USF Campus Autonomous Transit Feasibility Study

Hillsborough MPO
Metropolitan Planning for Transportation

DRAFT—August 2018

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Prepared for:

Hillsborough MPO
Metropolitan Planning
for Transportation

601 E. Kennedy Boulevard, 18th Floor
Tampa, FL 33602
(813) 272-5940
www.planhillsborough.org

Allison Yeh, AICP, LEED GA, Project Manager

Prepared by:

CUTR

USF Center for Urban Transportation Research

Brian Pessaro, Principal Investigator
(813) 974-5113
pessaro@cutr.usf.edu

DRAFT August 2018

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Executive Summary

Enormous strides are being made in the development of automated vehicle technologies. Although still very much in its infancy, automated transit has the potential to change the way that transit service is provided. Because no driver is needed, service could be extended to places and times that would otherwise be cost-prohibitive. In recent years, several start-up companies, most of them in Europe, have developed driverless shuttles. These shuttles were tested in Europe in live traffic as part of a demonstration project funded by the European Union called CityMobil2.

Since then, a number of U.S. cities have begun, or will soon begin, demonstration projects of driverless shuttles. In March 2018, the Contra Costa Transportation Authority in California entered into the third phase of its testing of driverless shuttles in the Bishop Ranch office park. The shuttle is now picking up commuters in the parking lot and taking them to their place of work. Since November 2017, the American Automobile Association (AAA) has been sponsoring a free driverless shuttle in the Freemont Street Entertainment District of Las Vegas. The shuttle operates in mixed traffic through eight intersections, including six traffic lights and two stop signs. In June 2018, the University of Michigan began operating two driverless shuttles on its Ann Arbor campus. Closer to home, Regional Transit Service (RTS) in Gainesville has signed a 3-year contract with transportation provider TransDev to provide automated shuttle service between the downtown and the University of Florida campus. Testing will begin at the end of August 2018.

At the federal level, the U.S. Department of Transportation is investing in the areas of connected and automated vehicles. In January 2018, the Federal Transit Administration (FTA) published its Strategic Transit Automation Research (STAR) Plan. The STAR Plan includes funding for five waves of demonstration projects with each wave dedicated to a particular aspect of transit automation. The second wave of demonstration projects will be automated shuttles. It is anticipated that the FTA will issue a Notice of Funding Opportunity (NOFO) for the second wave around September 2018.

The Hillsborough MPO, recognizing the interest in autonomous and connected vehicle technology as a mobility tool, included in its planning work program a feasibility study for a transit circulator using this technology. The University of South Florida (USF) was selected as an ideal setting for this study. Figure 1 shows a map of Hillsborough County and the location of USF. During the 2017-2018 Academic Year, USF had approximately 43,500 enrolled students plus 14,000

faculty and staff.[1] The campus is approximately three square miles, which can make getting from one side of campus to the other by foot a challenge, particularly during the warmer months. A number of transportation options already exist on the USF campus. The Bull Runner bus service provides both on-campus circulator service as well as off-campus service to nearby student apartments. A map of the Bull Runner system is shown in Figure 2. The Share-a-Bull campus bike share program has bike stations located throughout campus. The USF car share program offers short-term (i.e. hourly) car rentals to students, faculty, and staff through vehicles that are stationed at several locations on campus. Over the last several decades, USF has evolved from a commuter school to one where more and more students live on or near campus. The most recent example of this evolution has been the construction of The Village on the north side of campus south of Fletcher Avenue. The Village includes a number of residence halls, The Hub dining facility, The Fit recreation and wellness center. It will soon include an on-campus Publix grocery store.
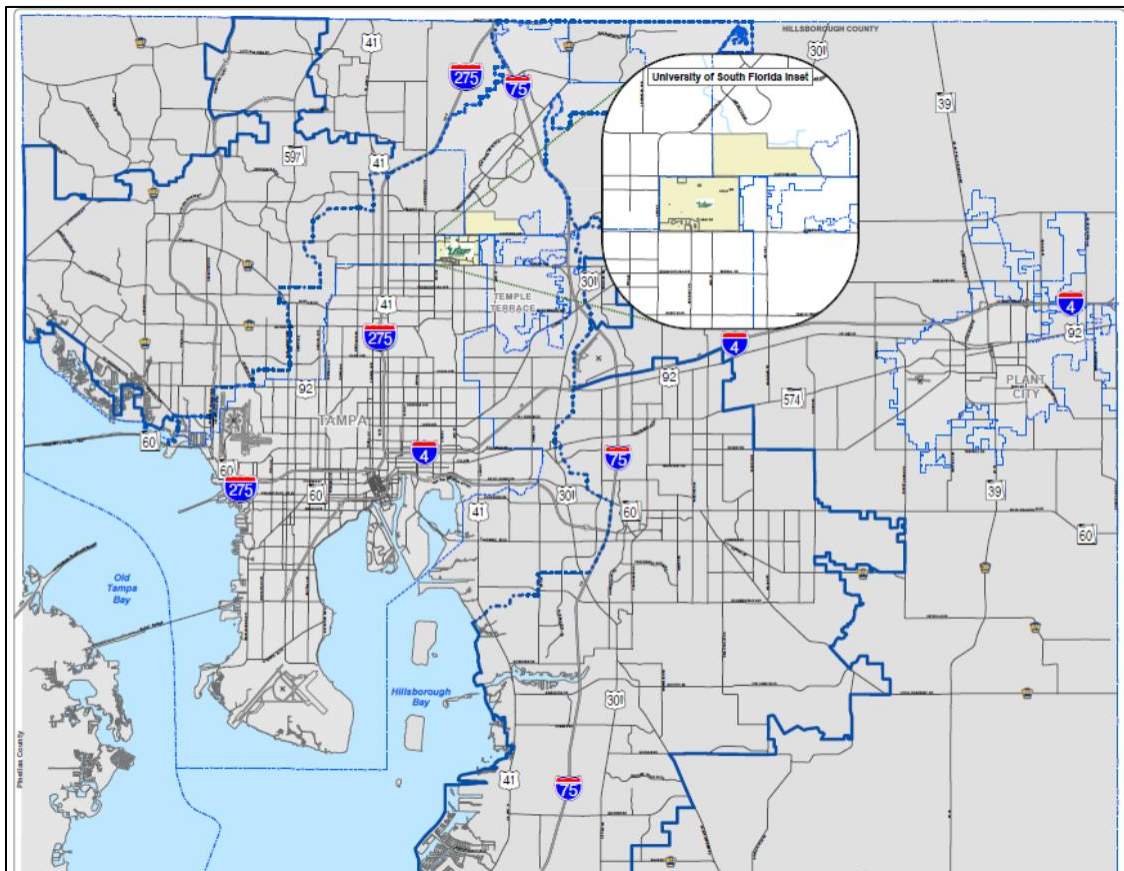
Figure 1: Hillsborough County

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[1] 43,542 total enrolled students, USF System Facts 2017-2018
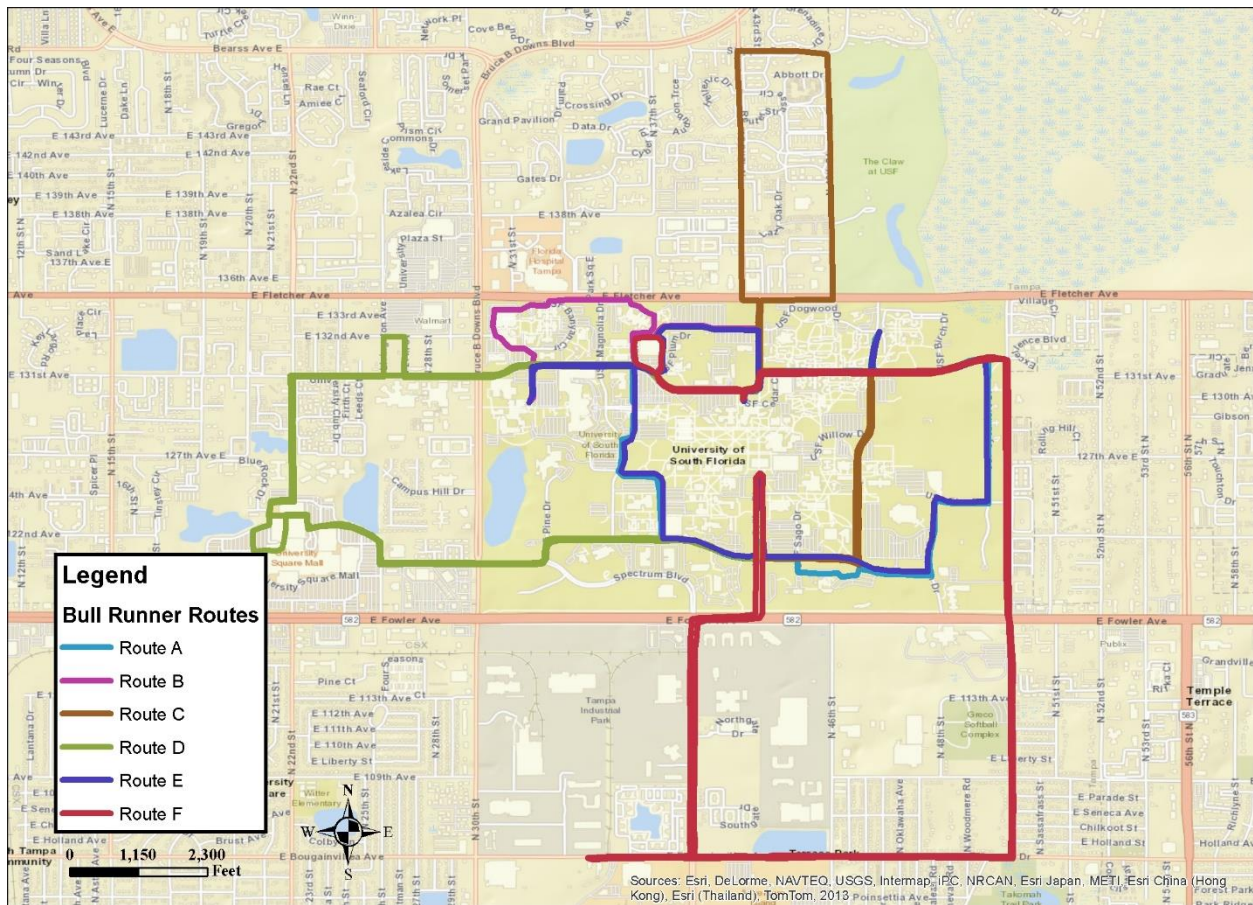
Figure 2: Bull Runner System Map

The USF Campus Autonomous Transit Feasibility Study had three tasks:

- to identify the areas of campus that would best be served by a driverless shuttle as well as the types of service

- to identify any legal, insurance, or other related restrictions

- to identify two to three potential service options that could be offered as part of a one-year demonstration

A detailed discussion of the individual tasks follows on the pages below. In summary, four potential routes are being recommended. They include:

- a daytime shuttle between Remote Parking Lot 18 and the Library

- a daytime shuttle between Juniper-Poplar Residence Hall and Campus Recreation

- a nighttime shuttle between Juniper-Poplar Residence Hall and The Hub Dining Facility

- a nighttime shuttle between Juniper-Poplar Residence Hall and the Library

These four routes were selected based on an analysis of both transportation data and survey data. The routes were further refined after being presented to key stakeholder group consisting of representatives from USF, Hillsborough County, the City of Tampa, the Florida Department of Transportation, and the Tampa Innovation Alliance.

It is estimated that a 12-month pilot project of the four proposed routes on the USF Tampa campus using two shuttles would cost approximately $700,000. A funding source(s) will need to be identified. Possible funding sources include the USF Student Green Energy Fund, the Federal Transit Administration (FTA) Strategic Transit Automation Research Program, foundation grants, FDOT Service Development Funds, and advertising revenue. If the shuttles prove to be successful, the long-term goal is to incorporate them permanently as a part of USF Bull Runner bus service.

Based on discussions with the USF Office of General Counsel, there are no specific legal or insurance issues that would prevent the operation of driverless shuttles on campus. USF would be covered under the state's general liability insurance in the event of a vehicle accident. Nevertheless, the Office of General Counsel would require any contracted shuttle operator to provide their own commercial liability insurance. Furthermore, they recommended adding signs on campus alerting drivers and pedestrians to the presence of autonomous shuttles.

The next implementation step will be a two-week demonstration of an autonomous shuttle on the campus, which is tentatively scheduled for Fall 2018. This step is part of a parallel study, the Campus Automated Shuttle Deployment Initiative, which is also being carried out by the Center for Urban Transportation Research (CUTR). The main purpose of the two-week demonstration will be to introduce students to these shuttles. Another purpose will be to get a better understanding of the current limitations of the technology. For example, it was learned during the course of this study that all of the currently available autonomous shuttles have difficulty making left turns through signalized intersections. These and other limitations will have to be addressed when working with the selected shuttle vendor.

Task One: Identify areas of campus that would best be served by an autonomous shuttle

For Task One, CUTR analyzed a variety of transportation data sets to get a better understanding of student travel patterns on campus. These data sets included bus stop level passenger on/off data from the USF Bull Runner, origin-destination data from the campus bike share program operated by Coast Bike Share, and trip logs from the USF SAFE Team, which provides nighttime escort trips back to the dorms. In addition to using these existing data sets, CUTR surveyed USF students about their method of travel to campus, their method of travel once on campus, and their opinions about autonomous shuttles. CUTR also looked at the Mobility Master Plan prepared by the Tampa Innovation Alliance, a partnership of businesses located in the area bordered by Busch Boulevard, Bearss Avenue, and Interstates 75 and 275. That master plan includes a proposed AV shuttle route.

Transportation data analysis

Bus stop level passenger on/off data for the USF Bull Runner was the first data set to be analyzed. The data set was provided by USF Parking and Transportation Services and was for Fiscal Year 2017. The data was mapped with Geographic Information Systems (GIS), the results of which are shown in Figure 3.

The top three on-campus bus stops in terms of passenger on/offs are the Marshall Student Center, the Library, and Math and Engineering building.
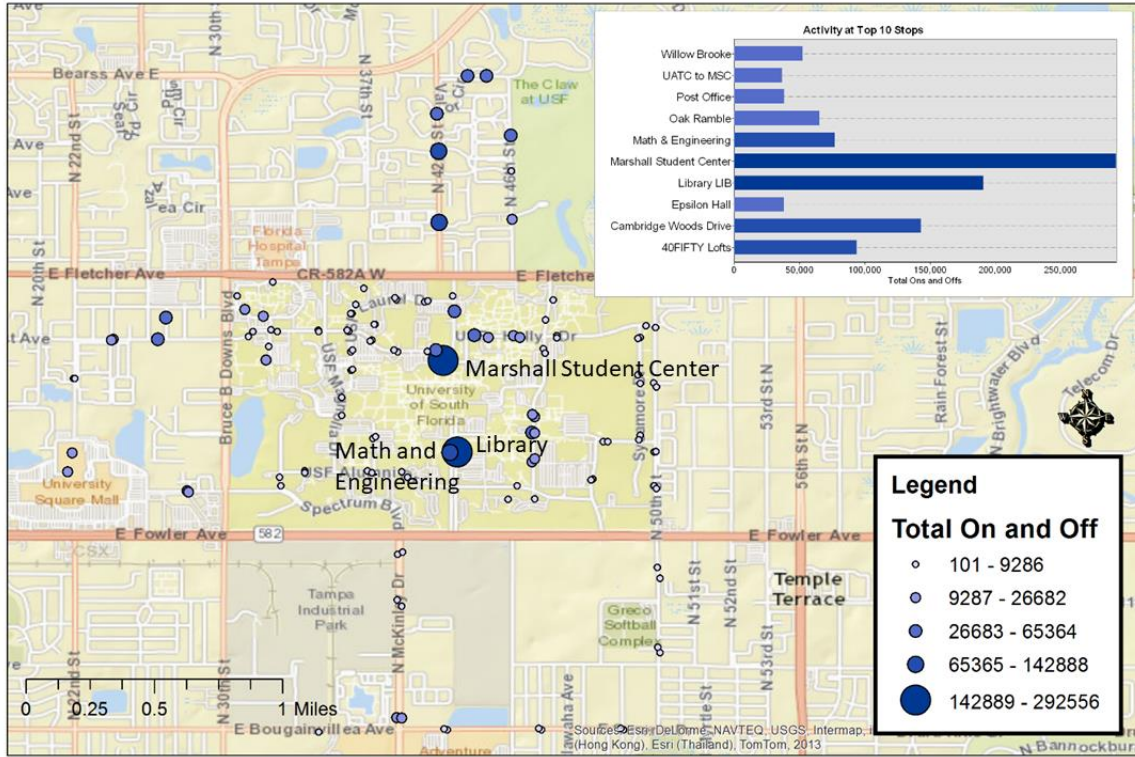
Figure 3: USF Bull Runner Passenger On/Off Activity

The second data set that was analyzed was trip level origin-destination data for the campus bike share program. This data was provided to CUTR by Coast, USF's contracted bike share program operator. The data set was roughly two months' worth of data, from August to October 2017. CUTR was able to map both the top activity hubs as well as the top origin-destination pairs. The top activity hubs are shown in Figure 4
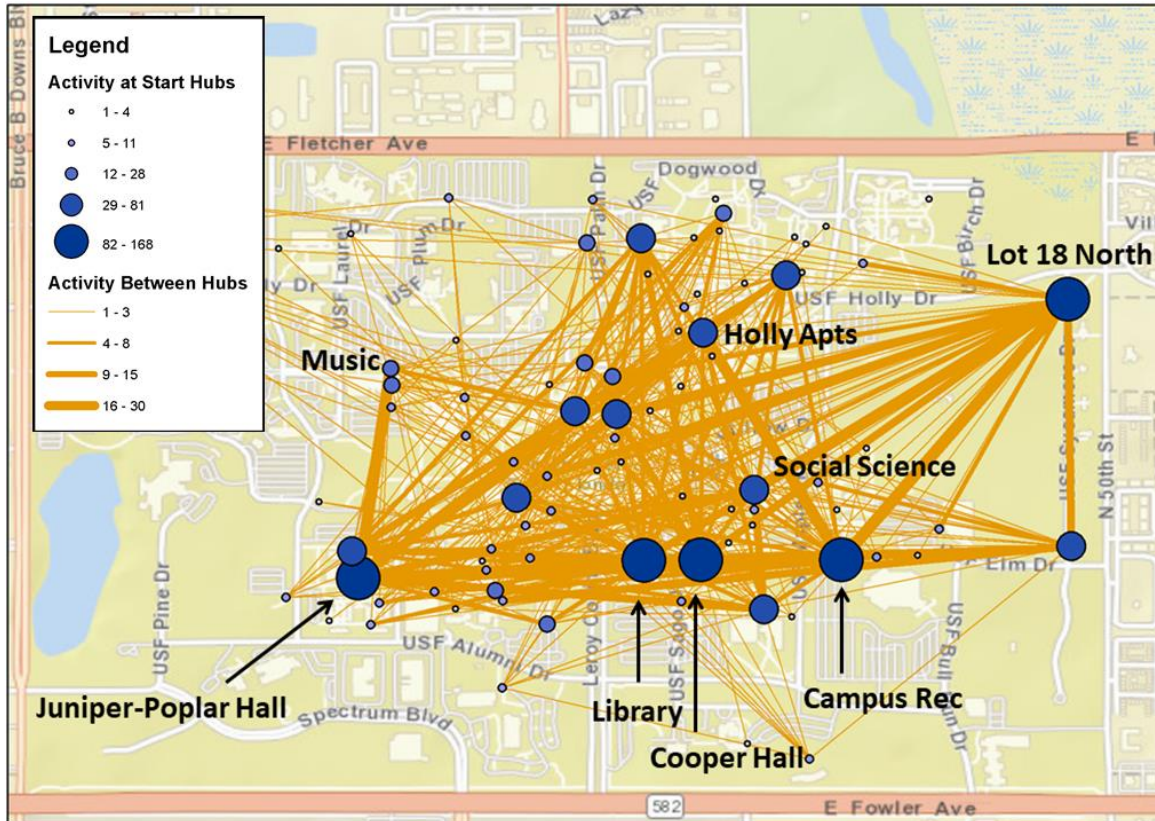
Figure 4: Campus Bike Share Activity

Table 1 shows the top origin-destination pairs. Map illustrations of where these O-D pairs are located are shown in Figure 5 through Figure 9.

Table 1: Top 5 Bike Share O-D Pairs

Rank	O-D Pair	Total Trips
1	Campus Rec & Juniper-Poplar Hall	30
2	Campus Rec & Holly Apartments	20
3	Juniper-Poplar Hall & Music Building	20
4	Lot 18 North & Campus Rec	19
5	Lot 18 North & Social Science Building	19
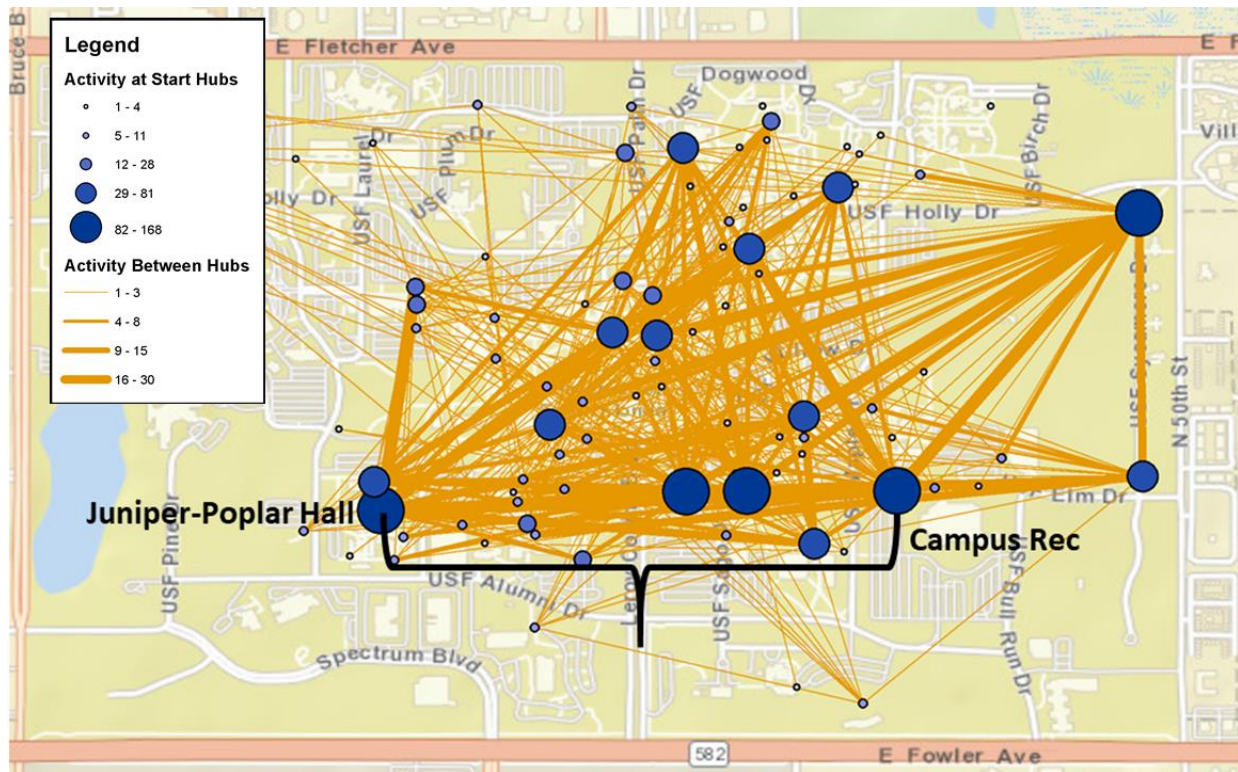
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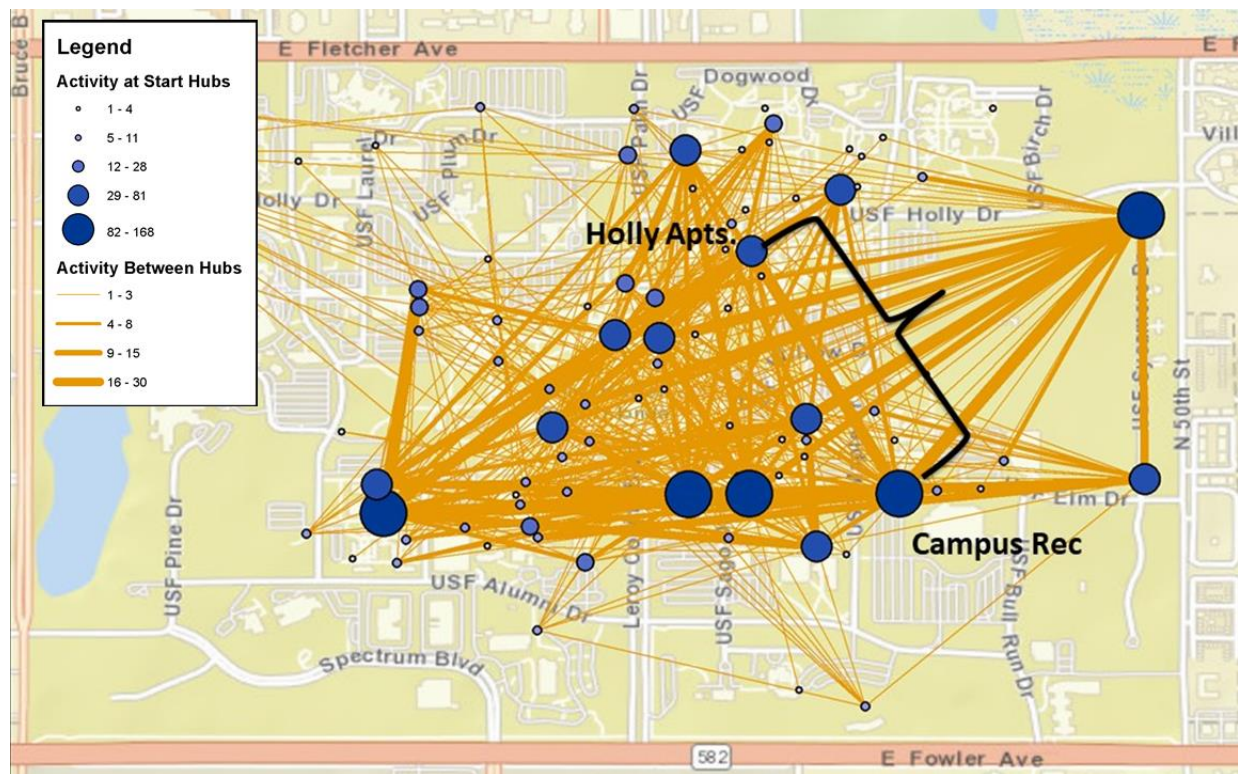
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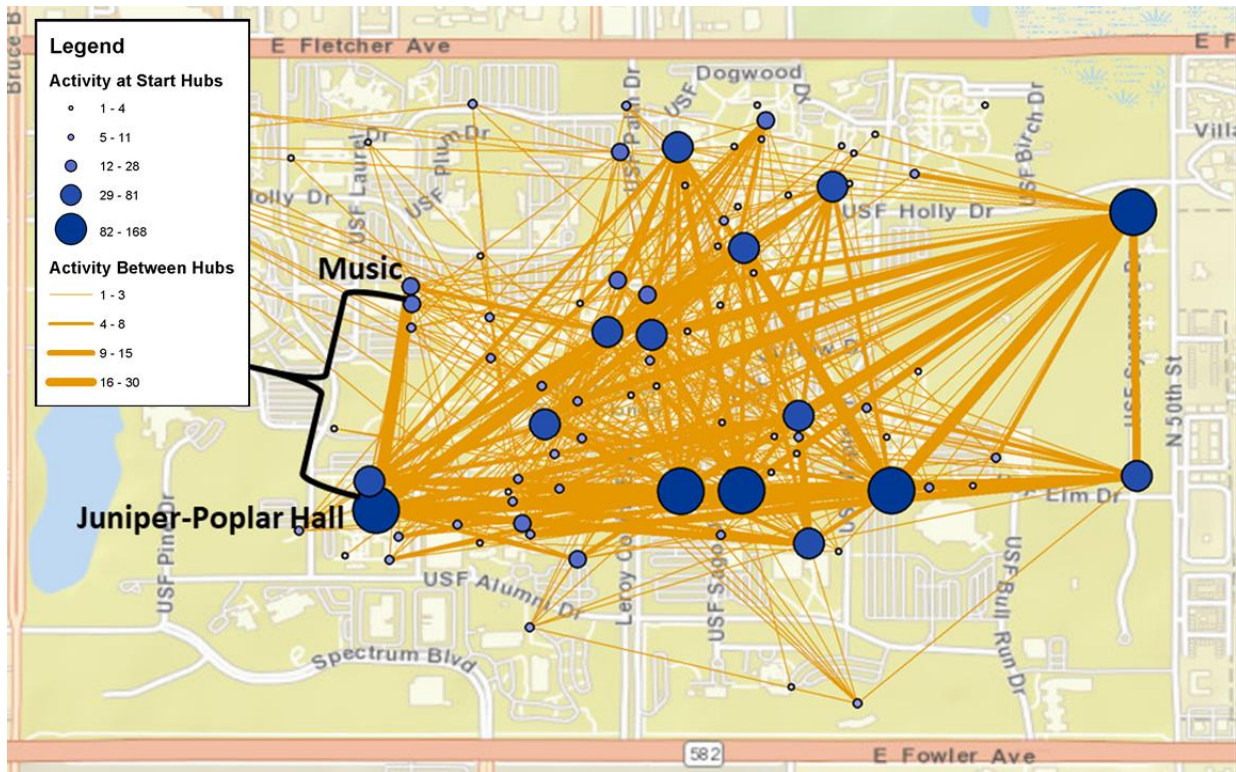
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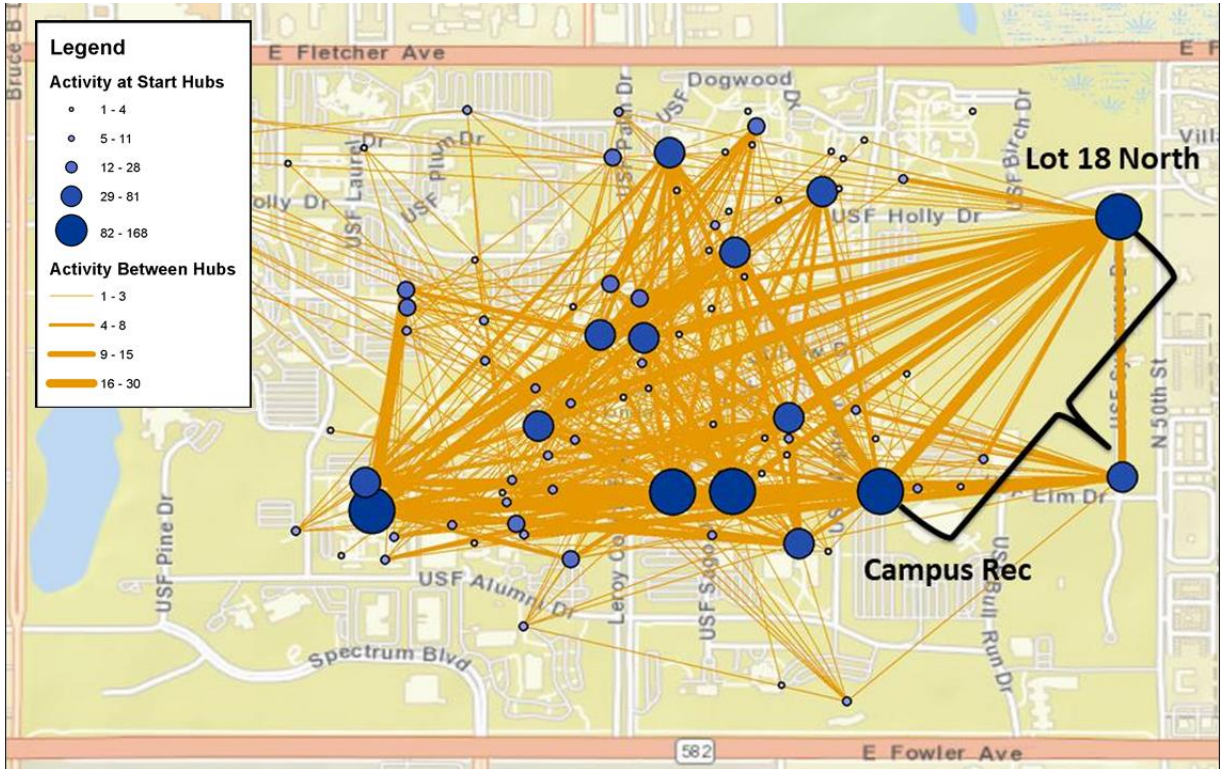
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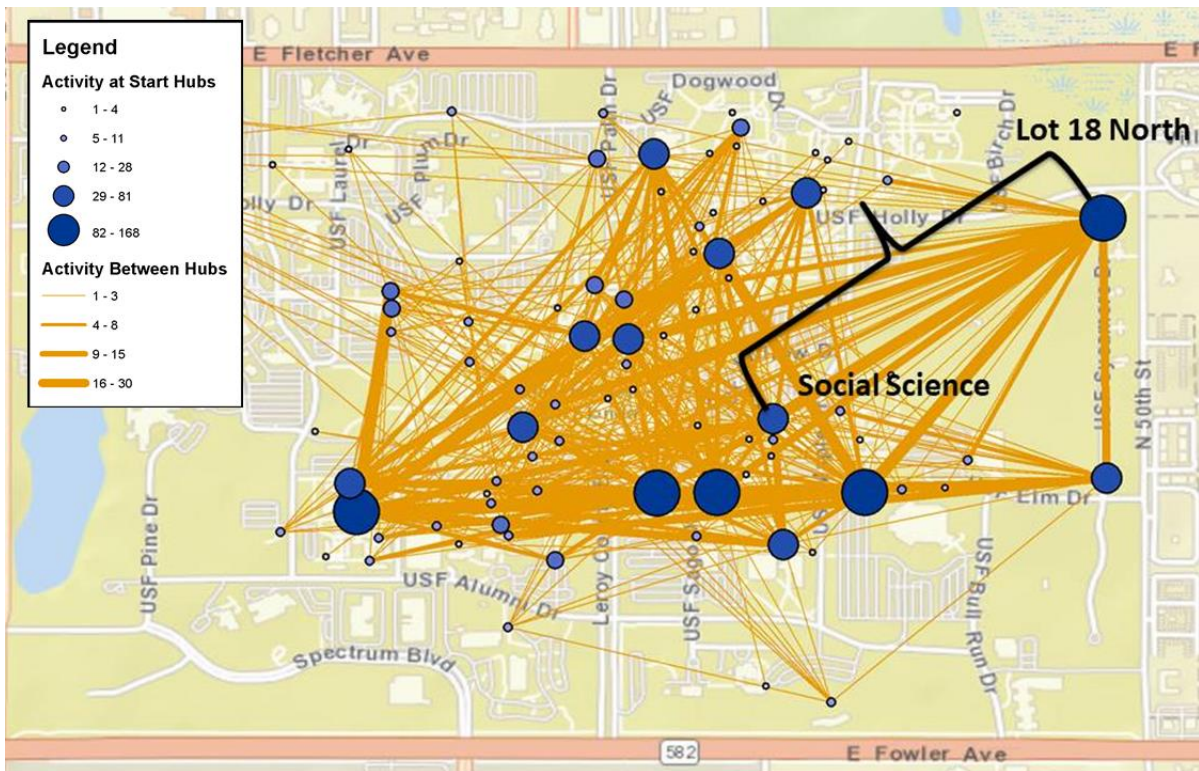
Figure 9: Lot 18 North & Social Science Building

The third dataset that was provided to CUTR was a month's worth of origin-destination data from the USF SAFE Team. The SAFE Team helps to improve night time security on campus by conducting patrols and offering safe escorts back to the dorms. The rides are provided by SAFE Team drivers using golf carts. CUTR was provided data for the month of November 2017. Only one month's worth of data was used because the data required extensive reformatting in order to map it in a geographic information system. Similar to what was done with the bike share data, the analysis of the SAFE Team data looked at activity hubs and origin-destination pairs.

Figure 10 shows some of the major drop-off locations for the SAFE Team trips, and Figure 11 shows some of the major pick-up locations. Major on-campus drop-off locations include, in order, Juniper-Poplar Hall, the Library, the Hub, Holly Apartments, and Cypress Apartments. Major on-campus pick-up locations include, in order, the Library, Juniper-Poplar Hall, the Hub, Holly Apartments, and Marshall Student Center.
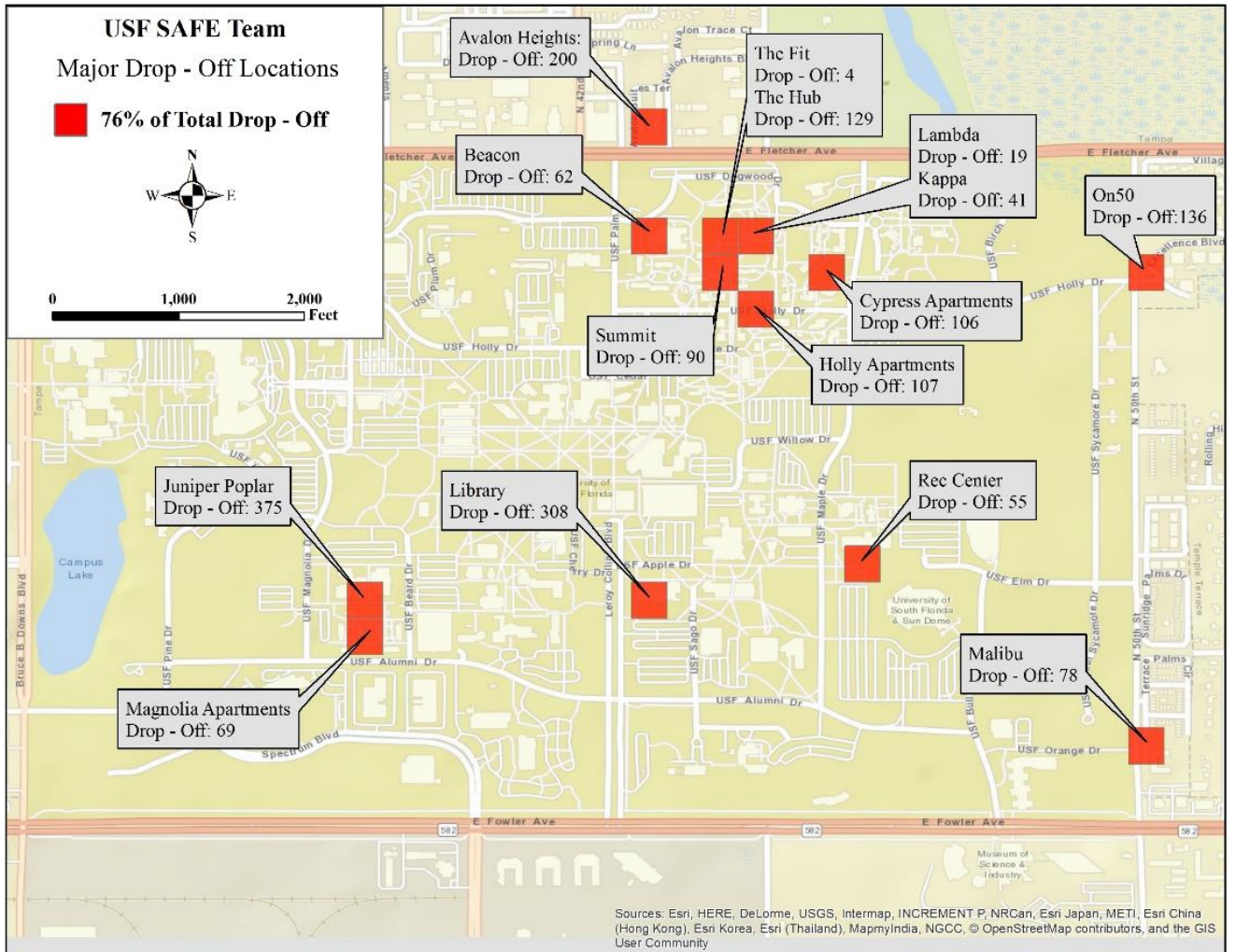
Source: November 2017 SAFE Team Data

Figure 10: SAFE Team Major Drop-Off Locations
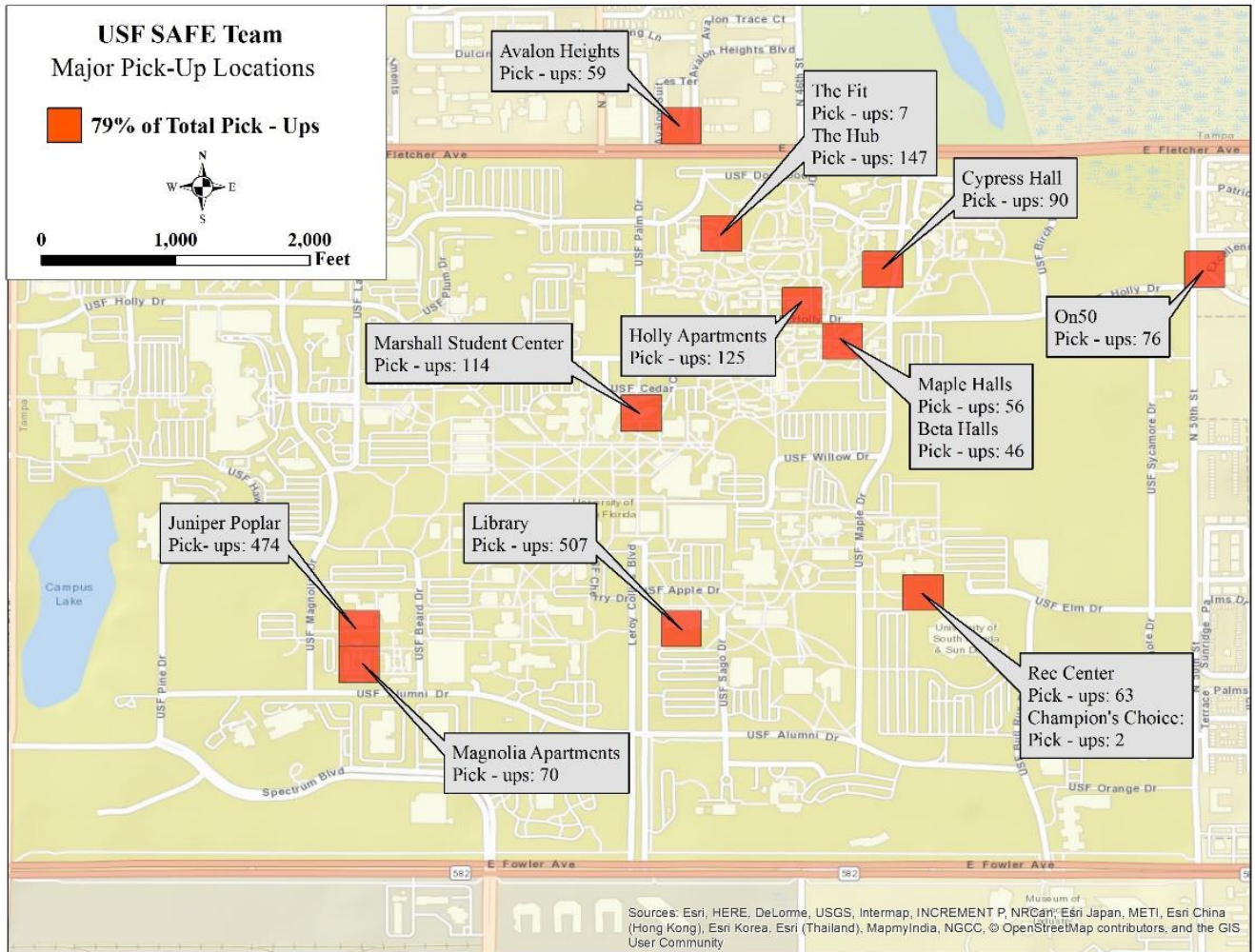
Figure 11: SAFE Team Major Pick-Up Locations

Table 2 shows the Top 5 SAFE Team origin-destination pairs. Some of these include destinations off campus, which is beyond the scope of this study. However, these are still shown for informational purposes. Map illustrations of where these O-D pairs are located are shown in Figure 12 through Figure 16. Juniper-Poplar Residence Hall appeared in four of the top five.

Table 2: Top 5 SAFE Team O-D Pairs

Rank	OD-Pair	Total Trips
1	Juniper-Poplar Hall & The Hub	62
2	Library and Avalon Apartments	60
3	Juniper-Poplar Hall & Avalon Apartments	53
4	Juniper-Poplar Hall & Library	51
5	Juniper-Poplar Hall & Summit Hall	50
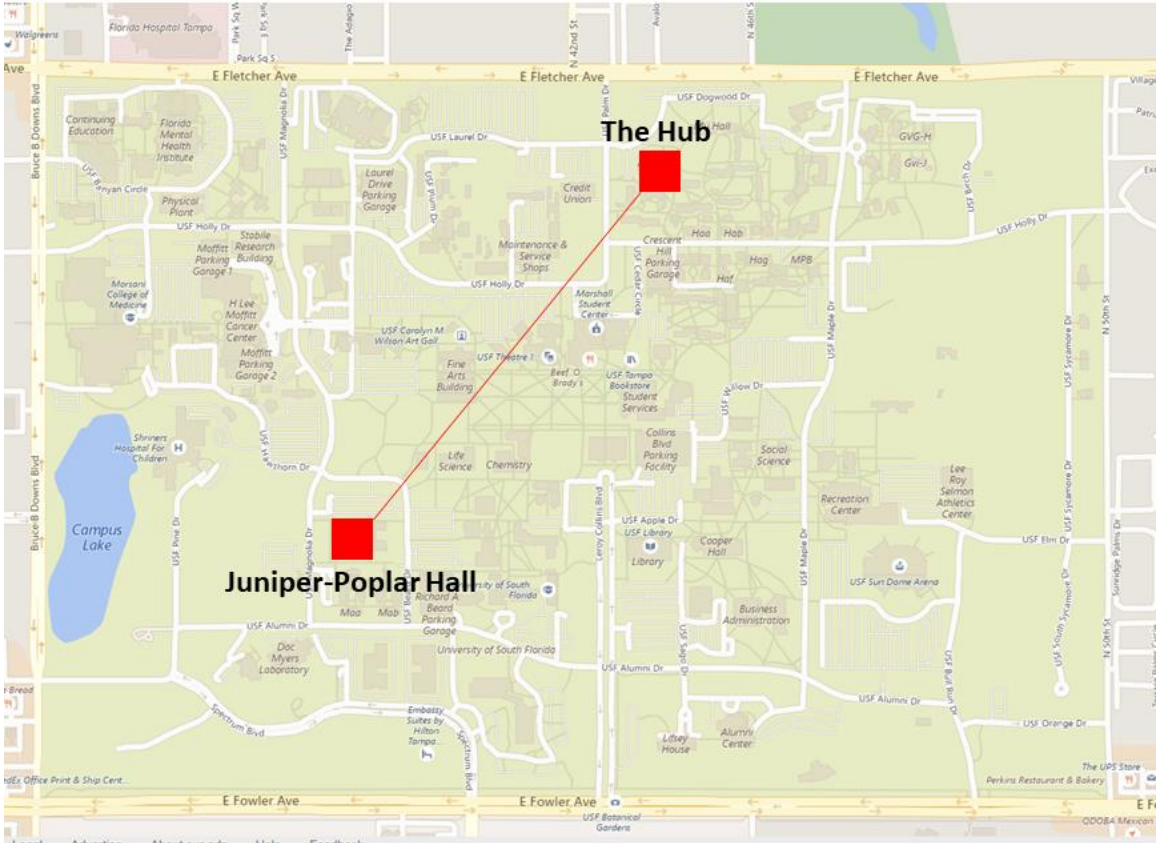
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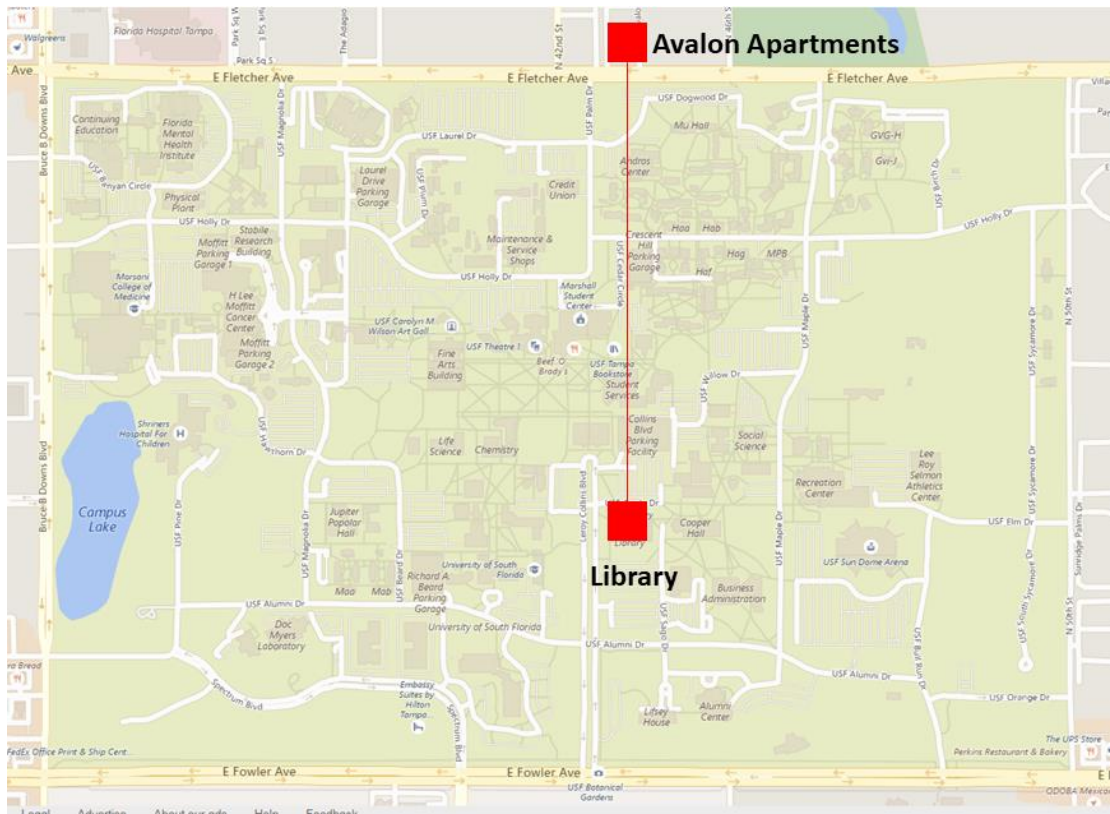
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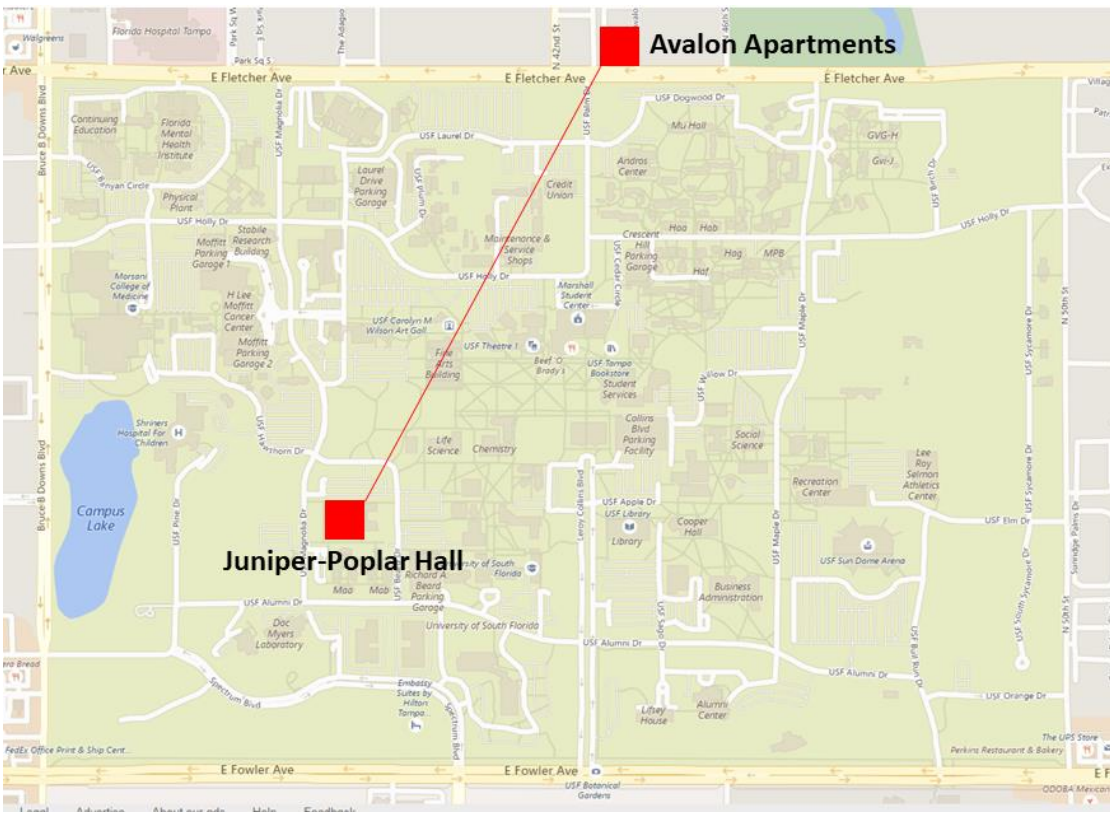
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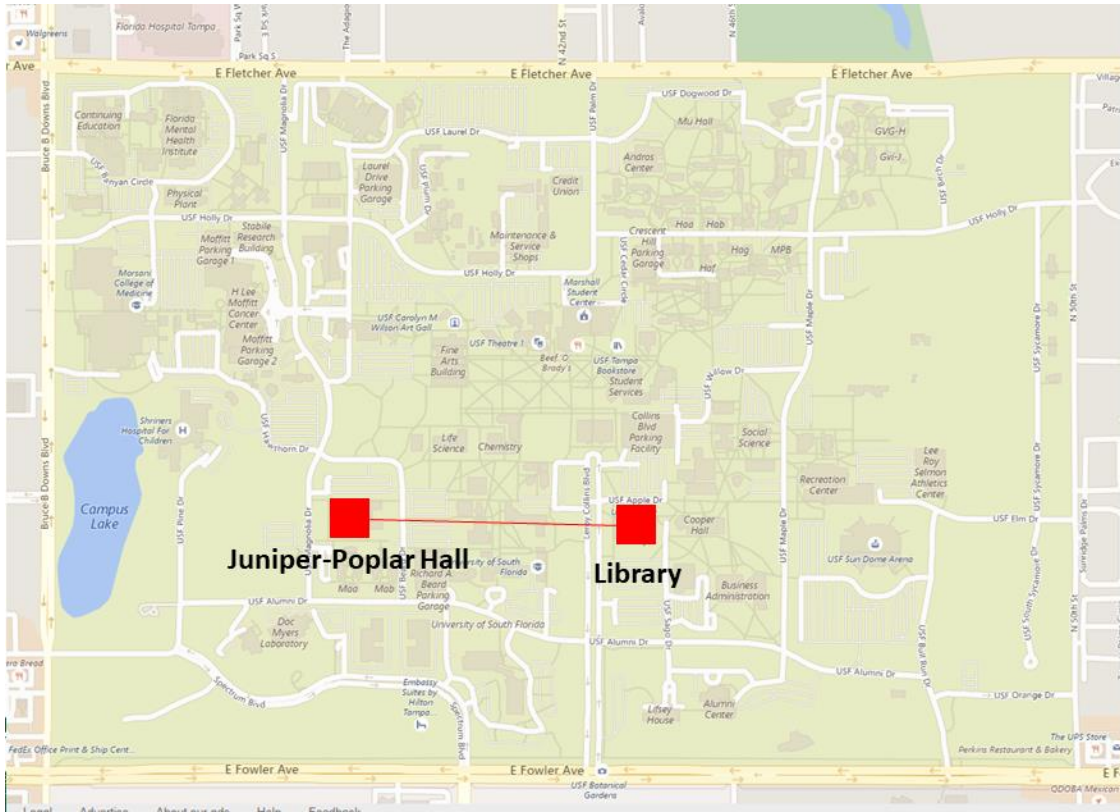
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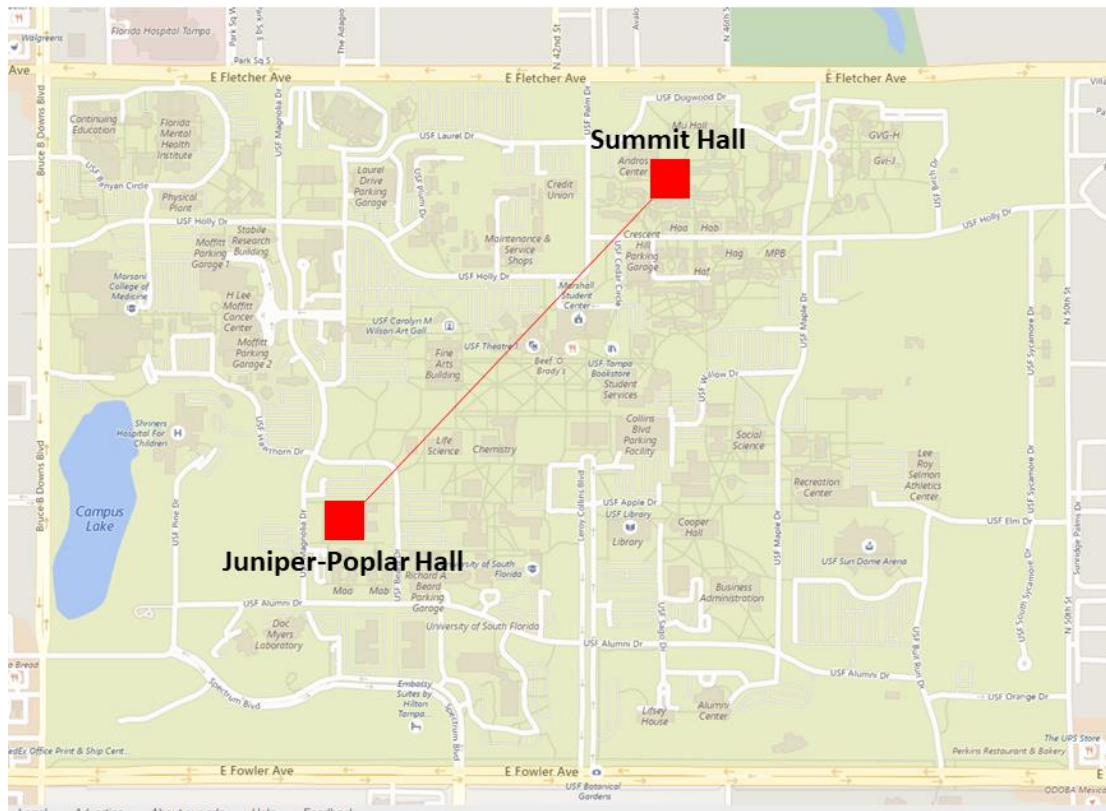
Figure 16: Juniper-Poplar Hall & Summit Hall

Survey data analysis

In addition to analyzing existing transportation data sets, CUTR surveyed USF students as another means of learning how they get about campus and also to get their opinions about possible autonomous shuttle service options. Three surveys were conducted. A total of 374 were collected. The initial survey was a paper survey distributed to students in classes taught by CUTR faculty. The main purpose was to solicit feedback on the types of service they would like to see on campus. A total of 49 students responded. The second and third surveys were both online surveys and had a more extensive list of questions. One online survey was distributed by USF Student Government and had 213 responses. The other online survey was distributed by USF Students with Disabilities Services and had 112 responses. The full list of survey questions and answers can be found in Appendix A. Five main conclusions can be drawn from the survey results.

1. **Students are tech savvy and willing to ride in automated vehicles even if they don't know a lot about them.**

On the one hand, USF students are comfortable with technology. Forty-six percent of the students in the student government survey and 61 percent in the disabled student services survey said they use new technologies before their peers (see Figure 17 and Figure 18). On the other hand, only about a quarter of the students in both surveys said that they were moderately familiar with driverless vehicles before taking the survey (see Figure 19). Nevertheless, 61 percent of the students from the student government survey and 70 percent from the disabled student survey said it was likely or very likely that that they would use driverless vehicles when they become available (see Figure 20).
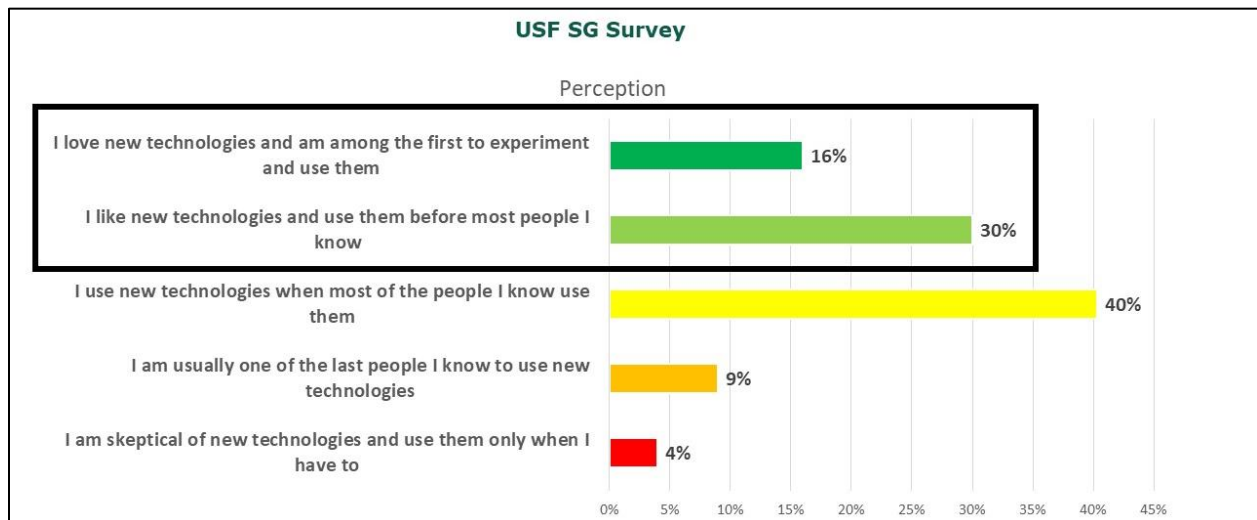
Figure 17: When it comes to new technology, what best describes you? (Student Government Survey)

Disabled Survey

Perception

Statement	Percentage
I love new technologies and am among the first to experiment and use them	28%
I like new technologies and use them before most people I know	33%
I use new technologies when most of the people I know use them	27%
I am usually one of the last people I know to use new technologies	10%
I am skeptical of new technologies and use them only when I have to	3%

0% 5% 10% 15% 20% 25% 30% 35%

Figure 18: When it comes to new technology, what best describes you? (Disabled Student Services Survey)

USF SG

Moderately familiar, 20%
Not at all familiar, 28%
Somewhat familiar, 21%
Slightly familiar, 32%

Disabled Survey

Moderately familiar, 27%
Not at all familiar, 19%
Slightly familiar, 27%
Somewhat familiar, 27%

Only about a quarter of the respondents were moderately familiar with driverless vehicles.
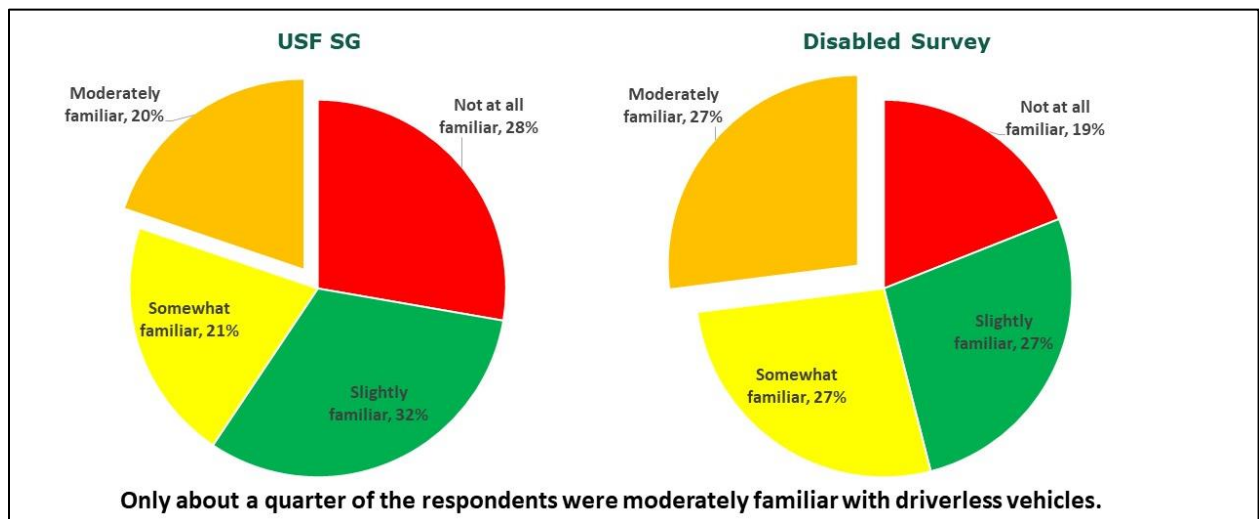
Figure 19: How familiar were you with driverless vehicles before taking this survey?
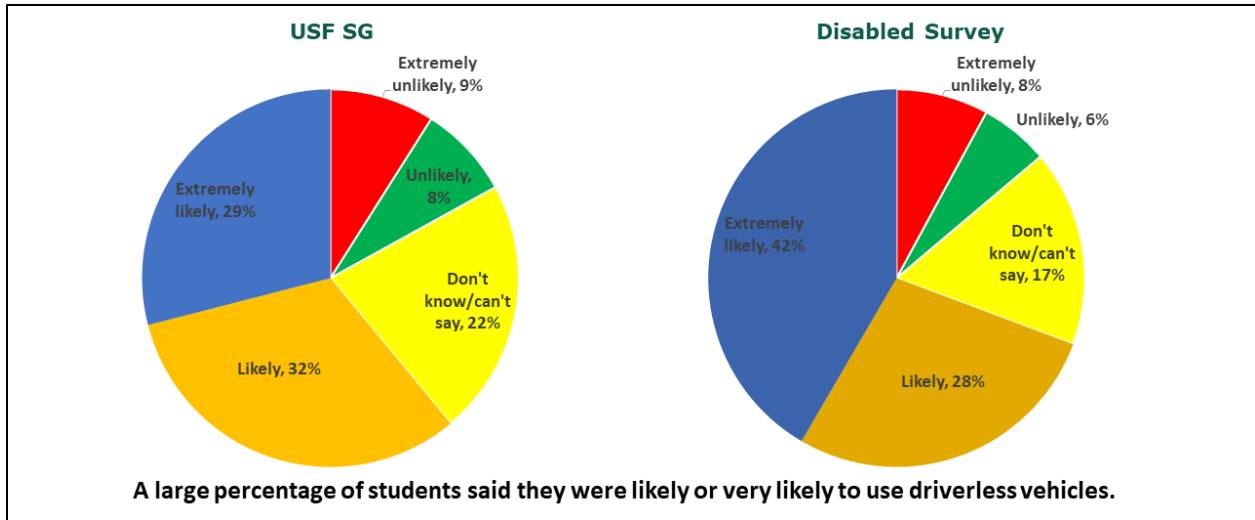
Figure 20: How likely do you see yourself using driverless vehicles when they become available?

2. A third of the students say it is hard to get to class from where they park.

In response to the statement, "It is easy to get from where I park to class," 29 percent of the respondents in the student government survey and 31 percent in the disabled student services survey disagreed or strongly disagreed (see Figure 21). Furthermore, 17 percent of the respondents in the disabled student services survey said they move their car around campus as they go to their various classes (see Figure 22).
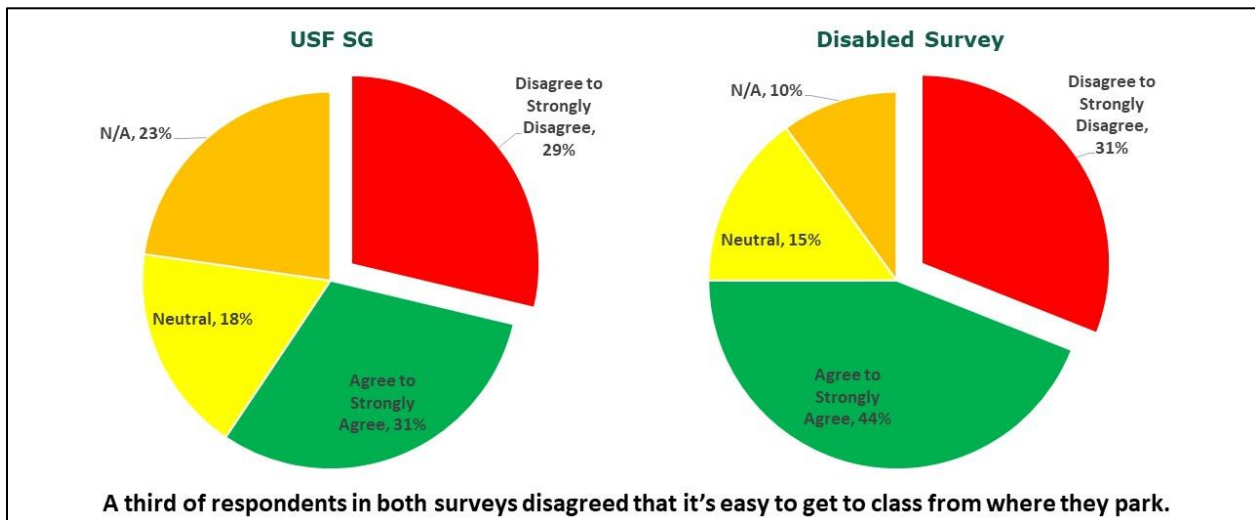
Figure 21: It is easy to get from where I park to class
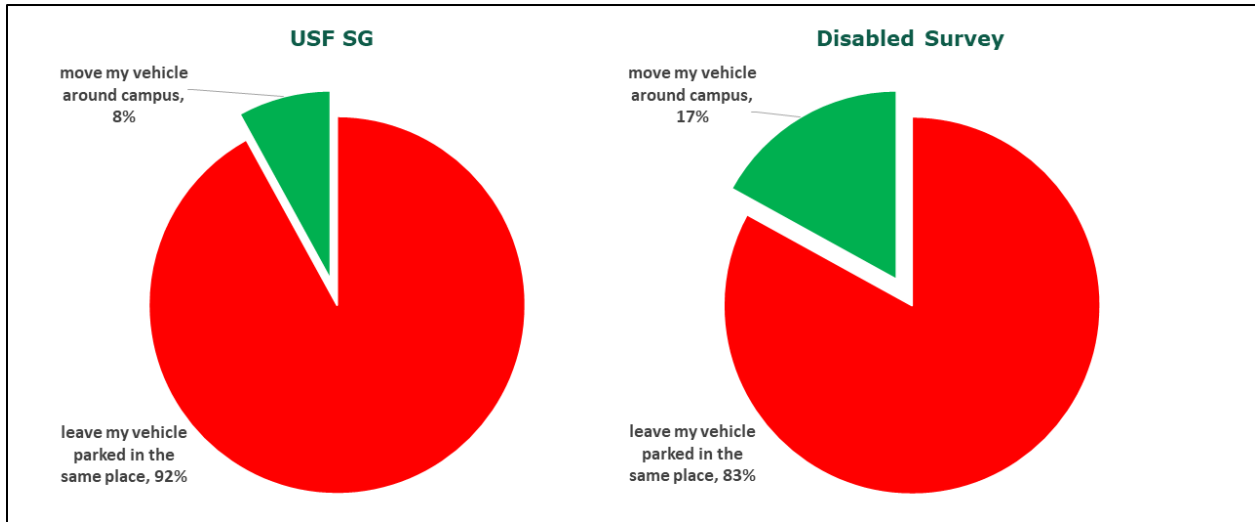
Figure 22: Upon arriving at campus, I usually...

3. **There is a demand for night time bus service combined with a sense that the campus is not safe to walk on at night.**

More than 60 percent of the respondents from both surveys agreed or strongly agreed with the statement, "I wish the Bull Runner ran at night" (Figure 23). It should be pointed out that all of the Bull Runner routes run from 7:00 a.m. to midnight Monday through Thursday. However, on Fridays, the Bull Runner only runs to 5:30 p.m. Weekend service is limited to the Routes C, D, and F, which run from 2:30 p.m. to 9:30 p.m. In regard to safety, almost 50 percent of the female respondents from both surveys disagreed or strongly disagreed with the statement, "I feel safe walking on campus at night" (see Figure 24). Autonomous shuttles could potentially fulfill the desire for more nighttime service and help improve student perceptions of campus safety.
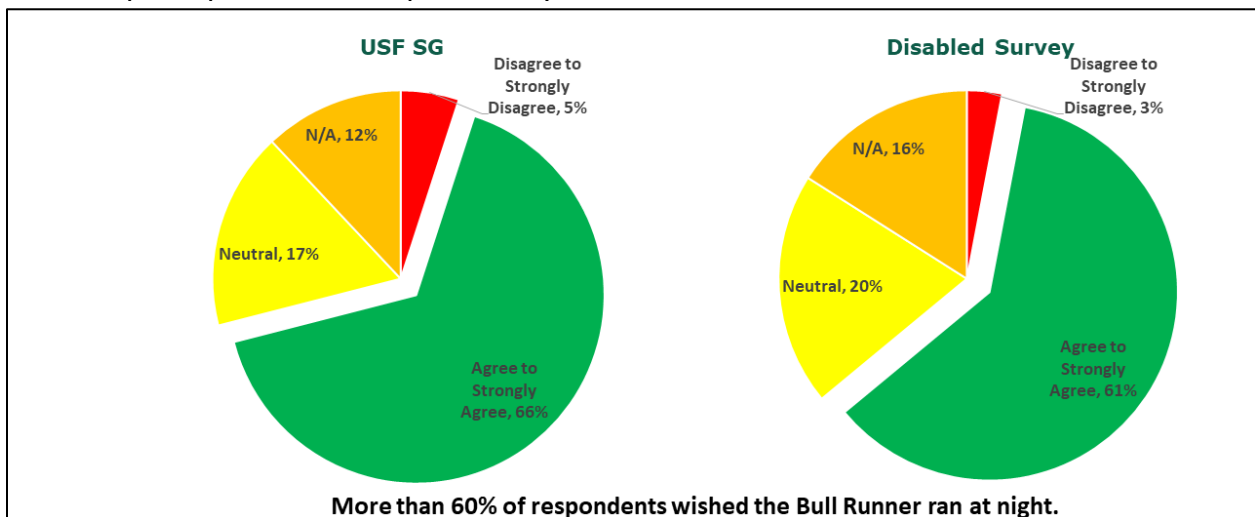
Figure 23: I wish the Bull Runner ran at night

Almost 50% of the female respondents do not feel safe walking on campus at night.
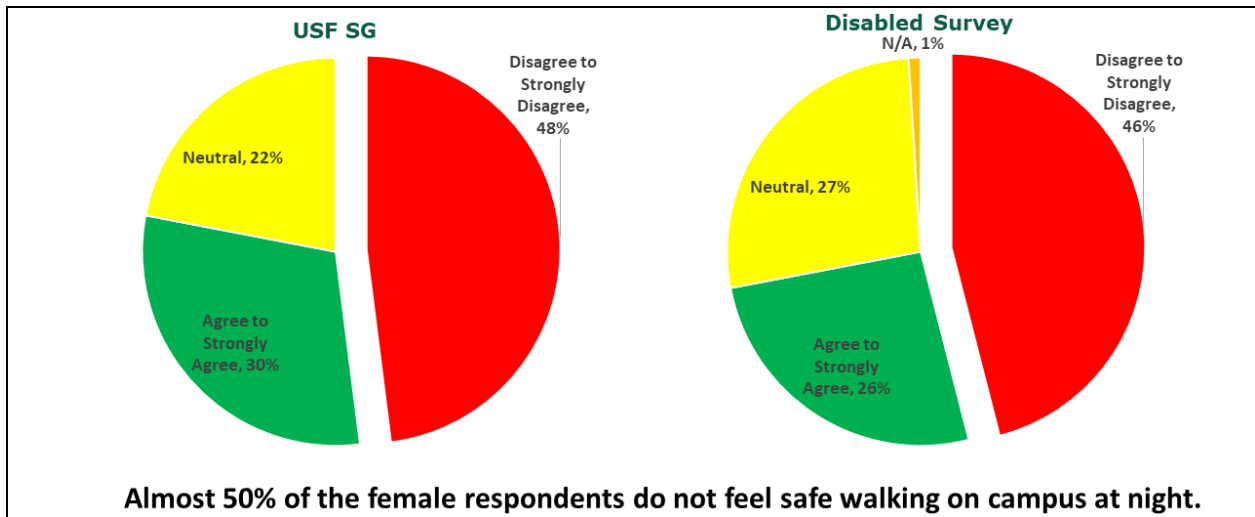
Figure 24: I feel safe walking on campus at night

4. **Students do not want to pay extra fees for autonomous shuttle service.**

Students have full access to the Bull Runner buses by showing their student ID. Although students are supportive of bringing autonomous shuttles to campus, they were clear in the surveys that they do not support paying extra fees to use them. Only 16 percent of the respondents from the student government survey and 21 percent of the respondents from disabled student services survey agreed or strongly agreed with the statement, "If necessary, I would be willing to pay a nominal fee to use the driverless shuttle" (see Figure 25).

Only 16% to 20% said they would be willing to pay a nominal fee.
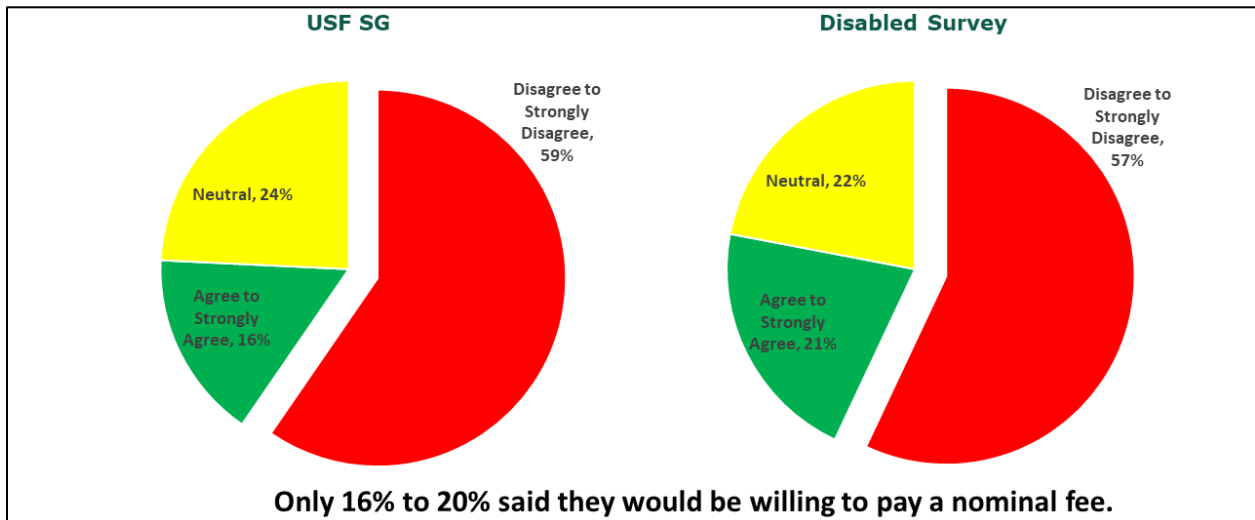
Figure 25: If necessary, I would be willing to pay a nominal fee to use the driverless shuttle

5. Across all three surveys, there is general agreement in how students would like to see autonomous shuttles used on campus.

In all three surveys, students were asked to select from a list of possible shuttle service options their top three choices. The results are shown in Figure 26. The ones highlighted in yellow represent the top three choices. In the case of the paper survey, which was distributed to students in classes taught by CUTR faculty, four service options are highlighted because there was a tie for third place. There was general agreement across the surveys on the types of service the students would like to see. The number one choice across all three surveys was for a nighttime shuttle. The other requested services included a remote parking lot shuttle, a campus circulator, transportation for students with disabilities, and a short distance connector between campus buildings and Bull Runner bus stops.

In conclusion, the survey confirmed that the USF campus would be an ideal setting to test autonomous shuttles. Students at USF are very comfortable with new technology even if they do not necessarily know much about autonomous shuttles. Furthermore autonomous transit shuttles could help fill a need for better connections between remote parking lots and the center of campus as well as additional nighttime service.

Service	Student Government Survey	Students with Disabilities Survey	Paper Survey
After hours /nighttime shuttle	148	70	31
Remote parking lot shuttle	90	62	21
Campus circulator	84	41	22
Transportation for students with disabilities	79	54	16
Shuttle from HART bus stop on edge of campus to nearest Bull Runner stop or to center of campus	66	29	n/a
A shuttle operating between the soon to be constructed campus Publix and student housing	54	27	16
A short distance connector between campus buildings and Bull Runner bus stops	52	20	21
Special event service	37	15	10
Campus tours for prospective students	24	11	5

Figure 26: Shuttle Services Requested by Students

	The top three service options are identified in yellow. In the case of the paper survey, there was a tie for third.

Stakeholder Group Meeting

After the survey and data analysis was completed, several routes were identified as potential options for the autonomous shuttles. The study findings along with the draft shuttle routes were presented to members of a stakeholder group on April 19, 2018 at the CUTR building. The stakeholders included representatives from USF, Hillsborough County, the City of Tampa, the Florida Department of Transportation, and the Tampa Innovation Alliance. A copy of attendee list and the meeting minutes is included in Appendix B.

USF Parking and Transportation Services (PATS), which operates the Bull Runner, provided valuable feedback on several of the proposed routes. Specially, PATS recommended adjusting the remote parking shuttle route by having it go to the Library instead of to Campus Rec. PATS also recommended a slight modification to the nighttime shuttle route between Juniper-Poplar Hall and The Hub. Specifically, PATS recommended that the route travel east-west on Laurel Drive, where there is less traffic, instead of on Holly Drive.

There was discussion regarding the new Publix that will be constructed on the north side of campus near Palm Drive and Fletcher Avenue. It is likely that students residing in Juniper-Poplar Residence Hall will want to use the nighttime shuttle to get to the Publix.

There was a discussion regarding signage. The stakeholder group recommended adding signage alerting people to the presence of automated shuttle on campus not just at the entrances but also along the shuttle routes.

There was also discussion of a two-week demonstration of an autonomous shuttle on campus. This is being pursued Dr. Pei-Sung Lin (CUTR) as part of a parallel study, the Campus Automated Shuttle Deployment Initiative. Dr. Lin stated that his study group is searching for a vendor to bring an autonomous shuttle to campus for a two-week demonstration during the summer term. The stakeholder group recommended that the demonstration wait until the fall when there will be more students on campus. Two of the four recommended routes are being considered by Dr. Lin's group for the two-week demo. These include the remote parking lot shuttle and the route between Juniper-Poplar Hall and the Library. However, the selection of the final route for the demo will depend on the capabilities of the vehicle. For example, it is known that all of the fully autonomous shuttles that are currently on the market have difficulty making left turns at intersections. Due to this current technical limitation, the two-week demo may only demonstrate a simple loop around Leroy Collins Boulevard in the vicinity of the USF Library.

Task Two: Identify legal, insurance, and other restrictions to operating an autonomous shuttle on campus

For Task Two, CUTR began by researching the existing Florida statutory language regarding autonomous vehicles. This first step was followed up by consulting with the USF General Counsel's Office. Florida has some of the most progressive laws in the nation regarding the testing and operating of autonomous vehicles. Autonomous vehicles are defined in the Florida Statues as follows:

AUTONOMOUS VEHICLE.—Any vehicle equipped with autonomous technology. The term "autonomous technology" means technology installed on a motor vehicle that has the capability to drive the vehicle on which the technology is installed without the active control or monitoring by a human operator. The term excludes a motor vehicle enabled with active safety systems or driver assistance systems, including, without limitation, a system to provide electronic blind spot assistance, crash avoidance, emergency braking, parking assistance, adaptive cruise control, lane keep assistance, lane departure warning, or traffic jam and queuing assistant, unless any such system alone or in combination with other systems enables the vehicle on which the technology is installed to drive without active control or monitoring by a human operator. *Title 23, Chapter 316.003 Florida Statues*

There is no requirement in state statute that a driver be present in the vehicle when it is operating in autonomous mode. There is no requirement that an autonomous vehicle must have a steering wheel or acceleration and brake pads. However, the vehicle must have a means of visually indicating when it is operating in autonomous mode, and it must include a system to safely alert the driver if an autonomous technology failure is detected (*Chapter 319.145 F.S.).* When such an alert is given, the system must require the driver to take control of the vehicle. If the driver does not or is not able to take control, the system must be capable of bringing the vehicle to a complete stop.

There is no special licensing requirement in Florida to operate an autonomous vehicle. Anyone who possesses a valid driver's license may do so (*Chapter 316.8 F.S.*). Florida law used to require autonomous vehicle testing entities to provide $5 million in insurance. That is no longer required.

CUTR contacted the USF General Counsel's Office for advice on any legal or insurance restrictions as well as any concerns they might have about autonomous vehicles on campus. The General Counsel's Office, in turn, contacted the state's Department of Financial Services, Division of Risk Management in Tallahassee. They informed the General Counsel's Office that USF would be covered under the state's general liability insurance in the event of a vehicle accident. Nevertheless, the

General Counsel's Office would require any autonomous shuttle operator that wants to operate on campus to provide their own commercial liability insurance. As a side note, CUTR obtained a copy of the request for proposals (RFP) that the City of Gainesville issued for their autonomous shuttle project. Their RFP included a requirement that the selected shuttle operator must carry $1,000,000 per occurrence in general liability insurance and $500,000 per occurrence in automobile liability insurance. Furthermore, the RFP required the selected vendor to indemnify and save harmless the City of Gainesville from all liability connected with the contract.

The General Counsel's Office pointed out that there are special laws in Florida regarding the operation of low speed vehicles (i.e. vehicles that operate greater than 20 mph but less than 25 mph). Per Chapter 320.01, they can only operate on roads with posted speed limits 35 mph or less. This will not be an issue for a campus shuttle since the campus-wide maximum speed limit is 25 mph. The General Counsel's Office recommended adding signs at the entrances to campus alerting drivers and pedestrians to the presence of autonomous shuttles. Finally, the General Counsel's Office recommended that CUTR keep them informed as the project moves closer to implementation.

There was some limited discussion about the possibility of operating the autonomous shuttles in the parts of campus that are restricted to pedestrians. This option is not being pursued. It is not a legal or insurance issue but rather a policy issue, namely the desire to make USF as pedestrian friendly as possible by limiting vehicular traffic in the central areas of campus.

Finally, Task Two included identifying any operational restrictions to operating autonomous shuttles on campus. Based on conversations CUTR had with the Contra Costa Transportation Authority on their AV testing as well as meeting with a representative from shuttle manufacturer NAVYA, it was discovered that many, if not all, autonomous shuttles currently have difficulty making left turns at intersections while in autonomous mode. In fact, CUTR representatives made a field trip to Babcock Ranch in Charlotte County, Florida where the EZ10 shuttle manufactured by EasyMile is being operated. There it was observed that the shuttle only makes left turns through intersections once the service attendant has checked to make sure there is no oncoming traffic. The attendant pushes a button to set the shuttle in motion. In other words, the steering of the vehicle through the intersection is autonomous, but the sensory detection is manual.

Task Three: Identify 2-3 potential service options for autonomous shuttles on USF Tampa Campus

For Task Three, CUTR compared the results from the transportation data analysis with the results of the survey analysis and developed four potential routes for an autonomous shuttle demonstration. They include:

Route 1: a daytime remote parking lot shuttle operating between Lot 18 (North and South) and the Library

Route 2: a daytime shuttle operating between Juniper-Poplar Residence Hall and the Campus Recreation Building

Route 3: a nighttime shuttle between Juniper-Poplar Residence Hall and The Hub

Route 4: a nighttime shuttle between Juniper-Poplar Residence Hall and the Library.

These routes were presented to the Stakeholder Group at an April 19 meeting at CUTR. Based on comments received, several adjustments were made to the routes. Specifically, USF Parking and Transportation Services (PATS), which operates the Bull Runner bus, recommended adjusting the remote parking shuttle route by having it go to the Library instead of to Campus Recreation. PATS also recommended a slight modification to the nighttime shuttle route between Juniper-Poplar and The Hub. Specifically, PATS recommended that the route travel east-west on Laurel Drive, where there is less traffic, instead of on Holly Drive. Maps of the proposed routes are shown in Figure 27, Figure 29, and Figure 31. The remote parking shuttle route would complement an existing Library Express service that the Bull Runner operates between Lot 18 and the USF Library. The other three recommended routes would fill a gap in Bull Runner service.

As mentioned earlier, the Campus Automated Shuttle Service Deployment Initiative is a parallel study being conducted by CUTR. It intends to conduct a two-week demonstration of an autonomous shuttle on the USF campus as a way to better understand its capabilities and limitations and to solicit feedback from students. Two of the four routes mentioned above are being considered for the two-week demo, namely the remote parking lot shuttle and the shuttle between Juniper-Poplar Hall and the Library. However, final selection of the route will depend on the capabilities of the shuttle.

As another part of Task Three, CUTR reached out to Regional Transit System (RTS) in Gainesville for information on their autonomous shuttle project. CUTR was able

to obtain a copy of the request for proposals (RFP) that was issued, a copy of the proposal that was submitted by the chosen vendor (Transdev), and a copy of the signed contract. This information was used to develop a rough cost estimate for a USF autonomous shuttle project.
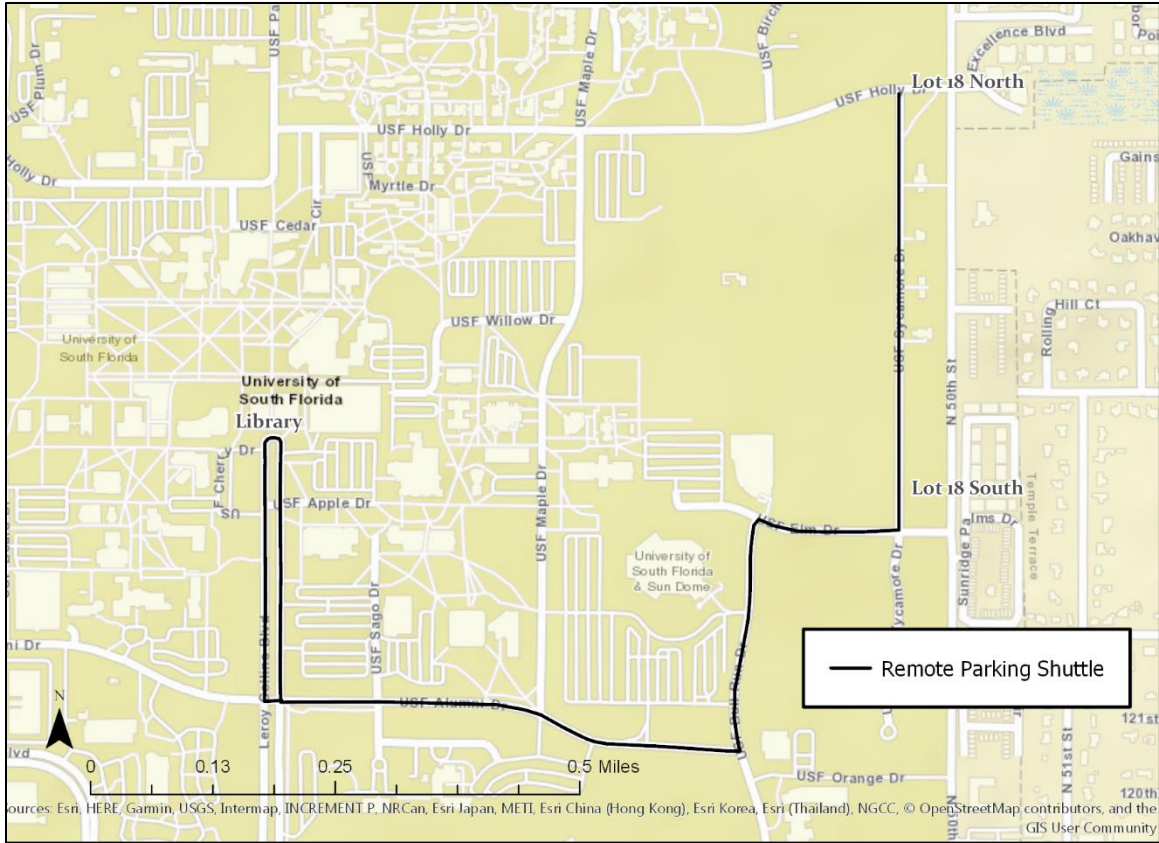
Figure 27: Route 1 (Remote Parking Shuttle)

Figure 28: Remote Parking Lot 18
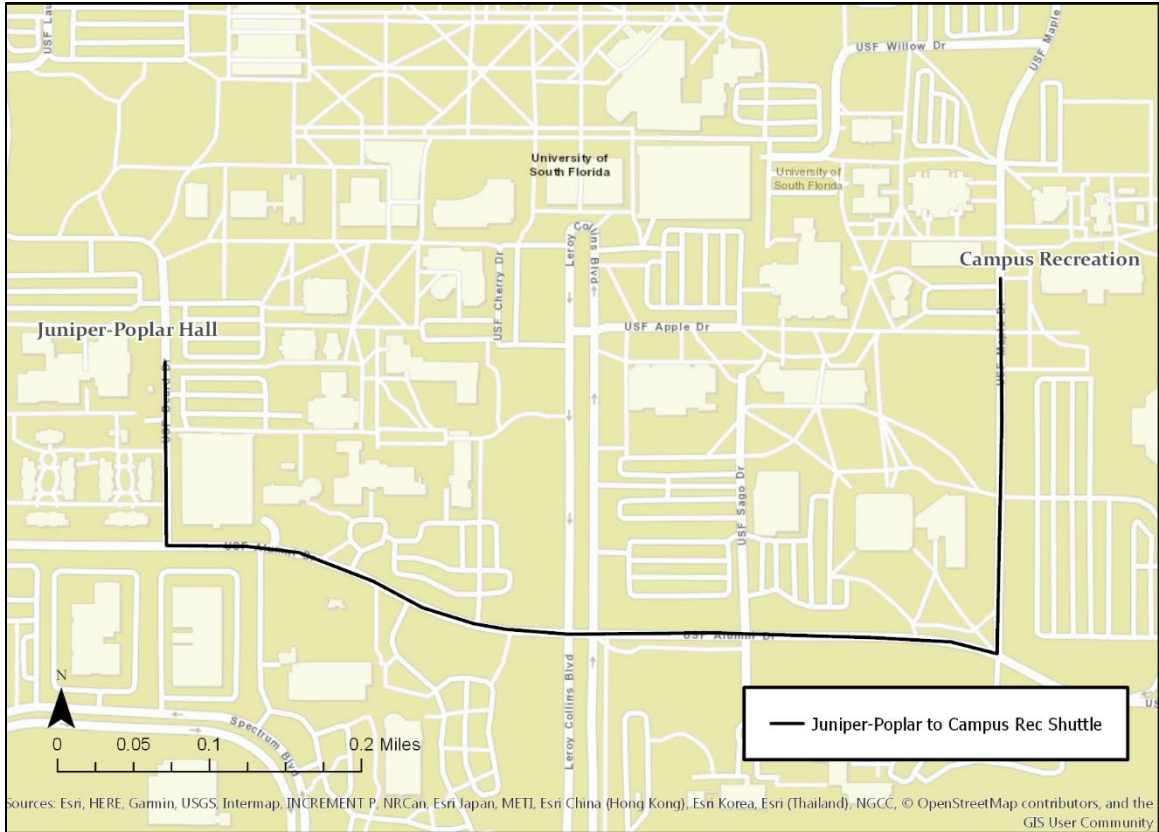
Figure 29: Route 2 (Juniper-Poplar Hall to Campus Rec)

Figure 30: Juniper-Poplar Hall and Campus Rec
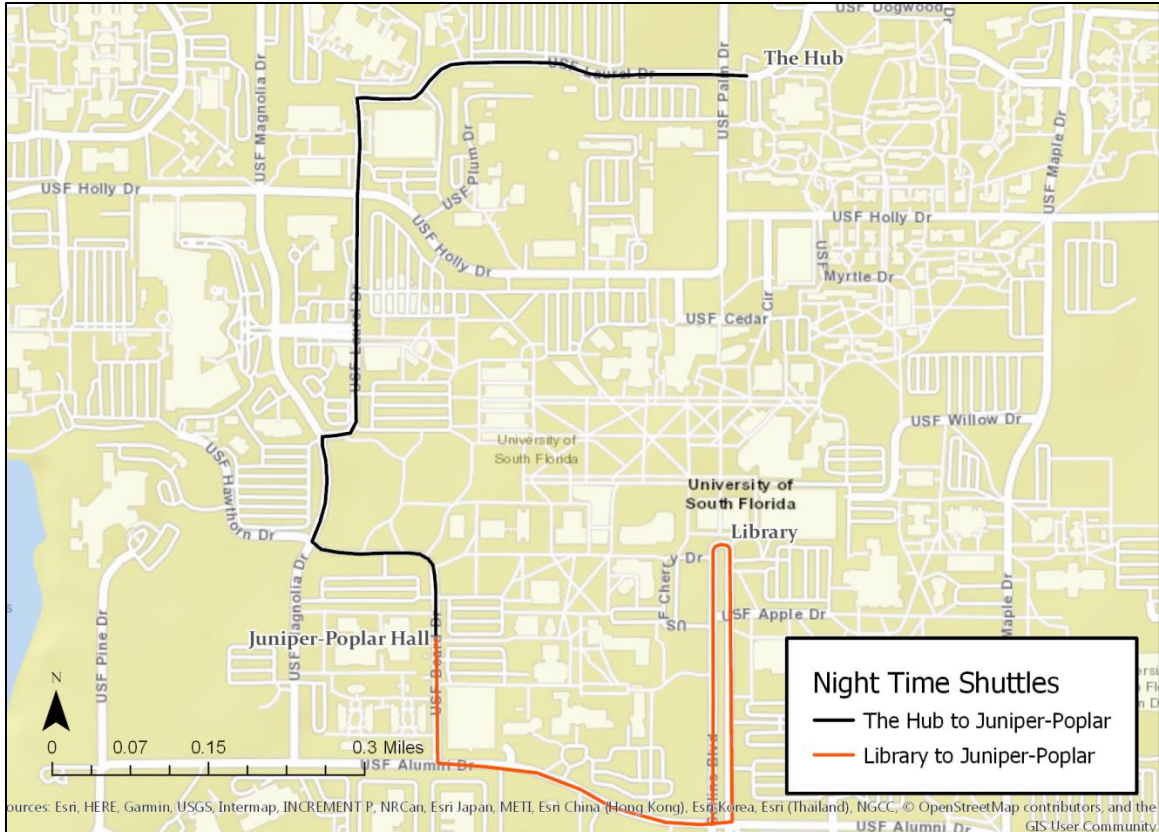
Figure 31: Routes 3 and 4 (Nighttime Shuttles)

Figure 32: Library and The Hub

The study included looking at the autonomous shuttle route proposed by the Tampa Innovation Alliance. That route is shown in Figure 33. It has some overlap with the Juniper-Poplar Hall to Campus Recreation route recommended in this study.
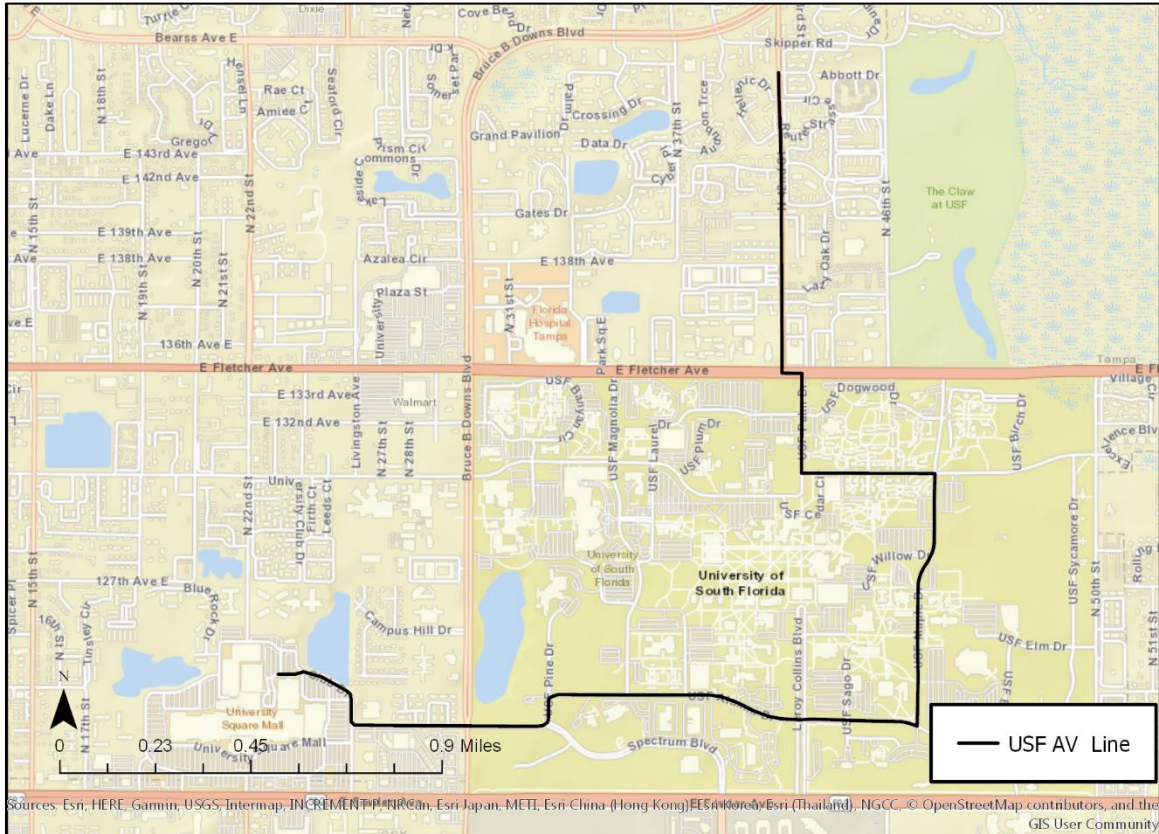
Figure 33: Tampa Innovation Alliance Recommended AV Shuttle Route

Basic order of magnitude for capital and operating costs

Task 3 included developing a basic order of magnitude for the capital, operating, and maintenance costs for the proposed autonomous shuttle service. To do this, CUTR reached out to the City of Gainesville, which has its own 3-year autonomous shuttle project totaling $2.5 Million. The Florida Department of Transportation (FDOT) is funding the project with Service Development Funds. In April 2018, the City signed a three-year service contract with the transportation provider Transdev. The contract provides for the lease, operation, and maintenance by Transdev of three autonomous shuttles. They will be used to provide service between downtown Gainesville and the University of Florida campus in mixed traffic on public streets. CUTR obtained copies of the request for proposals (RFP) that was issued by the City; Transdev's submitted proposal; and the signed contract between the City and Transdev. Additionally, CUTR contacted the director of Regional Transit System and received recommendations on what costs to use when developing estimates. For the lease, it was recommended to use $8,000 per month per vehicle. For operations (including maintenance and an on-board attendant), it was recommended to use $75 to $85 per hour per vehicle.

Based on this guidance, it is estimated that a 12-month pilot project on the USF Tampa campus using two autonomous shuttles would cost around $700,000. This cost estimate assumes 10 hours of daytime service from 8:00 a.m. to 6:00 p.m. and 6 hours of nighttime service from 8:00 p.m. to 2:00 a.m. during weekdays (Monday to Friday). It also assumes no service in the summer. Table 3 shows how this estimate was derived. Based on the distances of the four proposed routes, it is estimated that two shuttles will suffice. One shuttle each will serve the two daytime routes. The shuttles will be recharged between 6:00 and 8:00 p.m. and will then be used for the nighttime shuttle service.

Table 3: Basic Order of Costs (2 Shuttles)

Vehicle Lease			Operations Costs	
Number of shuttles	2		Number of shuttles	2
Number of months	12		Hours of service per day	16
Monthly lease per month per vehicle	$8,000		Approximate days of service*	184
			hourly rate/vehicle	$85
Total lease cost	$192,000		Total operations cost	$500,480

Total lease cost + Total operations $692,480

*subtracted out weekdays during summer sessions;

If, for example, there are not sufficient funds to operate all four routes, the estimated 12-month cost for 1 shuttle would be $346,240 (see Table 4).

Table 4: Basic Order of Costs (1 Shuttle)

Vehicle Lease		Operations Costs	
Number of shuttles	1	Number of shuttles	1
Number of months	12	Hours of service per day	16
Monthly lease per month per vehicle	$8,000	Approximate days of service*	184
		hourly rate/vehicle	$85
Total lease cost	$96,000	Total operations cost	$250,240

Total lease cost + Total operations $346,240

Potential Funding Sources

The long-term vision for the autonomous shuttles is that they become a part of the Bull Runner. However, so as not to compete with the limited funds for the existing bus fleet, a separate funding source will need to be identified. Potential funding sources for the automated shuttle include, but are not limited to, the following:

- USF Student Green Energy Fund

- Federal Transit Administration (FTA) Strategic Transit Automation Research Program

- Foundation Grants

- FDOT Service Development Funds

- Advertising Revenue

Because the proposed routes are limited to the USF campus, the first targeted source of funding would be the **USF Student Green Energy Fund**. This program is funded through the Student Green Energy Fee and is collectively managed by a 15-member Council. The Council has identified a three-tier grant system: Fast Track Grants for projects up to $5,000; Medium-Range Grants for projects between $5,001 to $250,000; and Signature Grants for projects over $250,000. There is no set due date for proposals. The Council reviews proposals on an ongoing basis and maintains a queue of vetted and approved projects. Proposals to the Green Energy Fund must address reductions in greenhouse gas emissions and/or energy consumption. Because the autonomous shuttles are fully electric, they would be an eligible project.

The Federal Transit Administration (FTA) has an expressed interest in promoting transit automation. To that end, the FTA published a **Strategic Transit Automation Research Plan** in January 2018. This program includes funding for five waves of demonstration projects. Each wave is dedicated to a particular aspect of transit automation: Demo 1 (Transit Bus Advanced Driver Assistance Systems); Demo 2 (Automated Shuttles); Demo 3 (Maintenance Yard, Parking Operations);

Demo 4 (Mobility-on-Demand Services); Demo 5 (Automated Bus Rapid Transit). The USF Autonomous Shuttle Project would be eligible for Demo 2. The latest information from FTA staff is that a Notice of Funding Opportunity (NOFO) for Demo 2 will be issued toward the end of Fiscal Year 2018 (i.e. around September 2018).

Another funding possibility, while remote, could be from a **Foundation Grant**. A foundation is a non-governmental entity that is established as a nonprofit corporation or a charitable trust, with a principal purpose of making grants to unrelated organizations, institutions, or individuals for scientific, educational, cultural, religious, or other charitable purposes. For example, the Energy Foundation is a foundation that according to its website, "makes grants that promote innovative state and federal policies to speed commercialization of clean transportation technologies and fuels." Another example is the Surdna Foundation. One of its three grant program areas is Sustainable Environments, which among other things funds projects that promote "next generation infrastructure to improve transit systems."

The Florida Department of Transportation has various categories of transportation funds. One of them is the **Public Transit Service Development Program**. This program provides initial funding for transit projects for up to three years. One of the eligible categories are transit projects that involve the use of new technologies. Funds from this program are being used to fund the autonomous shuttle project in Gainesville. Each FDOT district office develops a list of projects that it submits to the FDOT Central Office by July 1. Implementation of those projects can begin on or after July 1 of the following fiscal year.

Advertising is another possible source of revenue. USF Parking and Transportation Services (PATS) allows advertising via a bus sponsorship program. The stated objective of this program is to maintain good taste on the buses while offering the community a chance supplement the Bull Runner transit program. It does include restrictions on the type of advertising that is allowed. For example, the following types of material are prohibited:

- All tobacco products, alcohol, firearms or related products or activities.
- Anything containing adult themes, activities or products including but not limited to pornography, graphic art and violent content and any related material.
- Derogatory and/or discriminatory materials and messages.
- Promotion of any partisan political party, view or issue.
- Anything deemed to be detrimental to the best interests and goals of the University of South Florida and the Parking and Transportation Services Department.

There are three options for advertising via the bus sponsorship program: Interior Bus Cards; Exclusive Bus Stops and; Route Sponsors. The Interior Bus Card option allows a sponsor to place an 11" x 24" card inside all the buses at a rate of $600 per month or $7,200 per year. The Exclusive Bus Stop sponsor is only available on existing routes. Essentially, a business can pay to have a stop added along a route that serves their business. An example of a sponsored bus stop is the University Mall, which has two Bull Runner stops. The cost is $1,000 per month for the first stop and $2,000 for the second stop. The Route Sponsor options has two levels: Gold and Green. Gold is the higher level. For $2,500 per month or $30,000 per year, the Gold Level sponsor gets at least two stops on their property, interior cards on all buses, and the business's logo on all Bull Runner maps. The Green Level sponsor costs less, $1,500 per month or $18,000 per year. The Green Level sponsor gets interior cards on all buses and their business logo on all Bull Runner maps just like the Gold Level sponsor. However, they only get one stop at their location. Advertising revenue, while helpful, would not be sufficient to cover the full operating expense of one autonomous shuttle. The estimated operating expense for one shuttle, assuming ten hours a day, is $250,240. A Gold Level sponsorship would only cover $30,000.

Request for Proposal Sample Text

Task 3 included a requirement to develop some sample text that could be used in a request for proposals (RFP) for the operation of autonomous shuttle service on the USF Tampa campus. A full RFP will be developed after funding has been secured. However, what follows below is some sample text borrowed from the City of Gainesville RFP and adapted for USF.

Introduction and Background

The University of South Florida (USF) is requesting proposals from well qualified and experienced parties to provide a campus-based autonomous shared ride shuttle service for a one-year demonstration. The project consists of four routes, all of which are confined to the USF campus. The shuttles are to operate on campus roadways in mixed traffic. Aerial photographs of the campus with an overlay of the routes are provided in Exhibit A. The four routes include:

- A daytime parking shuttle from Lot 18 to the Library
- A daytime shuttle from Juniper-Poplar Residence Hall to the Campus Rec Building
- A nighttime shuttle from Juniper-Poplar Residence Hall to The Hub Dining Facility
- A nighttime shuttle from Juniper-Poplar Residence Hall to the Library.

Operating Requirements

- The shuttle service will operate on campus roads and be limited to the USF campus.
- The proposed service hours are as follows:
  - For the two daytime routes, there will be 10 hours of weekday daytime service from 8:00 a.m. to 6:00 p.m.
  - The shuttles will be recharged between 6:00 and 8:00 p.m.
  - For the two nighttime routes, there will be 6 hours of weekday nighttime service from 8:00 p.m. to 2:00 a.m.
- Service will be limited to the fall and spring semesters. There will be no summer semester service.
- The campus-wide speed limit is 25 miles per hour (mph). For safety purposes, the maximum speed of the shuttles will be 20 mph.

- The shuttle shall be able to board and alight passengers safely at predefined stops. Many of the stops will be existing USF Bull Runner bus stops.

- Level 4 autonomy is preferred.

- A trained safety attendant must be onboard the shuttle at all times and have the ability, if necessary, to take manual control of the shuttle.

- As USF cannot provide any of its staff to operate, maintain or supervise the service, proposer should provide for such resources if required in their project plan.

Vehicle Requirements

- The shuttle must be capable of operating in mixed traffic through signalized intersections. This includes the ability to transition from one lane to another and the ability to make left turns through signalized intersections.

- The shuttle must be capable of making visual and audible next stop announcements in English.

- The shuttle shall be electric, preferably with the ability to be charged without wireline infrastructure.

- Because it is anticipated the shuttles will operate during the day between 8:00 a.m. and 6:00 p.m., the shuttles should be able to operate continuously for ten hours. The shuttles must be able to be fully recharged within two hours in order to operate at 8:00 p.m.

- The shuttle shall have 4G or better wireless connectivity with the ability to stream video and other data in real-time for both management and operations of the vehicles, as well as, for passengers.

- The shuttle must have vehicle to Infrastructure (V2I) Dedicated Short Range Communications (DSRC) capability with traffic signals.

- The shuttle must be climate controlled. The air conditioning must be able to maintain an internal cabin temperature no higher than 75 degrees Fahrenheit.

- The proposer shall provide certification of their vehicle consistent with Federal Motor Vehicle Safety Standards (FMVSS) and the Highly Automated Vehicle (HAV) system consistent with the US DOT 15 point Safety Assessment for deploying automated vehicle technologies. (1) If a proposer cannot certify that their proposed vehicle complies with all applicable FMVSS, an exemption from the National Highway Traffic Safety Administration (NHTSA) must be obtained in order to test on public roads.

General Terms and Conditions

- Indemnification. The Contractor shall agree to indemnify and save harmless the University, its officers, agents, and employees, from and against any and all liability, claims, demands, fines, fees, expenses, penalties, suits, proceedings, actions and costs of action, including attorney's fees for trial and on appeal, of any kind and nature arising or growing out of or in any way connected with the performance of the contract whether by act or omission or negligence of the Contractor, its agents, servants, employees or others, or because of or due to the mere existence of the Contract between the parties.

- Insurance. Contractor shall provide proof of insurance in an amount as noted below:
  - Worker's Compensation Insurance providing coverage in compliance with Chapter 440, Florida Statutes.

  - Public Liability Insurance (other than automobile) consisting of broad form comprehensive general liability insurance including contractual coverage $1,000,000 per occurrence (combined single limit for bodily injury and property damage).

    - The University shall be an additional insured on such Public Liability Insurance and the Contractor shall provide copies of endorsements naming the University as additional insured.

  - Automobile Liability Insurance

    - Property Damage $500,000 per occurrence (combined single limit for bodily injury and property damage).

Appendices

Appendix A: Student Survey Results

1. What is your status at USF?

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Student (Undergraduate)	184	86		84	75
Student (Graduate)	22	10		15	13
Student (cont. education)	0	0		2	2
Post-doctoral fellow	1	0		0	0
Staff administration	1	0		4	4
Staff security	1	0		2	2
Faculty	0	0		1	1
Other	4	2		4	4
Total	213	100		112	100

2. Do you live on campus?

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Yes	56	26		20	18
No	157	74		92	82
Total	213	100		112	100

3. When commuting to the USF Tampa campus, I usually

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Drive alone	74	48		60	65
Use the Bull Runner	39	25		8	9
Bike (using my own bike)	13	8		5	5
Walk	9	6		4	4
Carpool as the passenger	8	5		5	5
Carpool as the driver	5	3		5	5
Use public transit (HART)	5	3		2	2
Use Uber or Lyft	1	1		1	1
Longboard/Skateboard	0	0		1	1
Ride motorcycle/Scooter	0	0		1	1
Total	154	100		92	100

4. Upon arriving at the campus, I usually

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Leave my vehicle parked in the same parking lot/garage until I leave campus	73	92		54	83
Move my vehicle around the campus to get to my classes	6	8		11	17
Total	79	100		65	100

5. To get around the USF Tampa campus, I usually

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Walk	110	71		60	65
Use Bull Runner	17	11		13	14
Drive	13	8		13	14
Bike, using own bike	10	6		2	2
Share ride with friends/co-workers	2	1		1	1
Bike, using Coast Bikeshare	1	1		0	0
Longboard/skateboard	1	1		3	3
Total	154	100		92	100

6. Please indicate the degree to which you agree or disagree with the following statements. (USF SG Survey)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A	Total
It is easy to get around campus without a car.	5%	22%	21%	34%	17%	1%	100%
It is easy to get from where I park on campus to where I have class or work.	5%	23%	18%	21%	10%	23%	100%
I feel safe walking on campus at night.	10%	27%	29%	25%	7%	1%	100%
I wish the Bull Runner ran at night.	3%	2%	17%	28%	38%	12%	100%
It is faster to walk from building to building on campus than to use the Bull Runner.	1%	3%	24%	39%	29%	4%	100%
I am afraid of skateboarders and golf carts on walkways.	11%	21%	26%	24%	15%	3%	100%

6. Please indicate the degree to which you agree or disagree with the following statements. (USF SDS Survey)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A	Total
It is easy to get around campus without a car.	7%	27%	16%	37%	13%	0%	100%
It is easy to get from where I park on campus to where I have class or work.	8%	24%	15%	34%	10%	10%	100%
I feel safe walking on campus at night.	7%	35%	18%	33%	6%	2%	100%
I wish the Bull Runner ran at night.	1%	2%	20%	34%	27%	16%	100%
It is faster to walk from building to building on campus than to use the Bull Runner.	3%	8%	22%	31%	26%	9%	100%
I am afraid of skateboarders and golf carts on walkways.	13%	20%	15%	29%	21%	1%	100%

7. How familiar were you with driverless vehicles before taking this survey?

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Not all familiar	57	28		21	19
Slightly familiar	65	32		29	27
Somewhat familiar	43	21		29	27
Moderately familiar	41	20		29	27
Total	206	100		108	100

8. What kind of reviews have you encountered about driverless vehicles?

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Mostly negative	5	2		4	4
Mix of positive and negative	64	31		35	32
Mostly positive	57	28		36	33
Have not encountered any reviews	78	38		33	31
Total	204	100		108	100

9. How likely do you see yourself using driverless vehicles that can fully drive by themselves when they become available?

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Extremely unlikely	19	9		9	8
Unlikely	16	8		6	6
Don't know/Can't say	44	22		18	17
Likely	65	32		30	28
Extremely likely	60	29		45	42
Total	204	100		108	100

10. If a driverless shuttle were to operate on-campus for a limited period demonstration, I would:

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Not consider riding it	18	9		10	9
Ride it just for the experience/think it would be cool	112	55		49	46
Ride it at every available opportunity	73	36		48	45
Total	203	100		107	100

11. If driverless shuttles were to become a permanent transportation service on the USF campus, how frequently would you use it for your on-campus trips?

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Never	8	4		9	9
Almost never	17	8		3	3
Occasionally/Sometimes	57	28		25	24
Almost every time	37	18		25	24
Every time	15	7		9	9
Depends on where it goes	68	34		33	32
Total	202	100		104	100

12. Please choose the appropriate response for each item (USF SG Survey)						
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
I would feel safe riding in a driverless shuttle that operates on campus roads at the posted speed limit of 25 mph.	6%	5%	18%	48%	23%	100%
I would be in favor of driverless shuttles operating through the center of campus where there are bicyclists and pedestrians if they were kept at low speed, for example 5 to 10 mph.	11%	11%	19%	41%	17%	100%
Driverless shuttles should always travel on dedicated lanes.	2%	7%	19%	41%	31%	100%
If necessary, I would be willing to pay a nominal fee to use the driverless shuttle.	36%	23%	24%	11%	5%	100%

12. Please choose the appropriate response for each item (USF SDS Survey)						
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
I would feel safe riding in a driverless shuttle that operates on campus roads at the posted speed limit of 25 mph.	8%	3%	10%	45%	35%	100%
I would be in favor of driverless shuttles operating through the center of campus where there are bicyclists and pedestrians if they were kept at low speed, for example 5 to 10 mph.	13%	10%	13%	43%	20%	100%
Driverless shuttles should always travel on dedicated lanes.	4%	10%	26%	35%	26%	100%
If necessary, I would be willing to pay a nominal fee to use the driverless shuttle.	33%	24%	22%	15%	6%	100%

13. Numerous service options for driverless shuttles are being considered. Of the service options shown below, rank the top three (3) options that you think would provide an added benefit to the USF campus.

	USF SG Survey	USF SDS Survey	Paper Survey
	No.	No.	No.
After hours /nighttime shuttle	148	70	31
Remote parking lot shuttle	90	62	21
Campus circulator	84	41	22
Transportation for students with disabilities	79	54	16
Shuttle from HART bus stop on edge of campus to nearest Bull Runner stop or to center of campus	66	29	n/a
A shuttle operating between the soon to be constructed campus Publix and student housing	54	27	16
A short distance connector between campus buildings and Bull Runner bus stops	52	20	21
Special event service	37	15	10
Campus tours for prospective students	24	11	5

14. Please select the range that includes your age

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
17 or younger	1	1		0	0
18-20	95	50		34	34
21-24	70	37		33	33
25-29	15	8		12	12
30-34	5	3		13	13
35 or older	5	3		9	9
Total	191	100		101	100

15. What is your gender?

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Male	62	32		44	44
Female	129	68		57	56
Total	191	100		101	100

16. When it comes to technology, what best describes you?

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
I am skeptical of new technologies and use them only when I have to	8	4		3	3
I am usually one of the last people I know to use new technologies	17	9		10	10
I use new technologies when most of the people I know use them	77	40		27	27
I like new technologies and use them before most people I know	58	30		33	33
I love new technologies and am among the first to experiment and use them	31	16		28	28
Total	191	100		101	100

17. Have you been involved in a traffic crash in the last 3 years?

	USF SG Survey			USF SDS Survey	
	No.	Percent		No.	Percent
Yes	46	24		32	32
No	144	76		69	68
Total	190	100		101	100

Appendix B: Stakeholder Meeting Notes

Date of Meeting: April 19, 2018

Attendee List

Name	Agency
Brian Pessaro	CUTR
Rob Bertini	CUTR
Dennis Hinebaugh	CUTR
Nikhil Menon	CUTR
Pei-Sung Lin	CUTR
John Patrick	Hillsborough County
Tony LaColla	Plan Hillsborough
Allison Madden	USF Research Park
Marie Bowen	USF Parking and Transportation
Raymond Mensah	USF Parking and Transportation
Alice Price	Atkins, representing FDOT District 7
Vik Bhide	City of Tampa
Rebecca Hessinger	Hillsborough County Economic Dev.
Allison Yeh	Hillsborough MPO
Richard Clarendon	Hillsborough MPO
Katina Kavouklis	FDOT District 7

Question and Answer after Brian Pessaro's presentation on the study

- Concerns/Comments related to cost:

  o Why is the operating cost per hour so high?

  o Is a safety attendant on the shuttle? If so, when will the shuttle operate without a safety attendant? Safety attendant as a comforter factor in the beginning of AV implementation

  o How many routes does the estimated project cost cover?

  o Both shuttles operating simultaneously without a spare

Responses: The high operational costs are likely due to the fact that currently there are a very limited number of vendors who can provide these types of autonomous shuttles. As this technology penetrates the market further, it is likely that the costs will come down. Yes, there will be a safety attendant on board at all times given that the shuttle will be operating in mixed traffic. It is too early to predict when the shuttles could operate without a safety attendant on board. The $700,000 estimated cost is for the four recommended routes. In order to keep costs down, it is recommended operating without a spare. If one or both of the shuttles go down for repair, the autonomous shuttle service will simply have to be temporarily suspended.

Concerns/Comments related to route options:

  o AV should be used as an enhancement to existing transportation on campus.

  o PATS recommended considering having Lot 18 routes go to the library rather than the rec center because it will get students closer to the center of campus.

  o Publix may have an impact on the routes once it opens, particularly the night route between Juniper-Poplar (JP) and the Hub; students from JP travelling to the Hub to get groceries from Publix.

  o PATS generally liked the JP to Library route option

  o PATS recommended adjusting a portion of the nighttime shuttle route between JP and the Hub. Recommended the shuttle use Laurel Drive instead of Holly Drive because there is less traffic.

  o Is there adequate street lighting on the routes at night?

  o Connection the routes to other modes of transportation?

  o Consider survey USF Health students and faculty for their opinions on the AV/its routes as they have different needs than the general USF population

  o Are "shortcuts" and guideways an eventual route option for the AVs?

Responses: Regarding the question about adequate street lighting, all models of autonomous shuttles that are currently on the market come equipped with front and rear lights similar to a regular vehicle. Therefore, the shuttle will be visible to other vehicle and pedestrians. The sensing technology used by the autonomous shuttles (lidar and radar) can penetrate darkness in order to see if there is anything in the path of the vehicle. Furthermore, a safety attendant will be on the vehicle at all times, and it is recommended that the speed of the shuttles will be restricted to no more than 20 mph.

- Concerns/Comments related to vehicle operation and supporting infrastructure

    o Left-hand turns are a safety concern

    o Role of signalized intersections

    o The cost associated with V2I and I2V communication technologies, the various form of that (center vs local communication between the signal and AV)

    o Indicators on the vehicles that identify them/distinguishes them from other vehicles on campus; also any audio or visual warnings on the vehicle to announce its presence

        ▪ This may help calm the "fear" associated with new technologies as well as market the AV

    o The range on vehicle operation, how long can it run on a single charge in FL conditions

    o ADA requirements on the shuttle and announcements/ques from visual impaired (such as audio stop announcements)

Responses: Regarding left-hand turns, CUTR made a field trip to Babcock Ranch, a planned residential community in Charlotte and Lee Counties. At Babcock Ranch, EZ10 autonomous shuttles manufactured by EasyMile are being used to provide transportation inside the development. It was observed that the EZ10 shuttles only makes left turns through intersections after the on-board safety attendant observes that the intersection is clear of traffic and pushes a button. CUTR heard similar stories about the difficulty of autonomous shuttles making left turns against opposing traffic from the Contra Costa Transportation Authority in California. CCTA is testing the EZ10 shuttle at the Bishop Ranch office park. Regarding the question about whether there are indicators on the shuttle that distinguish them from other vehicles, these shuttles do have an appearance that is distinct from any manned vehicle. Regarding the question whether these shuttles come equipped with any visual or audio warnings, they do come equipped with a horn. Regarding the question about range, information collected by CUTR on the NAVYA and Easy Mile shuttles indicates that they can operate for 8 hours with the air conditioning running. Regarding the question about the Americans with Disabilities (ADA) Act, none of the autonomous shuttles currently on the market meet the requirements of

the ADA. For example, although the shuttles are accessible in that they have deployable access ramps, they do not have tie-downs for wheelchairs.

- Concerns/Comments related to education and perception management

    o In addition to signage at the entrance to campus that informs about the presence of AVs on campus, consider including them at stops; people generally do not read signage as they come onto the campus

    o Implementing some sort of mass education effort geared to inform students and faculty about the AV, how it works, and familiarized them with the technology

    o How will the perception of the AV technology on campus be managed?

- Concerns/Comments related to risk analysis

    o What accidents and suits have already occurred that we would be able to learn from while implementing this technology on campus?

Response: The only known accident with a shuttle of the type being suggested for USF is the November 2017 accident in Las Vegas with a NAVYA shuttle. A delivery truck was backing up. The NAVYA shuttle detected the truck and came to a stop. However, the truck continued backing up and grazed the front bumper of the shuttle. No injuries were reported. It is not known whether there was any lawsuit.

- Key discussion point:

    o There are layers to the system that this project/AV technology on the USF campus could/should tap into; look at the needs vs wants related to the technology, USF is mostly comprised of commuter students who need to travel to and from campus rather than traveling within the contained campus system; there is also the potential to create infrastructure and support as well as sustainable ridership by working with area businesses and related projects/programs that are taking place or will be started soon; can also work with other studies and business partners to reinforce the education component of all of this.

Question and Answer after Dr. Lin's presentation on the proposed 2-week demo of an autonomous shuttle on campus

- September may be more ideal to hold the AV demo; particularly at least 3 weeks after classes have started; more students/faculty/people will be around at that time; before launching in September there are plenty of opportunities to market/advertise that "change is coming" as well as get people excited about the project

- As far as marketing goes, the vendor should be able to provide all of that and cater to the project's specific needs related to marketing and advertising

Comments for both projects

- It would be beneficial to gather more data related to usage/need surrounding AV technology on campus, such as more SAFE team data and a crime profile to analysis how that fits into the route options because AV provide additional eyes and ears along the routes that they travel