

Chapter 8: Transportation

8.1 Introduction

When analyzing the sustainability of a university, one factor that must be taken into account is the issue of transportation to and from the college campus. This includes both the methods used by the student body as well as faculty and staff. According to Transportation and Sustainable Campus Communities, “The daily movement of people back and forth to campus in automobiles burning fossil fuels is one of the largest impacts a typical educational institution imposes on the life support systems of the planet” (Toor, 2004). The United States is also known to be one of the largest users of petroleum and as a result one of the largest contributors of fossil fuel emissions as well. According to the Environmental Protection Agency, the U.S. is the second largest contributor of global carbon dioxide emissions from fossil fuel combustion and other industrial processes accounting for 19% of total global CO₂.” (United States Environmental Protection Agency, 2013) It is imperative that universities, such as Chapman, make a conscious effort to develop and implement sustainable transportation methods for their community or order to reduce its CO₂ footprint.

Chapman University is a private university in Orange, CA. Although the student and faculty population of Chapman may be much smaller than that of large public universities in surrounding areas, both the campus size and the student body have been steadily increasing over the past decade. This expansion has been beneficial in building the university as an institution, but it has put a strain on the transportation facilities provided for the university community. Due to this fact, the university must develop ways in which to accommodate for the growing number of commuter students and faculty traveling to and from campus in a way that is economically feasible, socially acceptable and environmentally sustainable.

8.2 History of Transportation at Chapman

8.2.1 Overview

Over the past decade, the student body population and campus size of Chapman University have been increasing at a faster rate than ever before. There have been many new additions to the campus in terms of building construction and more additions to the campus layout have been proposed or are currently in progress. Since 2002 the number of both undergraduate and graduate students has generally increased with the undergraduate student population(**Figure 8.1**) increasing each consecutive academic year, and the graduate student population experiencing the greatest increase between 2008 and 2009 (**Figure 8.2**).

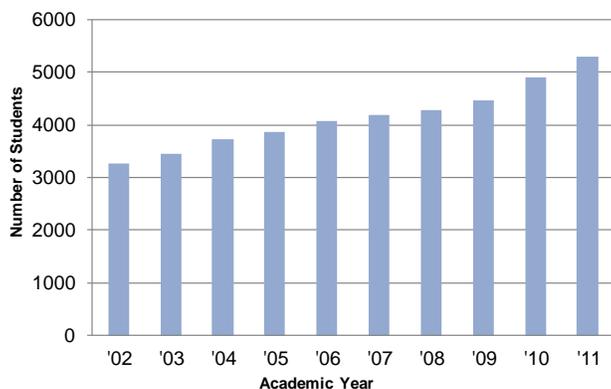


Figure 8.1. Undergraduate student population growth 2002-2011

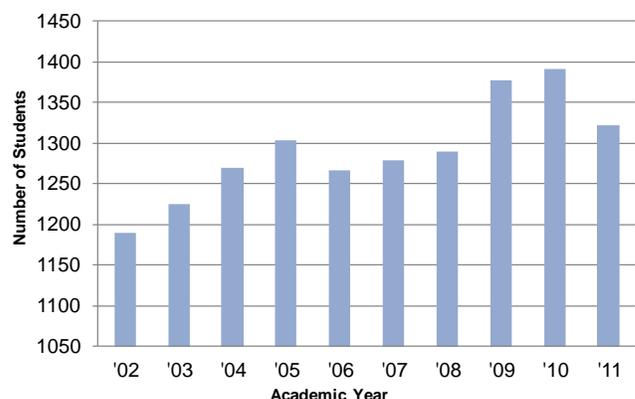


Figure 8.2. Graduate student population growth 2002-2011

This growing student population has led to an increase in the number of parking passes issued for both students and faculty/staff of Chapman University, while the number of available parking spaces has remained the same after the construction of the Lastinger parking structure. In 2013 there were 421 additional parking permits issued than in 2008, which has put a large amount of stress on the availability of open parking spaces for commuter students and faculty. The rate of change in the number of parking permits issued through the academic years of 2008-2013 is shown in **Figure 8.3**.

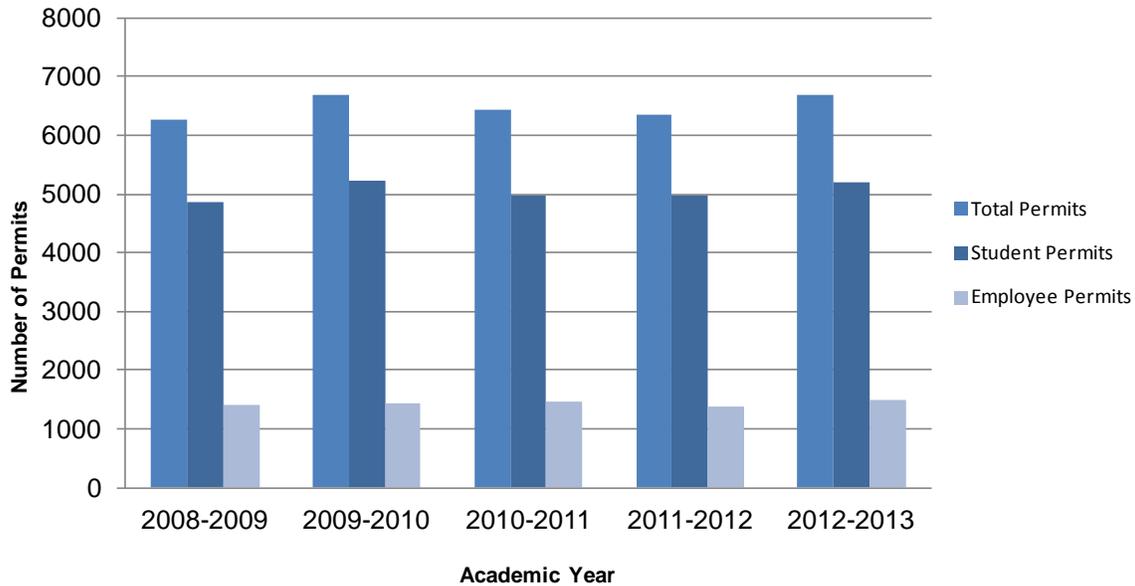


Figure 8.3. Number of parking permits issued 2008-2013

8.2.2 Past accomplishments

Although it is evident that the growing student body population has put increased stress on the capacity of the parking structures on campus, there have been many accomplishments of the transportation system at Chapman University that promote sustainable modes of travel.

Carpool Hangtags

One sustainable accomplishment is the availability of a carpool hangtag which was made available in 2010. With this option, students and employees of Chapman university can purchase a carpool hangtag which allows for a reduced price of parking for those vehicles traveling with 2 or more passengers. Every member of the carpool group purchases an ancillary parking permit for a price of \$110, as opposed to the regular full-time parking pass priced at \$300, and each group also receives one transponder for entry to the parking structures and one carpool hangtag. Both the transponder and hangtag can be transferred between the vehicles of each carpool group member so that one individual is not obligated to drive each time the permit is used. This not only provides for more available parking spaces, but it also lowers the cost of gas to travel to and from campus as well as decreasing the carbon footprint of both the campus as whole as well as the individuals who use this service.

Public Transportation Incentives

Chapman has also provided many discounts to students and employees that use public transit to travel to campus. Through Chapman's U-Pass program, established in 2009, participants who travel on all Orange County Transportation Authority (OCTA) bus lines are eligible for a reduced rate from \$2.00 per ride to \$1.25 per ride for members of the Chapman community. Monthly passes are also available for up to \$45 per month for students (originally \$69 per month for adults without U-pass) and \$69 per month for employees, actual prices are determined by the number of rides taken. Those who participate in this program will also be automatically entered into a lottery where 28 people will be chosen at random to win up to \$25 per month based on ridership during that month.

Orange County's local train service, The Metrolink, provides a Corporate Quick Card program that provides commuter students, staff and faculty with discounts depending on the distance traveled. In this discount program the first 60 participants to sign up will receive a \$40 monthly subsidy towards the price of their Metrolink Corporate Quick Card. Also commuters who do not bring a vehicle to campus because they bike or walk to campus are eligible to receive 1 entry for each work/school day for quarterly \$25 prize drawings as appreciation for their sustainable practices. Prizes include gift items or gift cards for restaurants, bookstores, cinemas, coffee houses, bicycle stores and other possible options.

Bike Auction and Bicycle Repair Stations

To encourage the use of bicycles by commuters, Chapman's Public Safety hosts an annual bike auction to provide used bicycles at a reduced price for those who enter. The bikes that are sold are those that have been lost, confiscated, or abandoned on campus for more than 90 days. This program not only provides the Chapman community with the availability of inexpensive bicycles that they can then ride to campus, but it also reuses these unclaimed bikes. In 2010, there had been a bicycle lottery where students, faculty and staff could enter and a certain number of names (depending on the number of bicycles available) were randomly picked to participate. Bicycles were sold for prices ranging from \$10-\$50 depending on brand and condition of the bicycle. According to Public Safety Officer Michael Kelley, In the 2009 bike lottery there were over 250 individuals that entered the lottery, 100 participants were selected to participate and only 70 bicycles were available. This alone shows there is a high demand for bicycle availability by the Chapman community.

Other ways that the university encourages the use of bicycles on campus is the development of bicycle repair stations in 2011, located near Henley Hall as well as between Argyros Forum and The Hashinger Science Center for use by both commuters and those living in the dormitories. These stations provide students with the tools to repair tires and seats of damaged bikes free of charge.

GE Wattstations

In 2012 Chapman provided EV charging stations for electric vehicles, where members of the Chapman community can charge their vehicles for no fee. This allows appreciation for the sustainable practices of those individuals who drive electric vehicles and it also may encourage other members of the community to invest in an electric vehicle instead of a traditional gas-powered vehicle, since these charging stations are so conveniently located (**Figure 8.4**).



Figure 8.4. Locations of GE Wattstations throughout campus (Crigger, 2012).

8.3 Current Status of Transportation at Chapman

One of the most effective ways to initiate a change to sustainable practices within administration is to display the cost-benefit analysis of making sustainable improvements on campus. With the idea of sustainability becoming more widespread, the availability of sustainable alternatives and becoming more and more affordable and in many cases will save money in the long run. In terms of transportation, the economic benefits of sustainable practices should come as no surprise, since the price of gasoline to fuel traditional vehicles has continued to rise over the past decade. The increase in the price of gas over the past few years has been significant, as the average price of fuel in 2003 was \$1.56 per gallon and now in 2013 it has increased to 4.04 per gallon, representing an estimated 260% price increase during this time. (californiagasprices.com, 2013)

8.3.1 The Price of Parking

Aside from economic savings through using less gasoline for transportation methods, the costs of providing space and maintaining parking facilities on a college campus may be much higher than one would expect. One must take into account the necessary square feet per space that must be met when designing parking structures, the cost of construction and maintenance costs of the spaces as well as surface parking lots versus parking structures. According to Transportation and Sustainable Campus Communities “typically, a surface parking lot will require about 350 sq. feet per space (Toor, 2004)”. It was also estimated that the cost of construction per parking space is \$3,000, which does not take into account the costs of maintenance of these spaces (Toor, 2004). Due to these figures, it is evident that one of the most effective cost-savings techniques, which also increases the sustainability of a campus, is to encourage a switch from driving private vehicles to finding other modes of transportation to and from campus.

The primary way in which to save money when it comes to transportation and parking structure costs is to shift the behaviors of students and faculty from driving to using other modes of transportation. “It costs two-and-one-half times as much to accommodate an additional person parking on campus than to shift one person from driving to riding the bus. (Toor, 2004)” This estimation further emphasizes the importance of adopting sustainable transportation practices rather than driving, especially since the demand for parking spaces at Chapman University has continued to rise over the past five years.

Another way to reduce the number of people entering the parking structures is to simply increase the cost of using those facilities. If students feel that they cannot afford to park in these structures, especially when they live within a short distance from campus, it will encourage a switch to more sustainable modes of transportation. This is one tactic that Chapman may have been deploying over the past five years, due to the increasing demand for the limited number of spaces. By increasing the price of a parking permit, it can encourage biking, walking or taking public transit to campus as they are often much more economically favorable to the average student/faculty member. The annual price increase of parking permits at Chapman is shown in the **Figure 8.5**.

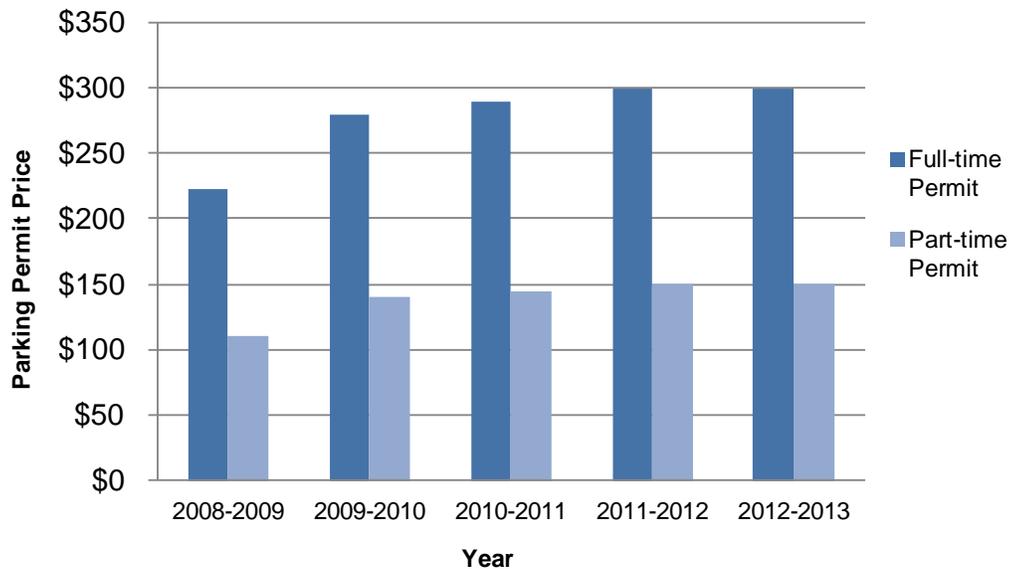


Figure 8.5. Increase in price of full-time and part-time parking permits from 2008-2013.

8.3.2 Parking on Campus

The current status of transportation methods used by the Chapman community has been largely dependent on the proportion of the student body that are living on campus as opposed to those that commute to campus. Due to the larger numbers of incoming freshman each academic year, the availability of on-campus housing has become very limited, and many upper class students are left with limited availability of on-campus housing. This not only leads to over-crowding of the residential parking structures, but it also results in more students moving off campus and needing to commute everyday, whereas they would not have needed to commute if they were still able to live in on-campus housing. This has led to much frustration among the commuting population as well, since sign indicating the number of available spaces in the parking structures often reads FULL at peak class-time hours (**Figure 8.6**). This leaves students with no available parking spaces and can often make some students late to class if they need to wait for a spot to open up.



Figure 8.6. Lastinger second floor parking structure filled at peak hours

The capacity of parking structures is determined during the building construction phase of a university. According to the Orange County, California Code of Ordinances in regards to building codes for parking structures on private university campuses, Sec. 7-9-145.6, there must be 1 parking space for every 3 full-time students plus 1 for every 2 faculty and employee members. The number of available parking spaces in the Lastinger parking structure is 893 spaces, which is the main structure used by commuters who have a regular class schedule on the main campus. The Barrera parking structure has a total of 701 parking spaces, resulting in a total of 1,594 non-reserved parking spaces available in these structures. There are a number of other surface parking lots available to be used by faculty and staff at Chapman University, as well as structure for separate departments such as the Dodge film school and the Dance department.

The most recent data available is for the 2011-2012 academic school year, where the total student population was 7,155 consisting of 5,300 undergraduate students and 1,855 graduate

students. Of this population 1,926 students, approximately 27% of the total student body, were living in on-campus housing and 5,229 students were commuting to campus. There were 994 resident parking permits issued this same year, accounting for 52% of the total resident student body. There were also 3,969 commuter-student permits issued in that same year, which accounts for 76% of the total commuter-student population. We can then infer from this data that approximately 24% of students who live in off-campus housing are traveling to campus in a way that is more sustainable than driving a private vehicle on a daily basis.

Unfortunately the carpool hangtags do not differentiate between students and faculty/staff, so the percentage of commuter students who use the carpool parking option could not be determined. However, the total number of commuter parking permits including faculty, staff and students comes to a total of 5,349 while this same year only 11 carpool tags were issued, accounting for only 0.2% of the total commuter population. The use of these permits has increased with each academic year consisting of 2 carpool hangtags issued in the 2010-2011 academic year, 11 issued in the 2011-2012 academic year and 19 issued in the 2012-2013 academic year. Although this number of carpoolers seems extremely low, one must keep in mind that only one hangtag is necessary for each member of a car pool. Therefore if each carpool party has 2 to 4 members per car this accounts for 22 to 44 carpooling participants. It is assumed that every non-carpooling permit issued is used by one individual passenger resulting in the carpooling population being 0.41% to 0.82% of the total commuter population. Although this number appears to be extremely low compared to the total number of commuters, one must keep in mind that the carpool parking permit option is a fairly new development for Chapman and was only introduced in 2010.

8.3.3 Biking/Walking to Campus

Due to the fact that nearly 25% of the total commuter student population do not possess a parking permit, they must be traveling to campus in another way. Biking is one mode of transportation that is relatively common among both commuter students as well as students who live on-campus but have classes in buildings further than the main campus. Chapman has been accommodating towards bicyclists in a number of ways, including the installation of additional bike racks around the main campus and residential buildings. The cost of the bicycle repair stations that were installed in 2011 was \$1,351 and was paid for by Chapman's Student Government Association. Also, streets around campus are relatively friendly to bicyclists, as some streets even have designated lanes for bicyclists that restricts side-street parking during busy hours to keep these lanes clear.

Although there is a registration fee and a required lock that must be purchased to park one's bike on campus, the overall cost of riding a bike to campus as opposed to driving a car (and paying for a vehicle parking permit) is much more beneficial to both the commuter's wallet, waistline and carbon footprint.

8.3.4 Shop n' Shuttle

A free shuttle service has recently been established in April of 2013 that provides a means of transportation for students living in the residence halls who do not have access to their own private vehicle. The program Shop n' Shuttle provides a free shuttle to local grocery and convenience stores including Albertson's, Trader Joe's, Walmart, Target, Sprouts and CVS. These shuttle vans have a capacity of seven passengers and they pick up students every 30 minutes from the Sandu Residence Lot, starting at 2 p.m. and students are later picked up and transported back to the Sandu Residence lot once their shopping is completed.

The Shop n' Shuttle service has been created by the Student Government Association and the estimated cost is \$275 to cover fuel expenses and student drivers to operate the vehicles. (Stroh, 2013) This service is a great source of transportation for students, especially those who do not have a

vehicle on-campus, such as international or out-of-state students. This service is expected to run until May 4th, 2013, but It is not yet known if this service will continue in the 2013-2014 academic year.

8.3.5 Public Transportation

If students who live off-campus do not live within a distance that is logical for them to bike or walk, Chapman is in a great location for the use of public transportation as a means of traveling to campus. There are a number of bus routes that have stops less than 1 mile away from the main campus (**Figure 8.7**), and commuters can even put their bikes on racks attached to the busses, so they can finish the trip on their bike. The Metrolink is also extremely close to campus, with a station located between Dodge College and the main campus. Both of these modes of public transportation give the commuting Chapman student many options when it comes to using public transportation.

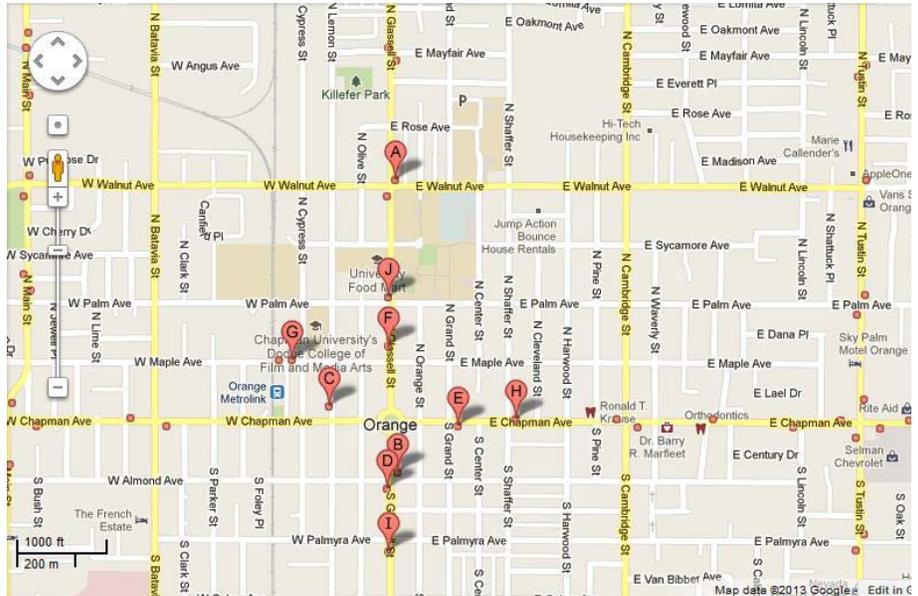


Figure 8.7. Locations of available bus stops around Chapman campus. (Orange County Transit Authority, 2013)

The Orange County Transit Authority was Nationally ranked in the top 50 largest public transportation systems, coming in #27 as largest transit agency and #20 in largest bus agency (American Public Transportation Association, 2011).

8.3.6 University Fleet Vehicles

The fleet vehicles of Chapman University are also a factor to consider when determining the level of sustainability of transportation on campus. Many of these vehicles operate Monday-Friday for long hours. Included in these vehicles are the small carts used by Facilities and maintenance staff of the campus, the public safety vehicles that are used for patrolling Chapman’s campus, and the fleet vans that can be used for travel to field trips.

One measure that Chapman University has taken to increase the sustainability of the fleet vehicles used on campus is that all of the maintenance vehicles used by Facilities are completely electrically-powered. Since these vehicles are

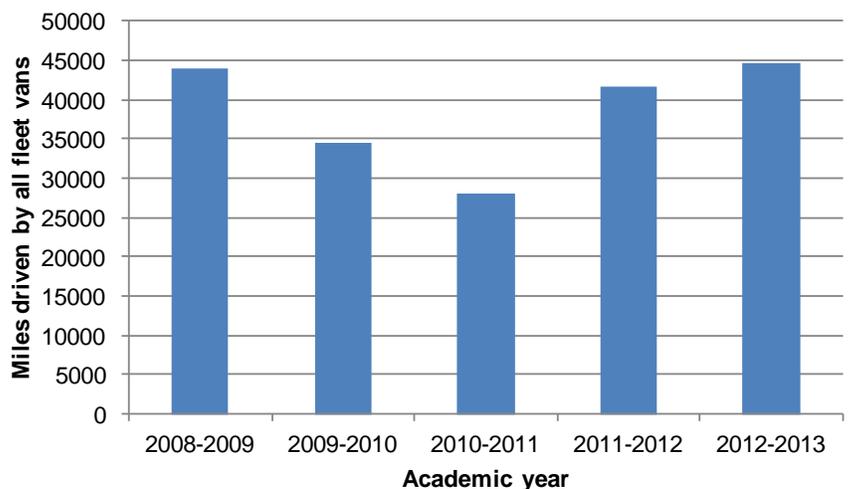


Figure 8.8. Cumulative number of miles driven by white fleet vans from 2008-2013

constantly driving all around campus for long hours, this can greatly reduce the carbon footprint that Chapman's Facilities department contributes to the transportation sector.

The white fleet vans that are used for in-class field trips are not electrically powered and their gas mileage is 12mpg city and 15 mpg highway. The annual number of miles driven by all of these fleet vans for 2008-2013 is shown in **Figure 8.8**.

8.3.7. Zipcars

Zipcars were brought to campus in 2010, which provides inexpensive rentals of vehicles for members of the Chapman community including students living on campus who do not have a vehicle and need to travel a distance that is not feasible to walk or bike (**Figure 8.9**). The Zipcars that are available for rent by members of the Chapman community are also environmentally sustainable vehicles. "Each and every Zipcar takes at least 20 personally-owned vehicles off the road (Zipcar, 2013)." There are currently two Zipcar vehicles available for rent, the Nissan Sentra and the Ford Focus hatchback, both of which are hybrid vehicles with an EPA estimated average of 35-50 MPGe depending on city or highway driving (Le Vesque). Unfortunately, the contract made between Zipcar and the university does not include any collection of the frequency of use of these vehicles by the Chapman community.



Figure 8.9. Reserved parking spaces for Zipcar vehicles in Argyros Forum parking lot.

8.3.8. 2013 Chapman Environmental Audit Survey

Through The 2013 Chapman Environmental Audit Survey that was deployed to all members of the Chapman community, the behaviors and trends in commuting patterns of students were recorded. The section of survey related to transportation asked commuter students questions regarding their current modes of transportation, as well as their willingness to make changes towards more sustainable methods of transportation.

The results of the transportation section of the survey showed that 70% of all students who participated in the survey were commuters. When asked how they normally travel to campus, 60% of these commuters stated they drove private vehicles to campus every day and 24% walked or rode bicycles (**Figure 8.10**). The survey also found that 5% of these commuters carpooled to campus on a regular basis, which is a much higher percentage of students than what was estimated from the number of commuter parking permits issued. This is most likely due to the fact that students may carpool to campus on a regular basis, but were not aware of the option to purchase a reduced-rate carpool hangtag.

When commuter students that drove to campus

- walk/bike
- public transportation
- carpool
- drive private vehicles
- other

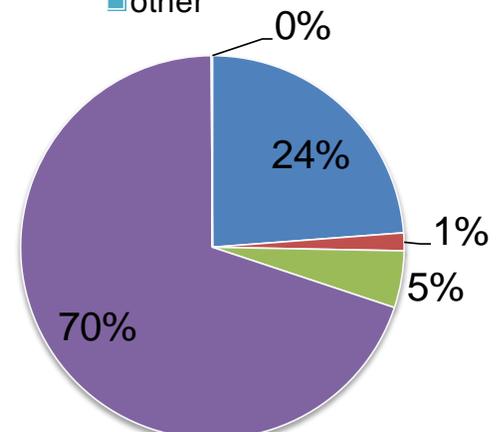


Figure 8.10. How do you travel to Chapman University?

were asked the average number of miles they traveled to school, the survey showed that 60% of students who currently drive private vehicles to campus are traveling no more than 5 miles to the Chapman campus each way (Figure 8.11).

The survey then determined how likely these commuter students would be to utilize sustainable transportation alternatives if they were to be made more readily available and convenient. Table 8.1 shows the likelihood that commuter students would use public transportation if there were buses that stopped at Chapman’s campus every 20 minutes, as well as the likelihood of walking/biking/skateboarding to campus if Chapman provided better accommodations for these types of transportation.

When the survey sample was scaled to the size of the entire 2012-2013 Chapman University student population, it was found that 18.5% of the current student population lives within 5 miles from campus, currently drives a private vehicle to school, and would be likely to adopt a more sustainable mode of transportation if these transportation practices were made more readily available.

Overall, these trends show that there is a demand for the use of more sustainable methods of transportation in the campus community. Students are willing to change their transportation behavior if the administration is willing to help in accommodating for these methods. Also, a much larger

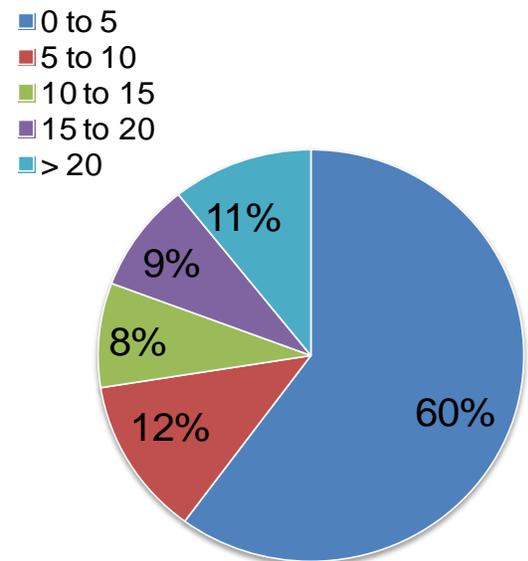


Figure 8.11. How many miles do you drive to Chapman University each way?

Table 8.1. Likelihood that commuter students would change their transportation habits to a more sustainable alternative when provided with the means to do so.

On a Scale of 1 to 5 how likely would you be to...	Not Likely		Neutral		Very likely	
	1	2	3	4	5	
Take public transportation if there were buses that had stops at the Chapman campus every 20 minutes	46%	10%	16%	13%	15%	
Walk, bike, or skateboard to campus if there were better accommodations for this (more bike racks, lockers for equipment)	40%	11%	14%	12%	23%	

percentage of commuters reported carpooling to campus than the number that was estimated from the carpool parking permit data. This suggests that more students are carpooling than recorded and therefore there may be a greater need for more advertisement of the carpool permit option instead of the standard parking permit.

8.4 Concluding Assessment

8.4.1 Areas of progress

Chapman University has experienced substantial growth over the past decade, and due to this growth they have begun to take into account the sustainability of their transportation accommodations. They have made many improvements over the past few years such as the development of the annual bike auction which not only raises money for the university and recycles bicycles, but it also gives the participating individuals the chance to purchase a bicycle at an affordable price. Another sustainable advancement is the option of purchasing a carpool parking

permit which encourages the use of carpooling for students and faculty, decreases the carbon footprint of the participants and the University as a whole, and also increases the availability of parking spaces.

Installation of additional bike racks encourages the likelihood of people riding bikes to campus as it may be more convenient than trying to find a place to park a vehicle. The discounts available for the OCTA bus lines and Metrolink provide an incentive for students to adopt these sustainable transportation alternatives and students may find these discounted rates more economically favorable than driving a private vehicle.

The installation of the electric-vehicle charging stations around campus has also increased the environmental sustainability of the Chapman Campus. By adding a number of these stations throughout campus, it reduces the wait time for re-charging vehicles and also encourages the use and purchase of electric vehicles. Since the burning of fossil fuels is one of the largest contributors to the carbon footprint of a college campus, all of these advancements can have a positive effect on the sustainability of transportation at this university.

8.4.2 Areas in which to improve

Although Chapman has made some significant changes over the past few years, when compared to other universities it is clear that there is much more that can be done to make Chapman's transportation practices more sustainable. One of these methods could be to provide a greater incentive for Chapman students and faculty to use the carpool hangtags. Although the environmental savings are apparent, many people may find them inconvenient and more time consuming to carpool to campus; therefore Chapman must make the incentives more significant in order to counteract the costs of the carpooling method. Also, there are not many areas on campus that are designated as 'bike crossing only' or specific bike lanes. This can make it difficult for bicyclists to travel throughout campus when there are many pedestrians traveling as well and can even result in collisions. By perhaps providing specific bike lanes throughout the major crosswalks and walk ways on campus, people would be more inclined to ride their bikes to campus

8.4.3 Existing gaps in knowledge

Through this analysis as well as the data collected from the 2013 Chapman Environmental Audit Survey, the primary transportation methods used by Chapman commuter students was collected and assessed. An evaluation of how often the Zipcars are used would have been useful data, but unfortunately this information was not available. The contract with ZipCar prevents this information from being released, and since the Zipcar vehicles are not owned by the University, the mileage and how often they are rented by Chapman students and employees is not available. Also the number of miles of the electric vehicles driven by the Facilities department was unavailable since these vehicles are not measured by miles but instead by hours, and this data is also not recorded on a regular basis.

Another area where information was unavailable included the use of the carpool hangtags, as the data provided did not differentiate between a student carpool hangtag and an employee carpool hangtag.

8.5 Recommendations:

8.5.1 Low cost/effort

- Human Resources and/or Public safety should provide more advertisement for:

- The incentive opportunities available to commuters that practice sustainable transportation habits.
- The option of a carpool parking permit as a way to increase parking space availability, decrease Chapman’s carbon foot print, and give students the opportunity to save with the purchase of the less-expensive carpool parking hangtag. Since the results from the 2013 Chapman Environmental Audit Survey showed that 5% of the commuter student population sample reported carpooling to campus, which was much larger than the estimates made from the number of carpool hangtags issued, shows that more advertisement for the option of a carpool parking permit needs to be available as some students may be carpooling to campus and are unaware of the less-expensive parking permit option.
- The annual bike auction, as this can provide commuter students with the opportunity to switch from driving to campus to riding a bike since these bicycles can be much more affordable than a new bicycle.
- Student and Campus Life representatives could provide to students a handout with local bus and train routes that could take them to nearby places of interest.

8.5.2 Moderate cost/effort

- Public Safety should change the parking permit distribution method to one in which students must request a parking permit, as opposed to the current method where those who do not drive to campus must sign a form to waive the parking permit fee.
- Student and Campus Life representatives could host a monthly “bike/walk to campus” day. This would allow the student and faculty population to become more aware of the environmental impact of driving to campus. Those who participate could be awarded with a free breakfast or other incentives. It could also raise awareness of how easy it is to use these alternatives, and therefore students may choose to bike/walk to campus more regularly.
- Bike Rental stations could be made available, such as those available at the University of California-Irvine through the company ‘Zotwheels’ (Figure 8.12) Chapman students could swipe their student ID to rent the bicycle, ride it to the desired campus location, and then return it to another bike station when they are done.



Figure 8.12. Zotwheels bike rental station at UC Irvine.

8.5.3 High cost/effort

- Develop a biodiesel production program on campus that would recycle the old cooking oil used at on-campus restaurants. This biodiesel could then be made available to fuel the fleet vans or buses for special events, or even made available to the students and faculty of Chapman. The

fleet vans and other vehicles would need to be retrofitted to use this fuel, depending on the age of the vehicle. There would also need to be a cost-analysis of this program as well as who would run it, although it has been successful on other college campuses throughout the country.

8.5.4 Future areas of research

In the future, the use of all Chapman vehicles should be recorded and maintained on an annual basis so that these figures can be applied to the cost in dollars of running those vehicles. The number of students that participate in the shop n' shuttle program, as well as the number of trips made each month, should be recorded to determine the demand for these services within the student population living in on-campus housing.

Carpool parking permits issued each year should also be recorded as student or employee permits. After further advertisement for these permits, the purchase of the carpooling permit option among students and employees should be recorded to determine the demand for this option.

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