Sustainable Solutions to Lafayette College Transportation

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Table of Contents

I. Introduction

II. Survey Methods

III. Informational Meetings

IV. Parking Alternatives

V. LCAT Alternatives

VI. Evaluative Criteria

VII. Evaluation and Recommendations

VIII. Appendix (A&B)
Figures

Figure 1 transit at other campuses
Figure 2 statistic on other campus transit
Figure 3 results from survey on parking options
Figure 4 breakdowns of registrations fees for current versus tiered parking
Figure 5 & 5.1 Green House Gas emissions reduction by Tiered Parking
Figure 6 Results from long survey on concerns about the LCAT
Figure 7 Approval of third party proposed route
Figure 8 Student’s response to where they would like the LCAT to go
Figure 9 breakdowns for cost of proposed off campus and on campus route
Figure 10 Criteria Evaluation
I. Introduction

Background- Lafayette College and other institutions at large

“In college and university communities, land use, travel patterns, density, and centralized policy control often provide the basis for innovative solutions that are designed to provide transit and other non-auto solutions to address contemporary mobility issues” (TCRP, 2001)

Across the United States, in the past two decades, universities have experienced substantial growth. Between 2001 and 2011, the number of undergraduate students in the United States has increased by 35 percent (NCES 2014-15). With this, demands on the established transit infrastructure, (i.e. roads, traffic, congestion) have swelled and institutions across the country have had to implement innovative transportation systems to meet the needs of students. No two institutions have perfectly similar transportation needs. In what is called the “construction arms race” by the BloombergView, universities look to attract students with the latest and greatest in infrastructural features and amenities (Taylor 2012). This construction arms race has not exempted transportation systems. Today, most college campuses provide comprehensive transportation alternatives so that students need not bring cars to campus, ultimately making a college community more environmentally friendly (TCRP, 2001). Because of this universities must have some sort of transit system that allows students who do not have cars to get certain necessities and access to basic recreational attractions.

The ability of a school to limit student usage of cars is at the core of the goal to reduce carbon emissions and create a more sustainable campus. With a campus of 340 acres, Lafayette College has a considerably smaller campus than most universities. For sake of comparison Lehigh University has a campus of about 1,600 acres. However, despite having a small campus,
if Lafayette College wants to be more sustainable, it must figure out how to allow students to more easily travel the campus and popular locations around it.

In order to go about solving a campus transit issue it is important to understand the context from which these issues have been solved historically. Generally campus transportation issues have been solved one of three ways. Cooperation with the local public transit authority, a University run management of the program where, if need be, students can become eligible to drive (driving down labor cost of hiring new pay) the shuttle, and a University run management of a program that is autonomously controlled by administration are all options that should be brought up. In Figure #1 is the breakdown of who and how different colleges pay for a quasi-campus transit authority (TCRP, 2001).

Figure #1 shows the different polices for transit at other campuses. (TCRP, 2001)

<table>
<thead>
<tr>
<th>University of Arkansas</th>
<th>Transit System</th>
<th>Who Operates the Service?</th>
<th>Who Pays the Cost?</th>
<th>If Part of the University, Who Approves Fares, Routes, etc.?</th>
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<tbody>
<tr>
<td>University of California-Davis</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td>Traffic, parking, transit committee</td>
</tr>
<tr>
<td>University of California-Santa Cruz</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td>Associate provost</td>
</tr>
<tr>
<td>University of California-San Diego</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td>Joint council—student gov. and city representatives</td>
</tr>
<tr>
<td>Colorado State University</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td>Advisory comm. student referendum on fare, regents approve</td>
</tr>
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<td>Florida State University</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td>Shuttles department</td>
</tr>
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<td>University of Georgia</td>
<td>-</td>
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<td>Student Association Mass Transit Board</td>
</tr>
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</tr>
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<td>University</td>
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</tr>
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<td>-</td>
<td>University</td>
<td>University</td>
<td>Department head and vice president</td>
</tr>
<tr>
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<td>-</td>
<td>University</td>
<td>University</td>
<td>Transit dept. of university and Transit Authority approves</td>
</tr>
<tr>
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<td>University</td>
<td>University</td>
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<tr>
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<td>University</td>
<td>University</td>
<td>Board of directors</td>
</tr>
<tr>
<td>University of Iowa</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td>Trans. Advisory Board</td>
</tr>
<tr>
<td>Louisiana State University</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td>University-student senate and transit dept.</td>
</tr>
<tr>
<td>University of Massachusetts-Amherst</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td>Board</td>
</tr>
<tr>
<td>Michigan State University</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td>Department director</td>
</tr>
<tr>
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<td>-</td>
<td>University</td>
<td>University</td>
<td>Assistant vice president</td>
</tr>
<tr>
<td>University of New Hampshire</td>
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<td></td>
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<td>University</td>
<td></td>
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<td>East Carolina University</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td></td>
</tr>
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<td>North Carolina State Univ.</td>
<td>-</td>
<td>University</td>
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<td></td>
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<td></td>
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<td>University</td>
<td></td>
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<tr>
<td>University of Texas</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td></td>
</tr>
<tr>
<td>American University</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td></td>
</tr>
<tr>
<td>Univ. of Wisconsin-Madison</td>
<td>-</td>
<td>University</td>
<td>University</td>
<td></td>
</tr>
</tbody>
</table>

Regardless of the economic times, people will need transportation resources, figure #2 below details the various metrics of a shuttle. Students are ultimately looking for the best means to conveniently transport them, while higher education institutions are constantly and carefully considering the “wisest” way to send you to the locations that are important to the student body.
Purpose and Focus: 3 points

In this study of campus sustainability, we research the possible options for campus transportation, and we evaluate the feasibility of different future policies that the College could possibly enact to increase the environmental friendliness of the means by which we use transportation. According to research and analysis the Lafayette College Area Transportation (LCAT) shuttle system will need to meet three key areas of transportation need: transportation for volunteerism, transportation to basic needs and recreational activities, and transportation to classes at the Williams Art Campus on Third Street.

With these areas of interest in mind, the LCAT system currently does not operate in a way that is of maximum benefit to the Lafayette community. From a survey of the student body it was found that 42.1% (±7.55%) of students would rather get in their car to take a brief trip to CVS or Giant, than use LCAT. One of the supposed benefits of the LCAT system is to assist the
college community in acting in more sustainable ways, yet (assuming one has their own car on campus) there is not a reasonable alternative to driving your own personal vehicle. As a result of this there are obvious differences in access to the area destinations around campus like Giant, local movie theaters, bars and restaurants. Succinctly: students who have cars are using them to go to destinations that the LCAT could bring them too, and students who do not have access to cars need to wait so long at their destination for the LCAT to return that it is not worth the time and they find alternative means, sometimes at their own cost (buying food from Lafayette Dining Services, lack of easy access to downtown Easton), to meet their needs efficiently.

In addition to this, we also focus this report in preparation of the imminently growing Lafayette College William’s Arts Campus at the foot of college hill. The development of the Williams Arts Campus is in progress, and under construction now. The Williams Visual Arts Building currently holds classes for various art classes (drawing, sculptures, painting) which require students to travel to the bottom of the hill for class. Using Fall Semester 2014 as an example, there will be classes that will hold at least 34 students (all at the same time) in the Williams Visual Arts Building (Lafayette College Registrar). Within the next year, the addition of 3 media enabled classrooms and many practice spaces, will allow the addition of many classes at the “arts campus”. As a result, one can expect close to 100 students at the arts campus at any given time. The college will need to provide an alternative to sparse walking resources that scale the 210 foot elevation difference to the arts campus. Currently the only options students have is to either take the zig zagged stairway pathways, or walk down the College Avenue sidewalk. While this issue is potentially manageable during the warmer months, during the colder months there is a heightened opportunity for risk in the form of ice and snow. In addition to this
logistical problem, the overall number of students who can effectively volunteer through the LANDIS center is directly affected by the LCAT timetable.

LANDIS sends hundreds of volunteers into Easton each week, but transportation options remain the largest obstacle to cross in order to encourage more students to join in. Currently, there are around 300 volunteers serving at Salvation Army, Kick, Easton Area Community Center, America Reads and Journey home among others. According to Bonnie Winnfield, director of the LANDIS Community Outreach Center, she predicts the number of LANDIS volunteers could double if adequate and frequent transportation was provided. The current stops that supposedly serve the Easton volunteers, also suffer from the same plague as the first problem: being stuck too long at one location. If a student has a lot of school work, then taking them out for two hours instead of one can be a very real burden to some. Ultimately the question that this report attempts to address is: Are the campus transportation issues problematic and is there a sustainable solution?

II. Survey- Methods

In order to get an accurate representation of student’s views and behaviors regarding campus transportation, two surveys were given out to the student body. The first survey was intended to get a general view on attitude and perception of the LCAT. This data was used in the final recommendations and also helped shape the questions that were asked on the long survey. The long survey was given out to professors who administered the surveys in their classes. The questions asked in the long survey went more in depth then the first survey in order to analyze students current issues with LCAT and parking, the long survey also looked at what students wished the LCAT would do.
The first survey (short survey, Appendix A) was administered by the group members during lunch hours in Farinon Student Center and Marquis Dining Hall. The group was able to get 154 students to complete the survey. The results were calculated using a 95% confidence level from an online calculator (Creative Research Systems), which means that we can be 95% certain that the results are accurate representation of x percentage amount of the 2400 member student body within a certain percent range (the confidence interval). In the survey the following questions were asked; usage of the LCAT in the past year, usefulness of the LCAT route, shuttles timeliness, enough stops on campus, finding the LCAT schedule and if students knew the LCAT tracking app existed. Through this survey we determined that 42.1% ($\pm$7.55%) of students never used the LCAT shuttle in the past year. This indicate to us that there was a definite problem with the shuttle system and there needed to be further investigation into this ridership number to determine if this was due to student attitude or poor shuttle service. Only 9.4% ($\pm$4.6%) of students use the LCAT once a week or more. The short survey results also found that 35.71% ($\pm$7.32%) of students find the current the LCAT route to be useful and 28.51% ($\pm$6.9%) wish it ran to more off campus stops and 21.43% ($\pm$6.27%) wish it ran more often. After this data was collected and analyzed the long survey was composed based on these results.

The long survey was distributed to professors in various disciplines. We had 379 responses from the student body which is 2400 students. The responses were slightly heavy from the engineering discipline with 47.23% of the response being engineering majors. However the survey data did represent 30 majors out of 49 areas of study offered at Lafayette. The breakdown on areas of study was 47.3% Engineering, 3.7% Humanities, Social Science 9.5% and Natural Sciences 27.7%. By class year 87 students were from the class of 2014, 71 students were from the class of 2015, 62 from the class of 2016, and 157 responses from the class of 2017. One
problem with having a large amount of responses from the class of 2017 was that most of those students do not have a car on campus which affected our results for the questions involving parking. The long survey (Appendix B) consisted of questions about parking such as car usage, purpose of having a car, parking enforcement rules, future parking options, and monetary values that students would be willing to pay for parking. There were also questions involving the LCAT such as interest in proposed route by a third party (Appendix B), where students would like the LCAT to go, and concerns about the LCAT. Also included on the long survey where questions on about students walking habits to downtown Easton and problems with abilities to walk to downtown Easton. The purpose of asking students about their methods of walking to downtown Easton was to see if there was a need to run the LCAT to downtown Easton.

III. Informational Meetings

In the beginning of the semester we met with different faculty and staff members to discuss with them the project we were undertaking. We wanted to gather as much information about parking on campus and the LCAT system to figure out areas of concern and where we wanted to go with the project. We had met with Mary Wilford-Hunt, Hugh Harris, Kari Fazio, and Mitch Wein. In these meetings we asked a multitude of questions regarding both the LCAT shuttle system and parking.

In our meeting with Mrs. Hunt she laid out possible opportunities to improve transportation options at Lafayette. On the topic of transportation, we covered a variety of issues ranging from biking, parking, the LCAT, and the stairs from the college to North Third Street; the possibilities were almost endless. She helped to point us in the direction of focusing on parking and the LCAT and recommended people for us to contact. In our meeting she suggested changes such as adding a cover to the LCAT stops and improving the route.
Next we met with Hugh Harris, interim Director of Public Safety. We discussed with him parking on campus as well as enforcement regulations. He told us the biggest problem with enforcement is when faculty and staff are on campus. For special events, such as Homecoming and Lafayette-Lehigh, parking can be an issue. The campus parking isn’t set up to handle the amount of cars that come for these events. Students are forced to move from Markle Parking Deck. With events similar to these, Public Safety contracts out to Bear Security. However, Bear Security is less strict in their enforcement and results to less available parking spots. He also informed us about number of parking spots on campus and enforcement hours. On campus there are 542 parking spots available to students during the week. From Monday through Friday Public Safety enforces parking regulations from 7:30 A.M. to 5 P.M. Parking infractions include, not being registered, parking in a no park zone, parking in a handicap spot, parking in a faculty only spot, etc.

Next we met with Kari Fazio, Assistant Vice President of Finance and Business Operations, to discuss the LCAT. In this meeting she seemed very unwilling to change the current LCAT system. Her main focus was costs and she did not seem very open to want to make changes that will increase the cost of the LCAT. She suggested finding out if students would be willing to pay for the LCAT and even suggested eliminating the shuttle all together.

Lastly we met with Mitch Wein, Vice President of Finance and Administration, to discuss both parking and the LCAT. He told us how they set the prices for parking to break even with Forks Township renting. Wein informed us that Forks lot usually has around 100 student cars there in a given semester and there is capacity for 200. In the meeting with him he told us that the purpose of the LCAT is to reduce the need to have a car. He was much more open to the ideas of changing the LCAT. Wein also explained the reasoning behind the U-Haul car share
program currently available on campus to all students with a driving license. The idea behind the program is to encourage students to use a car share program instead of bringing their own car to campus.

IV. Parking Alternatives

In January of 2013, Lafayette College published the Parking and Transportation Master Plan Summary done by Chance Management Advisors, Inc. According to the summary, there are just over 1,500 available parking spots on campus. Five hundred and forty three spots are for students and eight hundred thirty five spots are saved for faculty and staff. Based on the report, the campus has enough on campus parking. The problem with parking is the system and violations to the system. We have identified and explored three potential parking systems; keep the current system, changing to a tiered parking system, or changing to a flat rate park anywhere system. In Figure #3 shows student’s options on the three parking options.

Figure #3 represents the survey results when students where asked which parking option would they prefer.

The current parking system is not for profit. For this parking system students would pay for parking while faculty and staff do not. Also, all parking tickets go to the general fund. The
system is currently on and off campus. On campus spots go to juniors and seniors who register. If you are an underclassmen, freshman or sophomore, you can get an on campus spot if you have a particular need, such as for an off-campus job. Anyone who is not parked on campus parks at the Forks Township lot. This is for underclassman and is a first come first serve basis based on when you register. The cost for an off campus spot is $210. This is reduced from the $385 cost for parking on campus. Parking rules are enforced from 7:30 A.M. to 5:00 P.M. Monday through Friday. On the weekends, according to the meeting we had with Public Safety, all legal spots are open to whoever wishes to park. According to Hugh Harris, interim Director of Public Safety, the biggest problem with enforcement is when employees are on campus. According to Harris, the reason for the increase in enforcement problems is due to less available spots when staff and faculty are on campus. Students lose spots and therefore park out of place.

<table>
<thead>
<tr>
<th>Current System</th>
<th>Students</th>
<th>Cost per Student</th>
<th>Total</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Campus</td>
<td>550</td>
<td>$385</td>
<td>$211,750</td>
<td>$232,750</td>
</tr>
<tr>
<td>Off Campus</td>
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<td>$21,000</td>
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<table>
<thead>
<tr>
<th>Tiered Parking Options</th>
<th>Students</th>
<th>Proposed Cost per Student</th>
<th>Total</th>
<th>Overall</th>
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</thead>
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<td>$217,000</td>
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<th>Total</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
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<td>$500</td>
<td>$225,000</td>
</tr>
<tr>
<td>Off Campus</td>
<td>200</td>
<td>$50</td>
<td>$10,000</td>
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</tbody>
</table>

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<th>Proposed Cost per Student</th>
<th>Total</th>
<th>Overall</th>
</tr>
</thead>
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<th>Students</th>
<th>Proposed Cost per Student</th>
<th>Total</th>
<th>Overall</th>
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<tbody>
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<tr>
<td>Off Campus</td>
<td>200</td>
<td>$100</td>
<td>$20,000</td>
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</tbody>
</table>

Figure #4 is the breakdown of registration fee for each system.
The tiered parking system would be based on two tiers like the current system, on campus and off campus (Forks Township lot). Because the current system runs on the idea of breaking even, the cost for parking would be redistributed to promote people parking at Forks lot over on campus. The Forks lot parking, which holds 200 spots, would cost anywhere from free to $100. Depending on which price we set for Forks, on campus parking costs would be used to subsidize cost of renting out Forks. With this pricing system we are hoping to see fewer cars stay on campus, leading to less unnecessary short driving around campus we could reduce Carbon Dioxide emissions (see Figure #5 and #5.1). In this system, on campus spots would be reserved for Juniors and Seniors. Any Sophomores and Freshman who want to have a car on campus, not in Forks, would need to request for permission to be on campus and have some form of proof to show they need the car. This would not only promote less car use but also, hopefully, free up on campus spots. The idea is that Juniors and Seniors would also be enticed to go park at Forks instead of on campus. Please see the table for the pricing options we considered for this system. (Figure #4)

**How Tier Parking can reduce GHG emissions Figure #5 (EIA, 2013)**

According to the US EPA statistics, the average mileage for cars in the US is 21 mpg and the average amount of CO2 emitted from a gallon of gas is 8887 grams. There for the average US car running on conventional gasoline the car emits 423 grams of CO2 per mile. Based on our survey results, 53.02% (±4.5%) of the student body, who has a car, uses their car every day. This equates to 182 students. If each student drives 5 miles each day...

182 cars X 423 grams CO2 X 5 miles= 384,930 grams CO2 emitted

Tiered parking has a strong potential to cut down on everyday driving...if only 90 students used their car each day for 5 miles...

90 cars X 423 grams X 5 miles= 190,350 grams CO2 emitted

**Figure #5.1 Show the grams CO2 emitted by parking system**

<table>
<thead>
<tr>
<th></th>
<th>Current System</th>
<th>Tier Parking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grams CO2 emitted</td>
<td>384,930</td>
<td>190,350</td>
</tr>
</tbody>
</table>

0 50000 100000 150000 200000 250000 300000 350000 400000

Current System Tier Parking
The last system is a flat rate park anywhere system. This option was originally considered back during the early phases of this project to be considered an option that would discourage students from bringing their car on to campus. Students were asked about this option. While there was no strong opposition from students, it was also not an option that students favored. After meetings with Public Safety, Mitch Wein (Vice President of Finance & Administration), and evaluating our data it was decided flat rate parking would not be effective in meeting students and administration needs nor would it be a sustainable option since it may encourage more student driving. Therefore the two parking alternatives are either keep the current system or switch to tiered parking.

V. LCAT Alternatives

The current Lafayette College Transportation System is comprised of a single twenty passenger shuttle that provides free service for students to a variety of locations. Despite the availability of the service there is very low student use of the LCAT service. In the short survey, conducted over the week of March 3rd through the 7th, over 70% of the respondents said that they use the shuttle less than three times a semester and over 40% never use the shuttle. This lags behind the use of public transportation at other local schools. These results are in line with the general perception of the shuttle as being “a waste of tuition money”, “not convenient”, and “frustrating to use” (short survey results). In order to understand the lack of use, our group went through an in-depth analysis of the LCAT and conducted a second survey of students.

The current LCAT shuttle system runs on four different schedules, one for Mondays-Fridays, one for Saturdays, one for Sundays, and one for special events. These schedules are not always running on the designated day and the shuttle does not always adhere to the schedule.
This leads to confusion within the student body about the availability of the service. Additionally, the schedule for the LCAT is only available online and 20% (±6.2%) of the students do not know how to locate the schedule. The lack of knowledge about the shuttle results in misperceptions about the effectiveness of the system. Over half of the students who participated in the second survey stated that one of their main concerns about the LCAT was that it does not run frequently enough. (Figure #6) Additionally, the fear of being left behind by the shuttle was the second highest response. From our short survey results we found that 25.97% (±6.7%) of the student body felt that the LCAT is sometimes to never on time. Additionally only 20.4% (±6.2%) found the LCAT to always be on time. These concerns have spread through the campus resulting in an overinflated belief in the ineffectiveness of the shuttle.

The LCAT is an excellent mode of transportation for the Lafayette community that has been greatly underutilized since its inception. Improving campus knowledge of the LCAT schedule is essential in improving usage. One method that has been implemented to improve
ridership is the use of a live location tracking application for the shuttle. However, only 9.7% (±4.52) of the student body has the app and only 62.9% (±7.3%) are unaware of its existence. The first step in increasing ridership should be to increase student knowledge of the service. This can be accomplished a number of ways. Incorporating the information about the shuttle into the orientation for incoming students would be an easy way to help awareness of the service. Using the LCAT to take orientation groups to the center circle would give an immediate positive impression. Another way to help students use the shuttle would be to install benches and coverings for the LCAT stops on campus. These would aid usage during the colder times of the year. Additionally, the specific schedule for the shuttle could be posted on the interior and exterior of the stop structure. By increasing the student body’s awareness of the LCAT it will help the system be more effective.

The Metzger Express is a separate shuttle that is operated by Lafayette, but is paid for by the athletic boosters. The shuttle runs between the Williams Arts Center and the Metzger Athletic Complex. The Metzger Express is in operation Monday-Friday from 3:30-9:00pm. Expanding this service to include weekends would be a benefit to the campus. This service could be for a set period of time each day based on student need. However, constantly running on the weekends may not be cost effective. Limiting weekend service to only varsity, club, or intermural sporting events would have a reduced cost, but would allow for increased fan attendance by the Lafayette community. Another option to optimize service would be to include the option for the shuttle to stop at the Giant shopping center. This would be an on-call option where students could take the shuttle from Williams to Giant and then call the driver to get picked up once they have completed their errands. This would only add about two minutes to the
route and only when it is needed. By adding the stop at the Giant shopping center to the Metzger express service time could be saved on the LCAT routes.

The alternatives for the LCAT revolve around variations in number of hours the service runs each day and the route the shuttle uses. There are two route options. The first will be designated the campus route. It was originally proposed by Chance Management Advisors (Appendix B, map on end of survey) in their report for Lafayette College. Students were surveyed about the proposed route and 49.1% of students were in favor of the route. (Figure #7) The shuttle will run from the Williams Arts Center down McCartney St. to the Center Circle then take the turnabout back towards the campus. It will then turn down the Sterner Arts Trail behind the Spot and then back up the hill to the Arts Center via Sullivan Drive. The shuttle will stop at the North Third Street Campus, the Center Circle, the Sullivan Parking Deck, and the Performing Arts Center. In total, the route is about two and a half miles and takes approximately eight minutes, including three minutes of idle time at each stop, results in 20 minutes per route cycle. This alternative is best at meeting student needs while still providing speedy service.

The off campus route is intended to help students enjoy local restaurants and entertainment options, as well as complete errands. The longer survey was used to gain an idea
of where students want to go in the local area. The most common responses were associated with
downtown locations and lower Nazareth shopping center locations. These locations were
selected by 71% (±4.1%) and 65% (±4.3%), respectively, of the students surveyed. (Figure #8)
The shuttle would start at Williams Arts Center and then head down the hill and merge onto US
22 West. It would then exit toward 13th street and then continue down Hackett Avenue to the
Nazareth shopping center. The shuttle would make two stops in Nazareth. First, the shuttle
would stop in the back of the Wal-Mart parking lot and allow students to get on or off. Then it
would continue across the street and stop in the rear of the Wegmans parking lot. After waiting
for a few minutes the shuttle would then return to campus via Bushkill drive. The shuttle would
then make a stop at the Sullivan parking deck before returning to the Performing Arts Center.
The route is about eight miles in total and takes approximately 30 minutes to complete including
stop time. The option was selected because it has the lowest total mileage and would be less
influenced by fluctuations in traffic. This route would be run constantly during the allotted time.
Although it is a longer cycle than the campus route, the purpose of the off campus route-errands-
lends itself to more time between drop-off and pick-up. However, strict adherence to the
schedule will be necessary to make sure that no one is left waiting for too long.

Figure #8 is student’s response to where they would like the LCAT to go to.
The LCAT schedule has a significant amount of flexibility. The main structure includes several different time slots that the shuttle could run on different days. In order to avoid confusion, we decided to group Monday through Thursday and Friday through Sunday. After evaluating the groupings we decided to move Friday mornings to the weekday group, but afternoons and evenings on Fridays would be the same as Saturday and Sunday. Each grouping has three different time slots that can be assigned the campus route, the off campus route, or no service. For the weekday group the day is divided as follows, 7am-5:30pm, 5:30pm-9pm, and 9pm-1am. These times are constant with class hours, after school activities, and night service respectively. As such the best system to reach student needs would be to run the campus route during the class hours, the off campus route during the middle range, and the option to return to the campus route at night. In The last section of service would allow for students to travel to downtown bars without having to worry about driving themselves and give students a safer option for returning to their dorms. The weekend days would be divided into three times sections; 7am-2pm, 2pm-8pm, and 8pm-1am. The first two sections would both be off campus service while the third would use the campus route. The 7am-2pm service may be unnecessary, but time will be needed to observe usage.

After comparing several mileage estimates for shuttles we decided to use 10 miles per gallon as our standard. This is slightly under the average we found, but it allows for a slightly better cost estimate. Additionally we assumed twenty dollars per hour for the driver’s cost. Using these factors we were able estimate the cost of each LCAT service. The campus route would cost about twenty four dollars per hour including gas and driver costs. The off campus route would cost about twenty eight dollars per hour. This means if the shuttle is run during all time frames it would cost approximately $3200 per week or about $48000 per semester. On the opposite end,
only running the shuttle during class periods on weekdays would cost $1260 per week and $19000 per semester. The best option would probably be to run full service minus the weekday evening shift and the weekend morning shift. This option would cost $2418 per week and $36000 per semester.

Figure #9 is a breakdown of the cost for the proposed off/on campus route.

<table>
<thead>
<tr>
<th>Mon-Fri</th>
<th>Hours</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
<th>Option 4</th>
<th>Option 5</th>
<th>Option 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>7am-5:30pm</td>
<td>52.5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mon-Thur</td>
<td>14</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>9pm-1am</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Sat-Sun</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Fri-Sun</td>
<td>18</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2pm-8pm</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Weekly Cost</td>
<td>1260</td>
<td>2156</td>
<td>3292</td>
<td>2516</td>
<td>2900</td>
<td>2124</td>
<td></td>
</tr>
<tr>
<td>Semester Cost</td>
<td>18900</td>
<td>32340</td>
<td>49380</td>
<td>37740</td>
<td>43500</td>
<td>31860</td>
<td></td>
</tr>
<tr>
<td>Semester + Shuttle Cost</td>
<td>25400</td>
<td>38840</td>
<td>55880</td>
<td>44240</td>
<td>50000</td>
<td>38360</td>
<td></td>
</tr>
</tbody>
</table>

* 0 = no service, 1 = campus route, 2 = off campus route

The LCAT shuttle is currently operated by Palmeri. They are responsible for maintaining the shuttle and hiring the drivers. The study by Chance Management Advisors reviewed the cost of Palmeri’s service on an hourly basis and listed the total contract price with Palmeri at $156,913. Despite a large variation, from $55 per hour to $88 per hour, between routes and times, the prices were overly high compared to the above calculations. Even with the price of a shuttle ($65000) included in the cost, the service would still be less than continuing with
Palmeri. Additionally, there were a large number, more than 30, students who commented negatively on the Palmeri drivers. Since the drivers do not have to report directly to any Lafayette administration, there is a lack of accountability. This may be one of the reasons for the inconsistent service. Due to the price and driver problems, we recommend that Lafayette purchase their own shuttle and hire drivers. Although this would be a large up-front cost, the operational savings would eventually outweigh the startup. The most cost effective option would be to purchase a used shuttle at a discounted price. There are many currently available in the area, ranging from 14 passengers to 50 passengers. There are also electric and diesel shuttles that would help promote sustainability on campus.

VI. Evaluative Criteria

In order to get an accurate evaluation of the alternatives and find what best fits the school, alternatives will be evaluated by effectiveness, cost, and sustainability. Effectiveness will be used in order to understand if LCAT alternatives will meet student’s needs. The sustainability criteria will determine if the alternative will reduce student’s use of cars and increase usage of the LCAT. The last criteria to be evaluated will be cost, which will look to see if the alternatives will be a reasonable cost for the school to incur or could possibly save the school money.

Evaluating our alternatives based on effectiveness will determine if the alternative will help meet student’s needs. If the alternative does not meet students’ needs then there would be a strong chance the alternative would not be used for students and therefore not be an effective solution to campus transportation issue that effect the college. The most important student’s needs that have to be meet by these alternatives are the students who will take art classes at the downtown campus or volunteer with Landis center. These students are also the ones who would
use the LCAT the most if the alternative meet their needs for class and other reasons. Therefore on scoring the alternatives, an alternative that receives a 4 for effectiveness will have to meet both art class students and Landis students. Additionally to receive a 4 the alternative should also providing opportunities for other students to use the LCAT for errands and entertainment opposed to their car. For the alternative to receive a 3 the alternative meets the needs for Landis and Art students, however it does not encourage students to use the LCAT over their car and usage of driving on campus does not decrease. For the alternative to receive a 2 the alternative does not meet any students’ needs besides Landis and Art Students and car usage does not decrease. For the alternative to receive a 1 the alternative would be considered not useful and students are forced to completely rely on their car for transportation. Based on data collected from surveys, student schedules, and a meeting with the Landis coordinator we have data to base what students needs would be.

Evaluating the alternative based on sustainability will determine if the alternative will reduce greenhouse gas emissions on campus. One of the goals of going into this project was helping find solution to campus transportation that encouraged students to reduce driving around campus and use the LCAT shuttle as a greener alternative compared to driving their car. Alternatives that receive a four in sustainability reduce greenhouse gas emissions and the LCAT is a viable option instead of their car. For the alternative to receive a score of 3 the alternative reduces greenhouse gas emissions but does not allow the LCAT is be a viable option over their car. For an alternative to receive a score of 2 the alternative does not reduce greenhouse gas emissions and the LCAT is rarely seen as better than their car. An alternative to receive a score of 1 it would increase greenhouse gas emissions and students would never use the LCAT. From the survey data collected we were able to determine what students would like the LCAT to do
and therefore would be considered an option they would use more on a daily basis for things like errands. There are also calculations on greenhouse gas emissions that would be emitted by each type of parking system. This data will help in the evaluation of the sustainability criteria.

Evaluating cost will allow determination if the alternative is a feasible option for the school to fund or if the school would reject the alternative solely because the cost would be too much. Sustainability and effectiveness were important evaluations to make to determine if the alternatives reach the goal to fix campus transportation issues.

Cost evaluation will determine if the alternatives to fix the goal would even be considered by school on a cost basis. To evaluate cost on the 1-4 scale, current cost and prices will be used to determine if the alternatives fall into the current cost and price the administration currently uses. Therefore an alternative that receives the score of a 4 either be about the same cost as the current cost or falls below current cost. An alternative that receives a 3 is above the current cost but only by $2,000 to $3,000. An alternative that receives a score of 2 is at least $3,000 to $8,000 above the current cost. For an alternative to receive a score of a 1 the cost is at least $10,000+ above the current cost. The data we will use comes from calculations done by cost per space during registration and amount of spaces on either on campus or off campus (see figure 4).

**VII. Evaluation and Recommendations**

Both LCAT and Parking alternatives were evaluated on the scoring criteria. The alternative that scored the highest in its respective category was matched with the highest scoring alternative in the other category. On page #27 figure #10 shows the breakdown of all the score for the alternatives.
For the parking evaluation the current parking system received a total score of 9 out of 12. The current price is a breakeven price for the school and therefore received a 4 in the cost category. However for sustainability the current system encourages students to drive their cars throughout the day and would not reduce Carbon Dioxide (and other greenhouse gases) and therefore received a 2. Effectiveness received a 3, even if the current system was matched with an LCAT option that runs on a better schedule to meet student’s needs, students would still be able to access their car easily. The winning tiered parking option was the option that priced parking on campus at $620 (the highest option, #1 on figure #9). This option received a 4 in all categories (total score of 12) because it has the potential to save the school money, encourages the least amount of student driving around campus therefore reducing greenhouse gas emissions, and is most effective at encouraging students to reduce their driving and utilized the LCAT. This option was the alternative that was chosen since it meets all the top criteria preferred.

For the LCAT evaluation the current LCAT system received a total score of 4.5 out of 12. The biggest reason why the current system received such a low score was due how expensive the current system, which is contracted, is compared to moving services to in house. Therefore the cost score was a 1 out of 4. The sustainability score was a 2 since students’ needs are not meet and students are more likely to use their car over the LCAT shuttle. Effectiveness received a 1.5 because students current needs are not meet and student do not find the LCAT shuttle as a reliable source of transportation. The winning alternative was a proposed route (#4 on Figure #9), receiving a total score 11.3. The cost of this system would be $37,740 per a semester (current price is $ 78,456.50) and therefore received a 3.7 out of 4. The sustainability score was a perfect score of 4. The range of hours that the six different new options for the LCAT were between 52.5 hours to 129.5 hours, therefore the shuttles that ran in the median of this received
the highest scores due to students need an option that runs enough to meet their needs but not too much that it becomes a waste. The new LCAT option #4 runs for a total of 99.5 hours. The effectiveness score for this option received 3.8 out of 4. The 3.8 score was due to it ran during the most important hours that needed to meet student needs. Landis and students taking art classes need a shuttle running during the daytime hours until 5:30pm, this option meet this needs. Additionally it offers running times on the Friday through Sunday 2pm-8pm and 8pm to 1am (off and on campus), which would encourage students to use the LCAT for their errands, entertainment and dinning.

The concluding recommendation it to implement tiered parking a that allows 350 students ($620 registration fee) to park on campus and 300 students ($50 registration fee) off campus to replace the current parking system. Along with replacing the parking system, we recommend that the current LCAT system be replaced with a new more efficient LCAT shuttle that is runs one shuttle Mon-Fri from 7am-5:30pm on campus, off campus Mon-Thurs 5:30-9pm, off campus Fri-Sun 2pm to 8pm and on campus from 8pm to 1am. Additionally the LCAT would be run by Lafayette College and no longer contracted to Palmeri. One additional recommendation we suggest from our research and meeting with Mitch Wein would be to keep the U-Haul car share program since it would be another way for students to not need a car on campus. The two main recommendations on parking and the LCAT shuttle system together would promote Lafayette College to be a greener more sustainable campus and meets students’ transportation needs.
Figure #11 is the criteria evaluation, best possible score=12.

<table>
<thead>
<tr>
<th>Parking Evaluation</th>
<th>Cost</th>
<th>Sustainability</th>
<th>Effectiveness</th>
</tr>
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<tbody>
<tr>
<td>Current System</td>
<td>4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Tiered 1</strong></td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Tiered 2</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Tiered 3</td>
<td>3.8</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Tiered 4</td>
<td>3.5</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LCAT Evaluation</th>
<th>Cost</th>
<th>Sustainability</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current System</td>
<td>1</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>New Option 1</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>New Option 2</td>
<td>3.9</td>
<td>3.8</td>
<td>3.4</td>
</tr>
<tr>
<td>New Option 3</td>
<td>3.5</td>
<td>3.1</td>
<td>4</td>
</tr>
<tr>
<td><strong>New Option 4</strong></td>
<td>3.7</td>
<td><strong>4</strong></td>
<td><strong>3.6</strong></td>
</tr>
<tr>
<td>New Option 5</td>
<td>3.6</td>
<td>3.3</td>
<td>3.8</td>
</tr>
<tr>
<td>New Option 6</td>
<td>3.8</td>
<td>3.8</td>
<td>3</td>
</tr>
</tbody>
</table>
VII. Appendix

A. Short Survey

1) In the past year, how often have you used the LCAT?
   a. never
   b. one to three times a semester
   c. one to three times a month
   d. once a week or more

2) Do you find the LCAT route to be useful?
   a. It meets my needs
   b. I wish it had more off campus stops
   c. I wish it ran more often
   d. Not useful at all

3) Are the shuttles on time?
   a. Always
   b. Mostly
   c. Sometimes
   d. Never

4) Are there enough stops on campus?
   a. There are enough
   b. Enough, could be better located
   c. Not enough, could be better located
   d. Not enough, but location is okay

5) Do you know how to find the LCAT schedule?
   a. Yes
   b. No

6) Do you know of the LCAT tracking app?
   a. Yes, I have it
   b. Yes, but I don’t have the app
   c. No
B. Long Survey

Lafayette College Campus Transportation Survey

Engineering Studies, Sustainable Solutions

Class Year: ____________ Major: ______________________________________

1) How often do you use your car?
   a. One to three times a semester
   b. Once a month
   c. Once a week
   d. Everyday
   e. I don’t have a car

2) What is the purpose of using your car? Circle all that apply
   a. Going home
   b. Running errands
   c. Entertainment
   d. Work
   e. Class
   f. Gym
   g. Wawa
   h. Dining
   i. I don’t have a car

3) Are you aware of current parking enforcement rules?
   a. I know all the rules
   b. I know most of the rules
   c. I know some of the rules
   d. I know none of the rules
   e. I do not have a car on campus

4) Which parking option is most desirable to you?
   a. On campus and off campus (current policy)
   b. Flat rate parking (everyone pays same rate)
   c. Tiered parking (pay more for convenience of parking spot)

5) If tiered parking was implemented which system would you prefer?
   a. Highest amount- park anywhere you want (exception of handicap, service, red zone). Middle amount- park in Sullivan or Markle Deck. Lowest amount- Forks Township Lot.

6) What is the maximum you would pay annually to park under each of the following restrictions? (Check box that applies)
   - OR- Leave blank if you don’t foresee needing a parking space

<table>
<thead>
<tr>
<th>Maximum Price</th>
<th>Park anywhere (i.e. including small lots)</th>
<th>Markle Deck and Sullivan Deck</th>
<th>Off-Campus Parking Only (i.e. Forks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$50-$100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$100-$200</td>
<td></td>
<td></td>
<td></td>
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<td>$300-$400</td>
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<td></td>
<td></td>
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<tr>
<td>$400-$600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$600 +</td>
<td></td>
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</tr>
</tbody>
</table>

7) See attached page with proposed route, by a third party, with continuous service (meaning the LCAT bus would run continuously through this route throughout the day). What are your thoughts?
   a. Ideal route ie. “I would use this to go downtown, enjoy Easton, and go to the arts campus”
   b. I would not be interested in using this.
   c. Comments: ________________________________

8) Where would you like the LCAT go to? Circle all that apply
   a. Downtown Restaurants
   b. Downtown Shops
   c. Downtown Bars
   d. Forks Township Shopping Plaza (Giant, Bid Woody’s, etc.)
   e. Lower Nazareth Shopping Plaza (Wal-Mart, Wegmans, Kohls, Movie Theater)
   f. Lower Nazareth Dining (Longhorn, SO Fun, Buffalo Wild Wings, Panera Chick fil a, Five Guys)
   g. Phillipsburg Shopping Plaza (Wal-Mart, Movie Theater)
   h. Phillipsburg Dining (Chick Fil a, Panera)
9) What are your main concerns with the LCAT service? Circle the option(s) that best represent your concern.
   i. Negative Stigma  
   j. Not on time  
   k. Current route does not meet my needs  
   l. Do not want to wait in bad weather  
   m. Lack of adherence to schedule  
   n. Inability to find the schedule  
   o. Disgruntled driver  
   p. Fear of being left at destination  
   q. Doesn’t run often enough

10) Would you be willing to pay for LCAT shuttle services?
   j. Yes  
   k. No

11) What are your comments and or concerns about the LCAT shuttle?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

12) Which of the following are your concerns about the stairs to Downtown? Circle all that apply.
   c. Poor lighting on the stairs  
   d. Slope is too much  
   e. Slick conditions  
   f. General Safety  
   g. Take too much time  
   h. No need to use the stairs  
   i. Too much effort

13) How often do you walk to Downtown Easton? (circle all that apply)
   a. Often, use the sidewalk down the hill  
   b. Often, use the stairs  
   c. Sometimes use the stairs  
   d. Sometimes sidewalk down the hill  
   e. Sometimes trail behind the fishers  
   f. Often, trail behind the fishers  
   g. Not often

Proposed Route by Third Party
References


