Stantec

City of New Haven Fully Autonomous Vehicle Testing Pilot Program Application

November 6, 2019

Prepared for:

State of Connecticut, Office of Policy and Management

Prepared by:

City of New Haven
New Haven Parking Authority
Yale New Haven Health Systems
Yale University
Stantec Consulting Services Inc.

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Executive Summary

The City of New Haven and their stakeholders (the New Haven Parking Authority, Yale New Haven Health Systems, and Yale University) seek to deploy low-speed automated shuttles in downtown New Haven serving two Yale New Haven Hospital campuses per the State Connecticut's Office of Policy and Management (OPM) Fully Autonomous Vehicle Testing Pilot Program (FAVTPP) and Public Act No. 17-69. The project team has set three main objectives: 1) Provide greater access to YNHH campuses and parking facilities such as Air Rights Garage; 2) Observe how a low-speed autonomous vehicle performs under real-world conditions and meets user needs in comparison to legacy vehicles; and 3) Gain low-speed autonomous vehicle operations experience to create a short- and long-term AV strategy.

The New Haven Parking Authority (NHPA) has retained Stantec as program manager to help create a concept plan for automated vehicle (AV) deployment. After conducting site evaluations and stakeholder feedback/planning meetings, four preferred route options have been selected. Factors considered during route review included traffic volume of each travel segment, volume of conflicting traffic, operating speed of the roadway segment, segment geometric cross section (e.g. presence of a parking lane), capabilities of existing AV technology, and more.

Four route options are provided, to serve two Yale New Haven Hospital campuses – the main campus and the Saint Raphael campus. The four route options share a common core "route" while offering alternatives for flexible or diversionary routing. Together, they present a balanced cross section of challenges and testing opportunities. All routes are 1.6 or 1.7 miles in length (roundtrip) and would operate on a fixed-route and schedule Monday through Friday from 8am – 6pm with 30 minutes headways, when at full capacity. The service would provide mobility for hospital employees and patient's family members between the two campuses and parking structures such as the Air Rights Garage.

Roadway infrastructure improvements will be required including Connected Vehicle technology infrastructure (particularly, Dedicated Short Range Communication between vehicles and traffic signals), lane striping, signage, and electrical vehicle charging and storage facilities. The routes were chosen from a wider selection for their ability to meet City of New Haven goals and technological feasibility.

Vehicle providers and other potential technology partners have been evaluated through a Request for Qualifications process during Spring 2019, but a vendor partner has not been selected. The City of New Haven intends on publishing a Request for Proposal for vehicle procurement and entering into an agreement with said vendor after the State of Connecticut OPM have approved their FAVTPP application.

Through this application, the City of New Haven seeks approval to test low-speed automated shuttles to serve two Yale New Haven Hospital campuses in downtown New Haven on the provided route and route options. The City of New Haven and their stakeholders look forward to working with the State of Connecticut on implementing a safe and beneficial low-speed automated shuttle deployment under the FAVTPP.

1.0 APPLICANT'S IDENTIFICATION

1.1 CITY/TOWN INFORMATION

*Full Legal Name of Chief Elected Official or Chief Executive Officer of City/Town			
*Physical Street Address			
*City/Town	*State	*Zip Code	*Telephone Number ( )
Mailing Address (If different than Physical Street Address)			
City/Town	State	Zip Code	Telephone Number ( )
*Population of City/Town (as enumerated in the 2010 federal decennial census)			

1.2 CONTACT PERSON INFORMATION

*Name		*Title	
*Mailing Address			
*City/Town	*State	*Zip Code	*Telephone Number ( )
*Email Address			

1.3 MUNICIPAL TRAFFIC AUTHORITY CONTACT PERSON INFORMATION

*Name	*Title
*Mailing Address	

*City/Town	*State	*Zip Code	*Telephone Number ( )
*Email Address			

2.0 TESTING PARAMETERS

2.1 ANTICIPATED TESTING LOCATION INFORMATION AND LIMITATIONS

2.1.1 Overview

The City of New Haven and their stakeholders, the New Haven Parking Authority (NHPA), Yale New Haven Health Systems (YNHH), and Yale University, have designed a Fully Autonomous Vehicle Testing Pilot Program (FAVTPP) concept that satisfies State of Connecticut requirements for public road autonomous vehicle (AV) testing and would allow the City to investigate the operation of low-speed autonomous shuttles serving inter-campus hospital routes.

The objectives of establishing this fully autonomous transit deployment are as follows.

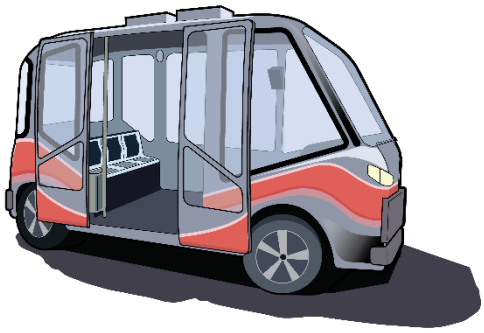
- Provide greater access to YNHH campuses and parking facilities such as Air Rights Garage;
- Observe how a low-speed autonomous vehicle performs under real-world conditions and meets user needs in comparison to legacy vehicles; and
- Gain low-speed autonomous vehicle operations experience to create a short- and long-term AV strategy.

The proposed deployment would be in downtown New Haven, on mixed-traffic, public rights-of-way. Several routes and route alternatives were reviewed for their suitability, according to the above objectives. In addition, a high-level technical analysis was performed to compare the traffic operations characteristics of the various routes, segments, and intersections, with the operating strengths and limitations of current low-speed autonomous shuttles.

Section 2.1.3 presents four viable route options. These proposed routes minimize the number of left turns and lane changes as much as practicable, to reduce conflicts, and minimize disruption to traffic. Diversionary routes can be adapted by combining the route options in order to avoid conflicts, in case of emergencies, and detours. All route options would be mapped as potential routes.

The autonomous shuttle deployment is proposed to operate Monday through Friday from 8am – 6pm on a fixed-route and schedule. Hours and style of operation (i.e. fixed, on-demand) may be modified during a later phase.

2.1.2 Low-Speed Autonomous Shuttles



At this point in time, self-driving technology is making rapid advancements and is being tested around the world in diverse conditions including public streets, private office parks, and university campuses. These electric shuttles carry between 8-16 passengers and typically operate at a top speed of 25 mph and an average of 12 mph. They are ideally suited for first/last mile solutions on quiet, lower speed streets and can operate in mixed traffic. However, they can increase their travel efficiency if operated within a dedicated right-of-way, much like a light-rail or bus rapid transit vehicle, only at a fraction of the upfront capital costs. Given their low speeds and somewhat limited carrying capacity, they are not particularly suited for long distance trips nor higher speed roads or highways.

Most vehicles on the market today have a tight turning radius of about 13-15 feet with some able to operate in both directions, eliminating the need to turn around. They can work seamlessly with a mobile phone-based app, can be called on-demand (although most currently operate on fixed-schedules), and monitored in real-time through a fleet management system. Most are wheelchair accessible and offer wheelchair securement and are working to offer more accessibility features and comply with the Americans with Disabilities Act (ADA) regulations.

The aesthetic of the shuttles varies depending on the manufacturer, but the dimensions are generally 16’ long x 7’ wide x 9’ high. However, some technology companies are modifying 6-passenger golf carts, offering a smaller platform for environments in which one is required. Yet another option is a “tram” type vehicle that connects and disconnects trailers to a drive-car for flexibility in carrying capacities. A vehicle can typically operate between 3-10 hours on a single charge—depending on operational environment and deployment strategy—and recharge by being physically plugged in. Given the rapid advances in battery technology, this range is being extended with each new version. Supportive infrastructure is generally lighter than with most transit vehicles. Technology partners typically require a secure storage site and prefer signalization or other intersection treatments, Intelligent Transportation System (ITS) infrastructure, and priority signal and lane treatment depending on the alignment. In addition, if placemaking and permanency are important, installations would include fixed-point stations with interactive signage and possibly fully dedicated lane(s).

Safety is paramount. Typical automated shuttles have 2-4 redundant braking mechanisms in case one fails – including braking if the engine fails or loses power. Emergency stop buttons inside the vehicle and a direct telecom connection to a central command hub are usually featured inside for passengers. Additionally, manufacturers recommend the employment of an on-board steward during early deployments to act as a customer liaison to riders and an added layer of redundancy/safety.

Figure 1: Low-speed autonomous shuttle overview

2.1.3 Planning Methodology

A concept planning level analysis was used to analyze the potential deployment routes. The primary objectives were first used to establish the general geography and desirable origin/destination stops near the YNHH Campuses and parking facilities, such as Air Rights Garage.

Next, individual segments, intersections, and turning movements were reviewed for operating characteristics conducive to fully autonomous shuttle operations. Factors considered during route review included:

- Traffic volume of each travel segment
- Volume of conflicting traffic
- Operating speed of the roadway segment
- Existing traffic controls (traffic signals and signage)
- Existing left turn movement treatments
- Mid-block pedestrian crossings
- Segment geometric cross section (e.g. presence of a parking lane)

Based on the planning analysis, and careful exploration of potential routing variables, four viable route options were identified.

2.1.4 Route Options

After several route options were carefully explored, four viable route options were established. Each of these four options meets the primary objectives, though with differences in some elements. These options meet the required operating characteristics for autonomous shuttles but have differences in operational complexity and infrastructure costs.

It is proposed that the four route variations be approved in this proposed application. During the implementation phase, additional analysis will allow for finalization of the route, taking into account initial field-testing results.

The four preferred routes operate within downtown New Haven on mixed-traffic, public rights-of-way. Depending on the technologies deployed, a segregated lane may need to be reserved on certain segments of the route – namely Frontage Rd and/or Legion Ave. High traffic volumes, signalized intersections, and mid-block pedestrian crossings will require vehicle accommodations for safe operation. The routes serve the same destinations – the Yale New Haven Hospital main campus and Saint Raphael campus. Drivers parking at Air Rights Garage may use the Main campus shuttle stop.

The routes do not travel along a limited access highway and all infrastructure is owned and maintained by the City of New Haven. Most travel lanes have either a shoulder lane or an on-street parking lane for the autonomous vehicle to pull into for any reason. Streets without a shoulder lane include Legion Avenue, Park Street, and Howard Avenue/Howe Street.

Table 1 – Comparison of Route Characteristics

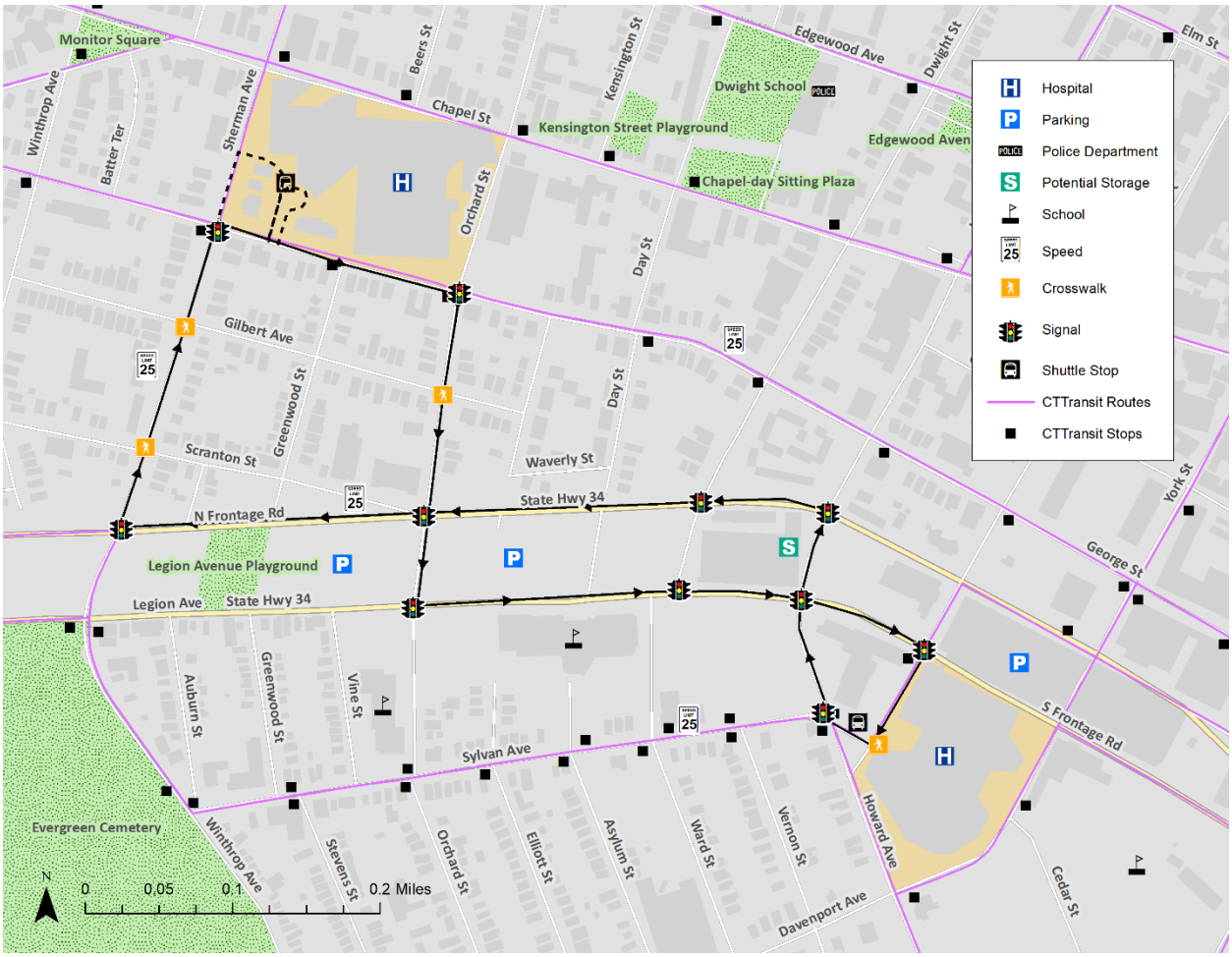
	Option 1 – Core Route	Option 2	Option 3	Option 4
Route Length (mi)	1.7	1.7	1.7	1.6
Avg. Route Speed (mph)	5.6	5.3	5.4	12
Headway with One Shuttle (min)	18	19	19	18
Speed limit <= 25 miles/hour	Yes	Yes	Yes	Yes
Viable Storage Location	Yes	Yes	Yes	Yes
Number Traffic Signals	11	14	13	12
Number of Stops at Stop Signs	0	0	0	1

Number of Pedestrian Crossings	4	3	7	7
Number of Lane Changes	3	3	1	1
Hours of Operation	M-F – 8am-6pm	M-F – 8am-6pm	M-F – 8am-6pm	M-F – 8am-6pm

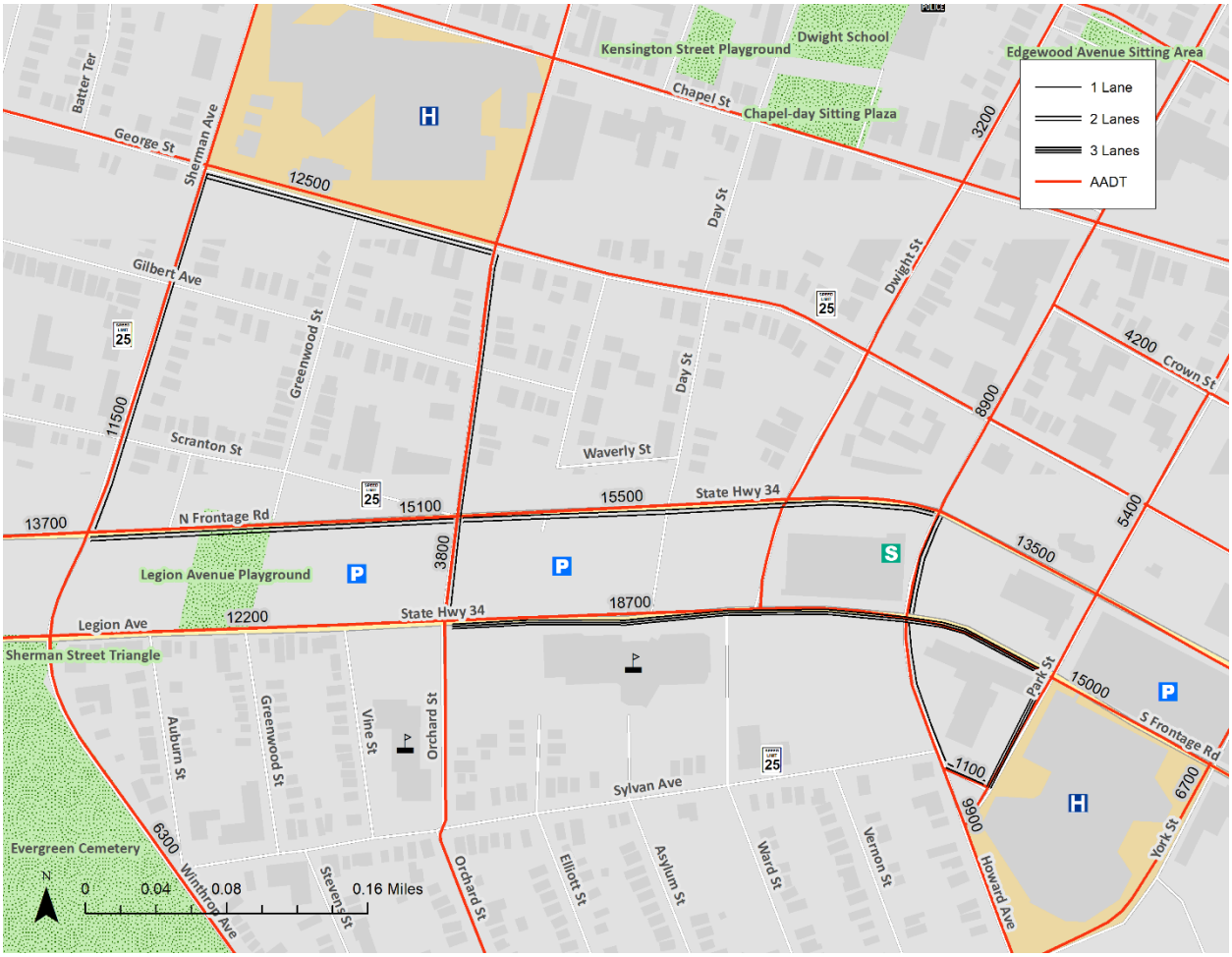
Table 2 – Level of Service Comparison

	Option 1 – Core Route	**Option 2**	**Option 3**	**Option 4**
Average Travel Speed between Stops (mph)	12	12	12	12
# of Roundtrip Stops	3	3	3	3
Dwell (seconds / stop)	120	120	120	120
Avg. Traffic Signal Delay (seconds / stop)	20	20	20	20
Passenger Load (passengers / vehicle)	12	12	12	12
Total Roundtrip Travel Time (hours)	0.30	0.32	0.31	0.3
Total Roundtrip Travel Time (minutes)	18	19	19	18
Average Route Speed (mph)	5.61	5.32	5.42	5.33
Vehicles Required for 10-minute headway	2	2	2	2
Actual Headway (minutes/vehicle)	9.08	9.58	9.41	9.00
Capacity (passengers/hour)	79	75	76	80

2.1.4.2 Hospital Connecter – Option 1 – Core Route



Map 1: AV Route, CT Transit, and critical infrastructure

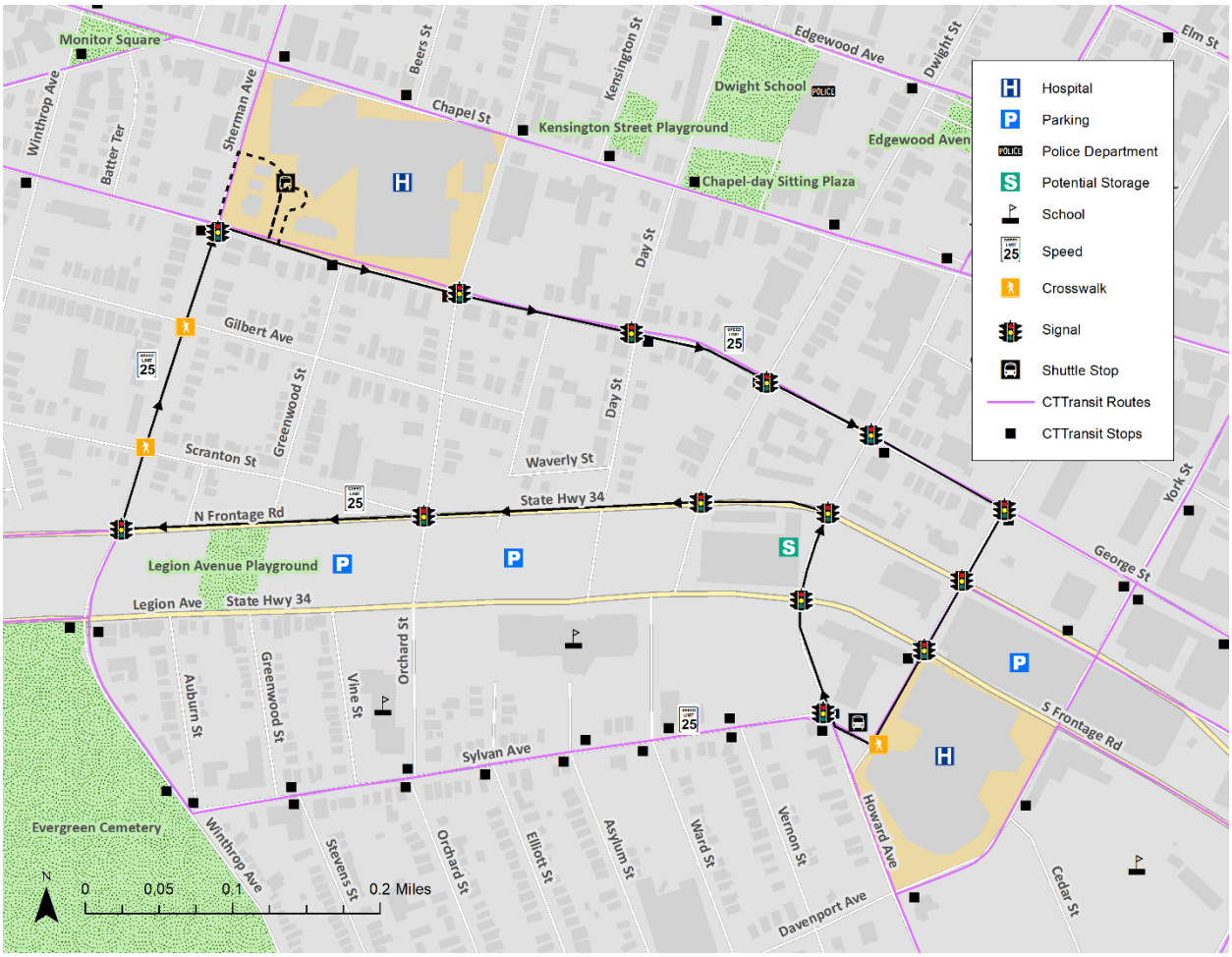


Map 2: Annual Average Daily Traffic and number of travel lanes

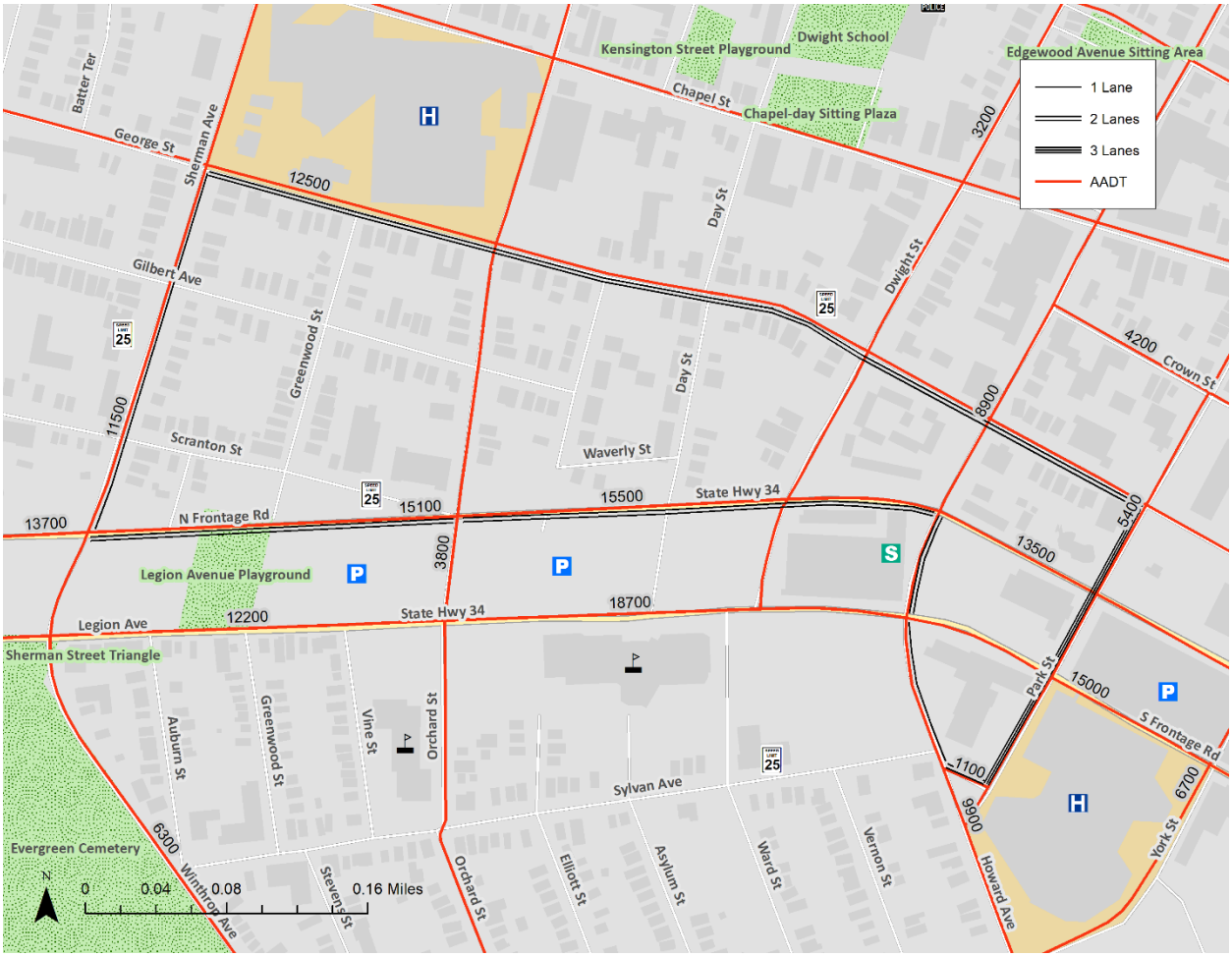
This route follows an existing inter-campus shuttle route connecting the two Yale New Haven Hospital campuses. This route would be important if a turn-for-turn comparison is preferred in evaluating existing shuttle technology to an autonomous shuttle. This route has more turns and time spent on a high traffic volume roadway compared to other options but has less signalized intersections that may need upgrading with Connected Vehicle (CV) communications technology. CV technology could be required by technology partners at signalized intersections to communicate Signal Phasing and Timing (SPaT) information from the signal controller to the shuttle. Such technical requirements for SPaT would be confirmed by the selected vendor.

As an alternative approach to the San Raphael stop, the vehicle may enter from Sherman Ave, making a right turn into the parking lot, and exiting on George Street. Testing during Phase 1 will operate on a fixed-route and schedule. There is an opportunity to introduce on-demand operations during a possible Phase 2, while extending hours of operation.

2.1.4.3 Hospital Connecter – Option 2



Map 3: AV Route, CT Transit, and critical infrastructure



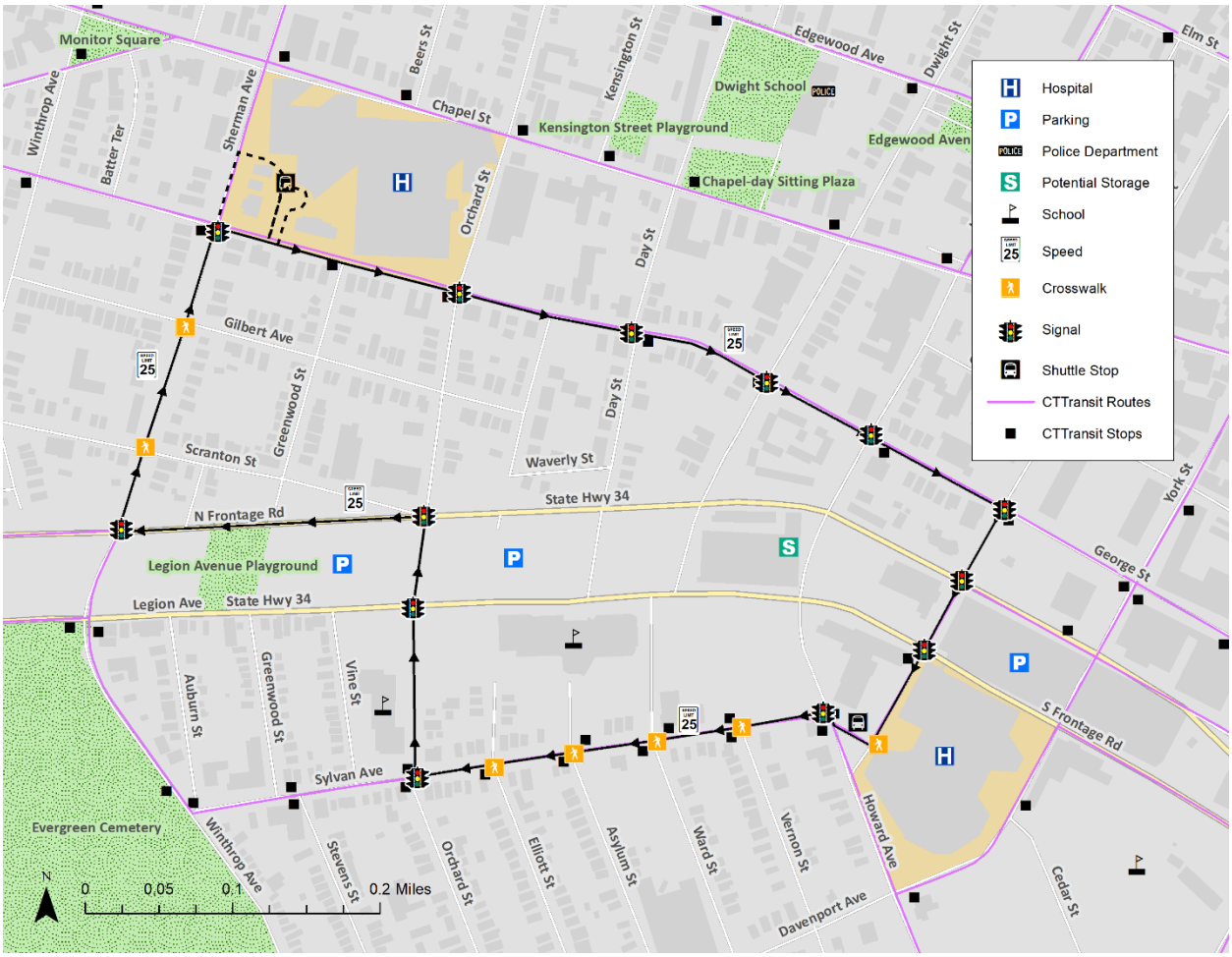
Map 4: Annual Average Daily Traffic and number of travel lanes

Option 2 is a modified routing of an existing inter-campus shuttle route connecting the two Yale New Haven Hospital campuses – Option 1-Core Route. This route minimizes the number of turns and avoids traversing Legion Avenue – a high traffic volume roadway. As an alternative approach to the San Raphael stop, the vehicle may enter from Sherman Ave, making a right turn into the parking lot, and exiting on George Street.

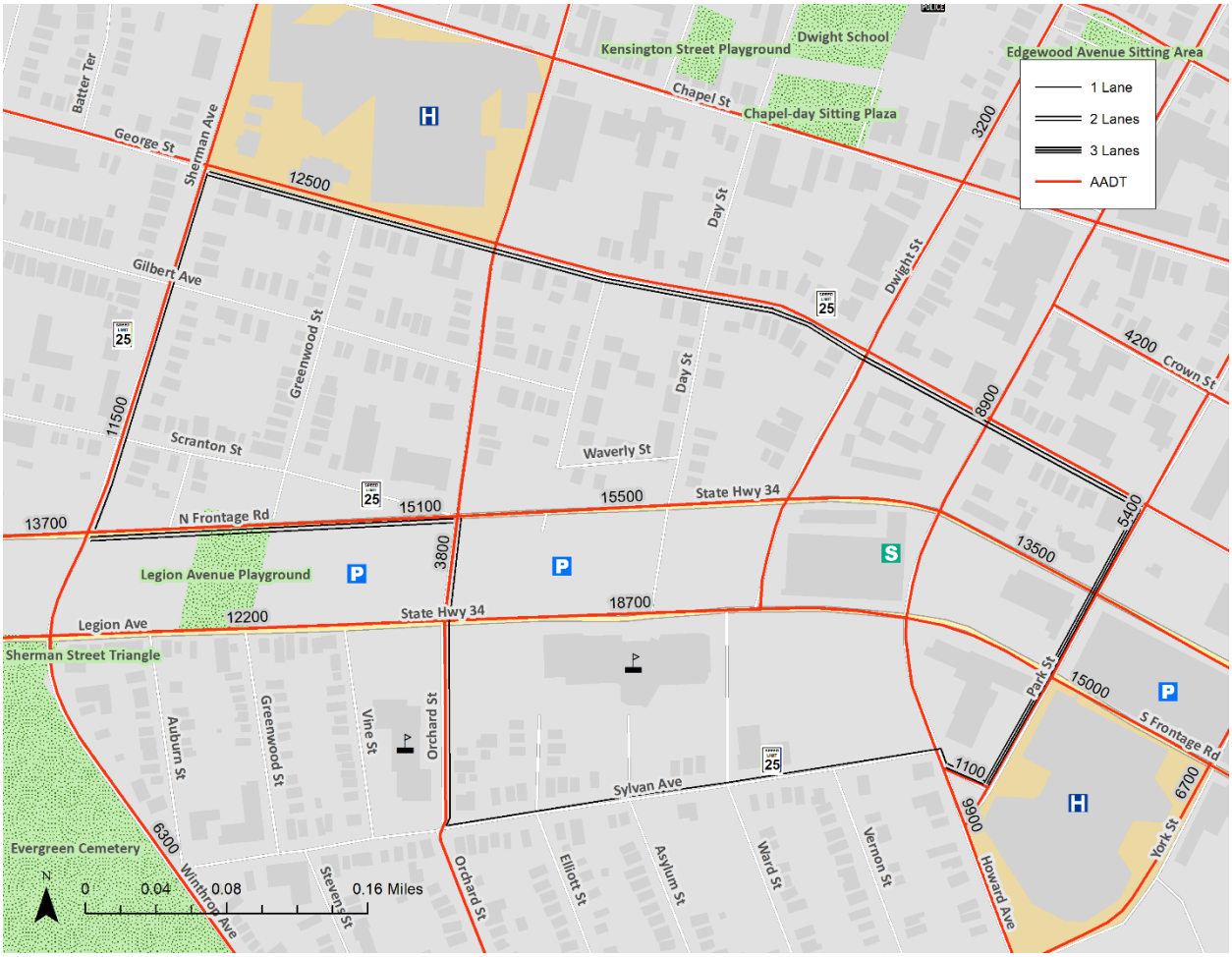
Connected Vehicle (CV) technology could be required by technology partners at signalized intersections to communicate Signal Phase and Timing (SPaT) information from the signal controller to the shuttle. Such technical requirements for SPaT would be confirmed by the selected vendor.

Testing during Phase 1 will operate on a fixed-route and schedule. There is an opportunity to introduce on-demand operations during a possible Phase 2, while extending hours of operation.

2.1.4.4 Hospital Connecter – Option 3



Map 5: AV Route, CT Transit, and critical infrastructure

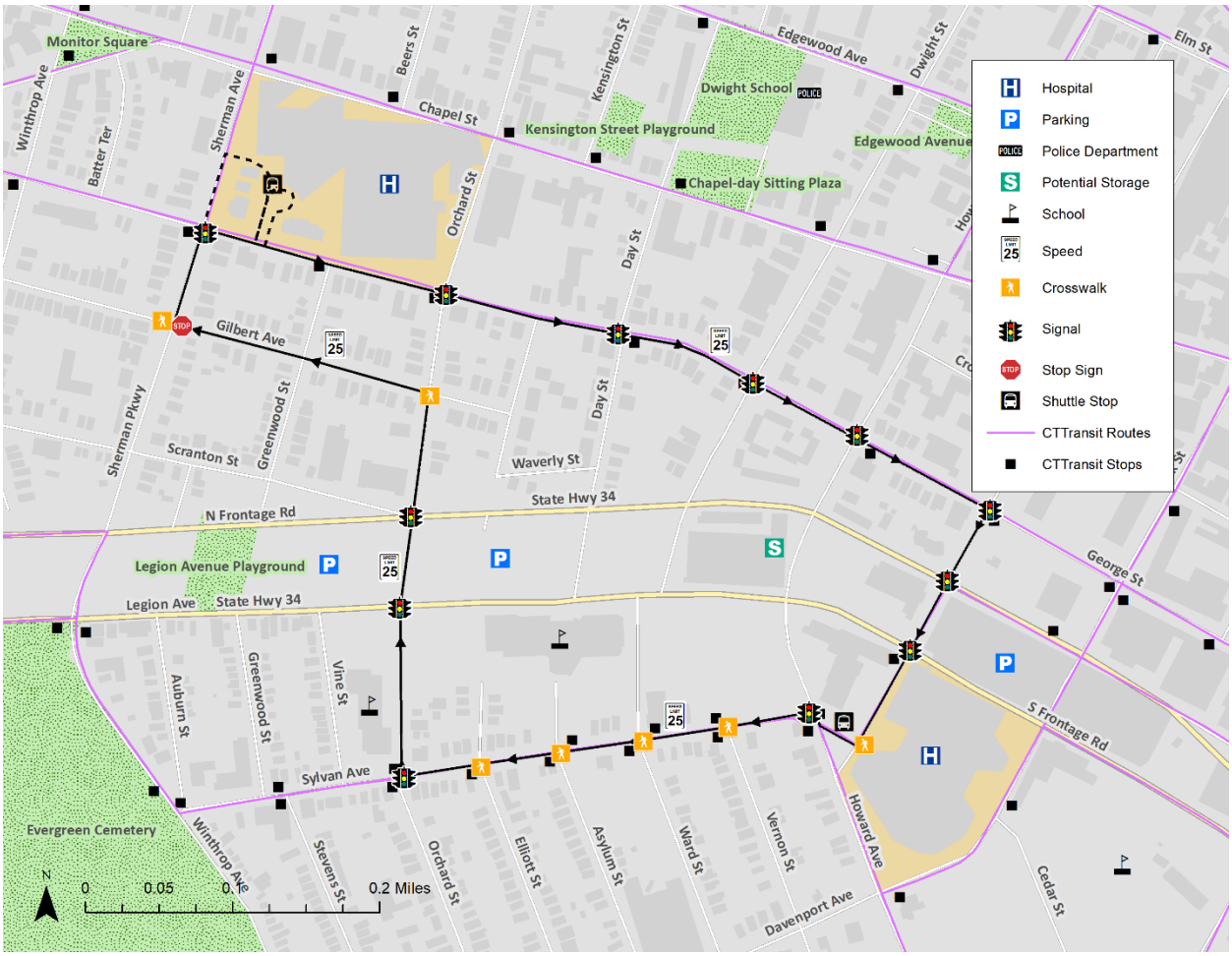


Map 6: Annual Average Daily Traffic and number of travel lanes

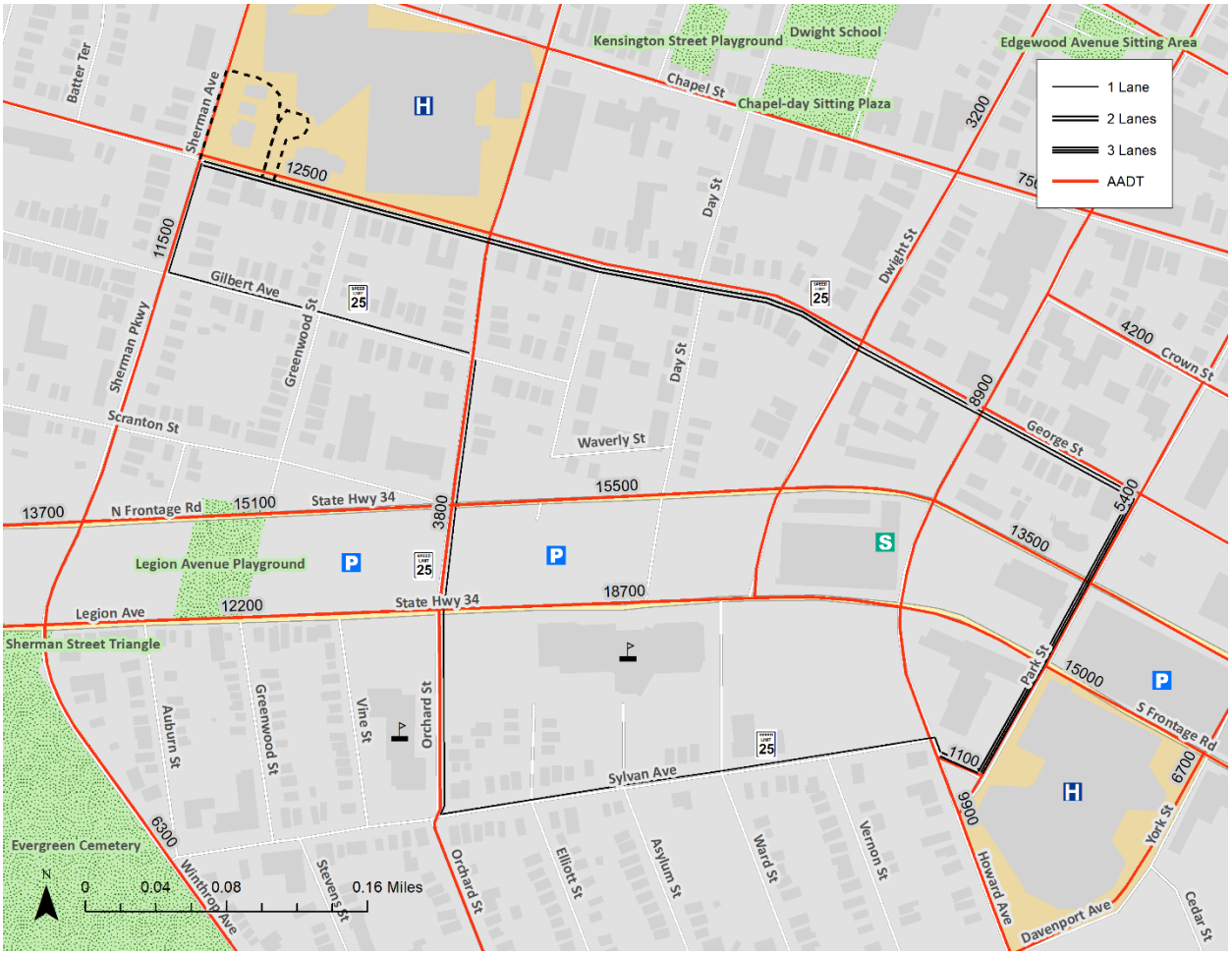
The Option 3 route serves the same destinations as the previous routes but minimizes time on the highest traffic volume roadways. The route instead travels Sylvan Ave, a local street with four pedestrian crosswalks, to avoid the busiest parts of Legion Ave and Frontage Rd. Once again, signalized intersections may need upgrading with Connected Vehicle (CV) communications technology. CV technology will be required at signalized intersections to communicate Signal Phasing and Timing (SPaT) information from the signal controller to the shuttle. Such technical requirements for SPaT would be confirmed by the selected vendor.

As an alternative approach to the San Raphael stop, the vehicle may enter from Sherman Ave, making a right turn into the parking lot, and exiting on George Street. Testing during Phase 1 will operate on a fixed-route and schedule. There is an opportunity to introduce on-demand operations during a possible Phase 2, while extending hours of operation.

2.1.4.5 Hospital Connecter – Option 4



Map 7: AV Route, CT Transit, and critical infrastructure



Map 8: Annual Average Daily Traffic and number of travel lanes

The Option 4 route serves the same destinations as the previous routes but only intersects the high traffic volume roadways and does not travel along them. The route travels Sylvan Ave, a local street with four pedestrian crosswalks, to avoid the busiest segments of Legion Ave and Frontage Rd. It continues north at Frontage Rd and travels west along Gilbert Ave where the low traffic volumes enable the AV to be managed by stop sign control. However, because of the high traffic volumes on Sherman Ave and Gilbert Ave, we recommend the 2-way stop sign controlled intersection be upgraded to a 4-way stops. Once again, signalized intersections may need upgrading with Connected Vehicle (CV) communications technology. CV technology will be required at signalized intersections to communicate SPaT information from the signal controller to the shuttle. Such technical requirements for SPaT would be confirmed by the selected vendor.

As an alternative approach to the San Raphael stop, the vehicle may enter from Sherman Ave, making a right turn into the parking lot, and exiting on George Street. Testing during Phase 1 will operate on a fixed-route and schedule. There is an opportunity to introduce on-demand operations during a possible Phase 2, while extending hours of operation.

2.1.5 Infrastructure Improvements

Connected Vehicle technology will be required at signalized intersections. A Road Side Unit (RSU) is proposed at each traffic signal controller. Dedicated Short Range Communications (DSRC) hardware, operating in accordance with SAE J2735 standards will allow the autonomous shuttle to receive a Basic Safety Message (BSM) and Signal Phasing and Timing (SPaT) information. This redundancy mitigates operational risk when vehicles are deployed on city streets either in constrained or mixed-traffic rights-of-way. The selected vendor would confirm the technical requirements required for CV communications.

Other modifications could include street treatments such as signage and lane striping. These are used to alert drivers, pedestrians, and other road users that they're operating on an autonomous shuttle route and should be aware. Furthermore, signage around the FAVTPP perimeter may be desired to alert roadway users they are entering/exiting an AV testing zone. These treatments may complement pick-up/drop-off improvements such as signage, benches, schedule information, or any other communications deemed necessary to create a positive user experience. Both pick-up/drop-off locations are existing YNHH inter-campus shuttle stops and may not require modification. Both vehicle fleets, autonomous and manually operated, will share these facilities. This will ensure passengers are familiar with boarding/alighting locations and will not disrupt other roadway users. It may be necessary to improve infrastructure in order to accommodate people with disabilities that remove barriers to accessing the system (i.e. sidewalk ramps, curb cuts, etc.). These areas will be identified and improved prior to system launch. The yet-to-be-procured vehicle and related system will be universally designed and able to be accessed by people with disabilities.

Charging, storage, and maintenance infrastructure must be made available for autonomous vehicle deployment. The vehicle can be accommodated by a storage location 10' wide, 10' high, and 18' long in either an existing parking structure or an off-the-shelf storage shed, sited in a nearby surface parking lot, located within 640' of the alignment. The space should be secure and protected from the elements to facilitate charging and any maintenance services. Several potential storage sites have been identified but the preferred storage location is the Howe/Dwight Garage at 2-18 Howe Street (denoted on the maps above as "Potential Storage") for its proximity to the preferred routes and vertical clearance of over 10 feet.

All roadway infrastructure is owned and maintained by the City of New Haven including the traffic signals. Suggested infrastructure improvements are wholly their responsibility. Storage and charging infrastructure improvements is the responsibility of the stakeholder team. It is not anticipated that there will be a need for State of Connecticut intervention on these matters.

2.1.6 Testing and Operations

The City of New Haven and its stakeholders anticipate regular hours of operation as Monday through Friday from 8am to 6pm. Vehicle preparation and stowage will take place in the hour before and after normal hours of operation, allowing time for operations staff to conduct daily launch and maintenance protocols (to be specified by vehicle vendor/technology partner). The vehicle will operate on roughly 30-minute headways during normal hours of operation and can be left to dwell (more likely at the Saint Raphael stop) if ahead of schedule (designated dwell location TBD). Later phasing could introduce on-

demand operations or scheduled operations offering greater flexibility when compared to the existing shuttle fleet. This will be subject to the success of initial phase operations on a fixed-schedule service. On-demand operations have not been conceptualized at this time.

In order to achieve a normal operating schedule, operations staff and the vehicle vendor/technology partner will phase the deployment. After initial site setup and mapping, the vehicle will be calibrated/tested during off-peak hours (M-F between 4am and 7am; M-F between 7pm and 10pm; Sat/Sun between 7am and 11am). Once calibration has been cleared for pre-deployment the vehicle may operate on a limited passenger serving schedule; off-peak hours, M-F between 10am and 2pm. This phase will continue until normal operating hours are considered viable by the operations staff and vehicle vendor/technology partner. Infrastructure modifications, including storage and charging requirements, should be finalized and installed before any on-site calibration and operations take place.

The combination of the four routes offer diversionary routing in case of emergency, conflict, or roadway maintenance. The entire service area will be mapped allowing for routing adjustments as needed. Rights-of-way are all multilane in the same travel direction or have shoulder/on-street parking lanes to allow for vehicle pull-off. The Saint Raphael stop has two approaches in case one is not accessible. The Main campus stop has a single approach but may use the driveway at 34 Park Street for passengers to alight in case of emergency.

The site setup and mapping schedule/needs will be coordinated by the chosen vehicle vendor/technology partner. It will likely consist of a vehicle with mounted mapping hardware operating the preferred routes, creating a point cloud of the environment to train the AV on the conditions of the site. It may also use the AV itself to operate the course with the deployment team onboard running the same procedures. Signage and an escort could be vital to completing the initial site setup and mapping. A detailed schedule of tasks will be made available to all stakeholders prior to any site setup, mapping, or testing/calibration.

2.2 TESTING LOCATION CAPACITY

2.2.1 Why New Haven?

New Haven wishes to introduce a Fully Autonomous Vehicle Testing Pilot Program (FAVTPP) to meet new mobility, safety, equity, and environmental goals. New Haven understands that transportation technology and mobility preferences are evolving, and the far-reaching impacts will change how their community moves; how urban development patterns shift; and how they do business. In a study conducted by FiveThirtyEight in 2016, New Haven was shown to be the most representative metro in the United States in terms of demographics so installing an autonomous vehicle (AV) system in the city may provide insight into how the U.S. engages with and responds to AV deployment more broadly.

New Haven has selected a test site that has been identified as a mobility gap – that of transporting hospital employees and patient's family members between two Yale New Haven Hospital campuses in downtown New Haven where parking can be limited, and roads are congested. A critical step to the mass adoption of autonomous vehicles is to understand how they fare against incumbent systems. In partnership, New Haven Parking Authority and Yale New Haven Hospital would like to compare fully

autonomous vehicle operations to their current inter-campus mobility solution – two, conventional 32-passenger shuttles.

Furthermore, this deployment site was chosen because it provides the best opportunity to pursue several objectives important to the City of New Haven and project stakeholders. These objectives include improving first/last mile mobility; offering additional accessible modes; augmenting public fleet with flexible and safe vehicle platforms; understanding AV operations and system requirements; improving access to large parking investments and employment centers; providing greater access to Yale New Haven Hospital campuses and parking facilities; observing how an autonomous vehicle (AV) performs under real-world conditions and meets user needs in comparison to legacy vehicles; and gaining AV operations experience to create a short- and long-term AV strategy.

Each of these objectives support broadly stated transportation-related efforts under the City's comprehensive plan, *New Haven Vision 2025,* such as improving connections north to south across Route 34; facilitating a Vision Zero policy; promoting "green streets"; and preparing the local workforce for a technology-based economy.

The functional, real-world use-case, strong stakeholder support, and community diversity all make New Haven and the chosen deployment site an attractive fully autonomous vehicle testing pilot program location.

2.2.2 Technology Partners

New Haven Parking Authority has contracted Stantec to assume the role of project manager for their autonomous vehicle planning and implementation. The first phase of their scope of work consists of Concept Plan development and production of the Application to the State of Connecticut Office of Policy and Management (OPM) for the FAVTPP, as follows:

- Task 1: Project start up and project purpose
- Task 2: Data collection and preliminary analysis
- Task 3: Route alternatives development
- Task 4: Alternatives refinement and analysis
- Task 5: Concept plan memorandum
- Task 6: Technology partner evaluation
- Task 7: System safety strategy
- Task 8: Communications strategy
- Task 9: Application to the State of Connecticut

Stantec has completed a site evaluation which has led to a concept of operations and deployment strategy. The documents are contained within this application as required by the State of Connecticut OPM for FAVTPP approval.

Furthermore, the New Haven Parking Authority publicly advertised a Request for Qualifications (project #18-056) in March 2019, garnering three responses - First Transit (Perrone), EasyMile, and Navya. New Haven Parking Authority and relevant stakeholders have had the opportunity to review these responses.

Stantec has conducted preliminary evaluations of five autonomous vehicle manufacturers/developers. Final selection of technology partner(s) will take place after notice to proceed from the OPM during a Request for Proposal process.

Table 3 – Technology Partner Summary

	EasyMile EZ10 (Gen 3)	**Navya Autonom**	**Local Motors Olli 2.0**	**May Mobility**	**First Transit (Perrone)**
Vehicle Manufacturer	Ligier	Navya	Local Motors	Polaris	Polaris (also multiplatform)
Robotics Developer	EasyMile	Navya	Robotic Research	May Mobility	Perrone
Vehicle Capacity (persons)	12	15	12	6	6
Wheelchair ramp/securement	Yes	Yes	Yes	No	No
Onboard Safety Operator	Yes	Yes	Yes	Yes	Yes

Once the City of New Haven and stakeholders have selected a vendor through a Request for Proposal process, and the vendor is awarded a contract, a chief elected official from the City of New Haven will enter into a written agreement with said vehicle tester per Public Act No. 17-69 and the Minimum Framework requirements.

2.2.3 Objectives

The City of New Haven and stakeholders hope to address a wide range of issues and obtain the following results:

- Increase Equity
    - Positive feedback from adjacent neighborhoods – measured through community survey or community engagement effort
    - Positive feedback from car-less households (if pilot moves beyond hospital employees) – measured through community survey or community engagement effort
    - Increased accessible mobility options – calculated through increase in accessible route miles

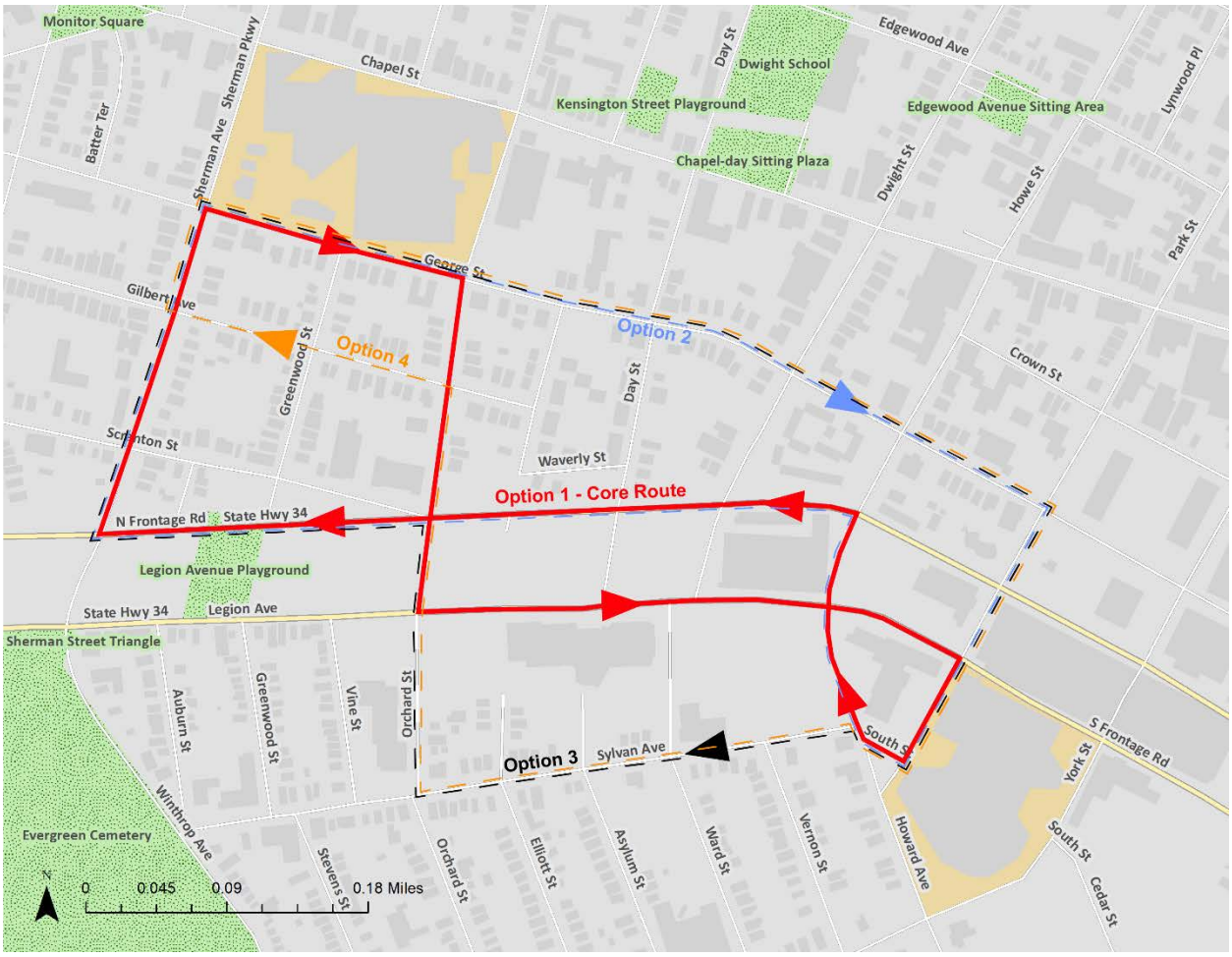
    - Improve transit/circulator rider experience – measured through rider experience survey or community engagement effort
    - Enhanced modal choice – calculated by increase in alternative mode route miles/facilities
- Improve first/last mile mobility
    - Meet or exceed performance of current conventional shuttle service in terms of:
        - Operational cost, headway, rider experience, and safety – measured through increase or decrease in applicable metric
        - Augment public fleet with flexible and safe vehicle platforms – measured through increase in fleet route miles and considered by safety measures (i.e. crash statistics, others)
    - Create flexible connection to and from parking structures/lots to YNHH campuses and between campuses – measured by improvement in wait time and operational cost savings
    - Create connection with CTTransit's Downtown to Union Station free shuttle (if stakeholders opt to pursue future phasing; not accounted for in this concept) – categorical measurement for if connection was implemented
- Support non-motorized modes
    - Encourage increase in walking and biking – measured by increase in pedestrian/bicycle flow
    - Garner support for active transportation infrastructure improvements – measured by qualitative analysis of public support for active transportation facilities improvement
- Understand AV operations and system requirements
    - Create knowledgeable public agency staff on the functions, requirements, constraints, and operations of autonomous vehicle technology – measured by qualitative analysis of increase in staff's AV knowledge (i.e. ability to implement and operate systems and support structure)
    - Increase knowledge of V2I Connected Vehicle infrastructure, on the functions, requirements, constraints and traffic signal controller integration challenges of DSRC technology – measured by qualitative analysis of increase in staff's CV knowledge (i.e. ability to implement and operate systems and maintain CV equipment)
- Understand if the technology can effectively serve the community
    - Get citizen feedback about mobility issues and solutions while introducing a safe and novel transportation system through an education campaign – measured through comparative analysis of legacy transit systems and citizen preferences/perceptions
    - Prepare infrastructure for advanced transportation systems – electrification, automation, connected infrastructure, and more – measured by qualitative analysis for ability to mobilize support for advanced transportation technology
    - Provide DSRC BSM and SPaT connected vehicle information to private vehicles capable of receiving DSRC messages if applicable – measured by gathering feedback on the usefulness of the system

Other standard metrics will be collected and analyzed, including:

- Total vehicle miles traveled

- Traffic incidences and severity
- System disengagements and details
- Average operating speed
- Ridership by location and time of day
- On-time percentage
- Service/maintenance records
- Electricity consumption/cost

2.2.4 Preferred Routes



Map 9: All preferred route options

The routes and deployment strategy are unique when compared to other AV deployment proposals within Connecticut. Stakeholders have chosen to leverage the strengths of fully autonomous vehicle technology (i.e. flexible operations schedule, lower operations cost, zero emission operations, shared mobility, etc.) to improve access between parking facilities and the Yale New Haven Hospital campuses. By filling this mobility gap, stakeholders will have extended the reach of their parking facilities and improved inter-

campus mobility while demonstrating a sustainable form of transportation to adjacent neighborhoods and the State.

Mixed-traffic operations pose a challenging but necessary function to the wide-spread commercial deployment of autonomous vehicles. Although in mixed-traffic, the low-speed environment offers a manageable deployment area, making this site an important test bed for future deployments and data sharing. It also provides stakeholders the opportunity to compare their current shuttle fleet to a fully autonomous shuttle fleet under identical conditions. This supports New Haven's comprehensive plan, *New Haven Vision 2025,* by offering a mobility solution for the planned transit-oriented and medical technology-related, mixed-use development along Route 34.

Current shuttle operations consist of two, 32-passenger inter-campus shuttles operating 24 hours per day, 7 days per week, with 30-minute headways. Ridership averages between 450-500 persons, daily. The stakeholders would like to test autonomous vehicle technology and compare it with current solutions. The current system demonstrates demand but presents several shortfalls. It cannot accommodate guests of patients traveling between hospital campuses. It is for employees only with hospital identification. Also, the scheduling is inflexible. It operates on fixed-headways without the ability to schedule rides or accommodate on-demand riders. A fully autonomous vehicle deployment can address these issues.

The planned routes serve a major employment population that is projected to increase. Congestion is already a concern for the business community and residents of adjacent neighborhoods. As infill development increases in the planned deployment area per *New Haven Vision 2025*, congestion is likely to increase. The stakeholders are proactively seeking solutions that will help mitigate these concerns. These solutions include fully autonomous vehicle fleets but also include improved pedestrian and bicycle infrastructure which is supported by autonomous vehicles. New Haven's dedication to these efforts is exhibited by it being the first city in Connecticut to adopt complete streets design standards in 2008.

This geographically small deployment site (less than 150 acres) is home to the densest and most diverse neighborhoods in New Haven[1]. The Hill and Downtown neighborhoods having made strides in increasing mixed-use development and improving connections north and south of Route 34. This project will continue to support these efforts and focus on equity and environmental issues by deploying state-of-the-art transportation technology to areas where the widest set of citizens can experience its potential. Part of this strategy is motivated by the desire of the business community to continue to be great neighbors to adjacent neighborhoods. Moving people via clean, electric, and quiet vehicles decreases environmental impacts and respects noise levels.

One of the most important conditions required for implementing fully autonomous vehicle testing is having a strong and motivated partnership of stakeholders to successfully guide such a project. The City of New Haven is proud to have the New Haven Parking Authority lead the charge towards system deployment,

[1] The Hill is the most ethnically diverse neighborhood in New Haven and Dwight and Downtown are the densest. This deployment site has the opportunity to impact a large and diverse set of citizens. Source: https://www.newhavenct.gov/civicax/filebank/blobdload.aspx?blobid=25816 (pp 11-4 – 11-5).

accompanied by a group of significant stakeholders, all of which have been involved in the planning for this FAVTPP concept of operations.

New Haven Parking Authority

The New Haven Parking Authority manages the City's 8,000 plus parking spaces at several large parking structures including Air Rights, Crown Street, Union Station, and more. They also maintain the surface parking lots situated throughout downtown New Haven. Their security team ensures safety at each location.

Yale New Haven Hospital

The Yale New Haven Hospital is a regional health care provider and the #1 employer in Connecticut with 25,000 employees statewide. The hospital system serves 1.5 million patient visits per year and has the 4th largest number of beds in the U.S. It has great interest in leveraging emerging transportation technologies to mitigate congestion and improve mobility between its campuses.

Yale University

Yale University has a storied and prestigious 300-plus year reputation. The student body hails from 118 different countries, studying subjects ranging from forestry to medicine. Yale's high standards are reflected in its award-winning faculty and competitive acceptance requirements. Yale University supports this pioneering project and intends on being actively engaged in its safe implementation with an eye towards future system expansion.

Industry Partner (Vehicle/Technology Partner)

Although the City and stakeholders have not yet chosen a vehicle vendor for their operation, they have received interested via an RFQ process from three leading providers – First Transit/Perrone Robotics, EasyMile, and Navya. During an RFP process, to be conducted after FAVTPP approval from the State of Connecticut OPM, they anticipate finding the best solution for their needs and deployment site.

Connecticut Department of Transportation

The Connecticut Department of Transportation has played an important role in advising New Haven's testing plan and has continued to stay engaged. New Haven looks forward to continuing to work with CT DOT on a mutually beneficial program implementation.

2.2.5 System Safety Strategy

The City of New Haven has a culture of safety reflected in its participation in Region 2 of the State's Division of Emergency Management and Homeland Security (DEMHS) Regional Emergency Planning Team (REPT). At a local level, an investment in site specific emergency management services for Yale University, Yale New Haven Hospital campuses, and New Haven Parking Authority facilities demonstrate New Haven's commitment to safety.

In addressing transportation safety specifically, a group of stakeholders have formed a traffic safety group. To keep traffic safety protocols and processes current the group assembles monthly to discuss traffic management matters. As autonomous vehicles become more prevalent, the stakeholders have proposed a new Safety Operations Committee focused on connected and autonomous vehicle technology and this specific project. A wider set of stakeholders will be included in this committee – i.e. CT DOT, Fire Department, Yale University Police, NHPA and NHTA security personnel, police commission, technology partner(s), Emergency Management Commission, and any other pertinent organizations.

In preparation for this submission, NHPA with the help of Stantec, have drafted a Safety Strategy that will guide a risk assessment and mitigation process to safely introduce autonomous vehicles to the community. This System Safety Strategy document is a high-level summary that outlines the key safety risk management steps that will be taken at various stages of the project to ensure proper implementation and ongoing, compliant operation of the City of New Haven Fully Autonomous Vehicle Testing Pilot Program (FAVTPP).

As recommended by the US DOT, the safety risk management process for this project will employ a mixture of industry best practices and voluntary guidance to manage safety risks along the different stages of project implementation.

The safety management plan will follow the State of Connecticut Public Act 17-69 to comply with all minimum requirements for FAVTPP operation. It will also follow National Highway Traffic Safety Administration (NHTSA) guidelines put forth in *Automated Driving Systems 2.0: A Vision for Safety* (*AV 2.0*) and *Preparing for the Future of Transportation: Automated Vehicles 3.0* (*AV 3.0*).

At each stage of the project, collaboration will be needed amongst various stakeholders including the vehicle manufacturer (technology partner), program manager (Stantec), infrastructure owners and operators (NHPA, Yale New Haven Hospital, Yale University), the vehicle owners and operators (TBD), local Emergency Management Services personnel, City of New Haven, the State of Connecticut Office of Policy and Management, Department of Motor Vehicles, Department of Emergency Services and Public Protection, Department of Transportation, and the Connecticut Insurance Department in order to ensure safety risks are appropriately managed and all testing is conducted in accordance with applicable laws and regulations.

The System Safety Strategy is divided into five main parts, discussed in detail below:

- State of Connecticut Compliance
- Risk Assessment and Mitigation
- Safety Operations Plan
- Emergency Response Protocols
- Project Team Responsibilities

2.2.5.1 State of Connecticut Compliance

The City of New Haven will take all necessary measures to ensure compliance with Public Act 17-69 and any provision of general statute or any ordinance of New Haven concerning the operation of motor vehicles before and during FAVTPP operation.

New Haven is eligible for selection by the State of Connecticut Office of Policy and Management to be one of four municipalities chosen to test fully autonomous vehicles on public roadways. The City of New Haven will enter into a written agreement with an autonomous vehicle tester to operate fully autonomous vehicles on the municipality's public streets and meet all conditions described within the application for FAVTPP and the required minimum framework for agreements between municipalities and autonomous vehicle testers.

New Haven will comply with all State insurance, registration, and licensure requirements for motor vehicles in accordance with Connecticut General Statutes Title 14. The "operator" will meet all licensure requirements for autonomous vehicle operations and perform duties in accordance to Public Act 17-69. The system will operate in accordance with the City's municipal code of general ordinances.

Deliverable: FAVTPP Application

2.2.5.2 Risk Assessment and Mitigation

Before system deployment, project stakeholders will carry out a site evaluation and risk assessment customized to meet the needs of the vehicle platform and Operational Design Domain (ODD).

The initial site evaluation will be conducted prior to technology partner selection. This will help develop a concept of operations that the City has approved. Once an autonomous vehicle tester is chosen, they will approve or adjust the initial concept of operations and help create a mitigation plan that will adhere to the specific capabilities and ODD of the chosen autonomous vehicles tester's system as well as local emergency response protocols.

Risk Assessment Guidelines

The risk assessment methodology, in line with best practices, is as follows:

- timely identification of hazards;
- risk assessment of each hazard;
- determination of control measures and the party responsible for implementation;
- reassessment of the hazard after controls are applied; and
- creation of a 'living' due diligence document that can be referenced and revised as necessary throughout the FAVTPP lifecycle.

NHSTA Voluntary Safety Self-Assessment (VSSA)

To ensure the autonomous vehicle tester has identified, analyzed, and resolved safety considerations prior to deployment of their Automated Driving System (ADS) technology, they will be required to complete the NHSTA Voluntary Safety Self-Assessment (VSSA) described in USDOT – NHTSA AV 2.0.

In the VSSA, the Technology Partner will document their use of industry standards, best practices, company policies, or other methods they have employed to provide for increased system safety in real-world conditions with respect to the following ADS Safety Design Elements:

- System safety
- Operational Design Domain
- Object and Event Detection and Response
- Fallback (minimal risk condition)
- Validation methods
- Human machine interface
- Vehicle cybersecurity
- Crashworthiness
- Post-crash ADS behavior
- Data recording
- Consumer education and training
- Federal, State, and Local Laws

NHTSA Approval Documentation

Other potential system validation measures include the presentation of the technology partner's NHTSA approval documentation. This documentation records the technology partner's compliance with NHTSA requirements for the operation of their system. It is system-specific and allows the technology partner to operate the named system within an approved deployment site.

Deliverable: Site evaluation; Concept of Operations; Risk Assessment; NHTSA VSSA; and NHTSA approval documentation.

2.2.5.3 Safety Operations Plan

The Safety Operations Plan will compile all previously detailed documentation for vehicle operation and risk mitigation. It will serve as a resource for system operators to reference for typical daily operations, routine maintenance procedures, and emergency protocols. It will introduce the digital toolkit used to ensure efficient and safe operation of the vehicle system. Potential tools include:

- dRisk – Risk assessment and mitigation platform
- Icarus – Daily operations digital checklist and record keeping

The Safety Operations Plan will issue best practices and training material for the various roles and responsibilities required for FAVTPP operation. Operations roles include:

- Onboard operator – licensed operator able to take control of vehicle in emergency situation; liaise with users as an ambassador for the vehicle system and technology, in general
- Safety supervisor – on-site supervisor to manage vehicle operations
- Remote supervisor – back-end remote supervisor to monitor fleet management system

2.2.5.4 Emergency Response Protocols

The development of emergency response protocols requires coordination with local first responders and law enforcement to capitalize on already established communications protocols, begin the education process for this new technology, and begin drafting roles and responsibilities for the 'what-if' scenarios.

This process will be conducted as a collaborative workshop where a chosen technology partner will introduce the specifics of their system and provide training for how to respond to a range of emergency situations. Emergency management personnel will use this information to incorporate into existing emergency response protocols.

Deliverable: Emergency Management services training and protocol documentation

2.2.5.5 Project Team Responsibilities - Summary

Stantec

- Route design and improvement:
  - Conduct site evaluation
  - Design concept of operations
  - Conduct risk assessment with technology partner
- Assist technology partner with completing the NHSTA Voluntary Safety Self-Assessment
- Facilitate emergency management services training and help develop/implement protocols

City of New Haven and New Haven Parking Authority

- Operations and maintenance
- Security (storage and charging)
- Coordination of Public Sector stakeholder participation in project meetings and emergency response protocols
- Participate with all stakeholders in completion of emergency management services training and protocol development

Technology Partner (autonomous vehicle tester)

- Completion of the following safety documentation, working with Stantec if/as required:
  - Concept of operations approval and risk assessment
  - NHSTA Voluntary Safety Self-Assessment
  - NHTSA approval documentation
- Emergency Management Services training
- Work with stakeholders to help develop Emergency Response Protocols
- Operator training
- System documentation delivery
- Site set-up/mapping

2.2.6 Communications Strategy

The City of New Haven is working to implement a fully autonomous vehicle testing pilot program (FAVTPP) in accordance with State of Connecticut Public Act No. 17-69. City stakeholders seek to provide greater access to Yale New Haven Hospital campuses and parking facilities, observe how an

autonomous vehicle (AV) performs under real-world conditions and meets user needs in comparison to legacy vehicles, and gain AV operations experience to create a short- and long-term AV strategy. Public engagement and promotion are a key tactic to achieve an informed and supportive user-base.

2.2.6.1 Communications Plan Purpose and Goals

PURPOSE

The City of New Haven has the opportunity to deploy fully autonomous vehicles under the State of Connecticut's testing pilot program per Public Act No. 17-69. In order to meet the objectives of the community by integrating a forward-thinking transportation system, this Communications Strategy will outline the engagement of stakeholders by disseminating project/technology information and soliciting feedback to ensure a successful deployment.

GOALS

Outreach and initiatives used to inform stakeholders should be based on the following goals and objectives:

- Provide a single point of contact and clear communication channels to ensure effective exchange of information and collaboration amongst team participants, agencies, stakeholders and members of the public
- Identify the affected and interested public within the project area and develop effective means of targeting outreach to maximize exposure
- Inform and educate the public in a timely fashion
- Receive input, and respond and/or address concerns from the public
- Encourage interaction with the community and incorporate their concerns into the decision-making process
- Provide clear and consistent messaging for the program in plain language

2.2.6.2 Marketing Autonomous Vehicles

Public education and stakeholder engagement are a critical component to the introduction of any new technology, and vehicle automation is no exception. Understanding the values and beliefs of the audience will help frame how the messaging is designed and delivered. It is important to engage the public and stakeholders early to help inform a positive and impactful outreach plan and successful vehicle deployment. Knowing the possible outlets for messaging while creating new opportunity for communication will have the highest chance of disseminating educational information, thereby involving potential users on the technology deployment journey.

Stantec will help create this journey and align it with the vision the City of New Haven has set for downtown New Haven and the employment district of Yale New Haven Hospital. Stantec will use a variety of channels, events, and tactics to raise awareness, inform, and gather feedback by way of technology demonstrations, surveys, working groups, social media campaigns, and more. The effectiveness of the communication plan will be continuously analyzed and improved as needed throughout the process.

2.2.6.3 Target Audiences

GROUP A

The New Haven Parking Authority and Stantec have identified a variety of stakeholders as a core group of entities that have a high interest and at least some decision-making power regarding the deployment of an autonomous vehicle system. These entities are included in concept planning, day-to-day decision making, and/or operations. These entities include:

- City of New Haven
- New Haven Parking Authority
- Yale New Haven Hospital
- Yale University

GROUP B

This group consists of all stakeholders that have a high interest in the project but are not involved in day-to-day planning and operations. They may provide feedback and in some cases approval. They are the primary contacts listed in **Appendix A, Table 1**.

GROUP C

A third target audience includes those groups that will use the autonomous vehicle system. This user group consists of Yale New Haven Hospital employees and family members of patients in the hospital system. They will provide feedback on their level of satisfaction and perception of vehicle service and its safety. They will be provided information on how to use the system and solicit feedback.

GROUP D

A final group consists of those that should be kept aware of the deployment process and technology and be able to provide feedback/questions about operations or the technology. These may be downtown New Haven residents and business owners.

COMMUNICATION APPROACH

Stakeholders from Groups A and B will be engaged through a series planning meetings and in-person workshops to address operational issues on topics such as emergency response and protocol integration, data management, charging/storage/maintenance, operations reporting, and more. These groups will also receive meeting minutes, task lists, and memorandums. During system planning, teleconference meetings will be held bi-weekly or as needed, with milestone meetings being held in-person according to schedule.

In general, the communications plan will target Groups C and D – those outside of the core group – such as users and area residents/business owners. Promotion will target the Group C to increase awareness and encourage use of the system. It will be educational in terms of its introduction to the technology and informational in terms of explaining the logistics of its use. This communication will provide an outlet for feedback as well.

Area residents and business owners will receive communications of technology descriptions and operations information, including site setup, testing, and calibration schedules. Communications will provide the opportunity to provide feedback and ask questions. Instructions on how to access public facing data may also be provided.

2.2.6.4 Communication Strategies

Stantec, in coordination with the New Haven Parking Authority and Yale New Haven Hospital, will undertake to introduce the technology to the public and stakeholders and raise awareness for the project. Tactics should aim to increase support, alleviate concerns, and generate enthusiasm for the technology and project.

Stantec will work with stakeholders to document and incorporate their vision of the project into campaign messaging by way of the previously mentioned methods. Early solicitations will frame early planning concepts/efforts and engagement will evolve to address current or future needs. Consistent communication will be necessary to ensure a smoothly functioning deployment. The stakeholder groups will decide on an effective meeting cadence.

PROJECT ADVISORY GROUP

Working with city officials and Groups A and B, an autonomous vehicle working group may be organized to set priorities for education, outreach, and operations while helping prioritize the future of the system. A working group could consist of members of the public and select individuals from stakeholder groups such as those from emergency management services and governmental bodies. A diverse perspective will be important in creating a working group focused on vehicle automation and its introduction into the community.

A key role and responsibility of this group will be to advise on any safety needs and set priorities for community education. Stantec will manage monthly meetings to ensure coordination between individuals and entities. Agendas will be based on the current needs of the project.

PRINT STRATEGIES

Fact sheets, technology summaries, and brochures can be used to introduce the project or certain aspects of the vehicle technology and will be made relevant to all audiences. Three tactics are addressed below.

Leave behinds

Marketing collateral will be produced as "leave behinds" for various local businesses and awareness events. Collateral can be tailored to a specific event or audience but will serve the purpose of communicating general information about the technology and an overview of the project.

Direct mail

If desirable, a direct mail campaign can be created to augment any other print strategies. Recipients can be segmented into different categories – such as local businesses, young hospital employees, families, etc. – with tailored messaging.

User Instruction

Signage can be created to provide quick how-to instructions for system use. Placement of these at vehicle stops, staff common areas, patient waiting rooms, and other key locations can help “on-board” users while raising awareness.

MEETINGS AND EVENTS

Stantec will help conduct in-person public engagement for the core group of stakeholders and the user group. Workshops will be held for planning and deployment purposes for the core group and the user group may be engaged at local events or technology demonstrations. The core group of stakeholders would also benefit from these user-centric engagements.

At key events, the technology and logistics for its use will be explained by producing collateral and representing the project while collecting feedback and introducing the value of autonomous transit. Initial public engagement efforts will be designed around feedback from early stakeholder workshops but will be refined as the team learns more about the public opinion toward vehicle automation. Surveys may be periodically employed to gather this information from any user group.

Continuous involvement in outside public events should take place before, during, and after system launch to strengthen community support and maintain a positive dialogue throughout operation. Key events will be selected that best foster this objective.

Accessibility Workshop

There is potential to host an Accessibility Workshop to engage the disability community on the topic of autonomous vehicle accessibility. The Workshop should feature a live vehicle demonstration from a partner vehicle manufacturer and offer attendees the opportunity to experience the vehicle while offering feedback for accessibility feature optimization. This would help the vehicle manufacturer gain insight into the needs of this underserved community in the New Haven service area and allow the disability community to voice their needs and become acquainted with the technology and the manufacturer’s objectives and development roadmap.

Steps to select Workshop attendees and format the agenda will be determined in partnership with the City of New Haven Disability Services department and the chosen vehicle manufacturer.

Open house

An open house or technology demonstration may be held to present information and strengthen enthusiasm and support for the project. Staff will be on-hand to answer questions, guide conversations, and distribute printed materials. Open houses are an informal way to interact with potential system users,

members of the press, elected officials, and community leaders and are typically well-received by the audience. The open house can be promoted using the communication strategies identified above.

Industry events

A variety of industry events can be targeted from vehicle automation/technology events to other industry-specific events. Stantec will work with stakeholders to identify a host of local and national events to promote the project.

Local events

Stakeholders will be able to identify a wide variety of local events and Stantec will help advise on which would best showcase and promote the project and vehicle service. Large- and small-scale events alike should be targeted to offer different types of engagement.

2.2.6.5 ELECTRONIC STRATEGIES

Digital content will be created to increase the reach and scalability of offline assets and in-person public engagement. Once again, communications will be made relevant to all audiences. Two tactics are addressed below.

Web content

Project information and status updates can be amended to the existing stakeholder websites. If desired, a dedicated website can be created to host vehicle technology overviews and other project specifics that link to the stakeholder websites. The website should be the ultimate resource for a self-guided tour of the technology, service, and overall project. It can give a historical overview of AVs, a current explanation, a project vision, a service design and deployment overview, and more.

It should offer tools for a user to communicate with the New Haven Parking Authority, Yale New Haven Hospital and other relevant stakeholders, whether they are asking questions, providing feedback, or looking for the next meet-up.

Social media content

Social media platforms will give the project the furthest reach and largest audience. Being tactical about messaging will help the autonomous vehicle service cut through the noise of social media. One tactic includes leveraging relevant relationships with accounts that have substantial followers and engagement – city, business, and community group accounts – to quickly scale the reach of the messaging. Evaluating these accounts for project/brand alignment will be important and primarily used to increase awareness.

City-owned and hospital social media accounts, such as the existing Facebook, Instagram, and Twitter pages, will play an important role in offering a consistent voice and vision as well as active and prompt user engagement. They will likely be the most active touchpoints and best opportunity for fostering an informed discussion with the public. It should be noted that social media engagement is a time sensitive process. The party responsible for this task must commit to managing a responsive

campaign. These platforms can offer general information on the technology and project as well as system-level updates targeted to users.

Video

Utilizing user-produced video for outreach events and promotion is an engaging and inexpensive way to demonstrate the functionality of the technology. As opposed to overly produced marketing pieces, these could more effectively humanize and authenticate an otherwise potentially intimidating technology.

For example, Stantec, New Haven, and the chosen technology partner could ask for users to post video/photos using predetermined hashtags to compile experience from an event. These could be repurposed during later campaigns. The use of Facebook Live or Instagram Live is also a great real-time engagement tactic that offers immediate feedback and is relatively inexpensive.

Professional video content can also be produced that is more educational and that would have greater longevity. It can be adapted to various platforms, audiences, and events. Video can live on any stakeholder website or stakeholder-owned YouTube channel. Other video features could focus directly on the vehicle technology partner(s) and their outlets could house the content.

2.2.6.6 Media

The media strategy should seek to raise awareness for the project and educate on the benefits of autonomous vehicles. It should provide an overview of the technology, so people understand its capabilities. It will not promote use of the system as the initial deployment phase will only be open to hospital staff and possibly patient's family members.

MEDIA KIT

A media kit will be provided that includes general information about the project and schedule, educational materials, photos and videos, and contact information. It will be hosted on a project website available for download or through the project's public relations officers upon request. It will be updated as needed.

PRESS COVERAGE

In coordination with the core group of stakeholders, Stantec will help create press coverage packages for local media outlets including TV, newspaper, and radio. The packages will be sent to contacts within these outlets.

COMMUNICATION MANAGEMENT

Thorough records of communication and public engagement will be kept in order to evaluate which methods were effective and which need refinement. Reports and summaries can be generated to convey project status updates and lessons learned.

CRISIS COMMUNICATION/EMERGENCY RESPONSE

Every communication campaign must anticipate adverse feedback. Maintaining a clear, consistent, and speedy response will alleviate much frustration for all stakeholders and the public. Stantec will work with stakeholders and the selected technology partner(s) to craft thorough responses and FAQ packages to alleviate adverse feedback. A lead contact and response team will be assigned during the next phase of planning.

2.2.7 Emergency Response

System safety is a paramount concern which is why NHPA and Stantec have created a safety strategy that identifies and mitigates risk by:

- Complying with State of Connecticut legislation and guidance
  - Public Act No. 17-69
  - OPM's minimum requirements framework
- Conducting Risk Assessment and Mitigation
  - NHTSA VSSA and approval documentation
- Creating a Safety Operations Plan
  - Operations tools and training for key roles
- Identifying Emergency Response Protocols
  - Protocol documentation and training for EMS (work with chosen technology partner)

NHPA and Stantec have designed a multiphase approach that engages and trains law enforcement and emergency response personnel through a series of in-person workshops and demonstrations. With each phase, stakeholders will work towards delivering a set of documents that reflect the specific conditions in which the New Haven autonomous vehicle system will operate and how to manage risk under those conditions.

Planning phase (Pre-submission)

- Objectives
  - Engage EMS personnel early, prior to application submission; review existing protocols pertaining to traffic/vehicle/transit safety; introduce autonomous vehicle-specific requirements, constraints, technology, and use cases
  - Create Safety Operations Committee to address connected and autonomous vehicle-specific concerns; set objectives and timelines
- Outcomes
  - Shared understanding of existing protocols applicable to the operation of autonomous vehicles in proposed deployment site
  - Understanding of the use-cases, capabilities, and realities of the proposed vehicle technology
  - Preliminary site evaluation and risk assessment
  - Safety Operations Committee schedule and tasks

Pre-deployment (Notice to Proceed)

- Objectives
  - Vehicle manufacturer will further engage EMS personnel and relevant stakeholders on the specific system once a selection has been made and before system launch
- Outcomes

  - Understanding of general operational protocols of chosen technology
  - Completion of Preliminary Hazard Analysis

Deployment (Notice to Proceed)

- Objectives
  - Safety user-guide will be delivered by the vehicle manufacturer and a risk assessment and VSSA will be completed prior to launch by Stantec and the technology partner
- Outcomes
  - These documents should be used for training purposes and as real-time references, if needed, for everything from Startup Procedures to Battery Fire protocols

Crash protocols

Crash mitigation has received much attention throughout each phase of the technology concept development through manufacturing processes long before a commercialized product was brought to market. It is part of the design for manufacture, component sourcing, and Operational Design Domain creation processes.

Intellectual property is also contained in how a technology partner ensures safety and mitigates the risk of crashes. In short:

- If another vehicle were to hit the AV, the onboard safety operator would take manual control and follow protocol. In the unlikely event of a crash, the onboard safety operator will ensure passenger safety by alerting authorities and securing the vehicle. They will refer to their training and emergency protocol documentation (to be delivered by the technology partner).

For more detailed information, please see Safety Strategy documentation (risk assessment and emergency response protocols plus technology partner training documentation).

3.0 CONTRACT REQUIREMENTS WITH AUTONOMOUS VEHICLE TESTER(S)

Discussions with autonomous vehicle testers have begun and a selection will be made following the publication and subsequent responses of a Request for Proposal from the City of New Haven after FAVTPP approval has been made by the State of Connecticut OPM. This concept of operations will inform RFP technical specifications and evaluation criteria. Similarly, responses from the New Haven Parking Authority's FAVTPP RFQ from Spring 2019 will be used to frame technical specifications and evaluation criteria.

Once a decision has been and a vendor is awarded the contract, a chief elected official from the City of New Haven will enter into a written agreement with said vehicle tester per Public Act No. 17-69 and the Minimum Framework requirements.

4.0 SIGNATURE/CERTIFICATION

I herein certify that I am duly authorized to make this application on behalf of, and with the power to bind, the above-named municipality, and all information I have provided in connection with this Application is true and complete to the best of my knowledge. The municipality named herein agrees to comply with all terms and conditions set forth herein. The Secretary of the Office of Policy and Management, in consultation with the Commissioners of Motor Vehicles, Transportation and Emergency Services and Public Protection, may revoke my authority to test fully autonomous vehicles if the municipality named herein, or the applicable autonomous vehicle tester, fails to comply with the terms and conditions set forth herein, or upon a determination that such testing poses a risk to public safety. The Secretary of the Office of Policy and Management reserves the right to request additional information from the municipality or autonomous vehicle tester prior to final approval of this application.

WARNING: *Intentionally making a false statement or providing false or misleading information in connection with this application is a criminal offense that may subject you to criminal prosecution under the Law.*

City/Town Name
(Please Print):_____

BY, (Sign) →_____

Print Name:_____

Title:_____ Date:____/_____/_____

5.0 APPENDIX A

5.1 TABLE 1: CONTACT LIST

5.1.1.1 State Government

Entity	Contact Name	Contact Email
Office of Policy and Management	Chris McClure	chris.mcclure@ct.gov
Department of Transportation	Peter Calcaterra	peter.calcaterra@ct.gov
Department of Motor Vehicles		
Department of Emergency Services and Public Protection		
Connecticut Insurance Department		

5.1.1.2 Local Government

Entity	Contact Name	Contact Email
City of New Haven		
South Central Regional Council of Governments		
New Haven County		

5.1.1.3 City of New Haven

Entity	Contact Name	Contact Email
New Haven Parking Authority	Doug Hausladen	dhausladen@newhavenct.gov
Yale New Haven Hospital	Rodney Slaughter	rodney.slaughter@ynhh.org
Traffic Authority	Bruce Fischer	bfischer@newhavenct.gov
Board of Alders		
Emergency Management	Rick Fontana	rfontana@newhavenct.gov
Disability Commission	Michelle Duprey	mduprey@newhavenct.gov

5.1.1.4 Transit/Transportation

Entity	Contact Name	Contact Email
Greater New Haven Transit District		
CT Transit		

5.1.1.5 Neighborhood

Entity	Contact Name	Contact Email

5.1.1.6 Civic and Business

Entity	Contact Name	Contact Email

5.1.1.7 Other

Entity	Contact Name	Contact Email
Yale University		
Quinnipiac University		