.2		3.6	25.1	33.3		22.0	25.6	8.2	8.2	19.9
Actuated g/C Ratio	0.13	0.37		0.04	0.28	0.37		0.24	0.28	0.09	0.09	0.22
Clearance Time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	212	1257		66	944	597		443	439	290	164	449
v/s Ratio Prot	c0.12	c0.27		0.03	0.20	c0.36		c0.23	0.01	0.06	0.04	0.00
v/s Ratio Perm									0.08			0.00
v/c Ratio	0.89	0.74		0.73	0.70	0.97		0.96	0.31	0.67	0.46	0.02
Uniform Delay, d1	38.5	24.6		42.7	29.1	27.9		33.6	25.3	39.6	38.8	27.4
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	0.95	0.94	1.00
Incremental Delay, d2	33.3	2.0		28.4	2.0	30.0		32.7	0.1	11.7	8.9	0.0
Delay (s)	71.8	26.6		71.1	31.1	57.9		66.3	25.4	49.4	45.1	27.4
Level of Service	E	C		E	C	E		E	C	D	D	C
Approach Delay (s)		34.3			46.0			50.8			45.7	
Approach LOS		C			D			D			D	

Intersection Summary

HCM 2000 Control Delay	43.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	27.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		

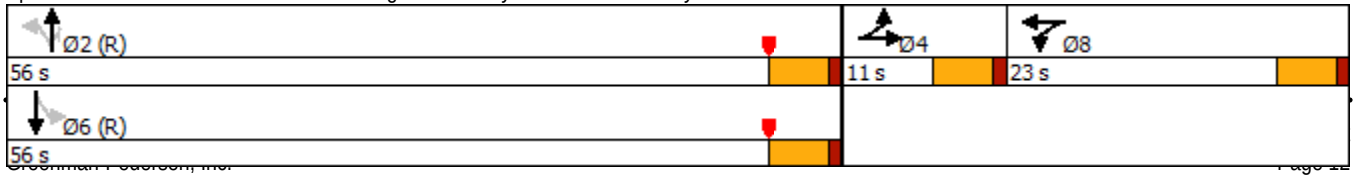
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	5	55	0	10	17	293	540	226	282	2
Future Volume (vph)	0	0	5	55	0	10	17	293	540	226	282	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	13	13	12	12	12	12	12	12
Storage Length (ft)	0		0	0		0	0		0	100		0
Storage Lanes	0		0	1		0	0		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865			0.953				0.850		0.999	
Flt Protected				0.950	0.967			0.997		0.950		
Satd. Flow (prot)	0	1611	0	1681	1685	0	0	1857	1583	1770	1861	0
Flt Permitted				0.950	0.967			0.978		0.557		
Satd. Flow (perm)	0	1611	0	1681	1685	0	0	1822	1583	1038	1861	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		596			85				587		1	
Link Speed (mph)		20			20			30			30	
Link Distance (ft)		431			469			462			408	
Travel Time (s)		14.7			16.0			10.5			9.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)				40%								
Turn Type		NA		Split	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	11.0	11.0		23.0	23.0		15.0	15.0	15.0	23.0	23.0	
Total Split (s)	11.0	11.0		23.0	23.0		56.0	56.0	56.0	56.0	56.0	
Total Split (%)	12.2%	12.2%		25.6%	25.6%		62.2%	62.2%	62.2%	62.2%	62.2%	
Maximum Green (s)	6.0	6.0		18.0	18.0		51.0	51.0	51.0	51.0	51.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None		C-Min	C-Min	C-Min	C-Min	C-Min	
Walk Time (s)				7.0	7.0					7.0	7.0	
Flash Dont Walk (s)				11.0	11.0					11.0	11.0	
Pedestrian Calls (#/hr)				0	0					0	0	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 49 (54%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 5: Gould Street & Wingate Driveway/Site South Driveway



Lane Group	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	5	36	35	336	587	246	309
v/c Ratio	0.01	0.26	0.16	0.23	0.42	0.29	0.20
Control Delay	0.0	42.5	1.6	3.0	1.0	4.7	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.4	0.0	0.0
Total Delay	0.0	42.5	1.6	3.0	1.5	4.7	3.6
Queue Length 50th (ft)	0	21	0	33	9	25	29
Queue Length 95th (ft)	0	50	1	m74	m28	99	101
Internal Link Dist (ft)	351		389	382			328
Turn Bay Length (ft)						100	
Base Capacity (vph)	663	336	405	1486	1399	846	1518
Starvation Cap Reductn	0	0	0	0	384	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.11	0.09	0.23	0.58	0.29	0.20

Intersection Summary

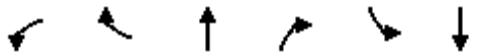
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	5	55	0	10	17	293	540	226	282	2
Future Volume (vph)	0	0	5	55	0	10	17	293	540	226	282	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13	12	12	12	12	12	12
Total Lost time (s)		5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00		0.95	0.95			1.00	1.00	1.00	1.00	
Frt		0.86		1.00	0.95			1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	0.97			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1611		1681	1685			1858	1583	1770	1861	
Flt Permitted		1.00		0.95	0.97			0.98	1.00	0.56	1.00	
Satd. Flow (perm)		1611		1681	1685			1822	1583	1037	1861	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	5	60	0	11	18	318	587	246	307	2
RTOR Reduction (vph)	0	5	0	0	33	0	0	0	147	0	0	0
Lane Group Flow (vph)	0	0	0	36	2	0	0	336	440	246	309	0
Turn Type		NA		Split	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2		2	6		
Actuated Green, G (s)		1.2		6.4	6.4			67.4	67.4	67.4	67.4	
Effective Green, g (s)		1.2		6.4	6.4			67.4	67.4	67.4	67.4	
Actuated g/C Ratio		0.01		0.07	0.07			0.75	0.75	0.75	0.75	
Clearance Time (s)		5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		21		119	119			1364	1185	776	1393	
v/s Ratio Prot		c0.00		c0.02	0.00						0.17	
v/s Ratio Perm								0.18	c0.28	0.24		
v/c Ratio		0.00		0.30	0.02			0.25	0.37	0.32	0.22	
Uniform Delay, d1		43.8		39.7	38.9			3.5	3.9	3.7	3.4	
Progression Factor		1.00		1.00	1.00			0.85	1.53	1.00	1.00	
Incremental Delay, d2		0.1		1.4	0.1			0.1	0.3	1.1	0.4	
Delay (s)		43.9		41.1	39.0			3.1	6.3	4.8	3.8	
Level of Service		D		D	D			A	A	A	A	
Approach Delay (s)		43.9			40.1			5.1			4.2	
Approach LOS		D			D			A			A	

Intersection Summary

HCM 2000 Control Delay	6.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	10	407	0	0	470
Future Volume (vph)	0	10	407	0	0	470
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865				
Flt Protected						
Satd. Flow (prot)	0	1644	1863	0	0	1845
Flt Permitted						
Satd. Flow (perm)	0	1644	1863	0	0	1845
Link Speed (mph)	20		30			30
Link Distance (ft)	474		408			540
Travel Time (s)	16.2		9.3			12.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	2%	2%	0%	3%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	10	407	0	0	470
Future Vol, veh/h	0	10	407	0	0	470
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	2	0	3
Mvmt Flow	0	11	442	0	0	511

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	442	0	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.2	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	620	-	0	0	-
Stage 1	0	-	-	0	0	-
Stage 2	0	-	-	0	0	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	-	620	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.9	0	0
HCM LOS	B		

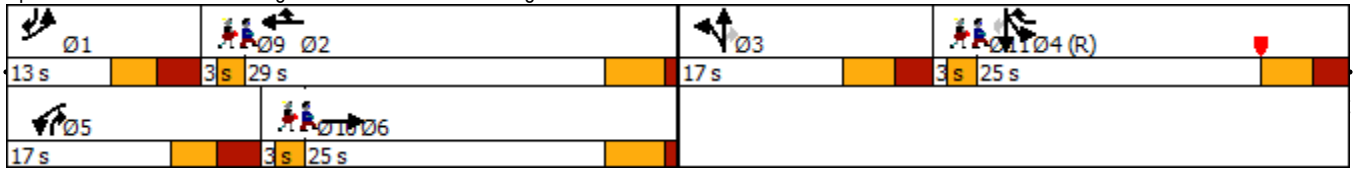
Minor Lane/Major Mvmt	NBT	WBLn1	SBT
Capacity (veh/h)	-	620	-
HCM Lane V/C Ratio	-	0.018	-
HCM Control Delay (s)	-	10.9	-
HCM Lane LOS	-	B	-
HCM 95th %tile Q(veh)	-	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Future Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	11	11	11	11	11	11
Storage Length (ft)	175		0	165		400	0		150	200		200
Storage Lanes	1		0	1		1	0		1	1		1
Taper Length (ft)	150			75			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frt		0.997				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.988		0.950		
Satd. Flow (prot)	1685	3413	0	1685	3116	1561	0	1801	1546	3351	1818	1516
Flt Permitted	0.950			0.950				0.988		0.950		
Satd. Flow (perm)	1685	3413	0	1685	3116	1561	0	1801	1546	3351	1818	1516
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				290			170			185
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1352			1324			681			465	
Travel Time (s)		30.7			30.1			15.5			10.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	12%	0%	0%	1%	1%	1%	1%	3%
Shared Lane Traffic (%)												
Turn Type	Prot	NA		Prot	NA	pt+ov	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2	2 4	3	3	5	4	4	1
Permitted Phases									3			4
Detector Phase	1	6		5	2	2	3	3	3	4	4	4
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	12.0	15.0		12.0	15.0		12.0	12.0	12.0	12.0	12.0	12.0
Total Split (s)	13.0	25.0		17.0	29.0		17.0	17.0	17.0	25.0	25.0	13.0
Total Split (%)	14.4%	27.8%		18.9%	32.2%		18.9%	18.9%	18.9%	27.8%	27.8%	14.4%
Maximum Green (s)	7.0	20.0		11.0	24.0		11.0	11.0	11.0	19.0	19.0	7.0
Yellow Time (s)	3.0	4.0		3.0	4.0		3.5	3.5	3.0	3.5	3.5	3.0
All-Red Time (s)	3.0	1.0		3.0	1.0		2.5	2.5	3.0	2.5	2.5	3.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead			Lead			Lead	Lead	Lead			Lead
Lead-Lag Optimize?	Yes			Yes			Yes	Yes	Yes			Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None	None	C-Min	C-Min	None
Walk Time (s)		4.0			4.0					4.0	4.0	
Flash Dont Walk (s)		11.0			12.0					19.5	19.5	
Pedestrian Calls (#/hr)		1			1					1	1	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:SBTL, Start of Yellow, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 4: Huntington Road/Gould Street & Highland Avenue



Lane Group	Ø9	Ø10	Ø11
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Peak Hour Factor			
Heavy Vehicles (%)			
Shared Lane Traffic (%)			
Turn Type			
Protected Phases	9	10	11
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	3.0	3.0	3.0
Total Split (s)	3.0	3.0	3.0
Total Split (%)	3%	3%	3%
Maximum Green (s)	1.0	1.0	1.0
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0	2.0
Recall Mode	None	None	None
Walk Time (s)	0.0	0.0	0.0
Flash Dont Walk (s)	0.0	0.0	0.0
Pedestrian Calls (#/hr)	1	1	1

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	73	775	145	863	290	159	113	733	337	185
v/c Ratio	0.57	0.88	0.77	0.86	0.28	0.77	0.23	0.89	0.75	0.28
Control Delay	58.9	46.2	64.8	40.9	1.5	63.7	1.8	45.1	41.6	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	58.9	46.2	64.8	40.9	1.5	63.7	1.8	45.1	41.6	6.0
Queue Length 50th (ft)	41	222	80	248	0	88	0	194	163	22
Queue Length 95th (ft)	#96	#366	#167	#400	19	#180	6	m#346	m#313	m39
Internal Link Dist (ft)		1272		1244		601			385	
Turn Bay Length (ft)	175		165		400		150	200		200
Base Capacity (vph)	131	878	205	1000	1040	220	493	827	448	667
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.88	0.71	0.86	0.28	0.72	0.23	0.89	0.75	0.28

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Future Volume (vph)	67	696	17	133	794	267	35	111	104	674	310	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	11	11	11	11	11	11
Total Lost time (s)	6.0	5.0		6.0	5.0	5.0		6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.97	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1685	3411		1685	3116	1561		1801	1546	3351	1818	1516
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.99	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1685	3411		1685	3116	1561		1801	1546	3351	1818	1516
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	73	757	18	145	863	290	38	121	113	733	337	185
RTOR Reduction (vph)	0	1	0	0	0	125	0	0	87	0	0	128
Lane Group Flow (vph)	73	774	0	145	863	165	0	159	26	733	337	57
Heavy Vehicles (%)	0%	2%	0%	0%	12%	0%	0%	1%	1%	1%	1%	3%
Turn Type	Prot	NA		Prot	NA	pt+ov	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2	2 4	3	3	5	4	4	1
Permitted Phases									3			4
Actuated Green, G (s)	5.6	24.3		10.2	28.9	51.1		10.3	20.5	22.2	22.2	27.8
Effective Green, g (s)	5.6	24.3		10.2	28.9	51.1		10.3	20.5	22.2	22.2	27.8
Actuated g/C Ratio	0.06	0.27		0.11	0.32	0.57		0.11	0.23	0.25	0.25	0.31
Clearance Time (s)	6.0	5.0		6.0	5.0			6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	104	920		190	1000	886		206	352	826	448	569
v/s Ratio Prot	0.04	0.23		c0.09	c0.28	0.11		c0.09	0.01	c0.22	0.19	0.01
v/s Ratio Perm									0.01			0.03
v/c Ratio	0.70	0.84		0.76	0.86	0.19		0.77	0.07	0.89	0.75	0.10
Uniform Delay, d1	41.4	31.0		38.7	28.7	9.4		38.7	27.3	32.7	31.4	22.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.04	1.02	1.62
Incremental Delay, d2	16.0	6.7		15.0	7.6	0.0		15.0	0.0	9.6	7.6	0.0
Delay (s)	57.4	37.7		53.7	36.2	9.4		53.7	27.3	43.6	39.4	35.8
Level of Service	E	D		D	D	A		D	C	D	D	D
Approach Delay (s)		39.4			32.2			42.7			41.3	
Approach LOS		D			C			D			D	

Intersection Summary

HCM 2000 Control Delay	37.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	27.0
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

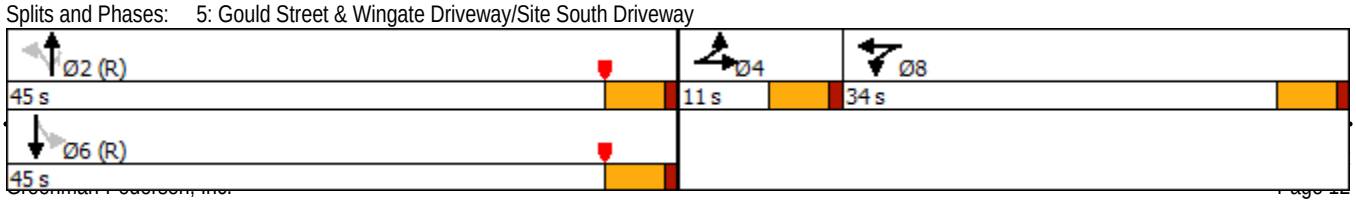
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	28	653	1	136	7	223	184	55	604	6
Future Volume (vph)	0	0	28	653	1	136	7	223	184	55	604	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	13	13	12	12	12	12	12	12
Storage Length (ft)	0		0	0		0	0		0	100		0
Storage Lanes	0		0	1		0	0		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865			0.947				0.850		0.998	
Flt Protected				0.950	0.969			0.998		0.950		
Satd. Flow (prot)	0	1611	0	1681	1678	0	0	1859	1583	1770	1859	0
Flt Permitted				0.950	0.969			0.980		0.570		
Satd. Flow (perm)	0	1611	0	1681	1678	0	0	1825	1583	1062	1859	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		114			32				200		1	
Link Speed (mph)		20			20			30			30	
Link Distance (ft)		431			469			465			408	
Travel Time (s)		14.7			16.0			10.6			9.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)				38%								
Turn Type		NA		Split	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	11.0	11.0		23.0	23.0		15.0	15.0	15.0	23.0	23.0	
Total Split (s)	11.0	11.0		34.0	34.0		45.0	45.0	45.0	45.0	45.0	
Total Split (%)	12.2%	12.2%		37.8%	37.8%		50.0%	50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	6.0	6.0		29.0	29.0		40.0	40.0	40.0	40.0	40.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0		0.0	0.0			0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None		C-Min	C-Min	C-Min	C-Min	C-Min	
Walk Time (s)				7.0	7.0					7.0	7.0	
Flash Dont Walk (s)				11.0	11.0					11.0	11.0	
Pedestrian Calls (#/hr)				0	0					0	0	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 8 (9%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle: 75
Control Type: Actuated-Coordinated

Splits and Phases: 5: Gould Street & Wingate Driveway/Site South Driveway



Lane Group	EBT	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	30	440	419	250	200	60	664
v/c Ratio	0.14	0.85	0.78	0.27	0.22	0.11	0.70
Control Delay	1.4	46.0	37.1	14.6	3.9	15.1	24.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.4	46.0	37.1	14.6	3.9	15.1	24.3
Queue Length 50th (ft)	0	234	201	77	0	20	324
Queue Length 95th (ft)	0	#404	#331	m114	m5	44	#481
Internal Link Dist (ft)	351		389	385			328
Turn Bay Length (ft)						100	
Base Capacity (vph)	213	546	566	931	905	542	949
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.81	0.74	0.27	0.22	0.11	0.70

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	28	653	1	136	7	223	184	55	604	6
Future Volume (vph)	0	0	28	653	1	136	7	223	184	55	604	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	13	13	12	12	12	12	12	12
Total Lost time (s)		5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00		0.95	0.95			1.00	1.00	1.00	1.00	
Frt		0.86		1.00	0.95			1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	0.97			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1611		1681	1678			1860	1583	1770	1860	
Flt Permitted		1.00		0.95	0.97			0.98	1.00	0.57	1.00	
Satd. Flow (perm)		1611		1681	1678			1826	1583	1062	1860	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	30	710	1	148	8	242	200	60	657	7
RTOR Reduction (vph)	0	29	0	0	22	0	0	0	103	0	1	0
Lane Group Flow (vph)	0	1	0	440	397	0	0	250	97	60	663	0
Turn Type		NA		Split	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2		2	6		
Actuated Green, G (s)		3.6		27.7	27.7			43.7	43.7	43.7	43.7	
Effective Green, g (s)		3.6		27.7	27.7			43.7	43.7	43.7	43.7	
Actuated g/C Ratio		0.04		0.31	0.31			0.49	0.49	0.49	0.49	
Clearance Time (s)		5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		64		517	516			886	768	515	903	
v/s Ratio Prot		c0.00		c0.26	0.24						c0.36	
v/s Ratio Perm								0.14	0.06	0.06		
v/c Ratio		0.02		0.85	0.77			0.28	0.13	0.12	0.73	
Uniform Delay, d1		41.5		29.2	28.2			13.8	12.7	12.6	18.5	
Progression Factor		1.00		1.00	1.00			0.95	1.39	1.00	1.00	
Incremental Delay, d2		0.1		12.7	6.8			0.7	0.3	0.5	5.3	
Delay (s)		41.6		41.9	35.1			13.8	18.0	13.1	23.8	
Level of Service		D		D	D			B	B	B	C	
Approach Delay (s)		41.6			38.6			15.6			22.9	
Approach LOS		D			D			B			C	

Intersection Summary

HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	137	368	0	0	561
Future Volume (vph)	0	137	368	0	0	561
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865				
Flt Protected						
Satd. Flow (prot)	0	1644	1900	0	0	1792
Flt Permitted						
Satd. Flow (perm)	0	1644	1900	0	0	1792
Link Speed (mph)	20		30			30
Link Distance (ft)	474		408			540
Travel Time (s)	16.2		9.3			12.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	6%
Shared Lane Traffic (%)						
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	1.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	137	368	0	0	561
Future Vol, veh/h	0	137	368	0	0	561
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	6
Mvmt Flow	0	149	400	0	0	610

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	400	0	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.2	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	654	-	0	0	-
Stage 1	0	-	-	0	0	-
Stage 2	0	-	-	0	0	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	-	654	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.1	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	WBLn1	SBT
Capacity (veh/h)	-	654	-
HCM Lane V/C Ratio	-	0.228	-
HCM Control Delay (s)	-	12.1	-
HCM Lane LOS	-	B	-
HCM 95th %tile Q(veh)	-	0.9	-

HIGHWAY COMMERCIAL 1 ZONING DISTRICT PLANNING

NEEDHAM, MA

MARCH 16, 2021

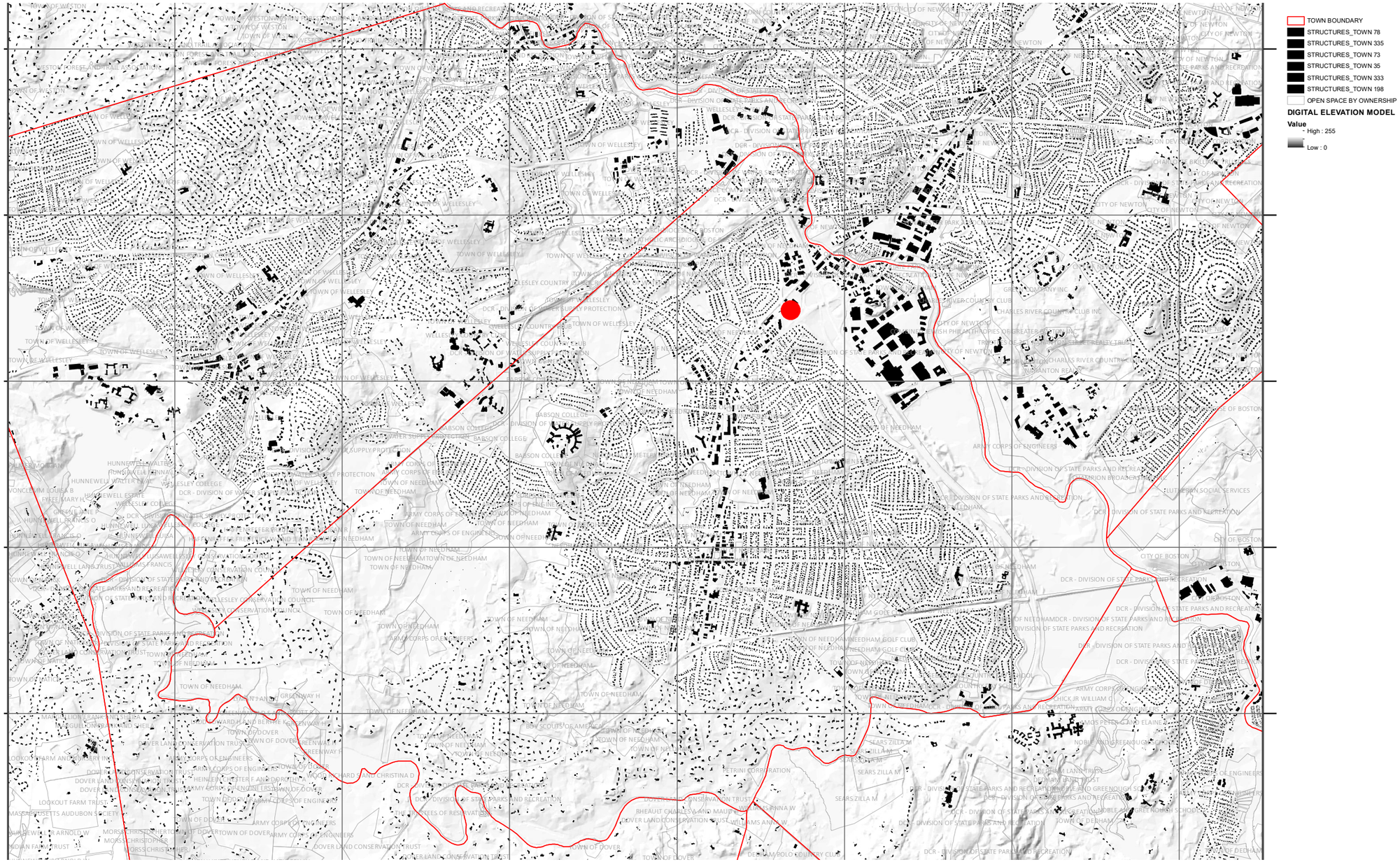
PREPARED BY:

STUDIO ENÉE

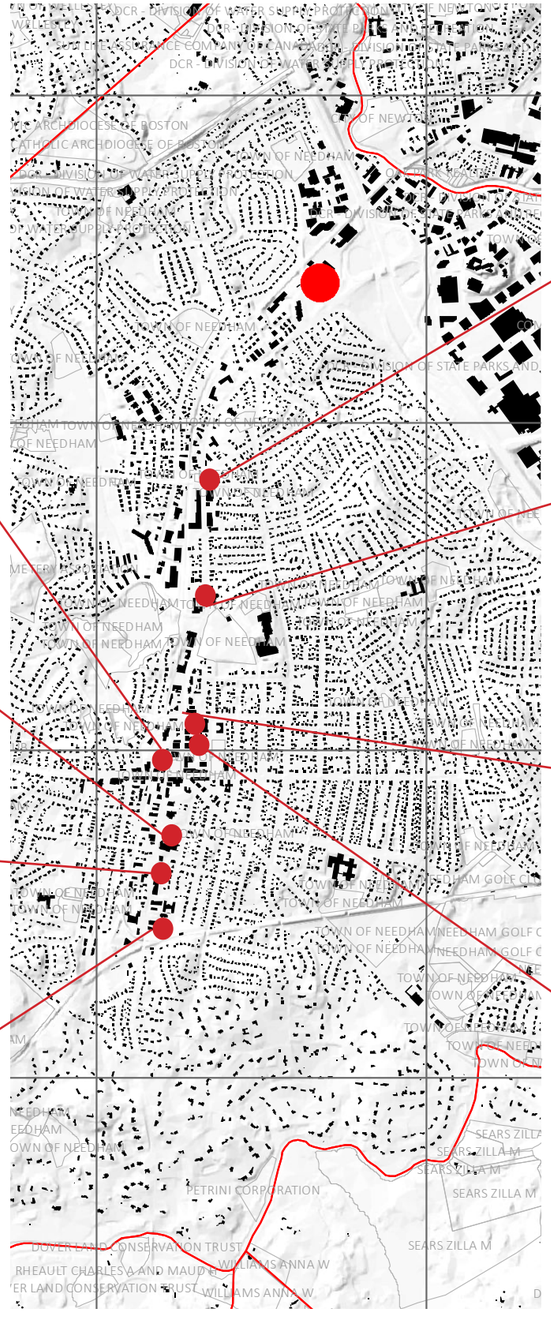

SITE 1
5.8 Acres = 252,952 SF
SITE 2
9.4 Acres = 411,250 SF
STATE CIRCUMF. HWY.
(RTE.128 - 1953 LO.)
SEE PLAN 300
SEE PLAN 300
HIGHLAND
AVE.
SEE PLAN 72
PLACE
GOULD
SEE PLAN 77
SEE PLAN 79

EXISTING AERIAL VIEW

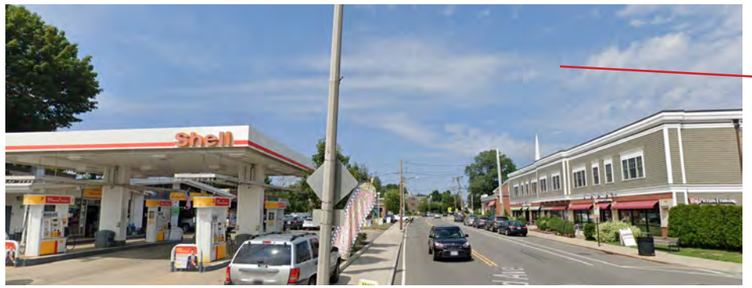
DENSITY

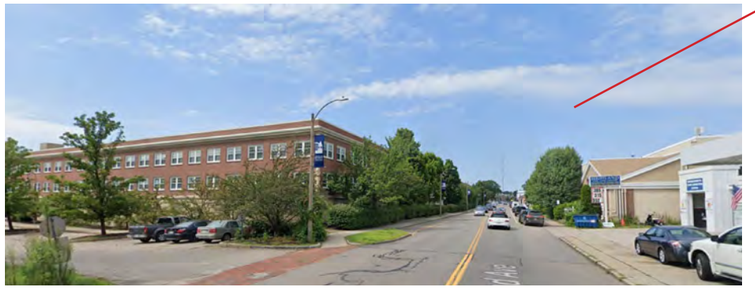

TOWN BOUNDARY
STRUCTURES_TOWN 78
STRUCTURES_TOWN 335
STRUCTURES_TOWN 73
STRUCTURES_TOWN 35
STRUCTURES_TOWN 333
STRUCTURES_TOWN 198
OPEN SPACE BY OWNERSHIP
DIGITAL ELEVATION MODEL
Value
High : 255
Low : 0

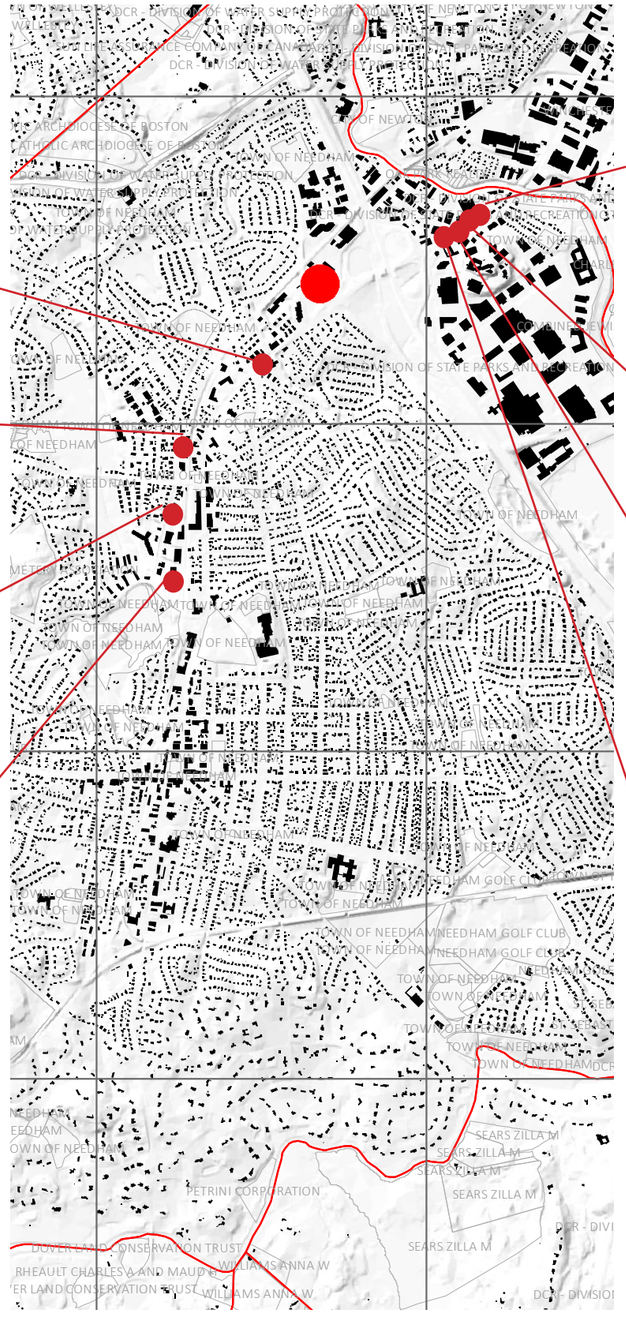
HIGHLAND AVENUE : CIVIC AND COMMERCIAL CORRIDOR



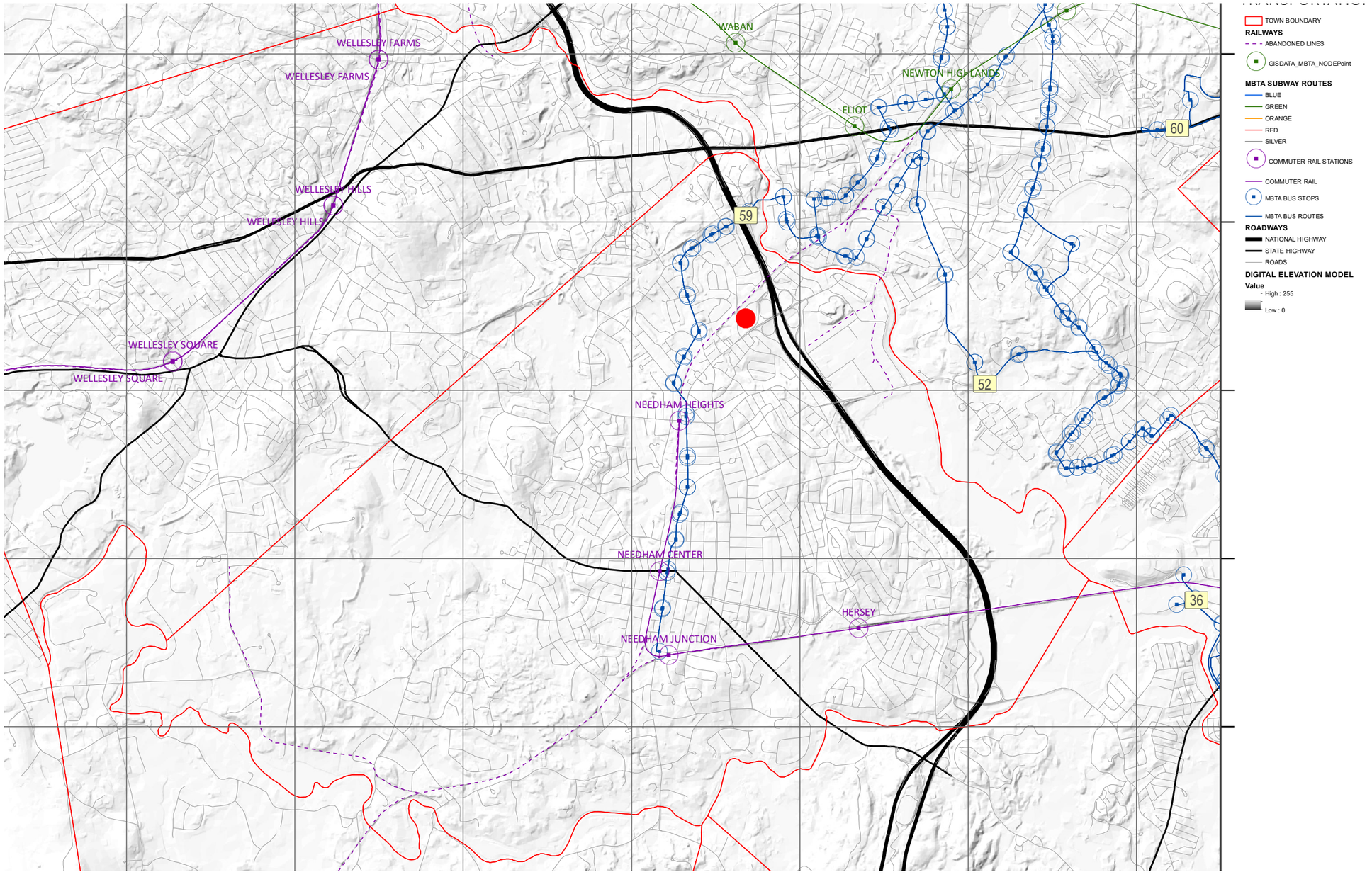
HIGHLAND AVENUE : CIVIC AND COMMERCIAL CORRIDOR







TRANSPORTATION



EXISTING AERIAL VIEW

3 Essential Changes to 2019 Proposal

- **Reduced scope and scale of development**
- **Reduced maximum build heights**
- **Included option for multifamily residential development**

Needham Planning Board
Highway Commercial 1
Use Table

Zoning Element	Existing By-law		2019 Proposal		2021 Proposal	
	By Right	Special Permit	By Right	Special Permit	By Right	Special Permit
Uses	Chapter 40A exempt uses, lib/mus, muni water tower, park, passenger station, single family, boarding house, dormitory, retail up to 5750 sf, accessory manufacturing, offices, banks, various services, theaters, movie houses, indoor athletic/exercise facilities, entertainment buildings, distribution warehouse, storage, machine shop, bottling plant, equipment rental, garment manufacturing, laboratory, radio/TV studio, light manufacturing, municipal building, accessory use for home office or small repairs	Farmers market, nursing home, private club, private school, retail over 5750 sf, fitness, trucking terminal, gas station, vehicle repair, laundry, junk yard, lumber establishment, hotel, restaurant, veterinary, medical clinic, medical marijuana treatment, car sales and parking, welding, stone cutting, autobody, food processing, genetic research, medical lab, more than one municipal building or use on a lot, off-street parking	Chapter 40A exempt uses, public parks, municipal buildings or uses, retail up to 10,000sf, accessory manufacturing, various services, offices, banks, medical laboratory or laboratory engaged in research and development, radio/TV studio, light manufacturing, telecommunications facility, laundry pickup/dropoff, more than one building or use on a lot	Light-rail train station, adult day care, private school or nursery, retail establishment from 10,000 to 25,000sf, equipment rental service, grocery store up to 25,000sf, restaurant, veterinary office, indoor athletic or exercise facility, drive-up window, medical group practice, live performance theater, bowling alley, and similar commercial amusement or entertainment places	Chapter 40A exempt uses, public parks, municipal buildings or uses, retail up to 5,750sf, accessory manufacturing, various services, offices, banks, medical laboratory or laboratory engaged in research and development, radio/TV studio, light manufacturing, telecommunications facility, laundry pickup/dropoff, more than one building or use on a lot	Up to 240 multi family dwelling units**, light-rail train station, adult day care, private school or nursery, retail establishment from 5750sf to 10,000sf, equipment rental service, grocery store up to 10,000sf, restaurant, veterinary office, indoor athletic or exercise facility, drive-up ATM/teller, medical group practice, live performance theater, bowling alley, and similar commercial amusement or entertainment places

discontinued uses
uses new in 2019
uses new in 2021

** Residential units are restricted in the following ways:
- min of 40% and max of 70% 1 bedroom units
- min of 12.5% of all units will be "affordable"

ZONING COMPARISON - DIMENSIONS

Needham Planning Board
Highway Commercial 1
Dimensional Requirements

Zoning Element	Existing By-law		2019 Proposal		2021 Proposal	
	By Right	Special Permit	By Right	Special Permit	By Right	Special Permit
FAR	0.5	0.65-0.75	1.00	1.75	1.00	1.35
Height	2 stories (30')	2 stories (30')	5 stories 70' [1]	6 stories 84' [1]	4 stories (56') [2]	5 stories (70') [3]
Front Setback	20' (50' on Gould + Highland)	20' (50' on Gould + Highland)	(internal - TV Pl) 5' [4]	(internal - TV Pl) 5' [4]	(internal - TV Pl) 5' [7]	(internal - TV Pl) 5' [7]
Side Setback	20'	20'	10' [5]	10' [5]	10' [8]	10' [8]
Rear Setback	10'	10'	10' [6]	10' [6]	10' [9]	10' [9]
Min Lot Area (SF)	20,000	20,000	20,000	20,000	20,000	20,000
Min Lot Frontage (Ft)	100	100	100	100	100	100
Max Lot Coverage	N/A	N/A	65%	65%	65%	65%
Min Open Space	N/A	N/A	20%	20%	20%	20%
Parking Garage Setback	N/A	N/A	200' Gould+ 150' Highland	150' Gould+ Highland	200' Gould + 250' Highland	200' Gould + 250' Highland
Max façade length	N/A	N/A	200'	200'	200'	200'
Traffic Mitigation	$ by Developer	$ by Developer	$ by Developer	$ by Developer	$ by Developer	$ by Developer

Legend

1. Except a building within 150 feet of Highland Avenue and 200 feet of Gould Street is limited to a height of 42 feet or 48 feet if under a pitched roof or recessed from the face of the building in a manner approved by the Planning Board.

2. Except a building within 200 feet of Highland Avenue and 200 feet of Gould Street is limited to 2 1/2 stories and a height of 35 feet.

[3] Except a building within 200 feet of Highland Avenue and 200 feet of Gould Street is limited to 3 stories and a height of 42 feet or 48 feet if under a pitched roof or recessed from the face of the building in a manner appoved by the Planning Board.

[4] Except where building height exceeds 42 feet, in which case the front setback increases to 15 feet, or the building sits on Highland Avenue, Gould Street and/or the layout of Route 95/128, where a 20-foot landscaped vegetative buffer is required.

[5] Except where building height exceeds 42 feet, in which case the side setback is increased to 20 feet for all side setbacks not abutting the MBTA right-of-way.

[6] Except where building height exceeds 42 feet, in which case the rear setback is increased to 20 feet for all rear setbacks not abutting the MBTA right-of-way.

[7] Front setback is 5' from any internal road such as TV Place.

[8] Except where building height exceeds 35 feet, in which case the side setback is increased to 20 feet for all side setbacks not abutting the MBTA right-of-way.

[9] Except where building height exceeds 35 feet, in which case the rear setback is increased to 20 feet for all rear setbacks not abutting the MBTA right-of-way.

Needham Planning Board
Highway Commercial 1
Dimensional Requirements

Dimensional Requirements for Highway Commercial 1 District

Zoning Element	Proposal Within 200 ft. Gould + Highland		Proposal Beyond 200 ft. Gould + Highland	
	By Right	Special Permit	By Right	Special Permit
FAR	1.00	1.35	1.00	1.35
Height	2 1/2 stories (35')	3 stories (42'/48)	4 stories (56')	5 stories (70')
Front Setback	20' [1]	20' [2]	20' [2]	20' [2]
Side Setback	10'	20' [3]	20' [3]	20' [3]
Rear Setback	10'	20' [3]	20' [3]	20' [3]
Min Lot Area (SF)	20,000	20,000	20,000	20,000
Min Lot Frontage (Ft)	100	100	100	100
Max Lot Coverage	65%	65%	65%	65%
Min Open Space	20%	20%	20%	20%
Parking Garage Setback	200' Gould+ 250' Highland	200' Gould+ 250' Highland	200' Gould + 250' Highland	200' Gould + 250' Highland
Max façade length	200'	200'	200'	200'
Traffic Mitigation	$ by Developer	$ by Developer	$ by Developer	$ by Developer

Legend

1 Front setback is 5' from any internal road such as TV Place.

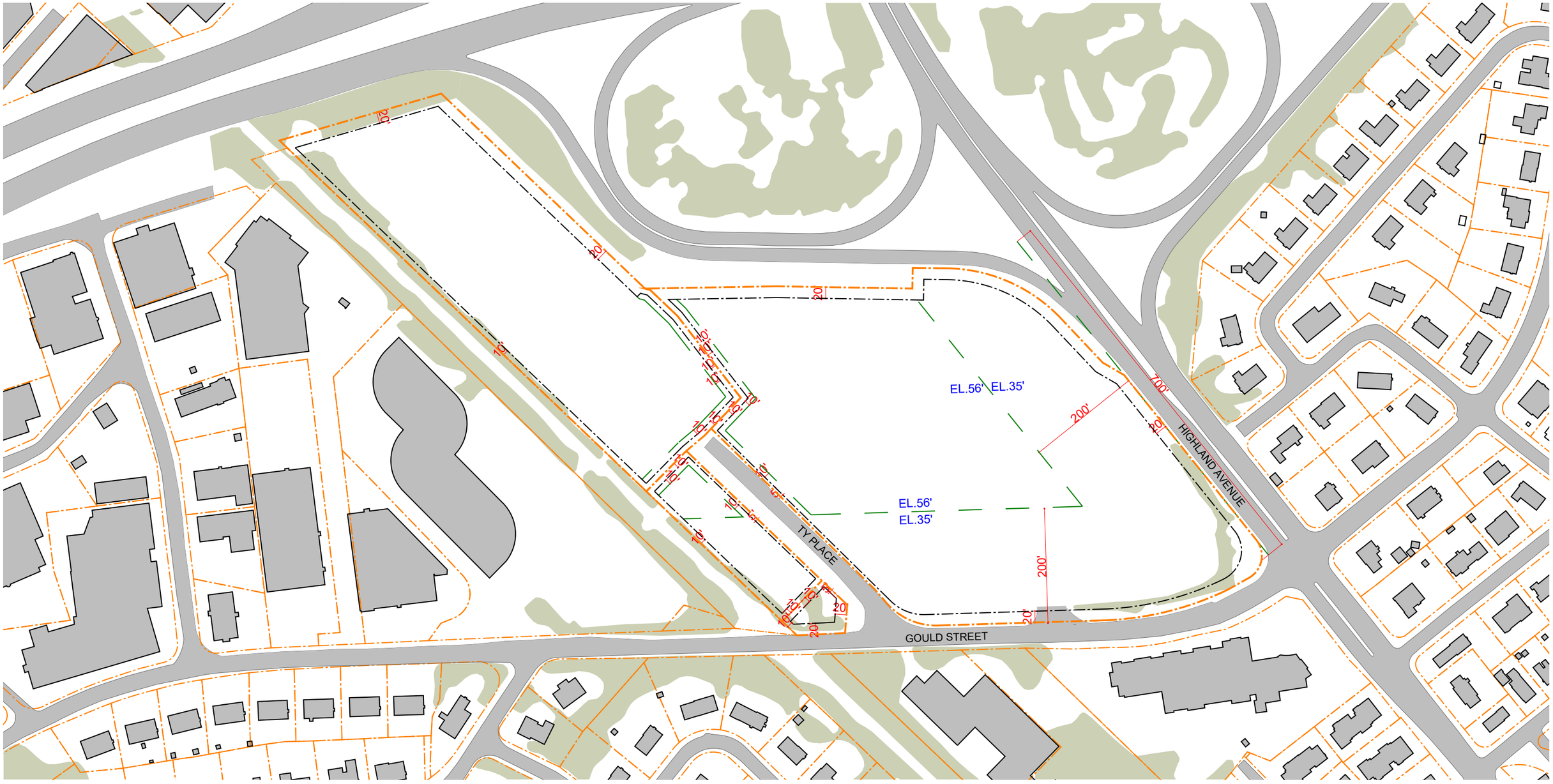
2 Front setback is 15' from any internal road such TV Place.

3 Except along the MBTA right of way where the setback is 10'.

Note: There is a 20' landscape buffer off each of Highland and Gould.

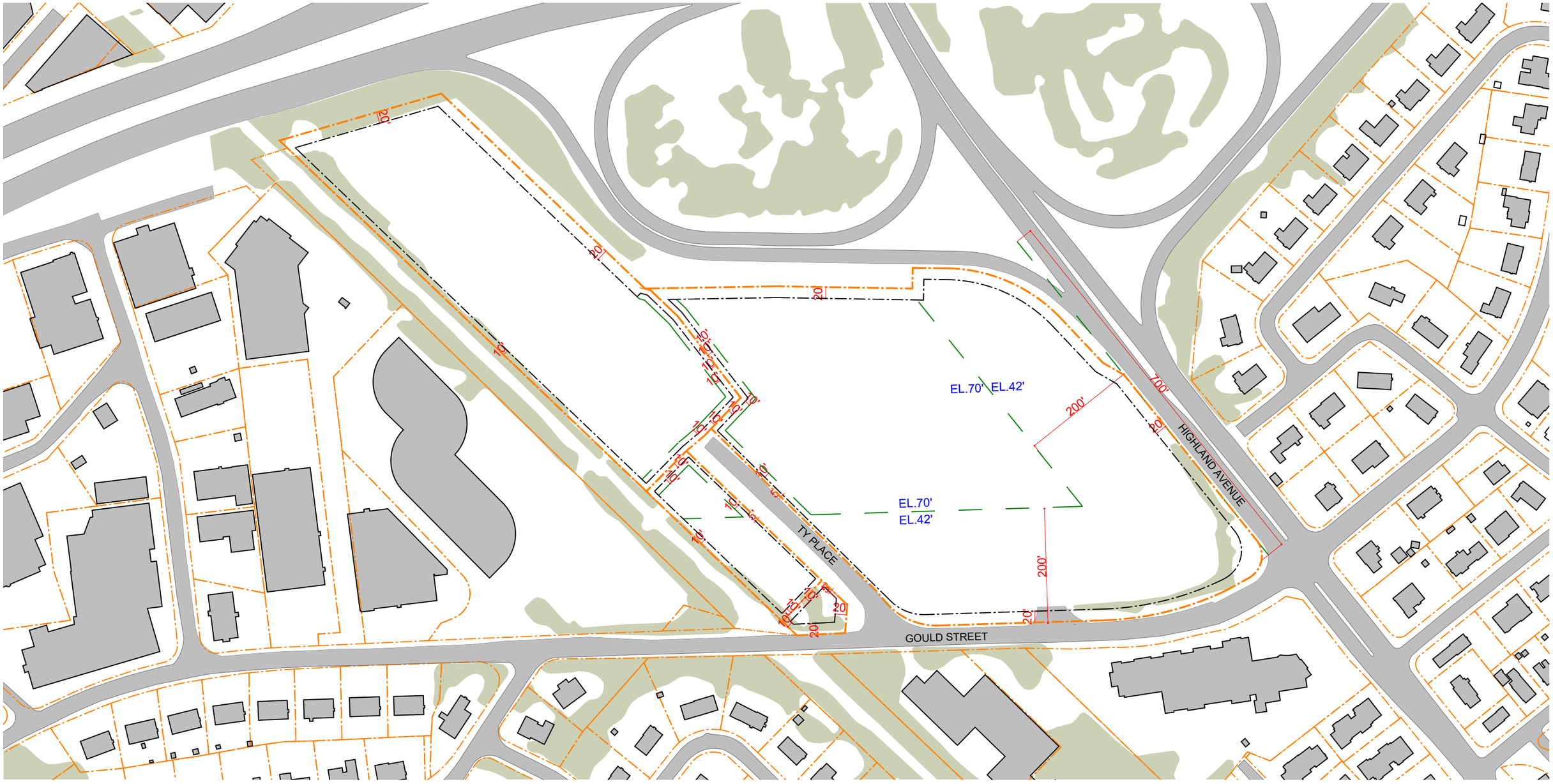
AS OF RIGHT ZONING SETBACKS

BUILDING SETBACKS
PROPERTY LINES



SPECIAL PERMIT ZONING SETBACKS

BUILDING SETBACKS
PROPERTY LINES



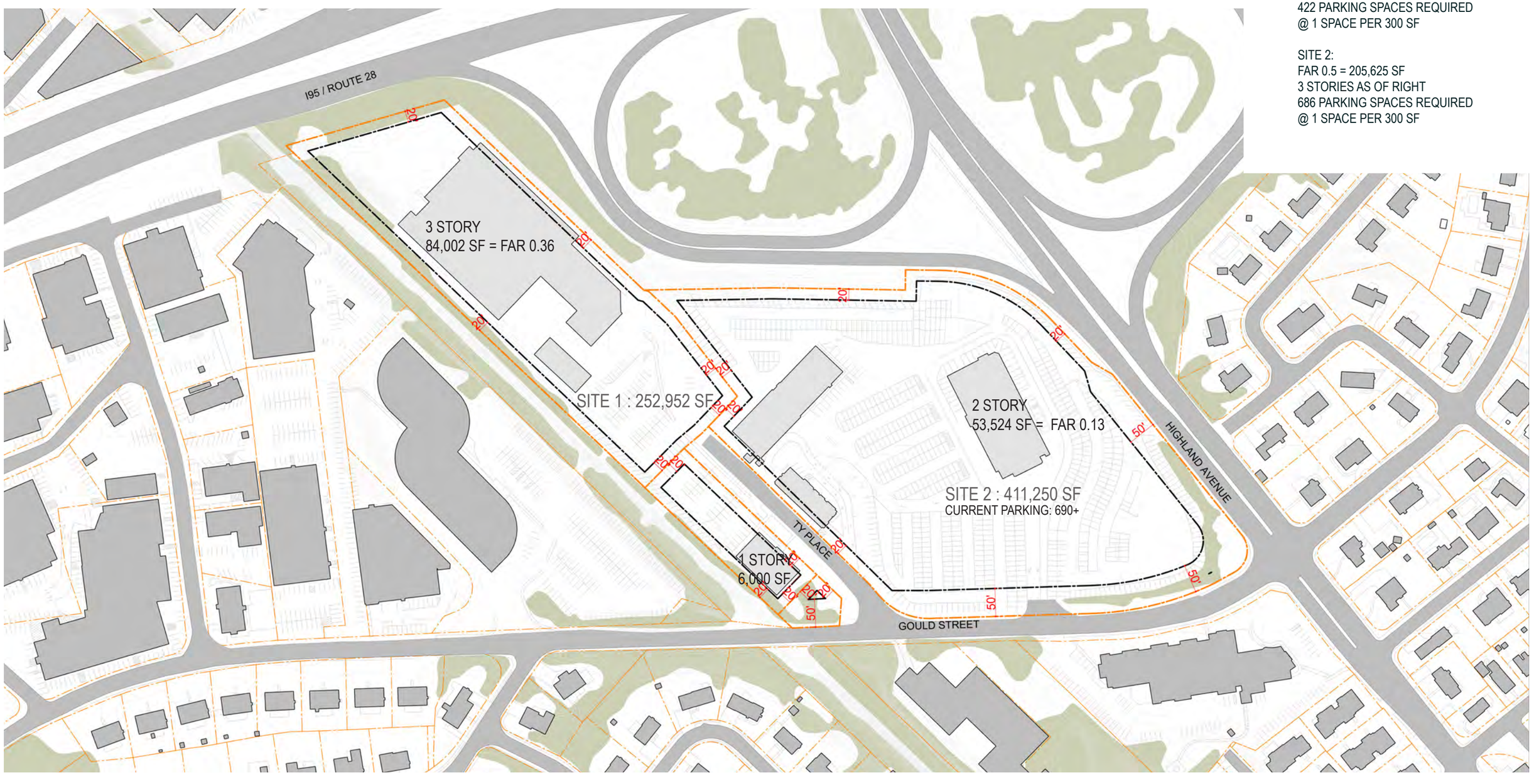
EXISTING SITE PLAN

BUILDING SETBACKS
PROPERTY LINES

EXISTING ZONING REQUIREMENTS

SITE 1:
FAR 0.5 = 126,476 SF
3 STORIES AS OF RIGHT
422 PARKING SPACES REQUIRED
@ 1 SPACE PER 300 SF

SITE 2:
FAR 0.5 = 205,625 SF
3 STORIES AS OF RIGHT
686 PARKING SPACES REQUIRED
@ 1 SPACE PER 300 SF



N

0 20' 40' 80' 160'

As of Right Zoning

FAR = 1.0

- Option 1: Single Building
- Option 2: Multiple Buildings

Special Permit Zoning

FAR = 1.35

- Option 1: Single Building
- Option 2: Multiple Buildings

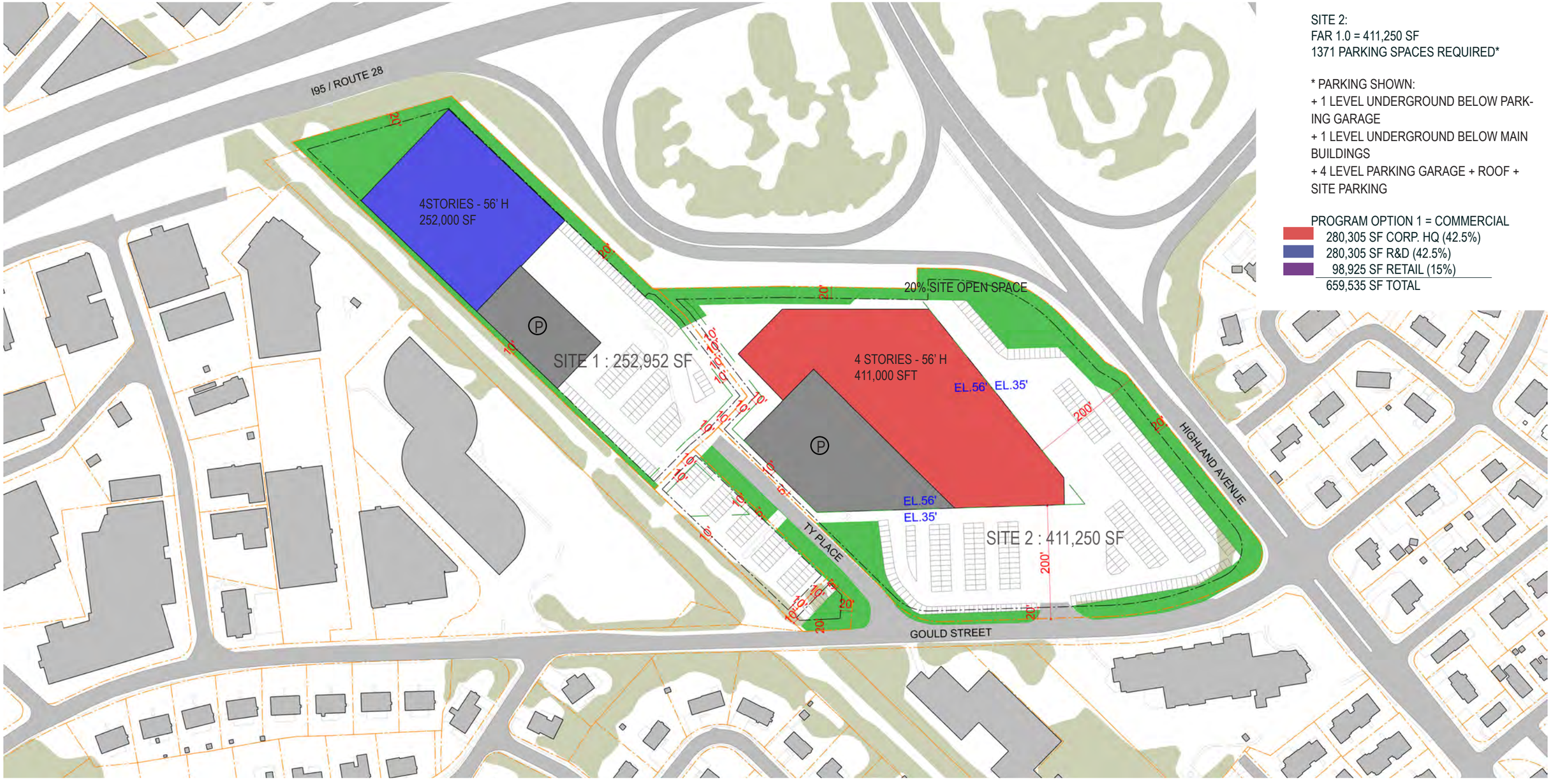
As of Right Zoning

FAR = 1.0

- Option 1: Single Building
- Option 2: Multiple Buildings

AS OF RIGHT ZONING - SITE PLAN - **OPTION 1 (1 BUILDING)**
FAR = 1.0

BUILDING SETBACKS
PROPERTY LINES
HEIGHT LIMIT 56'



AS OF RIGHT ZONING LEGEND

SITE 1:
FAR 1.0 = 252,952 SF
843 PARKING SPACES REQUIRED*

SITE 2:
FAR 1.0 = 411,250 SF
1371 PARKING SPACES REQUIRED*

* PARKING SHOWN:
+ 1 LEVEL UNDERGROUND BELOW PARKING GARAGE
+ 1 LEVEL UNDERGROUND BELOW MAIN BUILDINGS
+ 4 LEVEL PARKING GARAGE + ROOF + SITE PARKING

PROGRAM OPTION 1 = COMMERCIAL
280,305 SF CORP. HQ (42.5%)
280,305 SF R&D (42.5%)
98,925 SF RETAIL (15%)
659,535 SF TOTAL

N

0 20' 40' 80' 160'

AS OF RIGHT ZONING - AERIAL VIEW - **OPTION 1 (1 BUILDING)**

PROGRAM OPTION 1 = COMMERCIAL

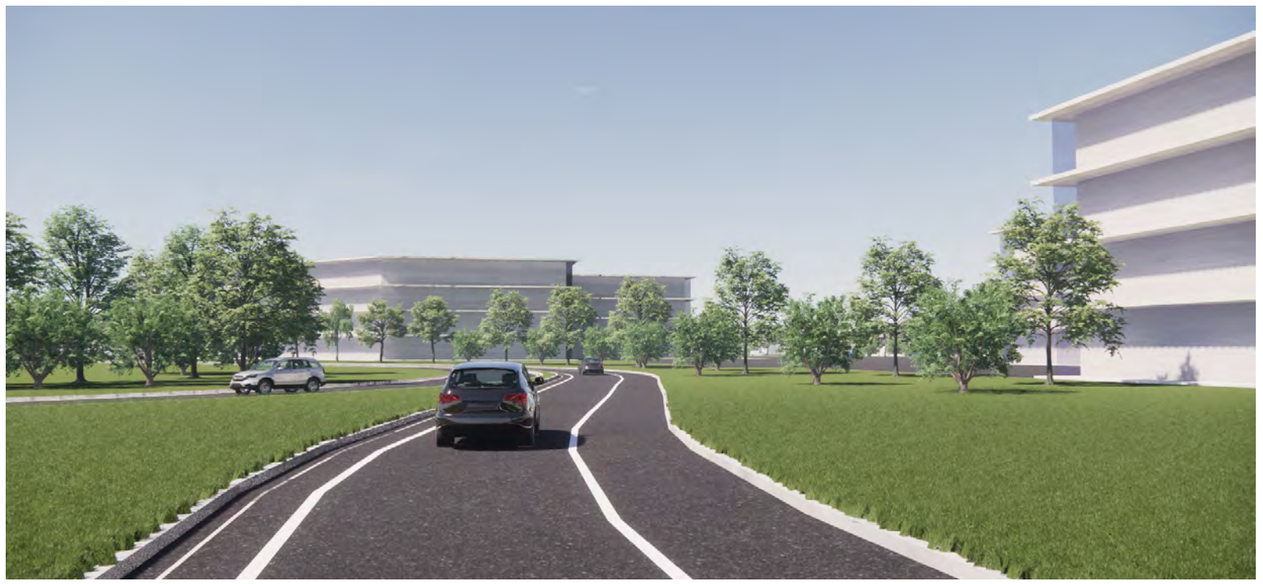
280,305 SF CORP. HQ (42.5%)
280,305 SF R&D (42.5%)
98,925 SF RETAIL (15%)
659,535 SF TOTAL

AS OF RIGHT ZONING - VIEW FROM GOULD STREET TOWARDS HIGHLAND AVE. - **OPTION 1 (1 BUILDING)**

AS OF RIGHT ZONING - VIEW FROM HIGHLAND AVE. TOWARDS NEWTON - **OPTION 1 (1 BUILDING)**

AS OF RIGHT ZONING - VIEW FROM HIGHLAND AVE BRIDGE TOWARDS NEEDHAM - **OPTION 1 (1 BUILDING)**

AS OF RIGHT ZONING - VIEW FROM EXIT 19B - **OPTION 1 (1 BUILDING)**



# AS OF RIGHT ZONING - MASSING SITE PLAN - **OPTION 2 (MIXED USE MF RESIDENTIAL)**
FAR = 1.0

BUILDING SETBACKS
PROPERTY LINES
HEIGHT LIMIT 56'

N

0 20' 40' 80' 160'

AS OF RIGHT ZONING LEGEND

SITE 1:
FAR 1.0 = 252,952 SF
751 PARKING SPACES REQUIRED *

SITE 2:
FAR 1.0 = 411,250 SF
1,199 SPACES REQUIRED *

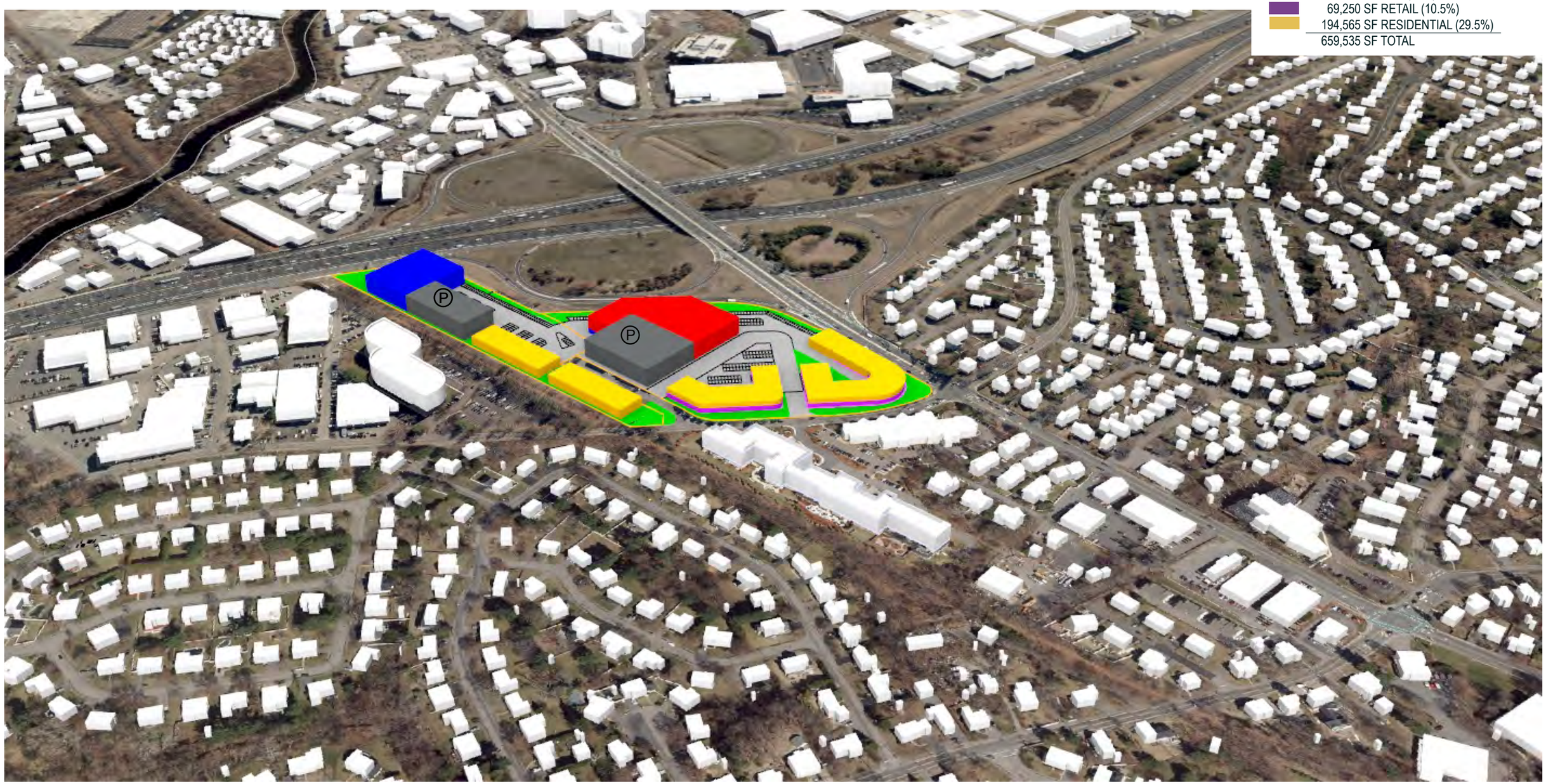
* PARKING SHOWN:
+ 1 LEVEL UNDERGROUND BELOW PARKING GARAGE
+ 1 LEVEL UNDERGROUND BELOW MAIN BUILDINGS
+ 4 LEVEL PARKING GARAGE + ROOF + SITE PARKING
(WITH 1.5 SPACES FOR RESIDENTIAL UNITS AND ONE SPACE PER 300 SF FOR OTHER PROGRAMS)

PROGRAM OPTION 2 = MIXED USE
197,860 SF CORP. HQ (30%)
197,860 SF R&D (30%)
69,250 SF RETAIL (10.5%)
194,565 SF RESIDENTIAL (29.5 %)
659,535 SF TOTAL

AS OF RIGHT ZONING - AERIAL VIEW - **OPTION 2 (MIXED USE MF RESIDENTIAL)**

PROGRAM OPTION 2 = MIXED USE

197,860 SF	CORP. HQ (30%)
197,860 SF	R&D (30%)
69,250 SF	RETAIL (10.5%)
194,565 SF	RESIDENTIAL (29.5%)
659,535 SF	TOTAL



AS OF RIGHT ZONING - VIEW FROM GOULD STREET TOWARDS HIGHLAND AVE. - **OPTION 2 (MIXED USE MF RESIDENTIAL)**

AS OF RIGHT ZONING - VIEW FROM HIGHLAND AVENUE TOWARDS NEWTON - **OPTION 2 (MIXED USE)**

AS OF RIGHT ZONING - VIEW FROM HIGHLAND AVE BRIDGE TOWARDS NEEDHAM - **OPTION 2 (MIXED USE MF RESIDENTIAL)**

AS OF RIGHT ZONING - VIEW FROM EXIT 19B - **OPTION 2 (MIXED USE)**

Special Permit Zoning

FAR = 1.35

- Option 1: Single Building
- Option 2: Multiple Buildings

# SPECIAL PERMIT ZONING - MASSING SITE PLAN - **OPTION 1 (1 BUILDING)**
FAR = 1.35

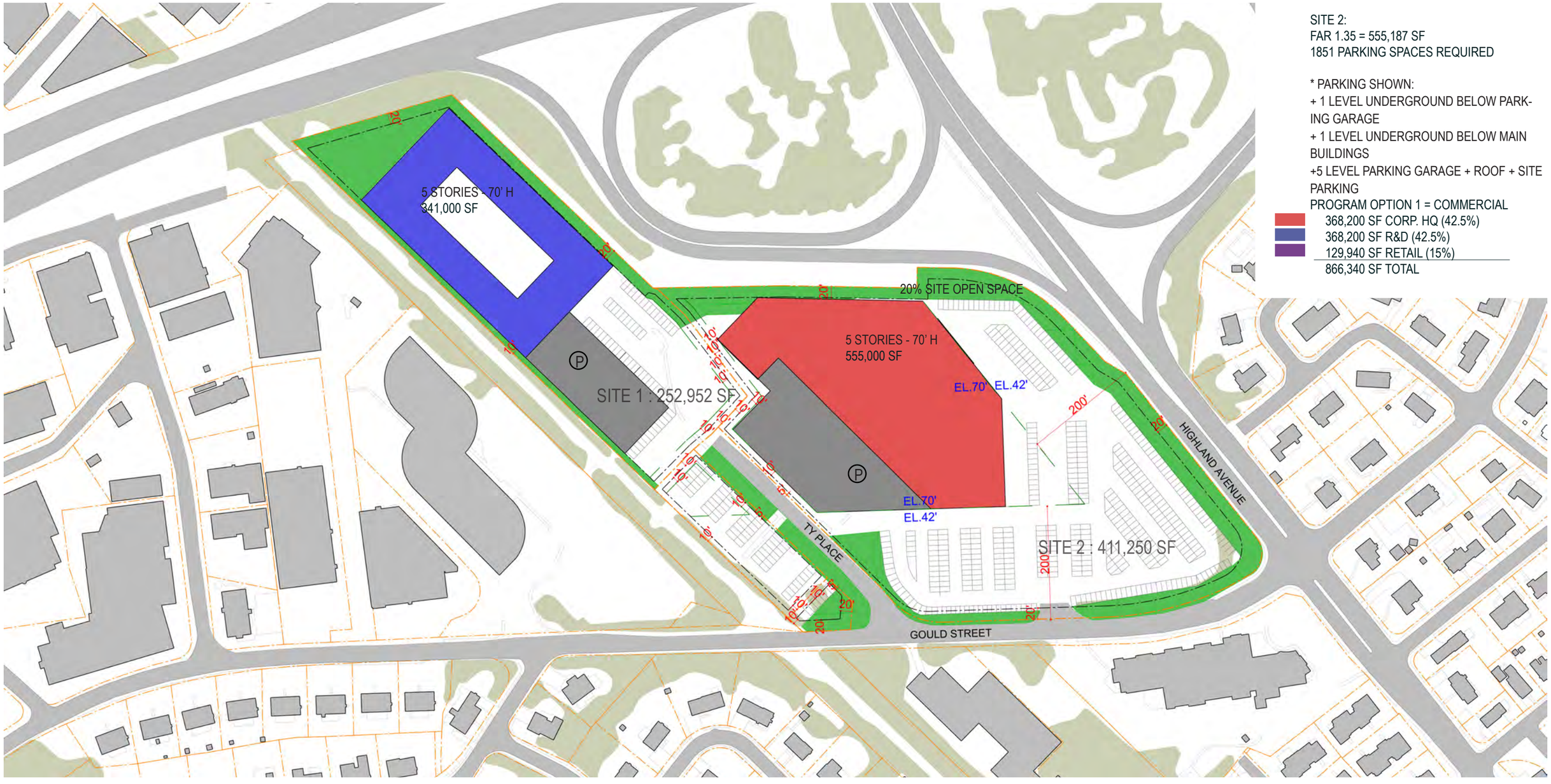
BUILDING SETBACKS
PROPERTY LINES
HEIGHT LIMIT 70'

SPECIAL PERMIT ZONING LEGEND

SITE 1:
FAR 1.35 = 341,485 SF
1138 PARKING SPACES REQUIRED

SITE 2:
FAR 1.35 = 555,187 SF
1851 PARKING SPACES REQUIRED

* PARKING SHOWN:
+ 1 LEVEL UNDERGROUND BELOW PARKING GARAGE
+ 1 LEVEL UNDERGROUND BELOW MAIN BUILDINGS
+5 LEVEL PARKING GARAGE + ROOF + SITE PARKING
PROGRAM OPTION 1 = COMMERCIAL
368,200 SF CORP. HQ (42.5%)
368,200 SF R&D (42.5%)
129,940 SF RETAIL (15%)
866,340 SF TOTAL



N

0 20' 40' 80' 160'

SPECIAL PERMIT ZONING - AERIAL VIEW - **OPTION 1 (1 BUILDING)**

PROGRAM OPTION 1 = COMMERCIAL

368,200 SF CORP. HQ (42.5%)	
368,200 SF R&D (42.5%)	
129,940 SF RETAIL (15%)	
866,340 SF TOTAL	

SPECIAL PERMIT ZONING - VIEW FROM GOULD STREET TOWARDS HIGHLAND AVE. - **OPTION 1 (1 BUILDING)**

SPECIAL PERMIT ZONING - VIEW FROM HIGHLAND AVENUE TOWARDS NEWTON - **OPTION 1 (1 BUILDING)**

SPECIAL PERMIT ZONING - VIEW FROM HIGHLAND AVE BRIDGE TO NEEDHAM - **OPTION 1 (1 BUILDING)**

SPECIAL PERMIT ZONING - VIEW FROM EXIT 19B - **OPTION 1 (1 BUILDING)**

SPECIAL PERMIT - MASSING SITE PLAN - **OPTION 2 (MIXED USE MF RESIDENTIAL)**
FAR = 1.35

BUILDING SETBACKS
PROPERTY LINES
HEIGHT LIMIT 70'

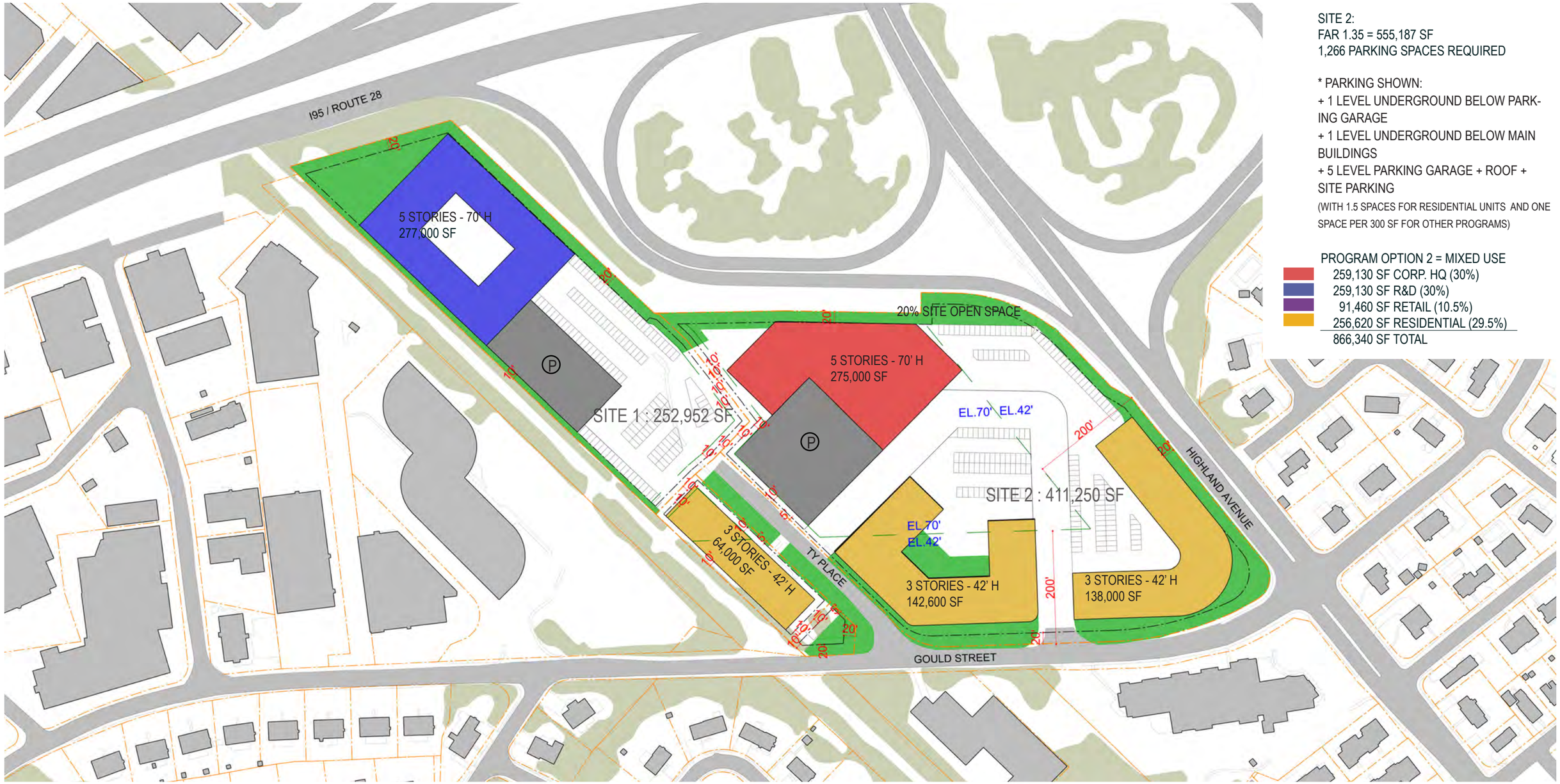
SPECIAL PERMIT ZONING LEGEND

SITE 1:
FAR 1.35 =341,485 SF
966 PARKING SPACES REQUIRED

SITE 2:
FAR 1.35 = 555,187 SF
1,266 PARKING SPACES REQUIRED

* PARKING SHOWN:
+ 1 LEVEL UNDERGROUND BELOW PARKING GARAGE
+ 1 LEVEL UNDERGROUND BELOW MAIN BUILDINGS
+ 5 LEVEL PARKING GARAGE + ROOF + SITE PARKING
(WITH 1.5 SPACES FOR RESIDENTIAL UNITS AND ONE SPACE PER 300 SF FOR OTHER PROGRAMS)

PROGRAM OPTION 2 = MIXED USE
259,130 SF CORP. HQ (30%)
259,130 SF R&D (30%)
91,460 SF RETAIL (10.5%)
256,620 SF RESIDENTIAL (29.5%)
866,340 SF TOTAL



N

0 20' 40' 80' 160'

SPECIAL PERMIT ZONING - AERIAL VIEW - **OPTION 2 (MIXED USE MF RESIDENTIAL)**

PROGRAM OPTION 2 = MIXED USE

259,130 SF CORP. HQ (30%)
259,130 SF R&D (30%)
91,460 SF RETAIL (10.5%)
256,620 SF RESIDENTIAL (29.5%)
866,340 SF TOTAL

SPECIAL PERMIT ZONING - VIEW FROM GOULD STREET TOWARDS HIGHLAND AVE. - **OPTION 2 (MIXED USE MF RESIDENTIAL)**

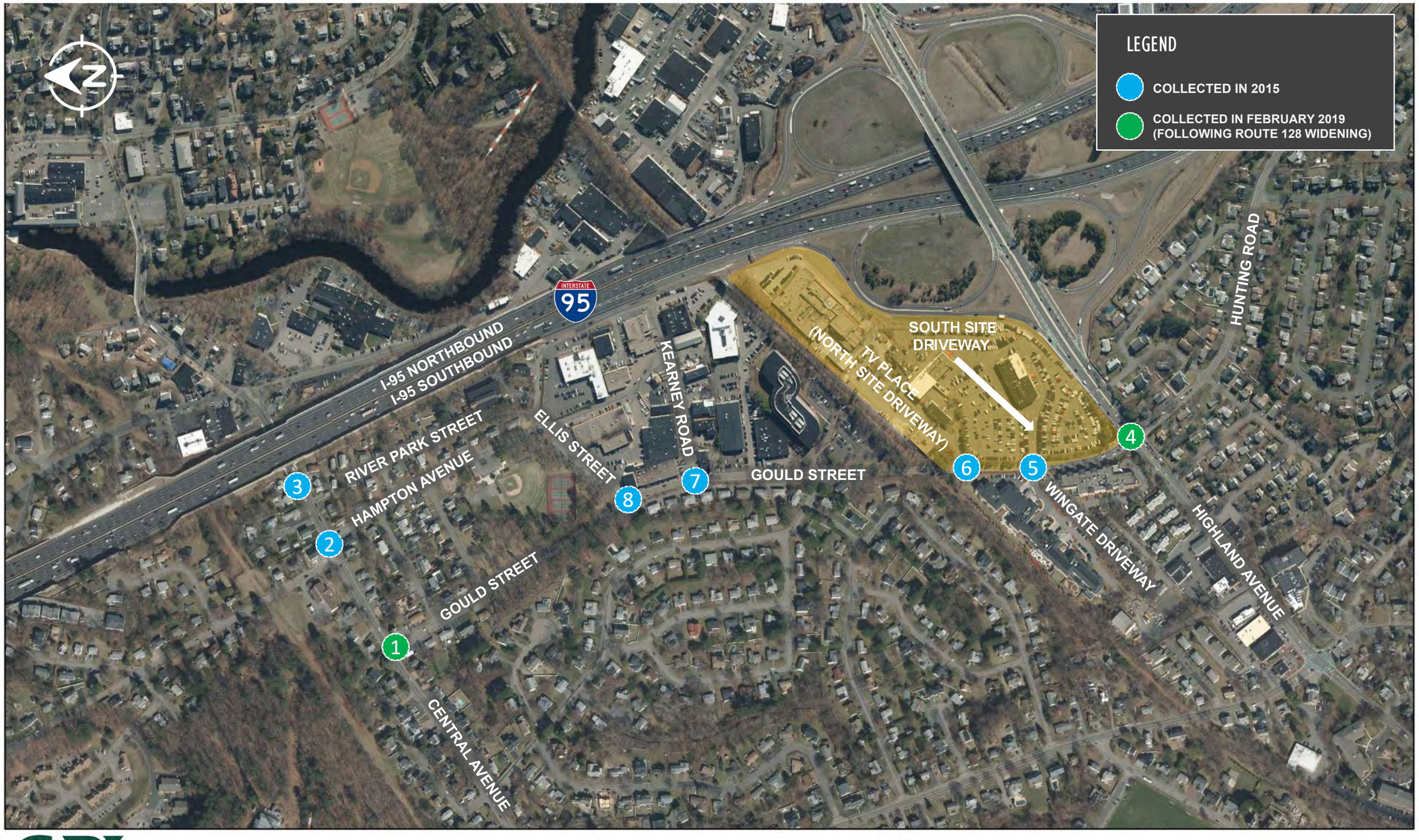
SPECIAL PERMIT - VIEW FROM HIGHLAND AVENUE TOWARDS NEWTON - **OPTION 2 (MIXED USE)**

SPECIAL PERMIT ZONING - VIEW FROM HIGHLAND AVE BRIDGE TOWARDS NEEDHAM - **OPTION 2 (MIXED USE MF RESIDENTIAL)**

SPECIAL PERMIT ZONING - VIEW FROM EXIT 19B - **OPTION 2 (MIXED USE)**

Highway Commercial 1
Needham, Massachusetts

Planning Board Meeting
March 16, 2021



GPI
Greenman-Pedersen, Inc. || 181 Ballardvale Street, Suite 202, Wilmington, MA 01887

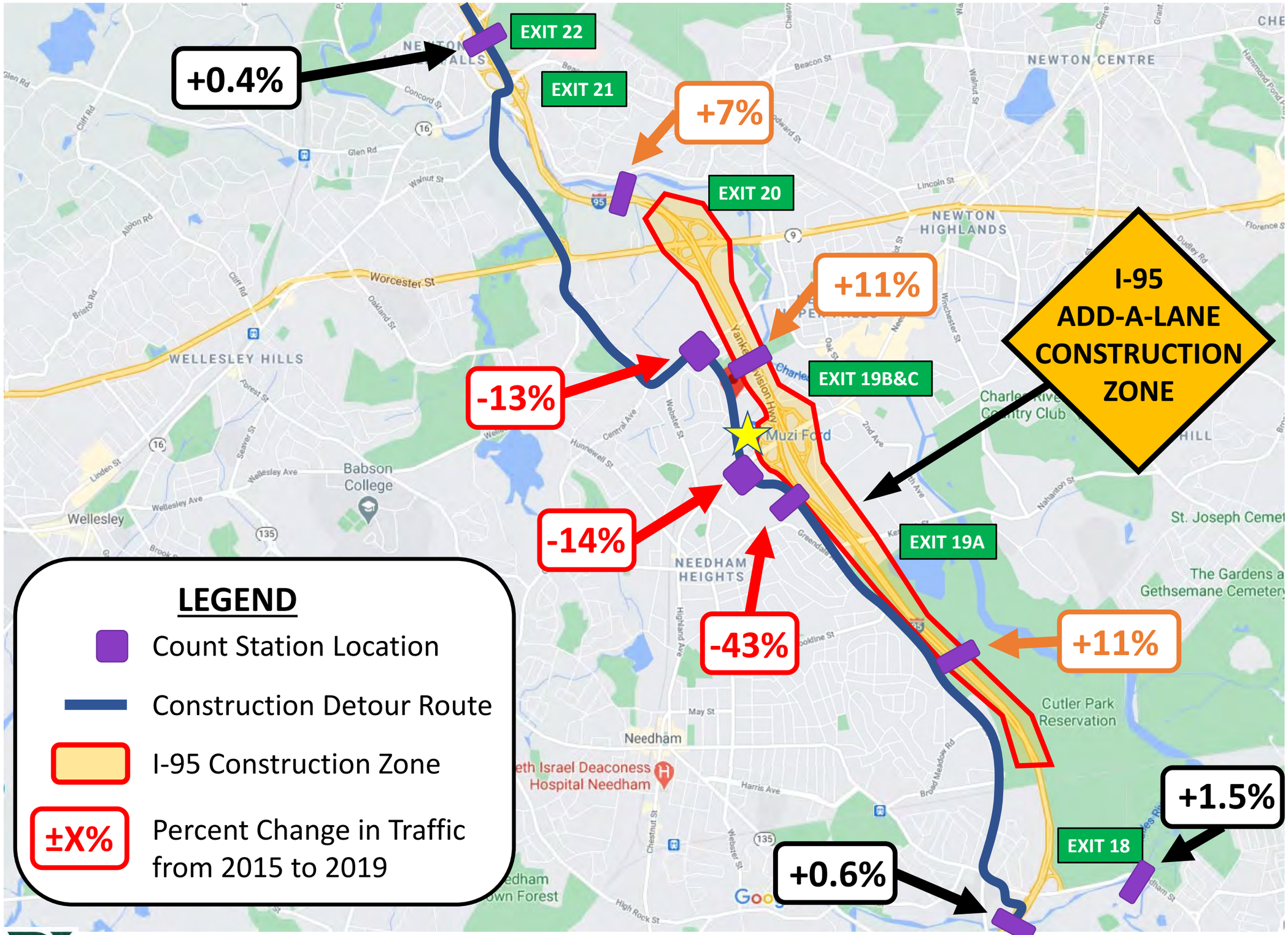
HIGHWAY COMMERCIAL 1 – NEEDHAM, MASSACHUSETTS

STUDY AREA

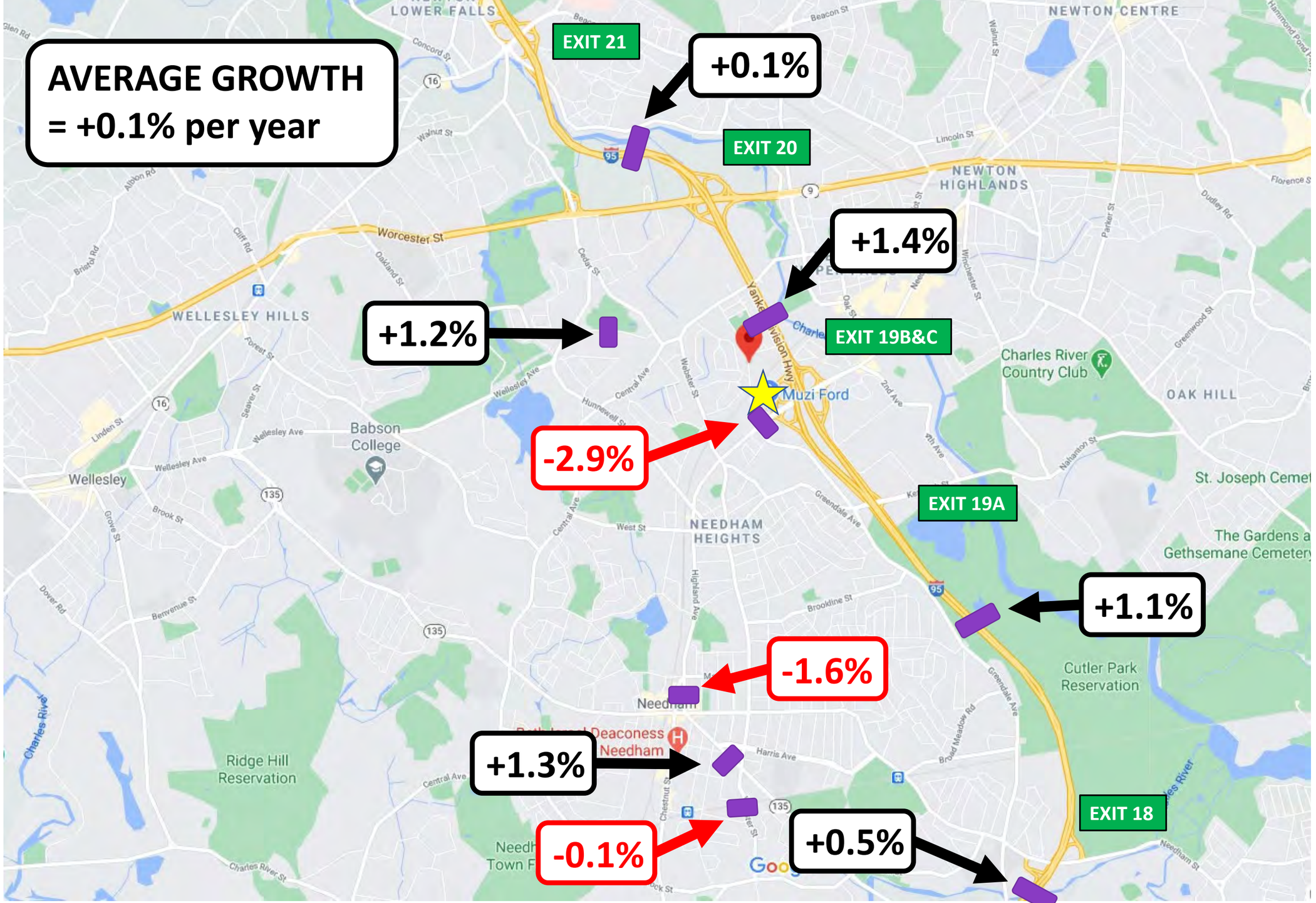
GPI
Greenman-Pedersen, Inc. || 181 Ballardvale Street, Suite 202, Wilmington, MA 01887

HIGHWAY COMMERCIAL 1 – NEEDHAM, MASSACHUSETTS

2015 ROADWAY CONDITIONS



2015 VERSUS 2019 VOLUMES



ANNUAL PERCENTAGE INCREASE
PRE (2013/14) VS POST (2019) ADD-A-LANE

Time Period / Direction	Existing Trips	Proposed Trips	Net Increase
Weekday Daily	1,462	10,402	**8,940**
Weekday AM Peak Hour			
Enter	126	766	**640**
Exit	65	75	**10**
Total	191	841	**650**
Weekday PM Peak Hour			
Enter	33	239	**206**
Exit	103	926	**823**
Total	136	1,165	**1,029**

TRIP GENERATION SUMMARY

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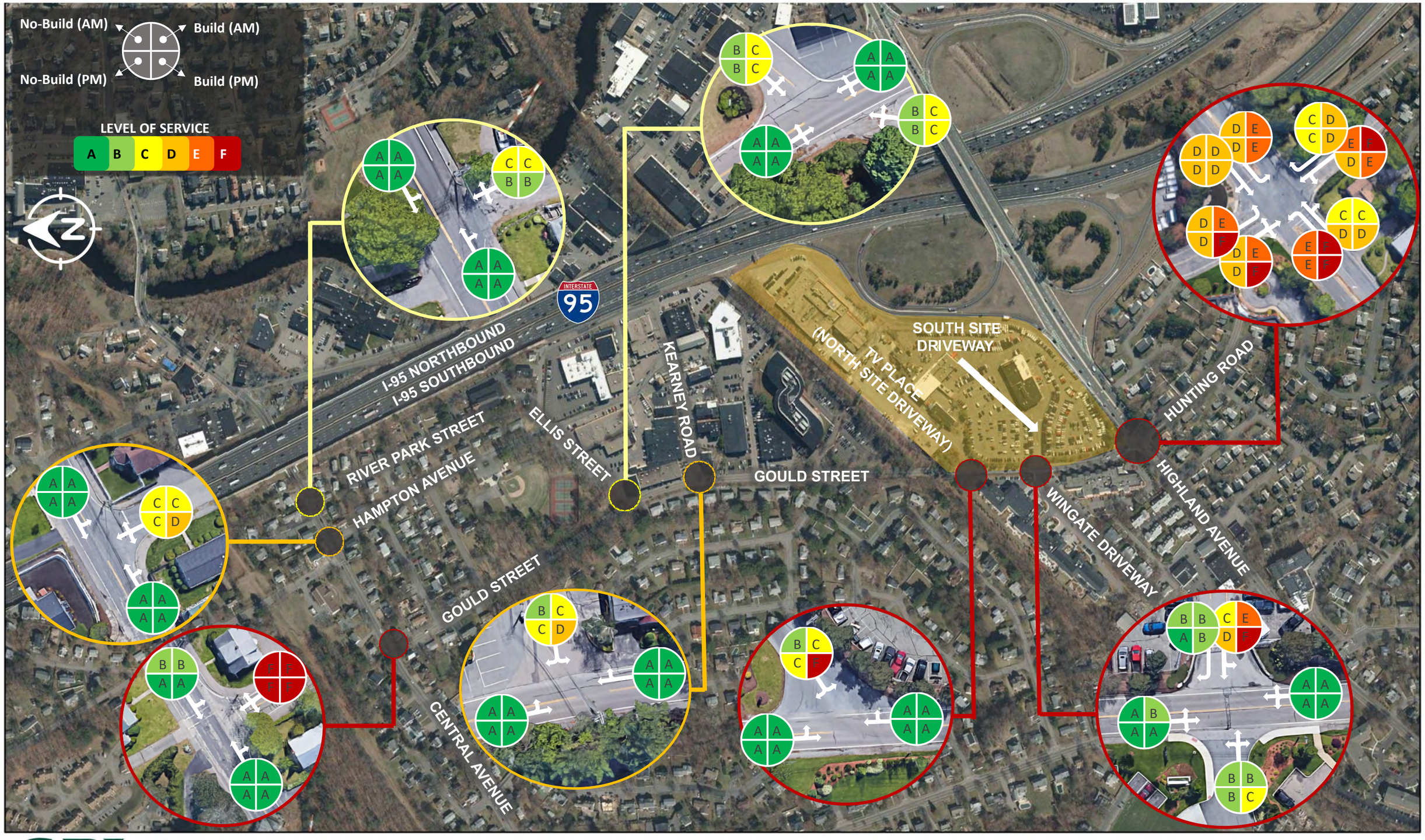
HIGHWAY COMMERCIAL 1 – NEEDHAM, MASSACHUSETTS

TRIP DISTRIBUTION

2030 CONDITIONS WITH NO MITIGATION



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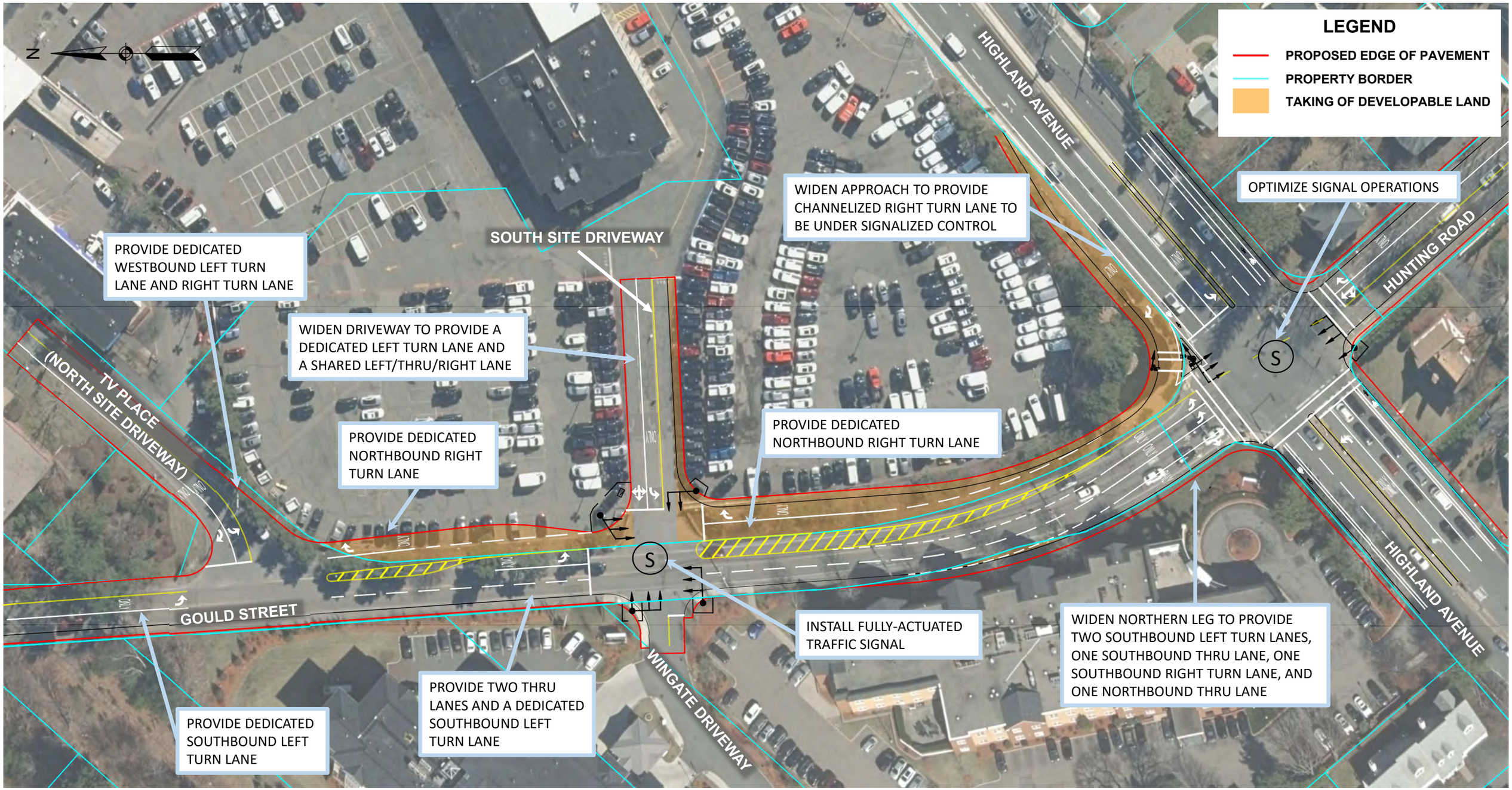
HIGHWAY COMMERCIAL 1 – NEEDHAM, MASSACHUSETTS

LEVEL-OF-SERVICE (LOS) 2030 NO-BUILD VS. BUILD



GPI
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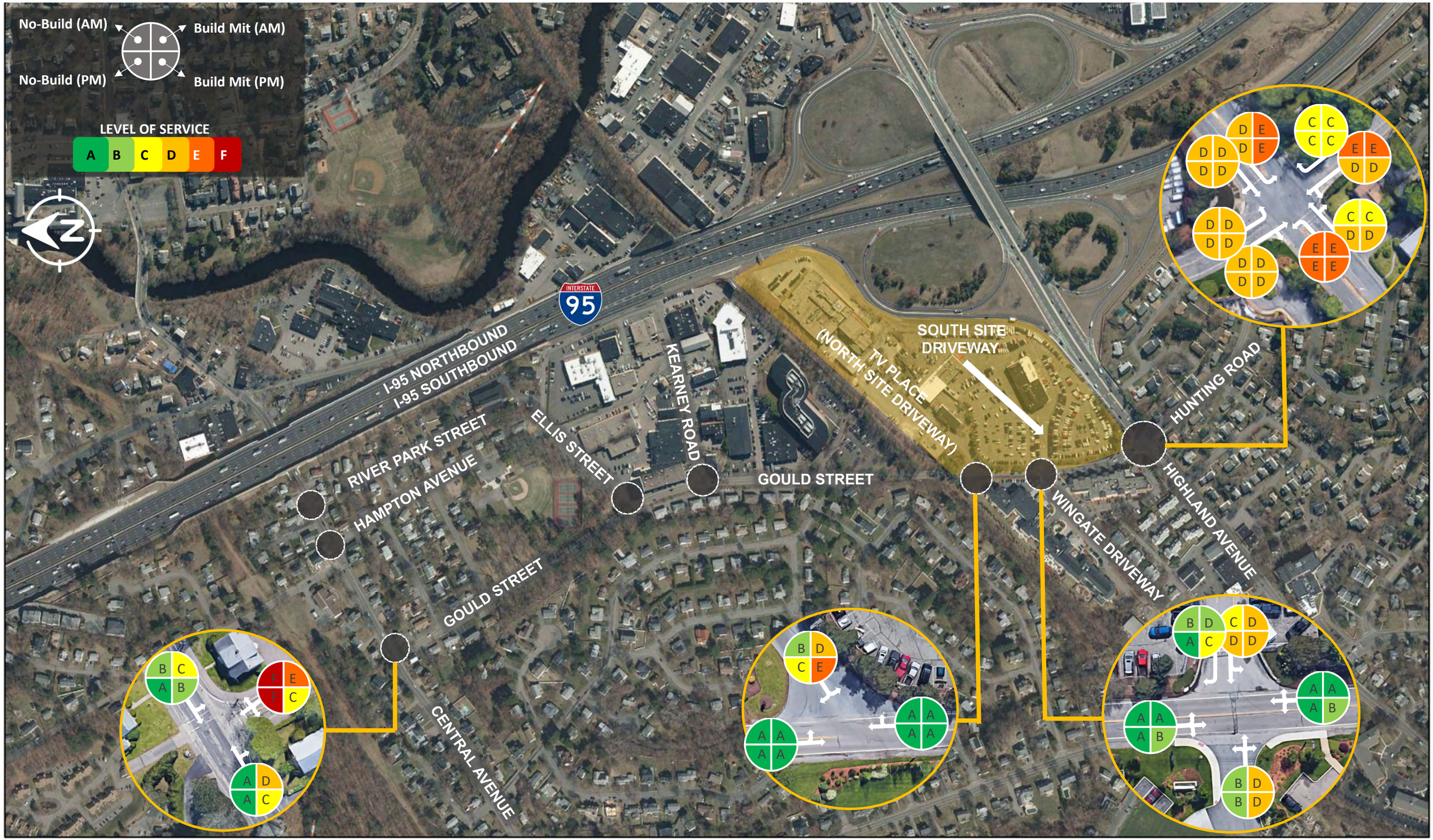
HIGHWAY COMMERCIAL 1 – NEEDHAM, MASSACHUSETTS

CONCEPT PLAN

2030 CONDITIONS WITH MITIGATION



GPI

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HIGHWAY COMMERCIAL 1 – NEEDHAM, MASSACHUSETTS

LEVEL-OF-SERVICE (LOS) 2030 NO-BUILD VS. BUILD MITIGATED

Looking out for Needham

The case for change

Fiscal Impact

ASSESSED VALUE AND NET REVENUE CHANGE, 2021 PROPOSED HIGHWAY COMMERCIAL 1

	Existing Conditions	If Redeveloped at 1.0 FAR for Nonresidential Uses	Gain/Loss at 1.0 FAR Outcome	If Redeveloped at 1.35 FAR for Nonresidential Uses	Gain/Loss at 1.35 FAR Outcome
Assessed Value	$19,087,100	$261,582,100	$242,495,000	$343,604,200	$324,517,100
Net Tax Revenue	$490,500	$6,352,100	$5,861,600	$8,342,400	$7,851,900
	Existing Conditions	**If Redeveloped at 1.0 FAR for Mixed-Use Option**	**Gain/Loss at 1.0 FAR Outcome**	**If Redeveloped at 1.35 FAR for Mixed- Use Option**	**Gain/Loss at 1.35 FAR Outcome**
Assessed Value	$19,087,100	$262,226,000	$243,138,900	$340,356,200	$321,269,100
Net Tax Revenue	$490,500	$4,467,585	$3,977,085	$5,782,800	$5,292,300
	Existing Conditions	**If Redeveloped as Warehouse/TV Studio**	**Gain/Loss**		
Assessed Value	$19,087,100	$35,854,000	$16,766,900		
Net Tax Revenue	$490,500	$743,900	$253,400		

Source: Barrett Planning Group, with data from Town of Needham, Municipal Data Bank and CoStar.

HIGHWAY COMMERCIAL 1 ZONING DISTRICT PLANNING

NEEDHAM, MA

MARCH 16, 2021

PREPARED BY:

STUDIO ENÉE

From: Larry Stein
To: Planning
Subject: Muzi
Date: Saturday, March 13, 2021 4:22:39 PM

To whom it may concern:

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Larry Stein

Sent from my iPhone

From:	Sarah Abdelaziz
To:	Planning
Subject:	Muzi
Date:	Saturday, March 13, 2021 4:24:58 PM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Sarah Abdelaziz
Needham, MA

From: Jason Stone
To: Planning
Subject: Objection to Proposed Rezoning
Date: Saturday, March 13, 2021 4:26:09 PM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

-Jason Stone
42 Hewitt Circle
Needham, MA 02494

From: Janice Bennett
To: Planning
Subject: Mizo Ford proposal
Date: Saturday, March 13, 2021 4:27:28 PM

I strongly object to the size of the project with five stories, are you serious? That’s going to wreck are area here in this neighborhood. Please reconsider the enormity of this project.

From: Casey Fedde
To: Planning
Subject: Reconsider Muzi rezoning plan
Date: Saturday, March 13, 2021 4:28:56 PM

Dear Planning Board,

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

As a Needham Heights resident who lives a few blocks away from the Muzi site, I'm especially wary of increased traffic to the area, and it will only get worse with the construction in Newton just on the other side of the highway. I urge the planning board to reconsider the use of this space.

Thank you,
Casey Fedde

Sent from my iPhone

From: Larry Tobin
To: Planning
Subject: Objection to Muzi rezoning
Date: Saturday, March 13, 2021 4:36:55 PM

Hello,

As an immediate neighbor to the vicinity at 31 greendale ave, I take issue with the proposed rezoning. The sets backs and height increases are ridiculous and unsightly and don't mesh with the neighborhood. The traffic report clearly states the huge problems and the proposed mitigation's don't solve them fully. Moreover, I believe strongly it would be wholly irresponsible for the town to shift the zoning without an explicit agreement for what development will ensue with a clear agreement for tax payments for years to come. By doing things out of order, it's only the property owners who stand to gain and it's not a guarantee the town will increase its tax base enough to offset the disaster. If, for instance, this project were to increase the tax base enough such that it could guarantee meaningfully lower property taxes for residents of 02494, then I'd be inclined to engage in a conversation. Otherwise the property owner wins me (which is perfectly fine by me) but we all lose, which is ludicrous.

Thank you!
Lawrence Tobin

Larry Tobin
LT@TheShapiroFoundation.org
781-864-2222

From: Victoria Martell
To: Planning
Subject: Muzi Rezoning
Date: Saturday, March 13, 2021 4:39:05 PM

Hello,

I am a Needham resident, living on Gary Road in the Heights, which as you likely know is rather close to the Muzi property. I am writing to ask that the planning board reconsider its position on the rezoning and place the best interests of the residents of this area above that of the Muzi family. The dealership isn't exactly a beautiful landmark, but surely we can do better than the current proposed zoning changes that allow for tall buildings with small setbacks. Why are we trying to cram five story buildings within feet of a residential road? Why are we trying to maximize the sale value of this property for the Muzi family? The message that is being sent is that the planning board is more concerned with assisting the Muzi family than it is the residents of the Heights. I sincerely hope that is untrue, and hope as a group that you will take a step back and reevaluate this zoning to prevent a monstrous eyesore that will result in a huge amount of traffic to the area from occurring. What about people who currently live on quiet streets that will turn into cut throughs as a result of this project? That is a change to their quality of life and property values. There are far reaching effects to the current proposal that seem to be getting intentionally ignored. Surely we can do better than what is currently on the table.

Thank you,
Victoria Martell

Sent from my iPhone

From:	Kathryn Bender
To:	Planning
Cc:	Kathryn C Bender
Subject:	No to rezoning of Muzi
Date:	Saturday, March 13, 2021 4:42:28 PM

Dear sirs and madams,
I sincerely implore you to vote down the development project of Muzi in Needham. I am a resident and enjoy the town and relative traffic congestion and do not want more traffic, less green space and more development.
Thank you for thinking about the residents beat interests, not those of business development.
Thank you,
Kathryn Bender

Sent from my iPhone

From: Kathryn Bender
To: Planning
Subject: Re: No to rezoning of Muzi
Date: Saturday, March 13, 2021 4:42:58 PM

My address is 1091, Highland Ave #1, Needham Heights MA 02494

Sent from my iPhone

> On Mar 13, 2021, at 4:42 PM, Kathryn Bender <kathrynesq@gmail.com> wrote:
>
> Dear sirs and madams,
> I sincerely implore you to vote down the development project of Muzi in Needham. I am a resident and enjoy the town and relative traffic congestion and do not want more traffic, less green space and more development.
> Thank you for thinking about the residents beat interests, not those of business development.
> Thank you,
> Kathryn Bender
>
> Sent from my iPhone

From: eileenoc114
To: Planning
Subject: Muzi rezoning
Date: Saturday, March 13, 2021 4:46:47 PM

I object to the current rezoning plan for the Muzi property. 5 story buildings would be an eyesore..not enough setback and certainly not enough green space..I am quite perplexed as to why the Town is proposing such a plan for this area, the gateway to Needham..a high rise? More business and traffic that has not been addressed. Traffic is a major consideration yet it is being ignored..that seems very suspicious to me.The Town should aquire the property..and dont reply "can't afford it" new police, fire, schools?
Eileen O'Connor 117 Sachem Rd Needham
"

Sent from my Sprint Samsung Galaxy Phone.

From: Alan Yee
To: Planning
Subject: Rezoning of Muzi
Date: Saturday, March 13, 2021 4:47:59 PM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.
I live on Central Avenue near Gould Street, I have two little ones, and am afraid for their safety as there will unprecedented amount of traffic through Gould Street and Central Avenue.

Best Regards,
Alan Yee

Needham Heights Resident

Sent from my T-Mobile 5G Device
Get Outlook for Android

From: Lois Sockol
To: Planning
Subject: REZoning of Muzi Property
Date: Saturday, March 13, 2021 4:49:49 PM

I know it is extremely difficult to balance the town's budgetary needs with community, and particularly neighborhood needs, but I do agree with the follow statement. “I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project." Filling the Planning Board's mailbox with such objections, in these or your own words, can only help us.”

Lois Sockol, 611 Greendale Ave. 02492

From: Victoria
To: Planning
Subject: Protest against new Zoning at Muzi
Date: Saturday, March 13, 2021 4:51:54 PM

To whomsoever it may concern,

I protest new zoning regarding proposed development at Muzi site, near route 128. My understanding is that this project will bring unprecedented level of traffic to already congested area. Squeezing tall buildings, increasing traffic and taking green space will make entering into Needham and surrounding neighborhoods challenging. I am against current proposal.
Thank you,
Victoria

From:	Mark Levine
To:	Planning
Subject:	Rezoning for Muzi
Date:	Saturday, March 13, 2021 4:52:11 PM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Mark Levine
1 Lakin Street

From: Julie Reich
To: Planning
Subject: Muzi redevelopment
Date: Saturday, March 13, 2021 4:54:44 PM

To the Planning Board:

I am writing to share my concern about the proposed rezoning for the area where Muzi Motors now sits. The possibility of developing 5-story buildings west of Route 128 is unprecedented, and the proposed setbacks and green space are insufficient. In addition, I am concerned about the effect that increased traffic will have on the surrounding community and the whole town. I hope you will consider a scaled-down project.

Thank you.

Sincerely,
Julie Reich
57 Hemlock St.
Needham 02492

From: Rob Dangel
To: Planning
Subject: Muzi rezoning
Date: Saturday, March 13, 2021 5:01:02 PM

I have been closely following the muzi rezoning I massively object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

I also live on Hewitt and see Gould from my back porch. The fact that the town is appearing to conspire with the property owners, seems a bit disingenuous. The word that we are hearing is that one of the options to mitigate traffic is to take property by eminent domain.
If you have to resort to that type of action just to get a certain type of development is a red flag.
I'm not really sure that people making these decisions will be as affected by us "commoners" that actually live here.

You must STOP this rezoning plan immediately. And actually listen to the people that live here.

Thank you.
Rob Dangel
28 Hewitt Cir
Needham 02494

Thumbed from my iPhone

From: Holly Charbonnier
To: Planning
Subject: Muzi Rezoning
Date: Saturday, March 13, 2021 5:11:36 PM

The proposed rezoning for Muzi should NOT be voted on as is. I object to the height of 5-story buildings at that site. It would be unprecedented on this side of Route 128 and too big for our small town. We are NOT a city nor do we want to be a city. The proposed rezoning offers insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Holly Charbonnier
94 Sachem Rod
Needham Heights

Sent from my iPhone

From:	Jodi
To:	Planning
Subject:	Objecting to the Proposed Rezoning for Muzi
Date:	Saturday, March 13, 2021 5:16:52 PM

Hello
This message is to make the board aware that we object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

We live at 54 high st in Needham. Along with our concern about the building height, we are very concerned about traffic issues and overflow traffic impacting this already busy street.

We appreciate your attention to this email.

Best
Jodi and Colin Feeney

From: cwrm72@mac.com
To: Planning
Subject: Muzi rezoning objection
Date: Saturday, March 13, 2021 5:16:59 PM

I strongly object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Carlos Rodriguez
Webster Street

From: Nancy Judge
To: Planning
Subject: Zoining of the Muzi property
Date: Saturday, March 13, 2021 5:19:54 PM

I feel there is better use of the land than building hi rises. I feel that an athletic complex would be a greater use of the land.< im sure that neighboring towns plus the people of needham would get greater enjoyment of using it. I also feel that there is to much going on behind closed doors, makes me think we are dealing with Beacon Hill and there politics.

From:	Nick Larsen
To:	Planning
Cc:	Ronnie Wei
Subject:	complaint about Muzi zoning
Date:	Saturday, March 13, 2021 5:28:51 PM

Dear Planning Board,
My family has lived at 120 Central Ave (02494) since 2009. Some years ago, you announced you would construct a behemoth St Mary pumping station immediately across the street from us, which has been an eyesore ever since. All the neighbors who attended the town meeting complained, but to no avail. The decision had already been made with no input from the community.

Now the Planning Board is making another decision about Muzi Ford zoning, with no input from the community. No one asked me for my opinion. But I will give it. The traffic along Central Ave is horrendous already. Cars go by my front door at 40-50 MPH. In the morning, I have counted from 600-900 cars going by per hour. We do NOT need more cars! As a resident, I do not appreciate the Board making arbitrary decisions about neighborhoods where they don't live. It's shameful. I therefore protest the new zoning plans and demand that something more reasonable be done.

Thank you
Nick Larsen & Ronnie Wei
120 Central Ave
Needham, MA 02494

From:	Nader Khedr
To:	Planning
Subject:	Muzi rezoning objection
Date:	Saturday, March 13, 2021 5:31:32 PM

Dears

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Kind regards

Nader Khedr
28 Guild Rd, Needham Heights, MA 02494

From:	patricia doyle
To:	Planning
Subject:	Muzi development
Date:	Saturday, March 13, 2021 5:31:34 PM

"I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project."

Patricia Doyle
Needham, MA 02492

From:	Vanderklish, Julie E.,N.P.
To:	Planning
Date:	Saturday, March 13, 2021 5:33:00 PM

Planning Department Needham Ma:

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Please Reconsider this!!

Julie Vanderklish
71 Ardmore Road
Needham Ma 02494
771-400-5544

From:	M M
To:	Planning
Subject:	Muzi rezoning objection
Date:	Saturday, March 13, 2021 5:33:23 PM

Hi

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Kind regards

Marwa Abdalla
28 Guild Rd Needham 02494

From: Richard
To: Planning
Subject: The Muzi rezoninf
Date: Saturday, March 13, 2021 5:41:47 PM

Dear zoning board

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Rick Freedman
Gilbert Road

Sent from Xfinity Connect Application

From: Matt Kence
To: Planning
Subject: Muzi Ford
Date: Saturday, March 13, 2021 5:44:42 PM

Hi,

I am concerned that this proposal is not being given the proper scrutiny. This is a great opportunity to make Needham more livable due to the addition of more green space and community services.

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Matt Kence

Sent from my iPhone

From:	MarySue Cotton
To:	Planning
Subject:	Muzi Property Zoning changes
Date:	Saturday, March 13, 2021 5:48:44 PM

Hi there
I am very concerned about the drastic changes being proposed for the Muzi site. The dramatic change in building height and set-backs from the road really are alarming.
Have all the studies been made about traffic? How does this affect Gould Street? Will the roads around the Muzi property be affected? Will the infrastructure be impacted? What will this do to the student population, can our schools handle this? I live in the heights, but behind the SWES school. This is not in my backyard but affects the town I have called home for over 30 years. This is a small town, and I would hate to trade in that small town feel, and create this dense area that really doesn't belong here.
Are there drawings of what this area will look like with these proposed changes?
I appreciate your time.
Thank you
MarySue Cotton
40 Sunset Road

From: Inga Puzikov
To: Planning
Subject: Muzi
Date: Saturday, March 13, 2021 6:36:20 PM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

I feel that the process itself was corrupted to the core, unfair and dishonest.

Please, let me know who I can talk to to follow up. People of Needham should be able to express their conserns and what is going on with construction in the area is unbelievable !!!!

We have a planning comiettee to protect us and I do not see any help, protection or even interest.

Very disappointed.

Please, put me in touch with person in charge

From: Heather Krechmer
To: Planning
Subject: Muzi rezoning concerns
Date: Saturday, March 13, 2021 7:01:50 PM

Dear Planning Board,

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

From:	Sara Zaiger
To:	Planning
Subject:	Muzi Rezoning
Date:	Saturday, March 13, 2021 7:07:39 PM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Thank you for your attention to my concerns.
Sincerely,
Sara Zaiger
35 Avery Street
Needham Heights MA 02494

From: Kate Home
To: Planning
Subject: Muzi plan objection.
Date: Saturday, March 13, 2021 7:07:54 PM

I live in the Perry Park area (203 Highgate street) and I use the intersection at Muzi frequently. I would like to send to you my concerns about the current proposed Muzi plan.

I object to the plan for the filling reasons:

• it allows possible development of 5 story buildings that are unsightly and unprecedented in our town. At this side of the highway this is too high, there are insufficient setbacks, not nearly enough green space.
• This process has and plan has resulted from an unreliable process, limited information sharing and will result in an excessive increase in traffic
• The true value of this proposal to the town (as opposed to the increase in value to the sellers) has never been fully explained. Specially the value of this size development over a scaled back, more reasonable project.

I hope that this project will not be approved as presented and more thought and sharing of information will be forthcoming.

Best regards,

Kate Findlen
Sent from my iPhone

From: Sarah Zilzer
To: Planning
Subject: Muzi development
Date: Saturday, March 13, 2021 7:31:52 PM

Dear Planning Board,

I am writing to express my objection to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Please hear your constituents on this matter and stop being party to the corruption that is so obviously prevalent in the Needham governance system today, first and foremost by the Select Board.

-Sarah Zilzer
247 Webster St.

Sent from my iPhone

From: jeanh293@gmail.com
To: Planning
Cc: jeanh293@gmail.com
Subject: Property currently occupied by Muzi Ford
Date: Saturday, March 13, 2021 7:33:57 PM

Dear members of the Planning Board,

My husband and I have lived in Needham since 1979 and care so much about what is happening with the rezoning of properly currently occupied by Muzi Ford.

We object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project."

The intersection of the highway, Highland Ave., Hunting Rd. and Gould Street is already at capacity. Please scale back any future plans for the Muzi property, keeping in mind the wishes of our community and the residents who live in this area.

Thank you.

Jean Higgins
293 Webster St.
Needham, MA 02494

From:	Kean, Linda
To:	Planning
Subject:	objection to the proposed rezoning for Muzi
Date:	Saturday, March 13, 2021 8:53:07 PM

Hello,

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project

Sincerely,
Linda Kean

From: mjz1021@comcast.net
To: Planning
Subject: Muzi re-zoning
Date: Saturday, March 13, 2021 9:05:27 PM

To whom I may concern,

I object to the proposed re-zoning of Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Melanie Zakin
99 Noanett Road

From:	Andrew Starr
To:	Planning
Subject:	Objection to proposed rezoning for Muzi
Date:	Saturday, March 13, 2021 9:11:55 PM

Hi,

My name is Andrew and I live at 99 Noanett Rd. I am sending this email to let you know I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Thank you,
Andrew

From: Justin
To: Planning
Subject: Planning Board
Date: Saturday, March 13, 2021 9:19:04 PM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Regards

Justin Oriel
47 Lee Rd
Needham, MA

From: Robyn Fink
To: Planning
Subject: Objection to rezoning
Date: Saturday, March 13, 2021 9:25:13 PM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project. I will be attending the Zoom meeting this week.

Robyn Fink
128b Hillside Ave 02494

Sent from my iPhone

From:	Kevin Henneberger
To:	Planning
Subject:	Objection to proposed rezoning for Muzi
Date:	Saturday, March 13, 2021 9:43:03 PM

I object to the proposed rezoning for Muzi because it is a short-sighted decision lacking comprehensive strategy and community unity for Needham.

The rezoning proposal has optimized tax revenue for the town while mitigating other obvious implications. Considering and presenting other extreme optimizations (ie 100% recreational zoning OR 100% residential zoning) — along with the ramifications of those options (ie schooling, taxes, traffic, etc) — will surface the most value for the entire town. This will empower the community to rally support for a good idea, with conscious trade-offs. The current proposal is a short-sighted sales pitch for easy revenue — it is one-sided and strategically incomplete.

Develop and communicate a comprehensive zoning decision based on a love for Needham.

Show the town you care, then showcase the revenue and other benefits . . . the opposite comes across as mindless or heartless.

Kevin Henneberger
16 Mills Rd
Needham Heights, MA 02494

From: Terence Ryan
To: Planning
Subject: Objection to Proposed Rezoning for Muzi/WCVB
Date: Saturday, March 13, 2021 10:36:24 PM

Dear Needham Planning Board,

I can appreciate the effort that you have put in to do something that you think will benefit Needham.

However, I object to the current, proposed rezoning for Muzi/WCVB because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Thank you,
Terence Ryan
79 Evelyn Rd
Needham, MA 02494

From: Gerri Shubow
To: Planning
Subject: Re: proposed rezoning for Muzi
Date: Sunday, March 14, 2021 12:15:43 AM

To: Planning Board Needham

I strongly object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

I live right near this spot - the proposed rezoning must be re-evaluated!

Sincerely,
Gerri Feuer Shubow
Sent from my iPhone

From:	Nathalie Blitz
To:	Planning
Subject:	proposed rezoning for Muzi objection
Date:	Sunday, March 14, 2021 8:29:01 AM

Hi there,

As a Noanett Rd resident, I object to the rezoning plans for Muzi lot and making it a five story building with no greenery. Please ask the residents who will be directly affected by your decisions. None of us want this current plan.
We want more transparency in the process and have our concerns taken seriously. We want greenery, enough setbacks, and a center who can benefit the residents, town and visitors like a little shopping center. The TJ Maxx plaza in Newton comes to mind.

See you Tuesday,

Nathalie Blitz
127 Noanett Rd
Needham

From: Jeff Pearson
To: Planning
Subject: Muzi Rezoning
Date: Sunday, March 14, 2021 8:40:28 AM

Dear Planning Board Members,

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Yes, I copied this for efficiency's sake. I support every word. I live half a mile from the proposed project.

Jeff Pearson
72 Avon Cir, Needham Heights, MA 02494
617-721-9673

From: Amy Mercer
To: Planning
Subject: Muzi Rezoning
Date: Sunday, March 14, 2021 8:41:03 AM

We strongly object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Best,

William and Amy Mercer
23 Gould St,
Needham, MA 02494

From: Michael Herman
To: Planning
Subject: Planning Board RE Rezoning for Muzi Property
Date: Sunday, March 14, 2021 8:51:46 AM

"We object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project."

Thank you for your careful consideration in this matter.

Michael Herman
13 Carey Road
Needham Heights, MA 02494

From:	Daniel Warn
To:	Planning
Subject:	Rezoning for Muzi - Opposed!!
Date:	Sunday, March 14, 2021 9:08:08 AM

Hello,

As someone who lives in Needham Heights, I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project. I pass through the intersection at Highland Ave and Gould streets daily to access my house, the town center, and the Mills sports complex. Rezoning the Muzi property without significant improvements accounting for families and kids who live in this area is unacceptable.

I urge you to also reject the current rezoning proposal along with me and numerous other concerned residents of Needham Heights.

Best regards,

Dan Warn
118 Parker Road
Needham Heights MA, 02494

From:	Ronha Loma
To:	Planning
Subject:	Muzi Ford Rezoning Objection
Date:	Sunday, March 14, 2021 9:11:20 AM

I am formally objecting to an allowed use of 5 story development on the corner of Gould Street and Highland Avenue, known as the Muzi Ford property.

Allowed uses, the traffic patterns and actual amount of traffic it brings should be of paramount importance to the Planning Board as it considers allowed uses for this property.

Please **do not** leave this to the Special Permit process.

It is of great importance that you consider the interests of Needham residents in your public deliberations.

Susan Herman
13 Cary Road

From: Ronit Velde
To: Planning
Subject: Rezoning for Muzi
Date: Sunday, March 14, 2021 10:09:41 AM

To whom it may concern,

I am writing to express my objection to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Warmly,
Ronit Velde
40 Homsy Ln, Needham Heights, MA 02494

From: Julia A. B. Pearson
To: Planning
Subject: Muzi
Date: Sunday, March 14, 2021 10:29:06 AM

To whom it may concern,

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Sincerely,

Julia Pearson
72 Avon Cir, Needham Heights, MA 02494

From:	Stephanie Wallace
To:	Planning
Date:	Sunday, March 14, 2021 11:30:50 AM

To the Planning Board,

As a resident of a neighborhood off of Gould Street, I heartily object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Sincerely,
Stephanie Wallace
Gary Road

From:	Debbie M. Jacobs
To:	Planning
Subject:	Muzi
Date:	Sunday, March 14, 2021 11:43:08 AM

Good Morning,

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Thank you for your time.

Debbie Jacobs

--
Debbie Jacobs, LCSW
A.R.T. Certified Practitioner
Allergy Release Technique®
EAT FREELY ● LIVE FULLY

From: Jennifer Wald Oriel
To: Planning
Subject: Planning Board
Date: Sunday, March 14, 2021 12:05:53 PM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Regards

Jen Oriel
47 Lee Rd
Needham, MA

From:	Chris Lalonde
To:	Planning
Subject:	In Re Proposed Muzi Rezoning
Date:	Sunday, March 14, 2021 12:07:53 PM

Members of the Planning Board,

I am writing to express my objection to the proposed rezoning of the land currently occupied by Muzi Ford, Muzi Chevrolet, Muzi Autobody, Wash World and WCVB. I do not believe that allowing for large scale commercial development of multi-story office buildings in that area is in the best interests of the town or its residents - which the residents of the town already indicated when a substantially similar proposal was voted down less than two years ago. The feasibility review of the proposal also seemed to indicate, though not fully address, the significant amount of land taking that would be necessary to attempt to accommodate the amount of additional traffic that such a development would create. Without such a taking, the ability for Needham residents, current business owners and those seeking to do business in Needham would be negatively impacted in a potentially severe manner due to the tremendous congestion the development would create at the main point of ingress to the town. The contemplated proposal puts the economic interests of a small few (the existing land holders) above those of the town and its other business and land owners.

I urge you to vote against the current proposal, which legally should not even be up for consideration given the aforementioned town vote, and to instead seek to identify a solution that would seek to better balance the needs and interests of the town's residents and other business owners with those of the current landowners. A smaller scale commercial development, with increased green space and perhaps additional community facilities could seemingly be such a compromise.

Best regards,

Chris Lalonde
38 Bennington St
Needham, MA 02494
781-400-1572

From: Janice Bennett
To: Planning
Subject: Re: Mizo Ford proposal
Date: Sunday, March 14, 2021 12:58:50 PM

On Sat, Mar 13, 2021 at 4:27 PM Janice Bennett <janicemb58@gmail.com> wrote:

> I strongly object to the size of the project with five stories, are you serious? That's going to wreck are area here in this neighborhood. Please reconsider the enormity of this project.

From: Lauren Soper
To: Planning
Subject: Muzi
Date: Sunday, March 14, 2021 1:19:38 PM

Hello planning board, I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Lauren Eilberg
32 Mark Lee Rd
Needham Ma

Sent from my iPhone

From:	Kenneth Phillips
To:	Planning
Subject:	Muzi
Date:	Sunday, March 14, 2021 1:28:23 PM

I have lived in this nice town for 40 years, your present disregard for this neighborhood is distressing. Whom do you represent?
I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project!!!

Ken Phillips
74 Sachem Rd.
Needham Hts., MA 02494-2148

From: Marge Phillips
To: Planning
Subject: Muzi Motors
Date: Sunday, March 14, 2021 1:33:32 PM

I am disappointed with the zoning board's proposal for Muzi Motors property.

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Marge Phillips
74 Sachem Rd.
Needham Hts., MA 02494

From:	Shari Stier
To:	Planning
Subject:	Please DO NOT rezone Muzi space
Date:	Sunday, March 14, 2021 3:14:12 PM

I object to the proposed rezoning for Muzi. It allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project. I live right near Muzi and do not want that space to have a 5 story building or stores or apartment buildings. The traffic alone will make it impossible getting in and out of Needham. You Can't allow this.

Shari Stier 23 Park Avenue Needham Ma 02494

From:	Debra Hoffman-Davidson
To:	Planning
Subject:	muzi Re-zoning
Date:	Sunday, March 14, 2021 3:59:04 PM

Hello,
As a resident of Needham Heights I am concerned about the potential land use for the current Muzi site. My specific concerns are regarding this being the entryway into Needham and making this attractive and useful to the nearby community. In addition I am concerned about increased traffic through nearby residential streets. I also wonder how a private business has gotten the town to consider zoning changes? Wouldn't this be up to any private developer to do after the land is purchased? I write you this letter not because NIMBY applies. I actually believe a thoughtful and sound development in the area could be positive and beneficial to the neighborhood and town as a whole. It is vital that Needham Heights residents voices are heard and that any proposals for the land are not based on political motives where any one or any entity profits at the expensive of the neighborhood.
Sincerely,
Deb Hoffman-Davidson
Elder Rd

Sent from my iPad

From:	Daniel Krechmer
To:	Planning
Subject:	Muzi rezoning and redevelopment concerns
Date:	Sunday, March 14, 2021 4:44:52 PM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Thanks,
Dan Krechmer
44 Yale Rd, Needham Heights, MA 02494

From: Abigail Harmon
To: Planning
Subject: Muzi Ford
Date: Sunday, March 14, 2021 4:50:43 PM

Hello,
I am concerned about the proposed zoning for the Muzi Ford site. I feel that it is important to incorporate additional green space (I saw the 33% number put somewhere) into any plan. The town has allowed tear down after tear down to remove trees for years with the excuse of tax base. Along with the aging trees of Needham, our air quality is in danger. Adding a building that takes additional houses (and their trees/grass) and adds additional cars in an unsafe way (according to the traffic study) is not what Needham needs - even for additional taxes. Please listen to the concerns of Needham and Needham Heights when considering this issue.

Thanks,
Abigail Harmon
Needham Heights

From: Leslie Prescott
To: Planning
Subject: Objection to rezoning for Muzi Ford lot
Date: Sunday, March 14, 2021 6:00:03 PM

I object to the proposed rezoning for Muzi. I live around the corner from Muzi and the traffic and congestion will dramatically impact my and our neighborhood's daily life. The new zoning allows the possibility for a development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space. The process has been too fast with not enough input from Needham residence. This will inevitably lead to too much traffic without understanding the incremental value to the town.

From:	Jodine Kuhlman
To:	Planning
Subject:	Rezoning
Date:	Sunday, March 14, 2021 7:01:33 PM

Hello Planning Board,

I object to the proposed rezoning for the Muzi site, because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Regards,

Jodine Kuhlman
Needham Resident

ejkuhlman@aol.com

From: Nelson Nemser
To: Planning
Subject: Proposed Rezoning for Muzi Site
Date: Sunday, March 14, 2021 9:27:46 PM

To:Town of Needham Planning Board,

We are concerned about the proposed rezoning for Muzi Site because I have not heard nor seen anything of substance from the Planning Board on their position regarding the pros and cons for the site. This seems to be a major decision for the town that doesn't involve town related services like the new fire stations and police facilities. It seems more like a private enterprise will be involved and more scrutiny required. Any private entity involved is unlikely to be as transparent as the board should/must be, and will not necessarily have the town's best interest in mind.
Trever Ballantyne's (Wicked Local) piece in the recent Needham Times shed some light on the situation. As not everyone in town has the time and inclination to follow the Planning Board activities it would be informative if the Planning Board made more of an effort to publicize the options and their position regarding this major project. This should include the available paths forward for this site and their impacts, including costs, traffic. revenue, etc. Also, allowing the possibile construction of a five story office building or office complex is likely to create a traffic nightmare at the already congested 128/95 overpass.
Personally, I prefer a facility that the residents of Needham could use and benefit from, rather than a business or businesses that just pay taxes (like Channel 5 and Muzi). What also is needed is the independent economic review and traffic assessment of all options being considered.

Nelson and Lesley Nemser
Needham MA 02494

From:	Bruce W
To:	Planning
Subject:	Fwd: Planning Board Meeting
Date:	Monday, March 15, 2021 8:36:49 AM

To the Needham Planning Board,

I am writing to express my deep opposition to the Planning Boards' proposal to "upzone" the Muzi Ford property.

This proposal was written by real estate developers and for real estate developers. It does not consider the short or long-term needs of Needham, nor does it consider how many in the Needham community would like to see this property developed.

Due to its location, the Muzi Ford property is extremely valuable and whoever develops the property stands to make a lot of money. The town should be working with those developers to build out a mixed-use property that includes green spaces, access (and upgrades) to the rail trail, support for small and local businesses, and an upgraded sports facility (indoor pool, ice rink, improved Y). The forthcoming development of the Marshalls plaza on Needham street is an example of how a developer can work with the local community to build something that improves the community while still delivering a substantial profit.

This property offers so much opportunity to the town. It would be a shame to lose that opportunity and end up with a large complex of over massed office buildings that end up destroying the character and quality of life in our beautiful town.

Thank you

Bruce Wolfeld

Bruce Wolfeld
brw917@gmail.com
617-901-5662
www.linkedin.com/in/brucewolfeld

From:	Lauren Greenstein
To:	Planning
Subject:	Petition Objecting to the Proposed Rezoning for Muzi
Date:	Monday, March 15, 2021 8:54:38 AM

Hello,

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Please preserve the beauty of Needham. It's becoming very concrete between the project on Greendale a few years ago and the whole technology area near TripAdvisor. Stop building! Everything is on top of one another.

Sincerely,

Lauren Greenstein
82 Cynthia Road
617-721-3554

From: Lauren Schuller
To: Planning
Subject: Objection to proposed rezoning for Muzi!
Date: Monday, March 15, 2021 11:38:38 AM

Good morning,

My name is Lauren Schuller, and I live at 25 Mills Rd in Needham. I want to make it very clear that I object to the proposed rezoning for Muzi. It allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project. I hope you will take into account the loud and passionate voices from the community objecting to this project and the negative impact it will have on all of us.

Thank you,
Lauren Schuller

From:	Barry Pollack
To:	Planning
Subject:	Objection to Proposed Rezoning for Muzi
Date:	Monday, March 15, 2021 11:41:24 AM
Attachments:	210315 letter to Planning Board.pdf 210315 PETITION CONCERNING ZONING AT THE GATEWAY TO NEEDHAM.pdf 210315 petition signatories.pdf

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Dear Chair McKnight and Members of the Needham Planning Board,

Please see the attached correspondence. I am a resident of Needham who lives at 15 Pandolf Lane, in Needham Heights, 02494. Also attached is a copy of a Petition, generated through Google Forms, and a list of Needham residents who joined the Petition as signatories, along with their zip code of residence. Between electronic and hard copy signatures to the Petition, more than 600 Needham residents object to the Planning Board's proposed rezoning for Muzi.

Respectfully submitted,

Barry Pollack

March 15, 2021

By Overnight Mail and Email planning@needhamma.gov

Chair Jeanne McKnight
Vice Chair Paul S. Alpert
Adam Block
Martin Jacobs
Ted Owens
Needham Planning Board
1471 Highland Avenue
Needham, MA 02492

Re: Objections to Proposal for Highway Commercial-1
Zoning Change at Muzi / Channel 5 Properties

Dear Chair McKnight and Members of the Planning Board:

A group of Needham residents has recently formed and registered the Needham Heights Alliance, Inc. (the "Heights Alliance"). A Facebook page for "Needham Heights Alliance" already enjoys 340 members. I am one of the incorporators of the Heights Alliance.

As you probably know, before forming the Heights Alliance, some of those who became its initial members organized a Petition objecting to the pending rezoning proposal by the Planning Board, raising objections to the permissible heights as excessive, the setbacks on Highland Avenue and Gould Street as inadequate, insufficient green space, and the lack of a tree easement. A copy of the form of Petition and the list of electronic signatories are attached hereto. Within less than 10 days, more than 600 Needham residents have signed the Petition either electronically or by hard copy. More than 1/3 of the electronic signatures come from residents of 02492, reflecting that concerns are spread across our town. I understand the hard copies are being submitted separately.

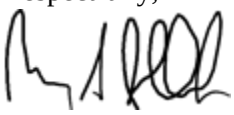
The signatories have provided certain responses that may contain personal identifiable information ("PII"), within the meaning of 2 CFR § 200.79. We removed those signatories who reside outside of Needham. We removed duplicate electronic entries. One or more emails have been sent to the signatories to validate email addresses. Any bounce-back has resulted in a removal or correction. One person asked to be removed (and was), when she reported that she spoke to Chair McKnight and believed there was a possibility of a compromise while she could await further information before taking a position. One person asked to be removed because he had just resigned from the Needham Heights Neighborhood Association and did not want involvement with the attention drawn to the controversy over the NHNA's recent determination that it would not take a position on any zoning issues. Appropriate steps have been taken to gather signatories for the Petition while protecting PII and maintaining social distancing. As you can see, the Petition does not seek a vote on any particular new

THE NEEDHAM HEIGHTS ALLIANCE, INC.
163 HIGHLAND AVENUE #1037 | NEEDHAM HEIGHTS, MA 02494 | www.facebook.com/groups/NeedhamHeightsAlliance

zoning, but rather only objects to the excessiveness of the pending proposal by the Planning Board. As a result, email addresses have been preserved, while only zip codes of residence accompany each person's name in this submission.

I know that members of the Heights Alliance look forward to working with the Planning Board on a more reasonable proposal.

Respectfully,



Barry S. Pollack
Incorporator

THE NEEDHAM HEIGHTS ALLIANCE, INC.
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PETITION CONCERNING ZONING AT THE GATEWAY TO NEEDHAM

* Required

Email address *

Your email

Objections and Responses to the Planning Board's Proposal

WHEREAS, in 2019, the Planning Board proposed a new zoning use district known as “Highway Commercial 1” (“HC-1”) that would have allowed buildings up to seven stories; and

WHEREAS, in November 2019 at a Special Town Meeting, a vote of Town Meeting Members rejected that zoning change; and

WHEREAS, the Planning Board has now re-proposed the creation of an HC-1 use district that would allow buildings up to five stories; and

WHEREAS, we believe that the residents of Needham seek zoning at the Gateway to Needham that balances the increase of a tax base with concerns about aesthetics, beneficial uses, green space, environmental impact, traffic and other burdens on neighbors; and

WHEREAS, for decades, Needham Heights residents have made efforts, in part through a formal association, “to enhance and protect the residential character and livability of the area," including the Gateway to Needham, and still seek to achieve those goals;

The undersigned object to the proposed building heights, insufficient setbacks, insufficient green space, and certain uses and special permit requirements and entitlements of the proposed HC-1 zoning district, as presently defined, and submit the following as their position to the Planning Board, Select Board and Town Meeting Members:

1. A setback for building shall be at least 100’ from Highland Avenue and from Gould Street.

2. Between 100’ and 200’ from Highland Avenue and from Gould Street, the permissible height of buildings shall be no higher than 42’, inclusive of any roof, whether or not pitched, and without further height allowances for any utility apparatus.

3. From 200’ and further from Highland Avenue and from Gould Street, the permissible height of buildings, with a special permit that requires developers to take mitigation efforts that maintain pre-build traffic conditions, shall be 56’, inclusive of any roof, whether or not pitched, and without further height allowances for utility apparatus.

4. Permissible uses shall be limited to those allowed for existing Business District zoning and existing zoning for the present lots, and shall be subject to Special Permits as allowed for existing Business District zoning and zoning for the present lots, except that (a) planned housing shall be allowed; (b) the size of office space may be increased by Special Permit, and (c) the following uses shall be expressly excluded from permissible uses: warehouses, distribution centers, industrial services, large retail operations in excess of 5,750 square feet, and junkyards.

5. To the extent that an owner constructs a building with a height in excess of 42’, the green space for the lot shall be no less than 33%.

6. The town shall hold a landscape easement requiring trees that are customarily used in the vicinity, spaced at regular intervals no less than 40’ apart in the setbacks along Highland Avenue and Gould Street.

Name *

Your answer

Email Address *

Your answer

Zip Code of Residence *

Your answer

Do you join the objections to the Planning Board's proposal for zoning changes in height, setback and greenspace at the Gateway to Needham? *

- ◯ Yes

Send me a copy of my responses.

Submit

Never submit passwords through Google Forms.

Barry Pollack	02494
Abigail Harmon	02494
Ada Chan	02494
Adam Mersky	02494
Ahmed Abdelaziz	02494
Aimee Stone	02494
Ajay Batra	02494
Alan Yee	02494
Alejandra Marroquin	02494
Alex Puzikov	02494
Alex Shtifman	02494
Alexa Moore	02494
Alison Reiser	02494
Alyse Winston	02494
Amanda Fernandes	02494
Amelia Egan	02494
Amy E Mercer	02494
Andrea cunningham	02494
Andrew Spear	02494
Andrew Starr	02494
Andy Effenson	02494
Anna Calvagna	02494
Anna W. Katsnelson	02494
AnnaMarie Defeo	02494
Anne Pickett	02494
Annie King	02494
Anthony Scarsella	02494

Ashly Scheufele	02494
Aurora Liao	02494
Ben Daniels	02494
Benjamin Shimamura	02494
Beth McCarthy	02494
Bipin Mistry	02494
Brandon Grunes	02494
Brian T Moore	02494
Bridget dangel	02494
Bridget Francescone	02494
Callie Curran Morrell	02494
Carlos Javier Rodríguez	02494
Carol Fraini	02494
Carol Macey	02494
Carol Richmond	02494
Carol Stuckey	02494
Caroline Valentini	02494
Carolyn M Spiros	02494
Carolyn McKee	02494
Caryn Manning	02494
Casey Fedde	02494
CATHERINE SPALDING	02494

Charla Turgel	02494
Cheri Pugatch	02494
Christina Bailey	02494
Christina Hua	02494
Christopher Lalonde	02494
Claudine Eilberg	02494
Colin Feeney	02494
Colleen Mutrie	02494
Corey Wilk	02494
Dan Warn	02494
Dana Fugate	02494
Daniel Colino	02494
Daniel Krechmer	02494
Daniel R Morrell	02494
Daniel Robert Morrell	02494
Danny Socci	02494
David Katsnelson	02494
David Linde	02494
David Murray	02494
David Packer	02494
Deb keene	02494
Debbie Jacobs	02494
Deborah Brown	02494
Deborah Johnson	02494
Debra Whitney	02494

Diana Babson	02494
Diana Rittenberg	02494
Dianne Sapra	02494
Dina Creiger	02494
Dory Fish	02494
Douglas Most	02494
Ecaterina	02494
Edmund Ho	02494
Edward Bayiates	02494
Eileen O'Connor	02494
Elaine Fortin	02494
Elina Kaplan	02494
Elisa Scarsella-Bayiates	02494
Elissa Schechner	02494
Elissa Schechner	02494
Elizabeth Gasman	02494
Ellen Fine	02494
Ellen May	02494
Ema Bimbli	02494
Emily cooper	02494
Emily McSweeney	02494
Emily Pick	02494
Eric Lim	02494
Eugene Ho	02494
Felicia Mathias	02494
FRancid M. Judge	02494
Frederica Lalonde	02494

Gabriela Spear	02494
Gabrielle	02494
Gail Stone	02494
Ganesh Rao	02494
Gary Bean	02494
Gena Koufos	02494
Gennady Solodar	02494
George Doukas	02494
Gerald Tracey	02494
Gerri Shubow	02494
Giuseppe	02494
Grace Chan	02494
Guanshi Li	02494
GUILLAUME BOURGEOIS-PIN	02494
Hajnalka Lakatos	02494
Heather Curtis	02494
Heather krechmer	02494
Heidi Wilson	02494
Helaine And Dennis Miller	02494
Henry Ragin	02494
Hilary Rosenbaum	02494
Hilary Rosengard	02494
Holly Charbonnier	02494
Howard Breslau	02494
Ilene Effenson	02494

Ilia Korboukh	02494
Inga Puzikov	02494
J Barry Sullivan	02494
Jacquie Sherman	02494
Jalvi Shah	02494
James DeFeo	02494
James DiMeo	02494
James G. Higgins	02494
James N. Calvagna	02494
Jane Breslau	02494
Janice Bennett	02494
Janice Bennett	02494
Janice Chen	02494
Jason Stone	02494
Jason Tuchin	02494
Jayne Colino	02494
Jean S Higgins	02494
Jeff greenstein	02494
Jeffrey Euse	02494
Jeffrey Pearson	02494
Jen Oriel	02494
Jen Sieczkowski	02494
Jennie Jonas	02494
Jennifer Lichtman	02494
Jennifer Yogel	02494
Jeremy Fiset	02494
Jesse Kaddy	02494

Jessica Tobin	02494
Jillian Erdos	02494
Jim Cook	02494
JOAN E FEENEY	02494
Joanne Neale	02494
Joanne tedeschi	02494
Jodi feeney	02494
Jodi Rooney	02494
Jodine Kuhlman	02494
John Keene	02494
John Kopellas	02494
John Reidy	02494
Jonah Lichtman	02494
Joni Schockett	02494
Joseph Knowles	02494
Joseph Lichtman	02494
julia fraini	02494
Julia Pearson	02494
Julie Levine	02494
Julie Tracey	02494
Julie Traub	02494
Julie VanderKlish	02494
Juliet SooHoo	02494
Justin Finkle	02494
Justin Oriel	02494
K. Hannele Saramo-Raja	02494

Kara Williams	02494
Karen Bejian	02494
Karin Wilinski	02494
Karl T Velde	02494
Kathryn C Bender	02494
Kathryn Kraft	02494
Katie ross	02494
Kelly Close	02494
Kevin Henneberger	02494
Kevin Leary	02494
Kevin Reulbach	02494
Kim Marie Nicols	02494
Kristen Casey	02494
Kristi Bimbli	02494
Larry Keller	02494
Larry Stein	02494
Laura Rosen	02494
Lauren Eilberg	02494
Lauren greenstein	02494
Lauren Knowles	02494
Lauren Levine	02494
Lauren Ross	02494
Lauren Schuller	02494
Lawrence J Gage	02494
Lawrence tobin	02494
Le Truong	02494

Leigh Rossi Doukas	02494
LeRoy Ullrich	02494
Lesley Nemser	02494
Leslie Susan Prescott	02494
Lev Gaitsgory	02494
Linda Bleakney	02494
Linda Flueckiger	02494
Linda Garcia	02494
Linda Kean	02494
Liron gal	02494
Lisa Durkin	02494
Lori B Peljovich	02494
Lynn Rodman	02494
MaeLynn Patten	02494
Maggie Flanagan	02494
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Kenneth M. Phillips	02494-2148
Marjorie A. Phillips	02494-2148

David N Berkowitz	02494-2128
Kim E Stone	02494-2128
Courtney Elf Rowe	02494-1811
Leslie Duberstein Ofer	02494-1403
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Sharon Ellis	02492
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Shyan-Yuan Kao	02492
Siobhan O’Connell	02492
Stacey Marino	02492
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Stu Carpenter	02492
Sunny singh	02492
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Travis Jonasson	02492
Trish Roach	02492
Veronica Schauer	02492
Victor Saratella	02492
Wayne Olson	02492
Wendie Murstein	02492
Wolfgang Floitgraf	02492
Yelena Perchenok	02492

From: Peter Schuller
To: Planning
Subject: I object to the proposed rezoning for Muzi
Date: Monday, March 15, 2021 11:47:52 AM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Peter Schuller
25 Mills Rd 02494

From:	Jill Kahn
To:	Planning; Selectboard; Kate Fitzpatrick; Sandy Cincotta; jbulian@rcn.com
Subject:	Planning Board Zoom Meeting 3-16-21, 7:15pm
Date:	Monday, March 15, 2021 4:34:30 PM

Good afternoon -

Planning Board Meeting Tuesday March 16th, 7:15pm: please resend email to Planning Board list subscribers with a direct link to the Zoom meeting, so that interested citizens who would like to attend and participate may do so easily, without logging into Zoom, then entering the 878-8270-9890 ID, etc.

More folks would like to participate in Town matters - - let's make it more streamlined and straightforward for them to do so.

Also, please make sure that all participants can see each speaker, not just see the Article proponents. Participatory government is important and good. Many participants in the recent Zoom meeting on this topic, myself included, were very disappointed that we could only see the name of each speaker, not see the actual speaker. Unless it was an Article proponent. Then we could see the speaker. Please make sure we can view all speakers as they speak, just as we did in non-virtual meetings prior to March 2020.

Thank you.

Jill Kahn

Sent from my iPhone

From: ssabda
To: Planning
Subject: Muzi Property Rezoning
Date: Monday, March 15, 2021 6:01:30 PM

Dear Planning Board,

I am opposed to the proposed rezoning under consideration for the development project on the Muzi Motors property. The proposed 5 story buildings are way too tall and imposing on the surrounding environs, especially with only a 20 foot setback

There should be more green space included, and it is likely to cause a large increase in traffic to an already busy intersection. The process must take into consideration the Needham residents who will be in daily contact with these structures which will not be a welcoming "gateway" to my Needham neighborhood.

I intend to attend the zoom meeting tomorrow and hope that these concerns are addressed and can result in this project being scaled down.

Thank you.

Susan Abdalian
21 Lee Rd
Needham, MA 02494

From:	Laura Koebler
To:	Planning
Subject:	Proposed Rezoning for Muzi Ford Area
Date:	Monday, March 15, 2021 11:24:02 PM

I am writing to object to the proposed rezoning at the Muzi Ford area because it allows the possible development of 5-story buildings which may be too big for this area without sufficient setbacks, it does not provide enough green space, and may result in increased and unsafe local traffic patterns, especially around the A to Z Daycare Center nearby.

Bernard and Laura Koebler
193 Melrose Avenue

From: Tamara C. Takoudes
To: Planning
Subject: Muzi Ford re zoning
Date: Tuesday, March 16, 2021 8:18:59 AM

I object to the proposed rezoning for Muzi because it allows the possible development of 5-story buildings that are unprecedented on this side of Route 128 and too big with insufficient setbacks, not enough green space, and has resulted from an unreliable process while leading to too much traffic without understanding the incremental value to the town over a reasonably scaled-down project.

Tamara C. Takoudes
Maternal Fetal Medicine
BOSTON MFM
www.bostonmfm.org
One Brookline Place Suite 301
(617) 264-0364 (office)
(617) 264-0365 (fax)

If you are a patient please call the office.

Sent from my iPhone

From:	DOUG FOX
To:	Planning
Subject:	Objection to Muzi rezoning
Date:	Tuesday, March 16, 2021 9:24:58 AM

Hi,

I write to object to the Muzi rezoning for the 3rd time in 2 years. Your objectives for this rezoning of maximizing tax revenue are so misaligned with those of my/our constituents.

And these are not NIMBY's (not that elected officials should ever refer to any citizens that way). I am a town meeting member from precinct F, so deep in 02492.

Not that it should matter. I always feel I represent all citizens, not just the ones in my precinct. But in my polling of my network, it was pretty similar to the past 2 times I've done it. Only 1 citizen spoke out for the zoning, while 50+ spoke against.

The consensus is the increase in tax revenue is not worth the increase in size/traffic. And once again that is in direct opposition to the goals of your board and town leadership with this parcel. For this reason, I am recommending you do not bring the proposed zoning changes before town meeting.

I am always pushing the town to do more data driven decision making. Hire a research company to survey broad swaths of the town on their goals for development overall. Not just at Muzi. Ask them whether they prioritize tax revenue or traffic reduction, retail amenities or small town feel, affordable housing or office space. Then the town's elected officials should follow the will of the people and let that drive our zoning.

I know there is a feeling from town leadership that we have to move on this now. I don't feel this urgency. But if you want to know what I would vote for now, here it is:

> I signed Barry Pollack's petition along with 600 others. Lower density with more green space. This would be the closest to a read of something acceptable to our citizens. So I would vote yes if you meet the terms of this petition.

> I would also vote yes to a pure residential rezoning. As of right it would match the residential area, ie multi family town homes. And on a special permit, building with more density for 30-40% affordable and/or senior housing. With each added story, an increase in %. And based on the new legislation, with a simple majority, you may not even need my vote.

Lastly I also fear with the continued release of public information around the workings of town leadership on this matter that this could lead to a very contentious town meeting. And one that will not reflect well on the town nor its leadership. That is another reason to think long and hard about what you bring (or don't bring) to town meeting.

Thank you.

Doug Fox
TMM Precinct F

Sent from my iPhone

From: Richard Putprush
To: Planning
Subject: Fwd: Proposed re-zoning of Industrial-1
Date: Tuesday, March 16, 2021 12:58:55 PM

Members of the Needham Planning Board,
As an important follow-up to the concerns of which I wrote to the Board on February 15, please see the link below to an article that appeared in the Boston Globe this morning that further supports my concerns. Again, I believe the public needs to be made aware that if action is not taken regarding the proposed zoning of Industrial 1, and further delays are the result, what can happen next may end up being the opposite of what the residents were hoping to see, to the detriment of Needham as a whole.

Rick Putprush

https://edition.pagesuite.com/popovers/dynamic_article_popover.aspx?artguid=fb694d40-396c-45a9-861b-23f452df3b03&appid=1165

---------- Forwarded message ---------
From: **Richard Putprush** <rick.putprush@gmail.com>
Date: Mon, Feb 15, 2021 at 5:14 PM
Subject: Proposed re-zoning of Industrial-1
To: <planning@needhamma.gov>

Members of the Needham Planning Board,

My name is Rick Putprush and I am writing to you as a concerned Needham resident (97 Manning Street), Needham business owner (Partner at Fulcrum Real Estate Partners, LLC, 935 Great Plain Avenue), and long-time member of Needham's Council of Economic Advisors (CEA). Over the past several years, I have had opportunities to voice my opinions on various matters of the Town, including the on-going discussions regarding the potential re-zoning of the current "Industrial -1" zoned area bordered by Gould Street, Highland Ave and Rt 128 (for sake of simplicity, hereinafter referred to as the "Muzi site") which is the topic of my concerns.

First, I applaud the inclusive process the Select Board has undertaken, and its desire to reach the required consensus in this matter. The goal has always been to convert the zoning of one of the last remaining major development sites along Rt 128 to its "highest and best" use, greatly increasing the tax revenues from the site to the relief of our residents, creating additional high paying jobs for our residents and others, as well as creating an architecturally pleasing entrance to Needham. The public concerns, in general, have always revolved around the increased traffic, particularly on Highland Ave, Gould Street, and Central Ave, fears of creating a "monolithic canyon" down Gould Street, and whether or not a less intensive "recreational" use might be better.

My concern is that the public does not realize or understand, especially considering their issues, that the current Industrial-1 zoning could allow the very situation they are hoping to avoid. Under the current zoning, if I'm not mistaken, approximately 300,000 square feet of 40' high warehouse/distribution space could be developed. Five years ago, this would be an unlikely scenario because such a development would not generate a "market value" for the

site. However, things have changed...the trend of internet shopping, e-commerce, has taken hold, ever more pronounced by the COVID-19 pandemic, with no signs of stopping, prompting the Amazons, Walmarts, etc., in this space to find new site locations meeting demographic and major highway access criteria for modern (1,000,000 SF) distribution hubs, and smaller satellite "fulfillment center" distribution centers. My company, Fulcrum Real Estate Partners, specializes in investment in industrial properties, and consultation services for various types of users for site selection. In our recent experience, we are learning that for the right location, price (whether it is for the site for their own development or for leasing a property built for their own specification on the site) is becoming a less important and influential criteria than others. Access to major highways, workforce, customers...and the ability to occupy relatively quickly without the risk of having to spend an inordinate amount of time and money for approvals and permits to operate their business with no guarantee of success...have become the major drivers. In short, the e-commerce giants will compete on price for a well-located site where they can develop a fulfillment center by right, with minimal oversight by the Town.

Again, having watched and participated in the public process of the proposed re-zoning for almost 5 years, I am concerned that the public still does not recognize or understand the potential problems that the continuous delay and revisiting of the merits of the rezoning may bring. The point here is that a 40' high, 300,000 SF "monolith" warehouse/distribution "fulfillment center" on the Muzi site, bringing 24/7 tractor trailer, box truck and van traffic on Gould Street and Highland Ave is not as far from a potential reality under the current zoning as the Planning Board, or the residents who are fighting what I personally believe to be a reasonable and well-thought out zoning change, might think it is. If it were to happen, it would be an incredible missed opportunity for Needham, in my opinion.

I support the Highway Commercial 1 rezoning effort and thank the Board for its consideration of my concerns.

Sincerely,
Rick Putprush

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Rick Putprush
Fulcrum Real Estate Partners, LLC / REP Realty Advisors, LLC
935 Great Plain Avenue, #123
Needham, MA 02492-3030
617.697.9750
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Suburbs gather to map Amazon's 'last mile'

Wary of warehouses, seek a regional plan

By Tim Logan, Globe Staff

In an ever-escalating race to get packages to your door faster, Amazon is opening shipping centers at a rapid clip in suburban towns all over Greater Boston — more rapidly, in fact, than those towns can figure out how to regulate them.

Now some of those suburbs are joining forces, trying to devise a regional approach to managing traffic and other issues related to all these warehouses, and to make sense of a segment of the retail industry that has grown rapidly during the COVID-19 pandemic and shows no signs of slowing.

The Metropolitan Area Planning Council recently released a 64-page report on the spread of e-commerce in Massachusetts. It focused on the front lines of the industry, the last-mile distribution centers that serve as way stations for packages dropped off overnight by the truckload and ushered out each morning by fleets of delivery drivers.

They're cropping up all over Greater Boston, as Amazon and its competitors expand their delivery networks closer to where customers live.

"There's an expectation now that deliveries happen ASAP,'' said Alison Felix, a transportation planner who wrote the report. "To meet that demand, companies are really focusing on these distribution centers.''

Amazon has 20 of them in Massachusetts — 10 of which opened since the start of 2020 — and 14 more are in the works, according to the council's report. When they're all up and running, Amazon will occupy 12.1 million square feet of warehouse space in the state, most of it along or inside Interstate 495.

Earlier this month, the Globe reported that Amazon is in the running to secure a site for a major shipping center at Widett Circle, just south of downtown Boston. The company is considering malls and big-box stores, too — former brick-and-mortar retail spaces that can be repurposed for the online age.

Other major retailers are also gobbling up warehouse space. Last week, home improvement chain Lowe's leased a 179,000-square-foot warehouse in Wilmington,

while Peloton earlier this month signed a five-year deal for a 75,000 square-foot shipping center in Middleborough, the better to get its exercise bikes to buyers faster.

No one, though, has an operation like that of Amazon, whose trademark blue delivery vans and legions of "Flex'' drivers in their personal cars fan out in waves from warehouses, sometimes several times a day.

Those trips take them through communities such as Dedham, where the company is seeking permission to more than triple the size of the 60,000-square-foot shipping center on Sprague Street it opened about five years ago.

Even at its current size, neighbors say, traffic generated by the busy warehouse clogs nearby streets with hundreds of vehicles a day. Residents are often roused from their sleep in the wee hours by the rumble of 16-wheelers. Some residents are pressuring the Planning Board to rein in Amazon's expansion plans, and the project has been stalled for months as the debate continues.

It can be hard to strike a balance between the desires of residents and the needs of businesses that occupy the same neighborhoods, said Dedham planning director Jeremy Rosenberger. That part of Sprague Street, just over the town line from Boston, has been industrial for decades and is zoned for warehouses.

Amazon wants to expand into space that was vacated by distribution centers for Macy's and Restoration Hardware, but those kinds of warehouses generated far less traffic.

"Trucks would come and go, and workers would arrive and leave, but it'd be pretty quiet,'' Rosenberger said. "Amazon runs a 24/7 operation.''

Adding to the frenzied activity, Amazon has changed the way it operates warehouses, speeding up delivery cycles and bringing in more drivers to meet customer demand. About five years ago, Everett approved a 51,000-square-foot Amazon warehouse on Beacham Street, near its bustling produce center along the Chelsea line. The city thought it had a handle on the amount of traffic Amazon would generate, said Jay Monty, a transportation planner for Everett. Then Amazon launched Flex.

"Everything changed. Suddenly [personal cars] were driving a lot in and out of the place,'' he said. "It's a much harder thing to track, much harder to regulate.''

The city is now asking operators of large warehouses to craft transportation management plans — the sort of consideration more commonly associated with big mixed-use developments in Boston — as they go through permitting. Monty hopes it will help mitigate the impact of a 222,000 square-foot distribution center that was recently approved for the city's bustling warehouse district. No tenant has yet been announced, but Amazon is always a possibility.

Then there are towns that don't have an Amazon warehouse, but are nonetheless affected by them.

This includes Wrentham, which straddles Interstate 495 just north of Rhode Island. There are Amazon distribution centers nearby in Bellingham and Milford and another one preparing to open next door in Mansfield. Amazon leases the lot of an undeveloped shopping center site in Wrentham as a satellite parking for delivery drivers, said planning and economic development director Rachel Benson. That alone generates dozens of extra car trips at busy times of day, and even causes lines at gas stations.

"I get calls about it all the time,'' Benson said. "People ask, 'Did you approve one of those Amazon warehouses?' ''

She is part of a group of local planners and administrators in the southwest region of Greater Boston — where Amazon's distribution network is thickest — who are starting to think about solutions that are broader than what any one community can execute.

That, Benson said, might include working with the Massachusetts Department of Transportation — which maintains many of the roads that delivery drivers travel — to better regulate traffic. Or it might involve mandating the kind of rigorous state environmental review that's typically required for larger office or residential projects, but not for most distribution centers.

The Metropolitan Area Planning Council is collaborating with Benson and her colleagues on a variety of ideas. The agency's recent report floats the prospect of requiring e-commerce companies to share more data about their delivery routes or offering incentives to minimize trips. Eric Bourassa, director of transportation at the council, acknowledged that it doesn't yet have an answer for dealing with the proliferation of Amazon centers.

"We raised more issues than we actually have policy solutions for at this point," he said.

Amazon disputed some of the report's findings, saying it "is not an accurate reflection of the benefits associated with our growth in Massachusetts." Warehouses, the company said, effectively reduce driving by replacing car trips of individual shoppers with a single delivery van. It added that Amazon has created 20,000 jobs across the state in recent years and has invested $6.2 billion over the last decade in Massachusetts facilities, infrastructure, and worker pay.

There is no disagreement over the reality of the e-commerce boom. Online shopping accounts for about 14 percent of retail sales, but that number has doubled in the last five years and continues to increase.

"What happens when it doubles again? When it gets to 30 percent?" What does that look like?" Bourassa said. "We're really only at the beginning of this."

Tim Logan can be reached at timothy.logan@globe.com.

From: Larry Stein
To: Planning
Subject: Muzi Zoning
Date: Thursday, March 18, 2021 1:49:17 PM

Dear Planning Board,

I am writing you to share my thoughts on the proposed re-zoning of the Muzi Ford site.

I have lived in Needham, more specifically in the Heights, for over 40 years and have seen our wonderful town grow and develop in so many ways that make me proud to call Needham home. I can still remember walking to Chanel 5 for the annual Labor Day carnival, riding my bike to Mills field to play tennis, baseball and basketball and I even recall people ice skating on the "pond" at Muzi Ford. While I don't expect time to stand still, I do think that the town has a unique opportunity to ensure that the zoning and any future development at the Muzi site is reflective of the **needs and desires** of its citizens.

The planning board's hearing on this topic earlier this week was both troubling and disappointing and as such I urge you to put down your pencils and listen to the concerned citizens of Needham as to how **WE** would like to see this property zoned as the plans presented this week, are not in the best interest of our town. I am confident that an open, transparent and collaborative exercise will be in the best interest of our entire community.

Regards,

Larry Stein
20 Harvard Circle
Needham MA 02494
Sent from my iPad

From:	Holly Charbonnier
To:	Planning
Subject:	Muzi/Channel 5 Site Rezoning Proposal
Date:	Thursday, March 18, 2021 2:11:01 PM

To the Planning Board,

I have been following this proposal for a couple of years and have attended all of the meetings open to the public. During the March 16th meeting, I had my hand raised and was never called on to share my questions and concerns with my fellow residents. I submit the following as my 2 minutes of speaking, and request that the Town not move forward with any votes until every Needham Resident that wishes to speak gets heard. (I was very disappointed with the setup of this last meeting, Adam Block spoke to Needham residents in a condescending tone and kept interrupting them so they couldn't speak clearly for their full time.)

My comment:
I have been working in the design industry since 1997, so I understand the need to improve neighborhoods and the desire to develop bigger and better things. However, over the past decade, Smart Growth Strategies have become more popular for good reason. Developing just for the sake of money does not improve a town. There needs to be a strategy in place to grow from the core of the town out, not in reverse. Natural growth starts at the core of any town or city - their business district. As it grows and spreads, the town becomes more prosperous. The current rezoning proposal is setup to do the opposite. We have height limits in the core and are looking to allow mid-size buildings three-stories above the current standard on the outer edge. Smart growth says that you should only increase a development by 1-2 stories at a time. That would mean that the zoning should put 3 story as right and 4 story as special permit.

There is more to Smart Growth than just height. As we know, we should be considering the environmental impacts of the site as well. A 1.0 FAR (and worse a special permit for 1.35 FAR) would be too dense for a town of our size. Looking at Smart Growth principles for a small town, I believe .85 FAR would be more than sufficient. Additionally, we should be requiring that any new development in our town meets the standard requirements for LEED Gold certification. Most new developments around the state of Massachusetts seem to be striving for LEED Platinum or even Net Zero. It seems irresponsible or maybe just neglectful to put no requirements at all.

Finally, we have the setbacks. 10' and 20' of setback provides no buffer for the residential housing surrounding this site. While we would love to (and dream of) 200', I also know that is an extreme request. I do not think; however, requiring 50' is too extreme of an ask. I believe if you came in with a 50' setback, many residents would be more accommodating. With any required setbacks, we also need to consider minimum open space. 20% is insufficient. A developer can add a little green around the perimeter of the site and meet the 20% requirement. Looking at our neighboring towns: Wellesley, Weston, Dover, Concord - towns we aspire to be like - they have 35% and 45% open space requirements. Our percentage must be increased.

Needham is a town. We are not the urban city of Newton, nor do we want to be. Newton has made many mistakes with their rezoning and developments. Their once quaint villages have been overrun with tall buildings and traffic. People no long flock to those sites, and the sites have become an eyesore for the residents. What we do now sets a precedent for future building and development throughout Needham. We need to protect and preserve our walkable town, the character that lives and breathes on these side streets, with neighbors talking and enjoying the late afternoons, children riding their bikes yelling "car" every five minutes to move out of the way, doors unlocked with no fear for our safety. Needham is special, and I fear that this change, if it continues as you have proposed, would change Needham into an urban blight.

I urge you to please, reconsider this rezoning. No amount of commercial tax revenue will save this town if people no longer wish to live here.

Holly Charbonnier
94 Sachem Road, Needham Heights

From:	Courtney Elf Rowe
To:	Planning
Subject:	ReZoning in Muzi Ford area
Date:	Thursday, March 18, 2021 2:17:58 PM

Hello to all on the Board!

I know there has been some contentious discussion on the subject of the Muzi Ford area and its future. As a resident of Needham Heights, I just wanted to voice concern with the idea of large scale buildings eventually going into that space. I regularly experience heavy traffic already on both Central Ave and on Highland between Gould/Hunting and Webster to Hunnewell Streets. I fear that adding a high-capacity building will only add to extreme traffic issues around that area. Furthermore, I am concerned that the ability to build large warehouse sized bulidings will detract from the neighborhood feeling of the Heights; already, the areas off of Gould feel very corporate, and I would hate to see more of that. I know you are being bombarded with opinions and I respect all the hard work you are doing. I just wanted to add my voice so that when you weigh options you would have a broader sense of how those living close to the area of discussion are feeling. Thank you so much for your time!

Sincerely,
Courtney Rowe, Lakin St, Needham Heights

From:	Jesse Kaddy
To:	Planning
Subject:	Muzi Rezoning
Date:	Thursday, March 18, 2021 2:26:12 PM

Regarding the Muzi rezoning:

Assuming you may have received a large amount of emails on this subject, I assembled a list of easily skimmable pros and cons I would like to share:

Pros:

- $5m in tax revenue for the city

Cons:

- Increased traffic and noise pollution near the Mills field playground, baseball field, basketball court, and tennis courts
- Increased traffic and noise pollution in residential neighborhoods that are *already* being used as a bypass when traffic backs up at Central/Gould + Highland/Gould (Arnold St, Beech St, Evelyn Rd, etc)
- Residents being forced to forfeit their property to accommodate additional lanes of traffic.
- Large structures that push Needham Heights further away from a residential area, and towards a commercialized/industrial area.
- Potentially unsightly or monotonous structures that aren't aligned with the spirit of the town we're trying to convey to visitors who enter this "gateway"
- The environmental impact that comes with maximizing the structural footprint of the parcel, and which does nothing to offset the carbon footprint of this development.
- A continued lack of public transit options, which will likely result in a compounded increase in traffic.
- A less walkable and bikeable area.

Overall, after watching the planning board meeting on March 16th in its entirety, I was profoundly disappointed with the presentation of the new build out analysis. The presentation, together with **Adam Block**'s demeanor, make it appear that the planning board does not have empathy for the residents who would be most negatively affected. This makes me draw a conclusion that Adam Block, and the greater planning board are focused *strictly* on maximizing the value of the Muzi property, and the future tax revenue that can be generated by the parcel. All of this at the expense of the residents of Needham, and those who enter the gateway in the future.

On a more granular level, I was disappointed that the traffic study did not include data for Beech Street or Arnold Street, both of which are often used as a bypass when traffic backs-up at the Gould/Central intersection. As a result, I *frequently* observe vehicles speeding through these otherwise quiet neighborhoods to avoid the congestion.

Given all of the above, my recommendation would be for the planning board to maintain the existing zoning for the parcel. This would give Needham and it's residents future leverage if and when a builder makes a plan for the parcel. As far as I can tell, the *only* benefit to change the zoning *now* would be to maximize the value of the parcel for the seller.

Best regards,
Jesse Kaddy
8 Arnold St.
Needham Heights MA, 02494

From:	Steve Buratowski
To:	Planning
Subject:	Opposition to the Muzi property re-zoning plan
Date:	Thursday, March 18, 2021 2:41:50 PM

To the Planning Board,

As a long-time Needham resident, I am writing to express my opposition to the current re-zoning proposal for the Muzi property. This "gateway" to Needham is already highly congested. The proposed development will bring too much additional traffic, depress property values in the neighborhood, and reduce the quality of residential life in Needham. Central and Highland Avenues are already choke points for commuters like me and this development will make things far worse. We are a small town, with no need or desire for an "urban edge".

I am also deeply disturbed by the emerging evidence that members of the Planning and Select Boards have been colluding with each other and representatives of the Muzi people to force this proposal down the throat of Town Meeting, who rejected an earlier version of this proposal not long ago. I am also disturbed that Mr. Adam Block purported to represent the residents of Needham Heights while also pushing the Muzi proposal as a member of the Planning Board. These hidden communications raise questions about who the Planning and Select Boards think they are supposed to represent, and I suspect voters who find out will take the appropriate actions to make that issue clear.

I urge you to re-think the proposal and downsize appropriately to better preserve the small town residential character of Needham.

Sincerely,

Stephen Buratowski
706 Webster St.

From: Karin Wilinski
To: Planning
Subject: muzi site
Date: Thursday, March 18, 2021 3:13:37 PM

To the Planning Board re: Muzi parcels:

Use this singular chance at rezoning in a way you won't regret. I am concerned with multiple aspects of the proposed rezoning:

1 - SCALE - Needham doesn't need creep of massive buildings from the other side of the highway. This is primarily a residential area, with many young children trying to ride bikes and play. If you do anything now, use rezoning to scale down what can happen there. People are more likely to support it.

2 - TRAFFIC AND LAND TAKINGS - On March 16, I heard "not proposing at this time" re: any land takings, which was NOT a promise that takings are off the table. That kind of equivocation is what makes people shudder about politics. I think we all understand (from the Nov 2020 joint meeting) that the planning board believes that in order to alleviate expected traffic conditions at Central and Gould, and at Highland and Hunting, residential property takings would be necessary (as well as taking from the Muzi site itself for the turn to/from highway). Besides that this residential area has endured projects for the past 7 years (highway widening, new exits, and the current Highland widening which seems to be in construction purgatory), the takings would be from comparatively small parcels (compared to other parts of town) thus taking a larger percentage of the owner's property, and on some of these houses leaving their front door literally on the street. Scale down the project and possibly avoid the traffic nonsense that would lead to land takings.

3 - SETBACKS - Large buildings with 20 foot setbacks are absurd. Why bother? Just put the building right up to the road and call it a day, since there's little room to mitigate the massiveness when you only have 20 feet to work with. I imagine Wingate was a compromise to get the setback on the corner along with mounded, attractive, and concealing landscaping. Twenty foot setbacks along with additional travel lanes will make attractive landscaping unlikely if not impossible. Instead, force major setbacks that include attractive green space.

I suggest you go look at Elm St next to Legacy Place to see lane widenings with unattractive and unwelcoming buildings. The entire point there was to create a race to the highway - and we don't need more of that here.

Yes, with the above compromises, you would lose tax income, but please do this zoning right so that Needham doesn't regret this rezone forever. You probably get one chance at this, please do it right.

Karin Wilinski
36 Hunting Rd

From: Sussman Family
To: Planning
Subject: Response to Needham Plans of Muzi Ford
Date: Thursday, March 18, 2021 3:19:42 PM

I was very disappointed with the format of the meeting which did not allow the residents to speak enough. My dealing with the Planning Board is based on their token open ears when Beth Shalom was expanded. They listened but did not hear thus the developer/owner got everything they requested with as few concessions to the neighbors as possible. Actually, I can't think of any, we were collateral damage. I wasn't as involved with the Charles River Landing but remember the neighbors were squashed there as well. I am sure there are other examples. The Muzi Ford project at this point seems to be heading in the same direction and then we'll get "the owner has the right to develop their property" song and we, as a town/board/committee, have little influence. There are issues with density, traffic, light pollution, green spaces, height restrictions, setbacks, buffers, physical attraction as the Gateway to Needham. Think with a vision not same old same old or it will end up looking like Rte 9 in Natick/Framingham or Rte 1 in Norwood. Just more overdeveloped commercial property which will benefit a few but not Needham and certainly not the neighborhoods close by. Mr Pollack should have been able to finish speaking since he was unofficially representing many. The board knew this and created the format purposely to silence his information. Shameful. If you can grant special permits to builders, grant a citizen the necessary time to make their points. The woman who made the presentation did not even know that this is not exit 19B anymore. Traffic data is questionable and data can be interpreted in various ways. I have lived near this intersection for 30 plus years. "You don't need a weatherman to know which way the wind blows".

From: Lulu Friedman
To: Planning
Subject: Muzi
Date: Thursday, March 18, 2021 3:34:02 PM

Hi,

I know this emails are due today.

I live in the area close to muzi, and we really think that adding more and more apartments to area will cause tons of traffic and and overflow on schools.

Please don’t approve such a big project

Thanks

Lulu Friedman
(508)561-2206
12 Harvard circle
Needham, ma

https://linkprotect.cudasvc.com/url?a=https%3a%2f%2fwww.dididesigngroup.com&c=E,1,SRnzBboMsfvtcYDOPNyxHqnl2-l2J7y4sELtjzWBtoXQbNjli9Bl8Cemmmjs0zVEakVIVwtWZwWRwRAv1o2jiSxLQmKLxA-mjd5SaROnZGeuRQ.,&typo=1
- Sent from a Mobile Device -

From:	Carol Stuckey
To:	Planning
Cc:	Selectboard
Subject:	Muzi Re-zoning Concerns
Date:	Thursday, March 18, 2021 3:41:18 PM

Dear Planning Board,

I am writing to express my disappointment with the Muzi re-zoning process and proposal. While I welcome new development on that parcel of land, I do not feel the current zoning proposal is acceptable.

Key concerns with the proposal:

- Proposed 20-foot setback is inadequate both from an aesthetic and green space perspective, but most importantly from a pedestrian safety aspect. Increased car and foot traffic in that area warrants a larger setback to accommodate strong curbs and a grass verge between the street and sidewalk.
- Traffic data does not take into account further planned development on the Newton side of 128 (Needham Street), nor the new development at the former Three Squares restaurant.
- Given the change in work habits from the pandemic, it is unclear what the demand for office space will be and whether the percentage of office space to residential and retail as outlined in the proposal makes sense in the post-pandemic world. A real-estate developer that approaches with a proposal will have a better handle on that.
- The proposal seems fully focused on squeezing out every last bit of tax revenue without regard to the livability and walkability of the area, nor the proximity to Mills Field. We can do better.
- The planning board has not addressed why the change in zoning is necessary at this time. The seller seems to be the true benefactor of this rezoning. It seems prudent to wait for a developer to come forward with a real proposal and consider rezoning at that time.

Key concerns with the process:

- The current proposal has changed very little from the original proposal voted down by Town Meeting. I question whether it meets the threshold of a substantive change.
- From the public records request, there seems to be inappropriate contact with the Muzi owner during this process, as well as several conflicts of interest that are concerning. While the planning board attempted to characterize these as “personal attacks,” in the zoning meeting, I think the real issue is that there is a widespread loss of faith in the planning board from those it should be serving.
- I am deeply disturbed by the lack of genuine interest the planning board members have in receiving input from residents. I, along with nearly 200 fellow Needham residents, attended the very lengthy March 16 Planning Meeting. I found the concerns raised by my neighbors to be intelligent and articulate. During that meeting, it was clear from the demeanor of Adam Block and Jeanne McKnight that input from Needham residents is not genuinely welcome or

appreciated. I was appalled by the lack of respect exhibited by the planning board. From the public records request, it is also clear that other members who have been involved in this process share this same aversion to receiving input by characterizing residents' concerns simply as "NIMBY."

Given the level of pushback on this proposal, I would expect the planning board to refrain advancing it forward. I also hope that members of the planning board will consider whether they are truly public servants seeking genuine and respectful input from Needham residents, or if it is time to step down.

Kind regards,

Carol Stuckey

6 Gary Road, Needham MA

From: Joan Berlin
To: Planning
Subject: Muzi rezonning
Date: Thursday, March 18, 2021 3:48:23 PM

As a resident of Needham Heights, I am opposed to the changes proposed by the Planning Board.
If Muzi wants to sell, then they should sell without the assistance of the town. A developer is welcome to buy the property and then submit their ideas for development. The town can then vote on an actual project...not a hypothetical.
There are way too many concerns in your current plan. Not to mention the taking of property (mine is not impacted.).
Needham is not a city. It's supposed to be a bedroom community.
Let the town decide on an actual plan. Let a developer make decisions based on town concerns.
Thank you.
Joan Berlin

From: Nathanson,Larry (HMFP - Emerg Med ISClinical RaD)
To: Planning
Subject: Comments from Larry Nathanson, Noanett Rd, Needham
Date: Thursday, March 18, 2021 4:20:54 PM

To the Planning Board:

I'd like to add my voice to the concerns over the negative traffic impact that increased development in the "Highway Commercial 1" area may bring.

In addition to increased congestion of the major roads, I'm concerned Noanett Road and the small connected side streets would see very negative impacts as frustrated drivers try to cut between Gould and Central. I was very disappointed to see that the effects on Noanett and side streets was not included in the traffic study.

Ideally I'd love to see commercial development balanced with other uses that more directly benefit our residents (ie, green space, etc). I realize that this is a trade off against the enhanced tax revenue that would be realized. We are extremely lucky that Needham has multiple other industrial areas that are better separated from the residential neighborhoods.

I'd like to add that while the vigorous debate on this topic is good for civic engagement, the level of some of the rancor I am seeing is regrettable. Despite our differences on this issue, I'd like to thank the planning board as well as our other local leaders for their professionalism and their dedication to Needham.

--Larry Nathanson
Noanett Rd, Needham

From:	Julie Devoll Tracey
To:	Planning
Subject:	Objection to the zoning change at Muzi
Date:	Thursday, March 18, 2021 4:30:49 PM

Dear Needham Planning Board,

My name is Julie Tracey and I reside at 33 Beech Street in Needham Heights. I'm writing to object to the proposed zoning changes to the Muzi/Channel 5 property.

If you've ever driven down Gould Street in the morning and again in the late afternoon, continuing into evening, you'll notice a back-up of cars waiting to turn onto Central Ave. As such, car after car after car cuts down Beech Street to get around the traffic - to then get to Hampton so they can get onto Central from there. People do this even with the sign that says do not turn from 7-9 AM and 4-6 PM. The sign is largely ignored.

Beech Street has 9 houses on it. And for the most part, the residents are young children and senior citizens. The speed by which the existing traffic drives down Beech is maddening, and frankly, scary at times. Now imagine this scenario with the new zoning--and the potential for a huge increase in traffic.

When the traffic is backed up even further on Gould - people cut down Ellis Street which abuts Mills Field and the tennis courts--largely enjoyed by kids and families.

When asked at the March 16th Town Meeting why these streets weren't included in the traffic study - we were told they'd be included in the next round--AFTER the zoning change and when a developer was brought in. Why is that? Why wouldn't the needs of the entire area be taken into account before making a decision? I suspect because if they had studied the traffic patterns on these side streets - they would have seen a different picture than what was portrayed to residents at the meeting.

I am all for growth in Needham - but making a zoning decision of this magnitude before Muzi is even looking at buyers is irresponsible and ignores the residents who stand to lose their quiet side streets. (I haven't even raised Noanett---also already a cut through that will be made worse by the traffic.)

Please take these thoughts and the thoughts of the 700+ Needham Heights residents into consideration. Needham will benefit from the taxes of whoever buys the property. Why does it have to be so large as to disrupt neighborhoods filled with the families that make up this great town?

Thank you for your time and consideration.
Sincerely,
Julie Tracey

From: Jennifer Kaddy
To: Planning; Selectboard
Subject: Muzi Ford/Gould Street
Date: Thursday, March 18, 2021 4:41:13 PM

Good afternoon,

I am writing to share my opinion on the proposed rezoning for the Muzi Ford/Gould Street site.

First, I strongly oppose rezoning the site without an updated traffic study. The current study is outdated and does not reflect the current traffic conditions in the immediate neighborhoods. My family lives on Arnold Street, and over the past couple of years, we have noted an increase in cars speeding down our road as a cut through to and from the highway and Central Avenue. Our neighborhood includes young children (including our son, who is disabled) as well as elderly residents who should be able to safely walk, bike, and cross the streets. Last year, our family purchased a Kid Alert Visual Warning Sign with Flag to post outside our house to alert drivers to the dangerous situation. Without an updated traffic study, the town cannot understand the current conditions and plan responsibly for zoning changes. This may not be the most affluent neighborhood in Needham, but we deserve proper analysis prior to making a decision of this magnitude.

Second, in the recent meeting, one town official suggested that Needham Heights residents would be opposed to any zoning change simply because "change is hard." This is untrue, at least for me. Personally, I would welcome the redevelopment of the Muzi Ford site, as I believe that the aesthetics of the area could be improved in the process, while also providing tax revenue to the town and potential opportunities for development that could serve the greater goals of the community (including lower income housing). However, I believe that Needham can and should hold itself to a higher standard for green space and livability. We should rezone the area in a manner that ensures that a developer will create something we can be proud of, something that will enhance the neighborhood and set the standard for environmental stewardship in town. Increasing the setback and the required green space around the property could go a long way in convincing me that the zoning change should be made.

Finally, please keep in mind that just because there is an industrial area nearby does not mean that Needham must position itself for the maximum amount of additional industrialization. Drive through Needham Heights, and you will see many residents doing their part to protect the environment—installing solar panels, driving electric vehicles, collecting rainwater for irrigation, replacing lawns with native trees and shrubs. We do this not because it is easy or profitable, but because we feel a fundamental responsibility to reduce our footprint on this ailing planet. As we all know, the issue of climate change is personal, urgent, and local. This belief should be at the forefront of any zoning decision.

In closing, the Muzi Ford site is more than a piece of land; it is an opportunity to set the tone for future commercial development in Needham. Let’s hold ourselves to the highest possible standard.

Sincerely,
Jennifer Kaddy

8 Arnold St.

From: Joni Schockett
To: Planning
Subject: Muzi Rezoning
Date: Thursday, March 18, 2021 4:42:29 PM

March 18. 2021
To Whom It May Concern:
I am writing in strong opposition to the Muzi rezoning proposal as it now stands. It is far too big, it is disrespectful of the residential area residents who abut the property, and it disregards all that was stated by the residents at meetings during the past few years.
I grew up in Newton at the corner of Aberdeen Street and Route 9. As a child I used to count the cars that came by as I tried to fall asleep. I once got to 100! But only once. When we played ball, we could run after the ball out to route 9 and safely retrieve our kickball. Times change. Coming home from work in Boston on Route 9 for 30 years, Route 9, to Elliot, to Central to Gould to Noanet finally made me retire. Once 35 minutes, the trip could take as long as 90 minutes. Times change. Traffic increases. The left turn to Gould was a daily exercise in frustration as I sat in the continuous Mobius strip of traffic every day. Once on Gould, I faced another snake of cars coming up to Noanet. Sometimes, it would take 15-20 minutes to get from Central to Noanet, usually a 2 minute drive. Imagine that with an additional 1,000 cars every day! I know Gould Street intimately, its traffic patterns, and its busy and quiet times. I have driven it for the 42 years we have lived on Evelyn Road.
I attended a meeting a few years ago at which 200 people expressed their concerns regarding the rezoning project in rebuttal of the proposal the Planning Board had presented. Almost every person who spoke requested small buildings, little retail, and lots of green, usable space for people, along the lines of picnics, play areas, and walkways. We expressed a need for more housing, elderly housing and affordable housing were both mentioned. Others desired a sports complex. The planning board seemed to hear us and said they would consider our concerns. This proposal does consider our concerns to a minimal degree – a very minimal degree. The FAR is too big, the green space too small, the height only minimally decreased. Traffic was not even minimally considered. That is not being sensitive to the needs of the people who live both right next to and very far from the property. It is being cognizant of and considerate of only the tax revenue that a development of this size and scope would create and the huge profit that would fall to the Muzi family, the GM, of which is involved in Needham political activities. This is a conflict that has not been addressed honestly.
The issue of traffic was and is a major concern and it has been ignored and obfuscated throughout these proceedings. The addition of 8,000 to 10,000 cars a day on these roads will lead to tragedy at some point, when some angry driver, having spent 40 minutes on Gould Street decides to cut through Noanet to any of the streets there, most likely Evelyn as it is the most direct to Webster. We have dozens of young kids who bike, roller skate, and play ball on these streets. Some even set up hockey nets and play street hockey. Those of us who live here, know these kids and drive these streets with the utmost caution. As my dad told me, when I got my Learner's permit, "If there is a ball, there is a child." There are lots of balls on these streets.
My children played at Mills Field throughout their childhoods. They would notice each equipment change and season and tree change and wildlife. It was so much a part of their lives that they would ask me to drive home on Gould Street, which they called, "The Park Way," so they could look at the park after school or in winter. Thousands of cars would make accessing that park difficult for anyone living across Gould from there. It is a tiny parcel of green that means a lot to this neighborhood. Most of us walk there. That will become dangerous.
The Daycare center there is at risk also. The fumes from thousands of cars a day are not

healthy for children playing in the playground on that site. This could ruin that business and good day care centers are very hard to find for young working families.
The bottom line is that the proposed building height is too high, the setback too small, the green space unusable and the FAR too great if we are to retain the residential feel of the Heights neighborhoods near that property.
On another note, I must say that this whole procedure has been difficult to watch. I have lived in Needham for 42 years. We love it and have always trusted our town officials to do what is best for its citizens. That is no longer the case and I am extremely disappointed.
The people at the NHNA meeting two years ago approached this issue with honesty and forthrightness. We believed what we were told and thought that the Planning Board had listened to our concerns. I stood up and voiced my concern for the commercial creep that was taking place beyond the Industrial park. That if Muzi fell to such huge development, it was not much of a stretch to see all of that side of Gould Street sell to the highest bidder and become nothing more than Industrial Park II. I then specifically asked if anyone from Muzi had spoken with the Planning Board. The gentleman hesitated and then said that no, no one from Muzi had spoken to town officials. I asked if the town had reached out to Muzi to find out what their plans were. Again the answer was no. That turned out to be a misstatement. As public records show, there are numerous, some insulting, emails between Planning Board members and Muzi personnel, one of who sits on the Economic Advisory Committee. This is a clear conflict of interest.
At the next meeting, the person who illustrated the traffic issues, stated that in order for there to be a 100 yard turn lane from Hunting to Highland, there would have to be a land taking. That would also be the case at Central and Gould. At the most recent meeting, she completely changed her story and said there would be no land taking required. Well, under that scenario, traffic would back up on Hunting in unacceptable ways. I drove that road for 3 decades, thought the 128 build, two bridge repairs and the house that was taken to make the Greendale to Nahantan turn. The traffic now backs up almost to Kendrick. Please tell us where the truth lies in this narrative.
There are other inconsistencies in what we have been told and what the public record reflects. The fact that this group, whose prime and only responsibility is to the people who elected them, has told us outright lies when we came to them in good faith, is unacceptable. We expect that our elected officials will deal with their constituents honestly and forthrightly. The public record shows otherwise and cannot be contested. Truth is truth. How might this have been different had the Planning Board dealt with us, from the very beginning, in an honest and trustworthy manner.
I hope that this plan is rejected and that the Planning Board and their experts decide to deal with the town's people in a more honest manner. Perhaps then, we can come to the table and resolve this to the satisfaction of the people for whom this is a tremendous and life altering issue. We all know that this property will change. We know there will be increased traffic. But, that change can be for the good of the populace or can be made to the detriment of their lives in the homes they love. It is your job to protect and plan for the best plan for the people who put you in this position of power.
Sincerely,
Joni and Michael Schockett
174 Evelyn Road

Joni

From:	Ashly Scheufele
To:	Planning
Subject:	Muzi/Channel 5 Rezoning
Date:	Thursday, March 18, 2021 4:43:01 PM

Dear Members of the Planning Board:

I object to the proposed amendment to the zoning by-law for the Highway Commercial 1 Zoning District (the "Muzi/Channel 5 site"). Needham can do better than what is currently on the table.

The proposed amendment would increase the allowable height from two stories to four (as of right) or five (by special permit). The FAR is also increased from 0.5 (as of right) and 0.65-.75 (by special permit) to 1.0 (as of right) and 1.35 (by special permit). The proposed height and density are not only a major change from the current zoning, they represent a departure from typical development on this side of Route 128. The Muzi/Channel 5 site directly abuts and impacts several residential neighborhoods, making it fundamentally different from the zoning districts on the other side of the highway. Development at the proposed densities would unfairly burden the Heights with traffic, taking Gould Street from three lanes at the Highland intersection to six. I strongly object to any zoning amendment, including this one, that permits the type of development existing east of Route 128 to cross the bridge into the residential neighborhoods of Needham Heights.

The proposed amendment requires the future developer of the Muzi/Channel 5 site to reserve only 20% of the site for open space. Twenty percent is insufficient, and as we saw during Natasha Espada's presentation, that open space is likely to be nothing more than an unusable patchwork of grass strips, most of which will directly abut the highway and offramps. Please use this rezoning opportunity to get creative about preserving green space and trees, and do not let developers cobble together strips of sod around the edge of the property and call it "open space." Zone for pedestrian accessibility and comfort, tree easements, and usable green space so that Needham Heights' commercial and residential uses can benefit from each other rather than being at odds.

The setbacks in the Proposed Amendment are drastically inadequate: under the proposed special permit dimensional regulations, a building could be built a mere twenty feet off of Gould Street and Highland Avenue. Constructing buildings of the height contemplated so close to a residential neighborhood fundamentally changes the character of the area. Instead of walkable town streets, we will have an urban shift at the Gateway to Needham. I object to the setbacks in the proposed amendment for this and other reasons.

I also note a provision in the proposed amendment, which I am still researching, that permits the Planning Board to issue a special permit waiving certain dimensional regulations (including, it seems, setbacks, FAR, and lot coverage) up to 25%. If this option were exercised, it would permit a FAR of 1.68, which is unacceptable. Citizens should also be made aware of this provision, which has the potential to shift important dimensional requirements by a substantial amount.

At the March 16th public hearing, citizens spoke overwhelmingly in opposition to the proposed amendment, echoing the more than 650 Needham residents who have signed a petition calling for the amendment to be scaled back. I urge you to listen to your neighbors and

constituents. We are not NIMBYs or categorically opposed to change. I do not object to change at the Muzi/Channel 5 site -- I object to decision-making that sells short citizens' legitimate concerns about protecting the residential character and livability of our neighborhood in favor of the relentless pursuit of increased tax revenue. Growing Needham's tax revenue is a worthy goal, but not at the cost of our neighborhoods, our safety, and our quality of life. I care deeply about Needham Heights and do not want to see it choked by traffic and the associated pollution, all for a marginal increase in tax revenue. Let's model intermediate options -- not just a warehouse vs. five-story commercial buildings -- so that the citizens can know the options and meaningfully participate in the process. Please reject the proposed amendment and engage in a transparent, data-driven rezoning analysis that welcomes input from the public on the possibilities for the Muzi/Channel 5 site.

Sincerely,

Ashly Scheufele
208 Webster Street, 02494

From: alyse winston
To: Planning
Cc: Selectboard
Subject: Rezoning of Muzi
Date: Thursday, March 18, 2021 4:54:09 PM

Hello.
I confess I am just getting caught up on the story of what the rezoning is about and what is proposed for that space.

While it is true that added businesses would increase the revenue in Taxes for the town, and that is an important point, there are other considerations that make Needham a town I want to live in, a town that many want to live in. Not everything comes with a price tag.

I researched 8 different towns, many years back. Sat in coffee shops, chatting with residents of those towns, including Needham, read the local papers, attended some free events, etc...all to get a feel of the town, the camaraderie - in short, all that a home town would offer. I bought my home in 1992 and have loved living here - the cozy town feel, small businesses and all sorts of town events, concerts, the senior center (a place I will frequent in the near future), the fabulous library and it's seminars, and the new recreation area !!! I have enjoyed them all. Collectively, that makes the town, that makes people want to live in this town - people who pay taxes in this town.

I live in the Heights and I will be affected by any industrial efforts encrouching on the residential area, **turning the area into a commercial and industrial center. No one wants to live in an industry.** Seeing tall structures, parking lots, more congested traffic than we have now....Needham street is already a nightmare as it is. Not to mention **noise levels.**

I want to see more walkable areas and little parks where people can relax and attend small social events. These are the things that make a town a home for so many.

I have not attended any meetings but I am reading all about them. I am understanding that there is disregard and a lack of empathy for the residents' concerns. And it is starting with a purposeful lack of listening. Again, may I remind the board that these residents pay taxes as well.

Can the board come up with a compromise that will BALANCE out tax revenue efforts and at the same time offer a small town feel? There are options here!

Please retain the existing zoning so that the town has more options for that space in the future.

Thank you for considering these concerns.

Alyse Winston
Needham

From:	Cynthia Landau
To:	Planning
Cc:	select@needhamMA.gov; finance@needhamMA.gov
Subject:	Muzi/Channel 5 Site
Date:	Thursday, March 18, 2021 4:56:04 PM

Ladies and Gentlemen of the Planning Board,
w/cc to Select Board, Finance Committee,
I am writing to object to your new zoning plan for the Muzi/Channel 5 site, and to give you some perspective on the reasons for my objections. Please do me the courtesy of reading this entire email, not just glancing at it to see if it is pro or con.
First, Needham is a small town, not a city or even a small city. In talking to my constituents, as a Town Meeting member, and to various friends in town, there seems to be a consensus that people wish to remain a town, not grow into a city. Nobody moved here because they wished to live in a city!
Second, we have current zoning laws that specify building heights, set backs, density in various areas, which have been widely agreed upon. When the Planning Board has brought proposals that greatly increase building heights and density, for the most part they have been rejected by Town Meeting (I cite the proposed development of the "Hartley-Greymount" parcel on Chestnut Street as well as the earlier proposal for the Muzi site). Priorities in town seem to be for preserving (or adding) green space, and for moderate building and development.
Third, I realize there is a lot of pressure from developers and real estate people (of whom there seem to be many on Needham's town boards) to develop to the max. Please recognize that they do not speak for the majority of folks who live in town. The Planning Board's, Select Board's and Finance Committee's goal to increase the tax base on commercial properties to alleviate taxes for homeowners is a noble one -- but the Muzi proposal carries that to an unnecessary extreme. A much more modest proposal, maintaining current building heights, creating more green space, etc., would also increase the tax base for the town, without overpowering the neighborhood in which it sits.
Please recognize that this is in the middle of a residential area of the town (despite being aligned with what you cite as the "commercial corridor" running down Chestnut Street and Highland Avenue). A dense development of four and five story buildings is out of place on this site. The town does not want an "office park" in this mainly residential space. The area on the other side of Rte 128 *is* an office park, appropriately separated from residential areas. It is not contiguous with this parcel.
Finally, I urge you to reconsider your proposal and scale it back to something we can all feel good about -- and more importantly, vote for. This *is* the gateway to Needham. It should be developed on a much more welcoming, human scale. It should not be 20 acres of buildings that overshadow all the surrounding buildings and homes.
Sincerely yours,
Cynthia Landau
Town Meeting Member Precinct C
57 Pine Street
Needham, MA 02492
781-455-0045

From:	Joan E. Feeney
To:	Planning
Subject:	Rezoning Muzi location/ Highland ave
Date:	Thursday, March 18, 2021 4:56:11 PM

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good afternoon,
I am writing to strongly voice my opinion about the current plan for rezoning.

I am against the planning department/town meeting/select people taking any action to rezone this parcel.

First, to zone the property with such a wide and broad stroke is no benefit to the town at this point. Let a developer come forward, and we can listed and entertain, and negotiate what is needed in regards to green space and traffic mitigation.

Second, the town's leaders (volunteer or paid) should not have been so involved with the current owner of this property. It looks like collusion to get the zoning changed, so the current owner can benefit from this zoning change in regards to his property value. this is not the job of the town.

Third, due to the potential collusion with town's leaders, the zoning change will NEVER sit well with the residents of needham.

Fourth, the Economy is such that businesses re-evaluating their office spaces, and several retail businesses have closed leaving empty locations. I am not quite sure the property would even be re-developed at this time, so there is no impending reason to do this.

Fifth, the entire process has not been fully transparent, and as such the clock needs to be stopped. The town certainly does not want the State's Attorney General in it's business with a review of this attempt to rezone.

Thank you for listening and for reconsideration,

Joan Feeney
74 Wayne Road, (in the Heights)
Needham MA 02494
781-444-8468

From: Peter Atallah
To: Planning
Subject: Feedback for Highway Commercial 1 Zoning
Date: Thursday, March 18, 2021 4:56:55 PM

Hello, I am a Town Meeting member (Precinct I), and I have been following the recent public meetings regarding Highway Commercial 1 zoning.
I feel that many residents are still concerned about three factors in particular:

- Traffic Impact - the current projections are for a very large increase in an already congested area, and mitigation plans are vague.
- Mass/scale of allowed development - it is natural to think about the current Needham Crossing scale and resist moving that density across Rte. 128 (especially looking at the Trip Advisor bldg.). Could you decrease the FAR in the proposal, for example?
- Lack of adequate open space - Suggestions were made regarding additional setbacks and increasing the % of open space, both of which seem prudent. There is a strong desire to factor in Quality of Life as a balance to the fiscal considerations.

I would ask that the Planning Board review the revised proposal and consider making further amendments to address these ongoing concerns. Thank you.
Sincerely,
Peter Atallah
617-306-1192

From:	Christine Mawhinney
To:	Planning
Subject:	Fwd: Muzi ReZoning
Date:	Thursday, March 18, 2021 5:01:18 PM

---------- Forwarded message ---------
From: **Christine Mawhinney** <cazmawhinney@gmail.com>
Date: Thu, Mar 18, 2021 at 4:57 PM
Subject: Muzi ReZoning
To: <@needhamma.gov>
Cc: <selectboard@needhamma.gov>

Hello Planning and Select Boards:

I am writing to you in reference to the ongoing discussion around re-zoning the parcel of land around Muzi Ford.

I am a town meeting member, precinct B. Since many of my neighbors have contacted me to express their concerns about this project, I feel compelled to write urging you to put the brakes on this train wreck immediately. I'll do my best to summarize the feedback I have received. Please know that these are not necessarily my personal sentiments, but what people in my precinct are saying to me.

- **Building height** -- they don't want to see anything above 3 stories. Period. Stop trying to slam in these large buildings around town in the name of taxes.
- **Set back** - do not change what's currently zoned.
- **Traffic** - is horrendous already and will worsen with the other projects across the line in Newton. Many residents feel our town does not really listen to concerns about traffic and are very off-put by that. Our town might want to think about "residents only" signs for all the streets that are used as cut-throughs. This isn't just around Gould Street, but really all along Central Ave. My street (Jarvis Circle) is a prime example along with Border Road off Nehoiden. This is a HUGE issue I heard about from just about everybody. It's got to be addressed. Not with old data, or data from right now when we're not at normal levels either.
- **Transparency** - some people want to see Adam Block immediately removed from the boards on which he serves. There is a concern that he is not honest and is acting in a manner that will just benefit his own wallet. Also, many believe that some members of the planning and select boards operate for their own interests and not for the community at large. They're outraged at the way Mr. Pollack was treated at the recent meeting via zoom.
- **Urban Edge** -- never ever refer to the borders of Needham as this term. It's completely off base. We are not densely populated like Cambridge and

Somerville, nor do we ever want to be. It angered people to see that members of the planning board casually use this term.

- **Housing** -- if it's to be housing, condos for over 55 and no families, not apartments. Our schools are bursting at the seams and we can't take any more increases to our enrollment.

As for my own opinion ... At town meeting, we have discussed this re-zoning issue several times. I am quite disappointed to see that yet again, another proposal is taking shape that does not reflect town sentiment. It feels like we are bending over backwards to make the Muzi parcel more profitable while ignoring the concerns being raised. Please do not waste valuable time at town meeting with this until you resolve the issues I've enumerated above.

Thank you for your consideration,
Christine Mawhinney

March 18, 2021

To the Needham Planning Board,

I am writing regarding the proposed rezoning of the Muzi property. I am strongly opposed to the proposal as presented during the Planning Board meeting on March 16th, 2021 for the following reasons:

1) The proposed 4-5 story building heights are too tall and are not in-line with the surrounding area. They will be an eyesore for anyone entering Needham, let alone the families in the surrounding neighborhoods.
2) The proposed 20' setbacks are inadequate. Having buildings right up to the roadway (the length of a passenger van away) without sufficient buffer will produce a tunnel effect on the gateway to Needham, leaving those in the vicinity staring at concrete facades.
3) The 20% green space allotment is inadequate and needs to be increased to 30% or more. We need more green space in this town for ourselves, for our families, and for our health.
4) The traffic studies were hand-picked from different time periods (some from 6 years ago) and the information was inconsistently presented from meeting to meeting. More current, transparent, and consistently described data is integral to helping members of this town make informed decisions.

I moved to this town almost seven years ago because of the small-town feel, the neighborhoods, and the community. Since that time, my neighbors on David Road have lost property to the highway widening and my neighbors on Highland Road have lost property due to the road widening. Each Fall I have to ask the Needham Transportation Department to bring the school buses across to the east side of Hunting Road so the kids do not have to cross the high-traffic road in the dark to catch the bus. Every day, even in the pandemic, I have to deal with people constantly turning around in my driveway. I've seen rollover accidents in front of my house on Hunting Road because people are trying to turn around. I've had kids almost get hit by cars turning around in our street.

To think of how many more cars there will be at the density currently in the proposal is disheartening, let alone frightening at what that could mean for the lives of my neighbors, my children, and anyone traveling in the vicinity.

I encourage you to consider submitting a more modest proposal that will still allow for increased tax revenue relative to current tax revenue, but put in boundaries for zoning that will not permanently and negatively harm the gateway to Needham and the immediate residents.

Sincerely,

Deb Whitney
36 Hunting Road, Needham Heights

From: Pam Fernandes
To: Planning
Subject: Inaccessible contact link/button
Date: Thursday, March 18, 2021 5:40:19 PM

Hello Needham Planning Board,

I am writing to express my concern regarding the current trajectory of the Muzzy Ford/Channel 5 property in Needham

I realize this email is a few minutes past your deadline. I hope you will understand my tardiness as I am blind and I tried to contact you through your "contact the planning board" button on the town web site and it doesn't appear to be "accessible" to people who are blind and use screen readers. I had to reach out to a fellow resident to get your email address. Because of this I do hope you will consider adding my email to the public record.

I did attend the last Planning Board meeting via Zoom audio. I do not agree with the current plan you presented. It does not seem to take into account the concerns of the residents of The Heights Neighborhood. The disregard of the board to have a fair and equitable hearing is not any way to represent those who live in this wonderful town. It seemed obvious that residents comments were not respected and one speaker was not allowed to finish remarks before the meeting was closed.

I am dismayed by the information that some residents have discovered through public records. I do not agree with the process thus far. Do not want to see large commercial buildings on the site. I do not believe that your 20 ft setback of "green space" satisfies anyone who lives in the Heights. Transparency seems to be lacking.

Please allow the town and the residents to work together to really make us a community that serves the needs of all the people.

Thank you,

Pam
Resident of Needham since 1996
Pam Fernandes
300 Second Avenue
Needham, MA 02494

From: Karen Mullen
To: Planning
Subject: Opposition to Muzi/Channel 5 site rezoning
Date: Thursday, March 18, 2021 6:03:33 PM

I am writing to voice my opposition to the proposal to rezone the Channel 5/Muzi site. I am strongly opposed to the size and scope and the lack of community friendly green space in the current Planning Board proposal.

Regards,

Karen Mullen
410 Webster St.
Needham, MA 02494

From:	Andrea Wizer
To:	Planning
Subject:	Muzi comments
Date:	Thursday, March 18, 2021 6:28:38 PM

To the Planning Board,

Please add my comments to the testimony relative to proposed zoning changes at the Muzi property.

I listened with great interest to the proposed zoning change and traffic study and citizen's testimony. I am generally in favor of the proposed changes. In addition, I believe that the property could handle smaller setbacks, taller buildings and greater density depending on the proposal.

I have a few specific comments.

1 - About traffic issues and concerns. - I noted that some testimony requested updated information. What I didn't hear mentioned is the frequent recent conversation about the likely reduced traffic, especially at commuting times potentially following Covid. Below is the link to a recent article linked in the CommonWealth Daily Download -

https://commonwealthmagazine.org/economy/remote-work-looks-like-its-here-to-stay/

2 - I understand the planning board cannot recommend specific projects. However, I am in favor of anyway that the zoning can be friendlier for a proposal of low and mixed income housing with some basic services that will help mitigate the distance that this parcel is from these services already in Needham.

3 - It is also my understanding that some individuals are interested in some type of sports center on the property while also wanting minimal density. I'm very concerned about the appearance of this combination as increasing the view of Needham as a community of privilege. However, combining mixed income housing and services with the sports complex that provided free membership or no fees to low and moderated community members would mitigate the sense of privilege.

4 - Finally, it is imperative that we change the zoning of this parcel so that we don't end up with large warehouses or some other development that doesn't enhance our community. It is time for us to send a message to our community and the Greater Boston community that we are truly a welcoming community.

Thank you for your time and consideration of my comments.

Sincerely,

Andrea Wizer
Robert Vecchi

From: victoria doroshenko
To: Planning
Subject: Muzi rezoning
Date: Thursday, March 18, 2021 11:34:50 PM

Dear Planning Board,

I was very disappointed with how the March 16th Muzi rezoning meeting was handled. I have some comments about it and questions for the next meeting. I hope you reconsider the format and the way you do presentations in the future meetings. I appreciate the time you put into it and I hope you will listen to your neighbors and let them help.

Comments:
1. Planning Board March 16th presentation was to long, lacked concrete info and was not visually helpful. It takes one actual size reference picture to show what each setback or building size mean. Residents did much better job doing it on our town FB page. Future presentations need to be shorter, right to the point and have assessment of the current situation.
2. Q&A should not be a marathon of Questions only. Each question should be answered and if you don't have an answer right away, it should be recorded in the meeting minutes and addressed at the beginning of next meeting or even better posted on Needham as a follow up.
3. Q&A should be a separate meeting where there is at least 5 min are allowed for each question.
4. Person who represents a large group of residents leaving in the addressed area should be considered as one of the presenters in the meeting and not just any who has questions

Questions:

1. Planning Board March 16th presentation was to long, lacked concrete info and was not visually helpful. It takes one actual size reference picture to show what each setback or building size mean. Residents did much better job doing it on our town FB page. Future presentations need to be shorter, right to the point and have assessment of the current situation.
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3. Q&A should be a separate meeting where there is at least 5 min are allowed for each question.
4. Person who represents a large group of residents leaving in the addressed area should be considered as one of the presenters in the meeting and not just any who has questions

Sincerely
Victoria Doroshenko
19 Beech St.

From: noreply@civicplus.com
To: Alexandra Clee; Lee Newman; Elisa Litchman
Subject: Online Form Submittal: Contact Planning Board
Date: Thursday, March 18, 2021 3:38:18 PM

The following form was submitted via your website: Contact Planning Board

Full Name:: Adam Cole

Email Address:: ajcole1@gmail.com

Address:: 361 H

City/Town:: Needham

State:: MA

Zip Code:: 02492

Telephone Number:: 6179210032

Comments / Questions: Hello,
I'm writing to voice my opposition to the change in zoning for the Muzi Property. I'm specifically opposed to the fact that the zoning change would remove the possibility of indoor athletic facilities by right and instead require a special permit. The YMCA has indicated an interest in expanding there, and an expanded YMCA would be an asset for our community. I am further opposed to the size and scale that is allowed by the proposed zoning change, and I urge the planning committee to wait until after the pandemic ends and work from home trends are more clear before trying to change the zoning. There is a way to improve the livability of the town and increase tax revenue, but the proposed zoning change does not strike that balance.
Thank you.

Additional Information:

Form submitted on: 3/18/2021 3:38:11 PM

Submitted from IP Address: 108.7.79.52

Referrer Page: https://linkprotect.cudasvc.com/url?a=https%3a%2f%2fwww.needhamma.gov%2f1114%2fPlanning-Board&c=E,1,zFJ-NSoNdFF3baPIVzYUPfAO5LzIiXoZ9QUbC1ZXt4mXCvH67pMgnAJ0RzSNdfMszwG1I30ib_KzVVVkUtft5ABYl7OUfCdGFpb0byeY&typo=1

Form Address: https://linkprotect.cudasvc.com/url?a=http%3a%2f%2fwww.needhamma.gov%2fForms.aspx%3fFID%3d229&c=E,1,z_JLTDNfhNaaljN2jSiDx-8WAwo8yiBxbhbqhAZyyX8QVM3BkeLdvFudtAuu_AJo17C2Y9g2sfAa3j6DT9XeQo8IC-DF2UEqgUzKEfQO7g,,&typo=1

From: Jennifer Yogel
To: Planning
Subject: Regarding rezoning
Date: Friday, March 19, 2021 5:45:15 PM

Hello-
My name is Jennifer Yogel. I live on Highland Ave 3 houses away from the Muzi Ford intersection. I want to express my deep concerns and disappointment for the proposed zoning and potential for the re-zoning.
Traffic. If you don't live in this neighborhood, you don't really understand how the concept of 24/7 works regarding the flow of the roads. Cars, trucks, ambulances and fire engines travel non-stop. The noise, soot, trash, exhaust smells, rumbling, accidents, congestion and difficultly pulling in and out of my driveway are the daily issues my neighbors and I deal with. I haven't open the first floor front windows of my house in 35 years. Not to mention dealing with how the snow plow trucks plow us all in whenever there's a heavy snow.
That's a lot to deal with daily.

If I could, I would move to another neighborhood. It saddens me to think this way. My husband and I grew up in Needham and chose to return to this town to raise our family.
We love Needham. It's our home. But nobody wants to live in an industrial zone. That's what it feels like this rezoning is looking like. Too big. Too much traffic, noise and commotion for this small intersection and corner of town.

My neighborhood hears too many car/bike accidents, sirens, fire engines and ambulances 24 hours a day from Wingate and 128. You take your life in your hands just crossing Highland Avenue at the crossing lights because people are trying to turn on a red light no matter who has the right of way in order to beat the light and get ahead of the traffic.

The plans you are proposing will create a nightmare for traffic noise, congestion and integrity. Needham is a town. Not a city. There is an industrial park across the highway.

Please consider planning for an open park with more family friendly and recreational day/night sports fields. Consider a new concept including more trees, walking and bike paths, exercise spaces for groups to gather and picnic tables to accommodate our residents. Use this opportunity to do good for our residents. We need to see healthier green space and trees. A location to hold festivals, farmers markets, art fairs and other town events. We need a neighborhood destination where it's safe to take a walk, ride a bike, push a carriage, gather in an open space an appreciate the nature in our town. Give us enough parking to accommodate our families and food trucks. Give us bike racks and offer us a bus stop for those who need it.

We'll lose all of that to the proposed multi lane traffic and huge buildings growing up close to the roads. No matter how much percent of grassy borders are planned for.

I don't want to see this happening in our neighborhood. I do want a destination that will preserve open healthy spaces filled with trees and respect for our town.
My town.
Thank you.
Jennifer Yogel

From: noreply@civicplus.com
To: Alexandra Clee; Lee Newman; Elisa Litchman
Subject: Online Form Submittal: Contact Planning Board
Date: Monday, March 22, 2021 1:19:38 PM

The following form was submitted via your website: Contact Planning Board

Full Name:: Joseph Leghorn

Email Address:: joe.leghorn74@gmail.com

Address:: 40 Linden Street

City/Town:: Needham

State:: MA

Zip Code:: 02492

Telephone Number:: 617-650-4649

Comments / Questions: I am wholeheartedly in favor of the Proposed Zoning Articles 1 -3. They address a concern that I raised at the first public hearing on this matter over two years ago. Warehouses as a matter of right, as currently allowed, would drastically change the nature of the area, increase heavy truck traffic and require infrastructural improvements and repair at the Town's expense. The current proposal removes this worst case from occurring. I am happy to see the proposal allows for residential development. If I were allowed a tweak, I would raise the affordable requirement to 20%. I truly fear that an organized special interest will result in the worst case to occur as it seeks to defeat the current proposal by gathering sufficient votes to defeat these Articles. There is also rumor abroad that this special interest will petition for a special Town Meeting to advance its proposal. It may be that it will use the worst case as a threat to force its, potentially, minority view on the town using the worst case as a stick to get its way. If this is the special interests strategy, the Planning Board and Town Meeting should recognize it for what it is - a gangland style shakedown. The current draft Articles are a sound approach to development, revenue enhancement and infrastructure protection. The Planning Board can count on my support for the current proposal at Town Meeting. Respectfully submitted, Joe Leghorn

Additional Information:

Form submitted on: 3/22/2021 1:19:32 PM

Submitted from IP Address: 73.186.129.92

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Form Address: https://linkprotect.cudasvc.com/url?a=http%3a%2f%2fwww.needhamma.gov%2fForms.aspx%3fFID%3d229&c=E,1,H7cZ-UpSP9PddXxItuIHXOrj62G3wSnlNiCUusB2tYWzwDh42X1FVDgeWeuMQyCIl0O3cFdSneF_6mJ8Yh8MK1EzcIjUbrvcTMTysS7NGrcbPVBNSQ,,&typo=1

From: Leigh Doukas
To: Planning
Subject: RE: Muzi Ford/Channel 5 rezoning
Date: Saturday, March 20, 2021 9:28:50 AM

Hi,

I would like to revise my previous comments. The landscape barrier should be 50 feet deep from the street, with an additional 25' set back for the Buildings for a total setback of 75' from street

FAR .75 as of right, 1.0 with special permit. This is still more than double the current as of right use.

Thank you

Leigh

Leigh Rossi Doukas, ABR, CIAS
International President's Circle 2018, 2019
Hall of Fame 2016, 100% Club 2012 - 2017
Coldwell Banker Realty
1498 Highland Ave, Needham MA 02492

Your Needham/Metrowest Real Estate Expert
Cell: 617-966-1245
Website: www.LRDHOMES.com

Your referrals are much appreciated!

Beat

Amazon opens smaller warehouses near big U.S. cities for faster delivery times

Reuters

March 3, 2020 1:56 AM

The logo of Amazon is seen at the company logistics center in Boves, France, September 18, 2019.
Image Credit: Reuters / Pascal Rossignol

(*Reuters*) — Amazon has quietly opened a series of small warehouses closer to big U.S. cities in a move to shave hours off delivery times, the company told Reuters.

On Tuesday, the world's largest online retailer is updating its same-day delivery program for shoppers in Phoenix, Philadelphia, Dallas, and Orlando, it said. Amazon will guarantee packages arrive by several set times daily.

The initiative underscores the company's aim to stay quick in online retail, outdoing competitors' free two-day delivery offers so shoppers remain loyal to Amazon's shipping and media-streaming club Prime, which costs $119 per year in the United States.

Amazon has long offered one- or two-hour delivery via Prime Now, a service that includes fresh groceries and more than 20,000 items.

The same-day offer will now guarantee delivery of more than 100,000 products, from phone chargers to dog food, in as little as five hours, from a new warehouse close to each launch city, said Jon Alexander, Amazon's director of delivery experience. For comparison, Amazon offers more than 100 million items for two-day U.S. delivery or faster via Prime.

"The smaller selection enables us to put these types of facilities much closer to customers," he said. Additional items — up to 3 million — will pass through the facilities on their way to same-day customers.




The new format combines the storage, picking, and packing functions of Amazon's fulfillment centers with the sorting and delivery functions of other facilities in a single building.

Compared with fulfillment centers, which are farther from urban cores and house much more inventory, the new warehouse is roughly a tenth the size, at 100,000 square feet. Amazon says shorter drive times will help it meet its pledge on carbon emissions.

The company declined to comment on the facilities' cost. Amazon, once famous for spending away profit, often cites warehouse build-outs as one of its biggest areas of investment.

   

According to Alexander, Amazon would typically lease existing spaces and alter them to accommodate the operation.

The new facilities are automated with the same "drive units" used in Amazon's fulfillment centers. These are squat, floor-scurrying robots that hoist up movable shelves of inventory and bring them to associates who pick customer orders. Amazon said each building will create hundreds of full- and part-time jobs.

While the same-day option is covered for Prime members who spend at least $35, those without Prime are charged $12.98 per order, a tactic that could encourage people to sign up.

Amazon will announce more cities for the program later this year, Alexander said.

(*Reporting by Jeffrey Dastin in San Francisco, editing by Greg Mitchell and Kenneth Maxwell.*)

Needham Planning Board
Highway Commercial 1
Frequently Asked Questions

1. **Why is the Planning Board trying to rezone Highway Commercial 1?**

   The Planning Board is responsible for guiding future physical growth and development in Needham. Zoning is a tool by which the Town shapes land use, housing, public facilities, economic development opportunities and transportation systems. The Planning Board regularly reviews existing zoning and recommends updates so that the Town may continue to be a desirable place to live and work.

   The land within the proposed Highway Commercial 1 district is currently governed under the rules of the Industrial-1 district, which was established in 1987. In 2018, the Planning Board identified Highway Commercial 1 as a priority area to rezone because the existing regulations are outdated, may result in uses that are no longer wanted (e.g. boarding houses, distribution warehouses, storage facilities) and as a key location, which serves as a gateway into Needham, was appropriate for conversion from an industrial district to a mixed-use district consistent with the land use profile of the remainder of the Highland Avenue corridor from Chestnut Street through Needham Center and Avery Square to this locale.

   Based on a build-out analysis, traffic report, and dimensional analysis, the Planning Board determined that certain dimensional requirements, including front setback, height, floor area ratio, and side setbacks, and use requirements are constraining development under the current zoning rules, and, given the properties' regionally prime commercial location along Route 128, is significantly underperforming economically, to the detriment of the Town. Further the Board found that the current industrial district zoning at the property was not reflective of the Town's land use policy goals for this gateway location and that a conversion to a mixed-use district consistent with the land use profile of the remainder of the Highland Avenue corridor was warranted. With rezoning, in time, the area should attract significant high value redevelopment consistent with the Town's land use objectives, which will be overseen by the Planning Board under its site plan review and special permit obligations.

2. **Why is the Planning Board rezoning before they have a specific proposal from a developer?**

   Rezoning can occur before or after a specific development proposal is received. Setting zoning requirements before a specific development proposal is received allows the Town to proactively determine a framework for the types of land uses the Planning Board will allow, or be willing to consider, in a particular geographic area. Determining the zoning requirements after a development is presented narrows the discussion to strictly reacting to what has been proposed. Proactively rezoning an area provides clear guidance for all stakeholders, including residents and current and future landowners.

Establishing the conditions that trigger a Special Permit allows the Planning Board to both proactively shape the zoning and reactively review a specific development proposal to make sure it adheres to Needham's land use goals. (see question #5 for more detail).

Examples of other proactive rezoning and planning efforts in the Town of Needham include the Avery Square , the Chestnut Street Corridor, the Center Business District as well as the New England Business Center.

3. Town Meeting rejected this proposal two years ago. Why is it up for debate again? What has changed?

A rezoning plan for Highway Commercial 1 was developed and presented to the October 2019 Special Town Meeting where it received a majority vote but fell short of the 2/3 vote required for passage. Concerns with the overall density profile, traffic impact, use profile and lack of sustainable development principles were noted by Town Meeting members.

In response to input received at the October 2019 Special Town Meeting, a Town-wide Community meeting was held in January 2020 with residents, neighbors, public officials, businesses and landowners to further develop and refine the Town's overall land use goals and strategy for the district. Additionally, a working group comprising representatives from the Planning Board, Select Board, Finance Committee, and Council of Economic Advisors was established to review the policy objectives of the district and to offer strategies to address the concerns raised at both the October 2019 Special Town Meeting and the January 2020 Community meeting. The working group commissioned an updated traffic study of the district to determine the capacity of the Town's traffic infrastructure to accommodate development at variable density and use profiles. 3D modeling and an updated fiscal impact analysis of the district were completed once the density and use profile of the district were finalized consistent with the capacity of the Town's traffic infrastructure to accommodate development at variable density and use profiles. A revised land use plan responsive to community concerns was developed. The following four changes were made from the 2019 rezoning proposal to the current 2021 proposal as follows: (1) The overall density of development within the district has been reduced. (2) The maximum building height within the district has been reduced by one story for both the as-of-right and special permit condition. (3) Permitted uses within the district have been expanded to include multi-family dwellings. (4) Special permit criteria for permit issuance has been expanded to include green building standards.

4. Does this zoning change require 2/3 vote at Town Meeting? Or less than that if housing is included?

The zoning change to Highway Commercial 1 which proposes mixed use development (commercial and housing land use) at the property will require a 2/3 vote at Town Meeting.

5. What is As of Right vs. Special Permit?

Zoning regulations are divided into what is allowed "as of right" versus what is allowed "via special permit". The Planning Board *must* approve any development proposal that complies with the "as of right" zoning requirements. Development proposals that include uses defined in the zoning as requiring a Special Permit must go through a more robust vetting process. For these proposals, the Planning Board has broad discretion to deny the application, or attach conditions or require mitigation, funded and completed by the developer, as part of a Special Permit process.

Notwithstanding the above, any project whether allowed by right or by special permit, which involves the construction of 10,000 or more square feet gross floor area, or an increase in gross floor area by 5,000 or more square feet, or any project that results in the creation of 25 or more new off-street parking spaces requires the developer to apply for a major project site plan special permit. This process empowers the Planning Board to impose conditions, limitations, and safeguards to mitigate adverse impacts on the Town's resources.

6. What mechanisms do you have to control the types of businesses that would occupy the site?

The zoning includes several mechanisms to control the types of businesses that could occupy the site. The use table sets out the uses allowed by right and by special permit. There are also various types of size restrictions. The most likely uses for this parcel are lab or office space as the primary use. Some housing is permitted, and ancillary retail. The Planning Board also utilizes the special permit process that enables the Town to alter or deny the project so it's in line with the community's vision. Part of that process includes a public hearing in which members of the public may comment and ask questions. Those comments and questions are considered as part of the Planning Board's open deliberation process.

7. Can you or will you be able to prevent this from becoming a destination like Legacy Place?

Yes, we can. Legacy Place is regarded as "destination retail." As an example, Whole Foods is over 80,000 square feet. We prohibit any retail store over 10,000 square feet – about the size of Trader Joe's on Highland Avenue. 10,000 square feet is permitted under a special permit; 5,750 square feet is permitted by right. This will not be destination retail.

8. Can you or will you be able to prevent a hazardous chemical or harmful pathogen lab from occupying the R & D space?

Any laboratory operator is required to adhere to federal, state, and local health and safety laws to safely handle any and all materials.

9. Are there incentives under the special permit that would allow for the increased volume with the addition of green space/buffer zone?

The greater density allowable by special permit is a natural incentive for a developer. The special permit process empowers the Planning Board to set standards on the location, size and contents of a buffer zone and green space, and the special permit provisions for HC-1 expressly provide for consideration of possible development of a landscape feature or park on Gould Street or Highland Avenue.

10. What is the projected cost to the town in terms of services with a full buildout at the 1.0 FAR and the 1.3 special permit FAR?

- The projected municipal cost of a by-right FAR buildout of 1.0 without housing is $381,000 per year. The fiscal analysis by the Town's consultant projects net tax revenue to the Town from this development scenario will be $6,352,100.
- The projected municipal cost at a by-right FAR buildout of 1.0 with housing is $1,154,900 per year. The net tax revenue to the Town is projected to be $4,652,700.
- The projected municipal cost of a special permit FAR buildout of 1.35 without housing is $502,000 per year. The net tax revenue to the Town is projected to be $8,342,400.

- The projected municipal cost of a special permit FAR buildout of 1.35 with housing is $1,479,600 per year. The net tax revenue to the Town is projected to be $6,028,900.

All these costs are based on modeled uses. For an actual project, new study data would be required as part of the permitting process.

11. How would an onsite taking affect the 20% green space requirement?

The green space requirement comes after any taking, if needed. Any onsite taking required to widen the layout of either Highland Ave. or Gould St. would push the 20' landscape buffer on Highland Ave. and Gould St. deeper into the lot, since the setback would be measured from the post-taking layout line. Furthermore, the developer would still be required to preserve the 20% open space requirement based on the new somewhat smaller lot size. The overall impact may reduce the density of proposed development in order to preserve the 20' buffer and the 20% open space requirement.

12. What is the current FAR at full buildout with the current zoning, if the warehouse and other undesirable uses were removed? What type of traffic would this generate?

Under current zoning, the maximum FAR is 0.75. The purpose of the traffic study was to understand the traffic impact based on a maximum buildout from the proposed zoning changes. The traffic study compared traffic impact based on this maximum buildout with the traffic impact from current development on the site rather than from the current maximum FAR of 0.75. Any actual project would include a traffic study based on the particular use and size of development proposed in an application.

13. What if an overlay district was used to increase building height at the highway, allowing for the 70' height as of right, but preserving more green space along Gould Street and put the lower profile retail/restaurants etc., similar to the Street in Chestnut Hill?

An overlay district is not required to achieve these goals which can be achieved under the zoning limits currently proposed. The current proposal only permits 70-foot/5 story buildings by special permit, and they must be located at a minimum of 200 feet set back from Gould Street and Highland Avenue. Within the 200-foot setback strip from Gould/Highland, the maximum heights are 2 ½ story/35 feet by right, with 3 stories/42

feet allowable by special permit and 48 feet allowable only if the roofline is gabled or set back. The by-right limits are no higher than the limits for the Needham Heights, Needham Center and Lower Chestnut Street zoning districts (2 ½ stories/35 feet) and the Business District along Highland Avenue where Sudbury Farms and the Bertucci plaza are located (3 stories/40 feet); the special-permit limits are similar to the overlay districts for Needham Heights/Carter Building (4 stories/44 feet), Needham Center and Chestnut Street (4 stories/48 feet).

14. Why is housing capped at 240 units?

We see this site as an opportunity to meet part of the demand for housing in Needham. The Town looks to balance impacts housing has across all town services and infrastructure. We believe this capacity achieves a reasonable balance and enables the Town to predict with confidence the likely modest impact on our public schools and residential-services budget. 240 units may be permitted by special permit with a minimum of 12 ½% units to be affordable. The housing would be expected to house up to 38 new students for Needham Public Schools.

15. What will be the effect on schools of multi-family residential development? Can the schools handle this?

Yes, the schools can handle this. Multifamily residential development at 1.0 FAR is projected to generate 28 school children. Multifamily residential development at 1.35 FAR is projected to generate 38 school children. This level of school growth can be absorbed by our existing school infrastructure. This site is in the Eliot Elementary School district, which can accommodate the projected 2-3 more children per grade.

16. Is it likely that a developer would build under the special permit process?

Yes – we have designed the zoning to set the as-of-right FAR at a level such that a developer who wants to unlock the full potential of the property would need to seek a special permit.

17. Are other buildings (not as large as the HC-1 zoning would allow) along Highland Avenue from this site to Needham Center, and is Wingate height lower than proposed heights and are Wingate setbacks further away than the proposed setbacks?

See response to Question 13 as to the comparable heights allowed for commercial and mixed-use buildings along Highland Avenue from this site to Needham Center and extending along Chestnut Street to Needham Junction.

As to Wingate, which is within the Elder Services Overlay District, the minimum required building setback from the front lot line is 25 feet (setback not required to be landscaped) and the minimum setback from the railroad right-of-way is 10 feet. The Wingate height limit is 40 feet/3 stories + uninhabited 4th story under a pitched roof. The proposed HC-1 zoning requires a fully landscaped setback of 20 feet all along Gould Street and Highland Avenue, and the setback from the railroad right-of-way is 10 feet; within the 200-foot setback strip from Gould/Highland, the maximum heights are 2 ½ story/35 feet by right, with 3 stories/42 feet allowable by special permit and 48 feet allowable only if the roofline is gabled or set back.

18. A number of people have asked why a sports complex requires a special permit when one is not required in current zoning.

The current zoning was written many years ago when the world was different. The Muzi family has owned their car dealership in Needham for 80 years now. As in Wellesley, sports complexes are governed by special permits because they are highly intensive land uses. They typically operate with extended hours (Wellesley operates from 5:30am to 12:30am seven days a week) serving traffic from a large geographic area (the Wellesley complex traffic study expected 3000 car trips per day – 1/3 of the total site anticipated to be generate on Highway Commercial 1 in the worst-case scenario). Gyms and fitness centers from decades ago are very different than athletic facilities today which now commonly include multiple pools, multiple ice rinks and turfs or courts for multiple sports to be played simultaneously, weight rooms, spinning classrooms, yoga studios, office space, food service, child care, changing rooms with showers and spa in addition to storage. These are large facilities and drive significant traffic. All neighbors are best served by oversight of the planning and construction process and operations. Therefore, a special permit is appropriate.

19. What is the impact of this development on neighboring commercially zoned sites? If they redeveloped by right, how much could they grow and contribute to traffic?

The impact a development here would have on neighboring commercial areas would depend on the specific type and size of development that would ultimately be developed on this site. We foresee demand for suburban office space and research and

development laboratory (R&D) on this site, which is complimentary to area commercial sites. We believe we can add significant office and R&D capacity without cannibalizing neighboring commercial sites. Future growth on the site is limited to the specifications set out in the zoning.

20. How do we factor in the likely long-term impact of covid on traffic?

The actual long-term impact of covid will unfold over time. Return-to-work patterns will evolve significantly. The role of zoning is to lay out a framework from which a developer devises their own proposed plan based on the opportunities and demand they see in the market by use and size. Once a developer presents an application to the planning department, the Planning Board will assess the impacts, including traffic, of the proposed development.

21. What recourse does the town have against a traffic study that reveals negative impacts on residential neighborhood streets such as Noanett, Lee and Gary, if a developer chose to build by right?

Any project which involves the construction of 10,000 or more square feet gross floor area, or an increase in gross floor area by 5,000 or more square feet, or any project that results in the creation of 25 or more new off-street parking spaces requires the developer to apply for a major project site plan special permit that empowers the Planning Board to impose conditions, limitations, and safeguards to mitigate adverse impacts on the Town's resources, including the streets in this area. Those mitigation efforts may include items such as signage prohibiting turns and traffic through the neighborhoods at peak hours.

22. If a developer decides to use the by right 1.0 FAR, can the town compel them to do the traffic remediations, which look costly?

Provided the traffic study for their specific use indicates mitigation is necessary relative to current traffic, yes. See 21 above.

23. Why does the Town's traffic study focus on the immediate area?

The purpose of the Town's traffic study is to examine the traffic impacts that a development would generate at primary intersections in the immediate area. A developer will be required to conduct their own traffic impact analysis and to provide that analysis to the Planning Board as part of its application process. The Planning

Board then engages a traffic engineering firm to conduct a peer review of the developer's analysis to validate, or not, the developer's traffic engineer's conclusions. The Planning Board has the authority to require a developer to broaden the geographic study area.

In addition, the development will be subject to review by MassDOT and MEPA (Massachusetts Environmental Policy Act), which will require preparation of a traffic study examining any intersections experiencing an increase of 100 or more vehicle trips per hour or five percent (or more) increase in traffic through the intersection as a result of the project. The Town will receive copies of the traffic study and will be allowed to comment during the MEPA review process.

24. What is the quality of traffic data? Are traffic counts only good for 5 years?

It is typically a standard in any traffic study that traffic counts are valid for a period of 5 years, as indicated by Tony Del Gaizo, because one would expect traffic to increase over the period. When the 2015 traffic counts were used in 2019, they were within the 5-year period. However, a traffic count now, or in the spring or fall of 2020, would not be valid due to the pandemic and to the ongoing Highland Avenue widening project to support bike lanes. We had data (the "2019 counts") that were collected prior to the pandemic. The Town fully appreciates that this area has been under significant construction due to the add-a-lane project, which resulted in increased traffic on Needham roads during construction (the "2015 counts"). We learned that the 2015 counts were high because of traffic avoiding Route 128, and with the completion of the add-a-lane project, traffic returned to the highway. The GPI traffic study identified that area traffic has been increasing at only 0.1% annually for nearly a decade – nevertheless, the traffic study uses the conservative projection that traffic may increase at 1.0% (10x higher than shown by studies).

It should also be noted that on May 15, 2020, MassDOT issued a directive allowing for traffic volumes collected as long ago as 2014 to be utilized to estimate 2020 Existing traffic-volume conditions.

25. Would mitigation require construction of turn lanes that would necessitate taking of private property at Gould Street and Central Ave?

The Town has itself prioritized this intersection for improvement and will study the intersection to see what is required. This year, the intersection at Highland Avenue and West Street is being rehabilitated. Next year (FY22), the intersection of Great Plain Avenue and Central Avenue has been prioritized, followed in FY23 by the intersection at

Gould Street and Central. If there is no development at the Highway Commercial 1 site before that time, the Town anticipates studying the intersection to determine what is required to improve the intersection. If Highway Commercial 1 is redeveloped sooner, then it is possible that a developer may be required to improve the intersection.

26. Would mitigation require construction of a turn lane on Hunting that would necessitate taking of private property at Hunting Road and Highland Avenue?

At a maximum FAR buildout, the traffic impact analysis presented at the March 16, 2021 public hearing revealed mitigation at this intersection would require only onsite takings at the Highway Commercial 1 property. Based on this analysis, no takings along Hunting would be required. Actual traffic mitigation requirements will be based on a developer's proposal. The left turn from Hunting onto Highland is the lowest turning frequency which is why the cue time is longer. Any takings required by development will be an influential factor in the Planning Board's deliberation process.

The mitigation that may be required at the Highland Avenue / Hunting Road / Gould Street intersection requires widening onto the development site only to provide additional turning lanes exiting Gould Street and an additional right-turn lane on Highland Avenue westbound. No widening is required along Hunting Road to return the overall intersection to a No-Build condition.

27. How accurate are GPI's traffic projections; does GPI go back post-construction and verify?

GPI's traffic engineer explained that a post-occupancy monitoring study is often required and that she has only seen one project where post-occupancy traffic was higher than projected in her 19 years of experience. Given that the traffic analysis was conducted on a 2015 base with a 1.0% annual growth in traffic (10 times the experienced rate of 0.1% for nearly the last decade), one would not expect the traffic to be higher than the presentation levels for a worst-case buildout. Depending on the scope of development, the Planning Board may require a post-construction traffic analysis. Further mitigation would be required if a post-construction analysis revealed heavier traffic than projected.

As part of permitting with MassDOT, a post-occupancy monitoring program will be required for any project estimated to generate over 2,000 vehicle trips per day. This post-monitoring study typically begins six months to a year after an occupancy permit is issued to allow traffic to normalize after opening. The study then continues on an annual basis for a period of five years. The results of this post-occupancy monitoring study are typically provided to MassDOT and the Town for review. Often these post-occupancy monitoring studies are tied to specific mitigation measures that a developer

must implement if the actual traffic generation is determined to exceed the original traffic projections by a certain pre-established threshold.

28. Traffic – what about the impact of development of Needham Street in Newton? What about intersections that are farther away than those we studied – isn't there a "trickle effect"? What is the cost of mitigation?

Although actual annual traffic growth in the vicinity is 0.1 %, the traffic engineer modeled growth at 1.0 % growth annually and started at the higher-traffic 2015 count. This methodology accounts for anticipated traffic growth from new development, including the Northland Development project on Needham St. in Newton.

It should be noted that the traffic study prepared for the purposes of the rezoning was intended to provide a preliminary analysis of whether a development of this size (FAR of 1.35) could be reasonably mitigated. It is expected that when a developer and build-out program is identified, the developer will conduct a more comprehensive traffic impact study that will likely include collecting new traffic volumes throughout a wider study area and including traffic volumes generated by any other development projects that have been approved or are in the approvals process in the surrounding area, including such development on Needham Street in Newton.

29. Will traffic "redirect" onto side streets to avoid backups? What will the effect of allowed development be on property values? What will the impact be on Mills Field;

The Planning Board will exercise its full authority to minimize traffic impacts within area residential neighborhoods, including the installation of signage that certain streets are for local resident use only. (See signage on residential streets near the Sunita Williams School for example.) Mills Field will continue to be used for tennis and baseball facilities, as well as enjoyed by local families. As to property values, Needham expects to continue to be a highly desired residential community and all properties in town have benefited from that cachet.

30. A question was asked about the traffic impact if the site were developed under HC-1 zoning as-of-right limits, not under higher special permit limits.

GPI has estimated that if the site were fully built out under the dimensions allowed as of right, traffic would be reduced by more than 20% in a non-residential configuration, as compared with the higher-density dimensions allowed by special permit. Including multi-family residential results in a further reduction in traffic.

Please continue to refer back here as we will continue to provide updated information.

Evolution of Highway Commercial 1 zoning through meetings:

October 13, 2013 – Council of Economic Advisors (CEA) meeting – they decide to start a subcommittee to review Industrial / Industrial 1 zones for potential rezoning. *All CEA meetings after this time contained some brief update on the zoning.*

April 29, 2014 & April 30, 2014 (invitees were to choose one) – CEA hosted meeting with landowners, business owners, neighbors, town officials discussing zoning in Industrial zone.

September 15, 2014 - presentation by Economic Development Director to Needham Heights Neighborhood Association

June 6, 2017 & June 8, 2017 (invitees were to choose one) – CEA hosted meeting with landowners, business owners, neighbors, town officials discussing zoning in Industrial zone.

July 11, 2017 – Planning Board meeting - presentation by Economic Development Director on proposed zoning in Industrial/Industrial 1 zoning.

September 17, 2017 – presentation by Economic Development Director to Needham Heights Neighborhood Association

November 28, 2017 – Select Board / Planning Board joint meeting - to hear presentation by CEA on proposed zoning in Industrial District.

December 7, 2017 – Planning Board, brief discussion.

January 9, 2018 – Select Board public hearing on possible Industrial/Highway Commercial Zoning

January 24, 2018 – Select Board and Planning Board joint meeting – discussion of various zoning initiatives.

February 7, 2018 – Council of Economic Advisors – discussion of Select Board's 1/9/18 hearing and next steps.

July 10, 2018 - Planning Board - brief conversation

October 4, 2018 – Planning Board meeting – discussion between Planning Board and Economic Development Director on the proposed Highway Commercial zoning initiative.

October 18, 2018 – Planning Board meeting – discussion on the proposed Highway Commercial zoning initiative.

December 4, 2018 – Planning Board meeting – discussion on the proposed Highway Commercial zoning.

December 18, 2018 – Planning Board meeting – discussion and vote to transmit for hearing.

January 29, 2019 – Planning Board Public Hearing on zoning

February 19, 2019 – Planning Board discussion of Zoning Articles for May 2019 Town Meeting

March 5, 2019 – Planning Board discussion of Zoning Articles for May 2019 Town Meeting

March 11, 2019 – Planning Board discussion of Zoning Articles for May 2019 Town Meeting

March 19, 2019 – Planning Board discussion of Zoning Articles for May 2019 Town Meeting

April 23, 2019 – Planning Board meeting – discussion of next steps on Highway Commercial 1 zoning.

July 2, 2019 – Joint meeting Select Board / Planning Board – Workshop on Highway Commercial 1 zoning

July 16, 2019 – Planning Board discussion of Highway Commercial Zoning

July 30, 2019 – Planning Board meeting - Economic Development Director present for discussion on zoning.

August 6, 2019 – Planning Board meeting – discussion and vote to transmit for hearing.

September 17, 2019 – Planning Board Public Hearing on zoning

October 28, 2019 – Fall Special Town Meeting, zoning was defeated by Town Meeting

December 3, 2019 – Planning Board discussion of Highway Commercial Zoning

January 7, 2020 – discussion of next steps, a couple FinCom members present

January 27, 2020 – Community Meeting

May 20, 2020 – brief discussion of next steps

November 18, 2020 – joint meeting with Select Board and Finance Committee to discuss zoning, particularly traffic

December 15, 2020 – discussion of next steps on zoning

January 4, 2021 – update and next steps

January 14, 2021 – Natasha Espada shows Design to Planning Board

January 19, 2021 – preparation for Community meeting

January 21, 2021 – Update, next steps

February 2, 2021 – Community Meeting preparation

February 3, 2021 – Community Meeting

February 16, 2021 – vote to transmit zoning for hearing

March 2, 2021 – project update

March 16, 2021 – public hearing