

Final Report of the Campus Congestion Task Force

July 14, 2016

Executive Summary

The Campus Congestion Task Force was created in November of 2015. It was charged with reviewing the current traffic situation on campus, as well as the likely future traffic situation once light rail begins operations on campus, and making recommendations as to how to relieve campus congestion. The task force worked throughout the spring 2016 semester. In the report that follows the task force makes thirty-four specific recommendations for improving traffic on campus.

Congestion on campus is caused by a myriad of interconnected factors, and reducing congestion will require a coordinated effort across many campus units. For logical clarity as well as ease of exposition, the task force divided its analysis into four topics: Roads and Physical Layouts, Parking, Campus Transit, and Campus Operations. This division should not, however, be interpreted as meaning that the recommendations of each section are independent of each other; they are intended to be taken as a whole and to present a comprehensive approach to reducing campus congestion.

Overall the task force makes thirty-four specific recommendations. Below are listed the most critical recommendations from each of the four areas of the report.

Roads and Physical Layout:

- Extend the right turn lane on Broadrick Boulevard completely to the Broadrick Boulevard/Mary Alexander Road traffic circle.
- Complete the planned John Kirk Road improvements as rapidly as possible.
- Modify the Mary Alexander Road/East Mallard Creek Church Road intersection by:
 - Providing a protected left turn from Mary Alexander Road to East Mallard Creek Church Road.
 - Improve traffic flow and pedestrian safety by making infrastructure changes that will encourage pedestrians to cross East Mallard Creek Church Road on the east side of Mary Alexander Road instead of the west side as they currently do.
- Move the electrical box at the entrance to East Deck 2 to improve driver visibility.
- Close Craver Road to non-official traffic between 7:30 am and 6:00 pm each weekday.

Parking:

- Use location-based pricing for campus parking.
 - Designate and price the CRI and North decks as remote parking.
 - Increase the cost to park in certain areas in the core of campus to encourage commuters to park in more distant locations.
- Revise the pricing of visitor parking on campus to remove incentives for students to use visitor parking in lieu of purchasing a parking pass.
- Provide a mechanism so that commuter students can buy a daily “on demand” parking pass to the commuter lots.

Campus Transit:

- Modify the campus bus routes to improve reliability and speed.

- Consider bringing the campus bus system in-house. This would allow better campus branding, as well as better control of routes and timing.
- Centralize deliveries to campus and the chartering of motor coaches on campus to better control the flow of large vehicles.

Campus Operations

- Modify the campus class schedule so that classes which currently end at 4:45 pm would end at 5:15 pm. This can be most efficiently done by changing from the current MW class schedule to a MWF class schedule.
- Encourage staff schedules to be modified to allow staff to leave at 4:30 pm or 4:45 pm. This, coupled with class schedule changes, would help alleviate the severe congestion at 5:00 pm.
- Provide an online, “on-demand” parking pass system for the North Deck for the first few days of classes.
- Continue to build an infrastructure for bicycles on campus.

Table of Contents

1. Introduction.....	6
1.1 Organization of the Report.....	7
2. Roads and Physical Layout.....	8
2.1 Short Term	8
2.2. Medium Term	13
2.3. Long Term	15
3. Parking.....	17
3.1. The Current Parking System.....	17
3.2 Visitor Parking.....	20
3.3. Location Based Pricing.....	22
3.3.1. Remote Deck Parking	22
3.3.2. Campus Core Parking	24
3.4 Zoned Parking.....	25
3.5. Premium Parking	27
3.6. Resident Parking.....	28
4. Campus Transit.....	29
4.1 Modified Bus Routes	29
4.2. Transportation and Transit Services Hubs	31
4.3. In-house Transit System.....	31
4.4. Improved ADA Service	32
4.5. Bicycle Infrastructure.....	32
4.5.1 Bicycle Road Network.....	33
4.5.2. Bicycle Parking.....	34
4.5.3. Bicycle Lockers.....	35
4.5.4. Bicycle Enforcement.....	35
4.6 Pedestrian Infrastructure	36
5. Campus Operations.....	37
5.1. Class Schedules.....	37
5.1.1. Stretching the Day to Evening Transition.....	40
5.1.2. Changing Time of the Day to Evening Transition	40
5.2. Employee Schedules	43
5.3. Employee Work and Transit Options.....	46

5.4. Early Semester Operations.....	47
5.4.1. Student Parking Pass Issuance	47
5.4.2. Active Gridlock Prevention	47
5.5. Centralization of State Vehicle Fleet	48
5.6. Central Receiving / Deliveries	48
5.7 Centralized Motor Coach Contracting	49
6. Summary	50

1. Introduction

Chancellor Phillip Dubois created the Campus Congestion Task Force on November 19, 2015. This task force was given a broad mandate to identify sources of campus congestion and to recommend potential solutions. Specifically, the task force charge was to:

“Review the current traffic situation on campus and evaluate future predicted traffic issues once Light Rail begins operating with its terminal stop on campus and with other stops along North Tryon Street. The Task Force should answer the primary question of whether it is possible to moderate or reduce the amount of traffic on campus at critical periods, most notably at class-time changes, noon, and the end of the working day. The work of the Task Force is principally to identify options for improving the management of campus traffic and to assess the strengths, weaknesses, and potential costs of each option, either singularly or in combination.

The options might include:

- Changes in the parking permit system to promote ride-sharing by faculty, staff, and students.
- Changes in the parking permit system to promote the use of more remote lots, including the North Deck and the CRI Deck.
- Changes in the parking permit system to minimize intra-campus traffic from one campus location to another. An example of such a change might be to assign most campus vehicles to park in one specific lot for the day and then to either walk or use the shuttle system to other locations on campus.
- Changes in the campus shuttle system to improve its utilization and convenience for members of the campus community, including routes and available roadways. (For instance, would it be helpful to close Craver Road to other vehicular traffic and run at least one point-to-point shuttle to CRI and back from the Student Union?)
- Changes in employee working and lunch break schedules to avoid conflicts with class change periods.
- Changes in the class schedule to restore the full utilization of Fridays for instructional purposes.
- Special arrangements for parking and transportation that might be in effect for only the first 2-3 weeks of each semester until parking demand subsides.
- Other ideas as may be generated within the discussions of the Task Force itself. “

The task force was comprised of faculty members, staff members, and students. The specific members of the task force included:

- Richard Buttimer, Task Force Chair, Senior Associate Dean, Belk College;
- Brian Boudreau, Academic Affairs;

- David Naylor, Lecturer in Civil and Environmental Engineering, States College of Engineering;
- Fahn Darkor, Student and SGA Representative;
- Garrett Holloway, Graduate Student Representative;
- Lieutenant Rodger Hughes, Police and Public Safety;
- Jared Waugh, Human Resources;
- Melanie Witherspoon, Facilities Management Business Officer;
- Donna Merck, Cone Center Operations;
- Helena Connors, Parking and Transportation Services Transportation Manager;
- Doug Lape, Director of Parking and Transportation Services;
- Mike Lizotte, Campus Sustainability Officer; and
- Peter Franz, Campus Landscape Architect.

1.1 Organization of the Report

This report is organized into four major sections and a brief conclusion. The first section examines the campus road network, the physical layout of certain parts of campus, and the integration of the campus road system with the surrounding Charlotte road system. The second section examines the campus parking system and how it influences traffic currently, as well as how it could be used to change campus congestion patterns. The third section examines campus transit, both how it operates today as well as how it will need to operate once light rail service begins on campus. The fourth section examines campus operations including campus scheduling, early semester operations, and campus deliveries to see how they could improve campus congestion.

In many cases there are tradeoffs that have to be made when analyzing the different potential options. Where there are such tradeoffs, in addition to simply reporting back a recommendation, the task force has attempted to explain both the costs and benefits to each option and the thought process behind the ultimate recommendation.

The task force has developed the report in four sections for ease of exposition and readability. The task force notes, however, that it does not intend to imply that the solutions to campus congestion are separable. The reality is that many of the solutions proposed herein will only work if they are linked together. For example, a plan to increase the utilization of the CRI and North Decks as a way of reducing congestion in the inner core of campus will only be viable if there is rapid, frequent, and reliable transit from those decks to the inner core of campus. Further, the task force acknowledges that many of its recommendations would require additional planning and logistics to implement.

2. Roads and Physical Layout

The task force first looked at the roads and the physical layout of the campus. The task force identified several capacity and operation chokepoints on campus and in the surrounding area that contribute to congestions both on campus and in the area immediately surrounding campus. In examining these chokepoints, the task force recognized that some were either in the process of being addressed or could be addressed in the relative short term while others would require working with external agencies or significant planning. As a result, the task force has elected to divide its analysis and recommendations into short, medium, and long-term actions.

2.1 Short Term

The task force identified six areas that could be addressed within a one to two-year period. Each is discussed below in order of the priority assigned to it by the task force. The task force notes that some proposals are not completely within the control of the university and would require coordination and financial participation with both the Charlotte and North Carolina Departments of Transportation.

- Broadrick Boulevard at University City Boulevard – When the main campus entrance/exit was originally designed, the right turn lane from Broadrick Boulevard to University City Boulevard was intended to extend completely to the traffic circle. Due to budget constraints this right turn lane was only built to about half-way from University City Boulevard to the traffic circle. Currently at peak times drivers turning left onto University City Boulevard back up to the point that drivers who wish to turn right cannot reach the right turn lane. This exacerbates congestion and frequently causes backups that extend onto Mary Alexander Road and Broadrick Road beyond the traffic circle.

Recommendation: The task force recommends extending the right turn lane on Broadrick Boulevard to the traffic circle.

- Cameron Boulevard and University City Boulevard traffic lights – The intersection at Cameron Boulevard and University City Boulevard was designed with the expectation that there would be traffic lights to permit left turns from Cameron Boulevard to University City Boulevard. Those lights have not yet been installed, keeping the left turn lane closed. This pushes additional traffic to the Broadrick Boulevard exit and exacerbates congestion there. The task force understands that the installation of the lights rests with the Charlotte Department of Transportation.

Recommendation: The task force recommends continuing to push for the installation of the lights at Cameron Boulevard and University City Boulevard as soon as possible.

- Craver Road – The task force debated at length whether Craver Road should be closed. The main two arguments in favor of closing it related to pedestrian safety and the ability of the campus transit system to use it as an “express” lane between CRI and the east side of campus. The task force looked at a variety of options, each of which is discussed below. The task force notes, however, that any closing of Craver Road will change traffic patterns in other parts of campus and it is difficult to forecast what those secondary effects might be. The options the task force

discussed are presented below in order from the most restrictive to the least restrictive.

- **Permanently close Craver Road and create dual cul-de-sacs at the Student Union.** This is the most pedestrian-friendly option. The road would be severed at the Student Union and two cul-de-sacs would be created. There would be a way for emergency vehicles to traverse the cul-de-sacs, but cars, buses, and delivery vehicles would not be able to do so. This would create a very safe pedestrian and bike corridor between the Union and the CHHS/COED quad area.

Despite the benefits to pedestrians, the task force noted many downsides to this proposal. By creating the cul-de-sacs, the university gives up flexibility to use the road at non-peak times. It is also not clear that the physical landscape would allow for the cul-de-sacs to be created while still allowing appropriate delivery vehicle access to many of the buildings along Craver Road. The biggest downside, however, is that it would be impossible for the campus transit system to have a direct east-west service between CRI and the east side of campus. Riders would have to get off on bus at the Union and then get on another bus to continue their journey. That would almost certainly make the trip time too long for most users.

- **Close Craver Road to non-authorized traffic.** Under this option Craver road would be closed to non-authorized traffic either permanently or for some subset of the day. The task force envisions that the only traffic allowed on the road would be emergency vehicles, campus transit vehicles, maintenance vehicles, certain delivery vehicles, and vehicles that are authorized to park in lots 15 and 16A. This would cut down on the number of vehicles using the road, and would end the continual problem of vehicles blocking the road while waiting on pickups/drop-offs at the Student Union.

The task force felt that the majority of benefits from closing Craver would occur between 7:30 am and 6:00 pm during the week. The task force felt that the road could remain open to all traffic at other times, and that it is especially useful to have the road be open during campus events such as graduation, football games, and basketball games. As a result, the task force feels that using a gate system to close Craver road during the day is a better option than permanent closure.

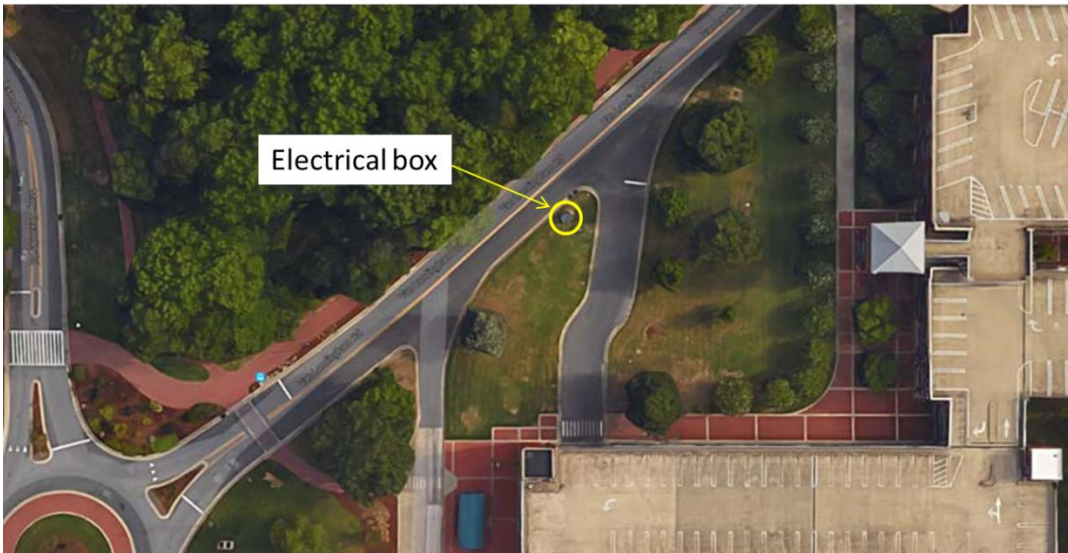
- **Do not allow left turns from Mary Alexander to Craver Road.** Cars making left turns onto Craver Road from Mary Alexander Road cause backups on Mary Alexander Road at peak travel times. Should the university decide not to close Craver Road to general traffic, banning left turns, except for buses and certain other authorized vehicles, from Mary Alexander onto Craver Road would reduce congestion on Mary Alexander. While this would help the flow of traffic on Mary Alexander, it would not help traffic on Craver, the campus transit system, or pedestrian safety other than at that intersection, and would require additional enforcement efforts.

Recommendation: After discussing all three options, the task force recommends closing Craver Road to non-authorized traffic between 7:30 am and 6:00 pm on weekdays. The task force acknowledges that there will be operational and logistical challenges, such as purchasing and installing a gate-card system and determining how access will be monitored and controlled, etc., that will have to be addressed when implementing this recommendation. Still, the task force felt this option provided the most benefits to the campus while retaining usage flexibility.

- Entry/exit to East Deck 2 – The entry and exit road to East Deck 2 is poorly designed. As can be seen in Figure 1, cars that are proceeding eastward on Van Landingham from the traffic circle must make a more than 90 degree turn to enter East Deck 2. This causes them to slow dramatically and backs up both eastbound and westbound traffic on Van Landingham Road at peak times. Cars proceeding westbound on Van Landingham Road have a less than 90-degree entrance into the deck, and as a result these cars occasionally make this turn at relatively high speed, a potential safety hazard given the high pedestrian activity in the area.

Exiting East Deck 2 is also problematic because exiting drivers have an obstructed view to their left, i.e. looking westward toward the traffic circle, because of a large electrical box. This box makes it difficult to see both vehicular and pedestrian traffic between the entrance and the traffic circle. Indeed, the entrance to East Deck 2 appears to have been literally built around that electrical box.

Figure 1
East Deck 2 Entry/Exit from Van Landingham



Recommendation: The task force recommends that the electrical box be moved further back from the road and that the entrance/exit to East Deck 2 be re-routed to make it a 90-degree intersection with Van Landingham road.

- Mary Alexander Road at East Mallard Creek Church Road – The Mary Alexander/East Mallard Creek intersection, presented in Figure 2 below, is a major exit point for traffic leaving the university. It is also a continual chokepoint around 5:00 pm. The addition of a traffic light at Mary Alexander and Cameron Boulevard has greatly improved the flow of traffic through that intersection but there continues to be significant congestion at the Mary Alexander/East Mallard Creek intersection. At 5:00 pm it is not unusual for drivers to have to wait for three light change cycles to get through this intersection.

Figure 2
Mary Alexander/East Mallard Creek Church Road Intersection



The main problem is accommodating drivers turning left onto East Mallard Creek Church Road. There is only one left turn lane, yet the majority of cars exiting at that point are making left turns. Further, there is not a protected left turn at that intersection, so drivers must be certain that there is no oncoming traffic before turning. While the volume of oncoming traffic is quite low, the intersection sits at the top of a slight rise so that a driver waiting at the Mary Alexander intersection cannot see if there is oncoming traffic until they are well into the intersection. This results in all cars going slowly through the intersection.

There are two short-run actions that can alleviate some of the problem. The first would be to have sensors installed at the intersection that could detect backups on Mary Alexander Road and would either trigger a green light or extend the green light on Mary Alexander. In addition, having a protected left turn arrow from Mary Alexander to East Mallard Creek Church Road would greatly improve the flow of traffic exiting campus. In the longer-term, adding a second left turn lane would be an even bigger improvement. There appears to be physical space at that intersection to have two left turn lanes that would tie into the two westbound travel lanes of East Mallard Creek Church Road. If a protected left turn from Mary Alexander at East Mallard Creek Church Road were put in place it would need to be accompanied by appropriate pedestrian signal and control devices.

Pedestrians and their safety are another issue at this intersection. The majority of pedestrians crossing East Mallard Creek Church Road at this intersection are doing so to get to the Flats at Mallard Creek Apartments, which are on the northwest side of the intersection. There is a sidewalk on the east side of Mary Alexander Road from campus to East Mallard Creek Church Road, which the majority of pedestrians use. The problem is that most pedestrians cross to the west side of Mary Alexander Road just before they get to the intersection. They then cross East Mallard Creek Church Road on the west side of the intersection. This results in the pedestrians crossing traffic twice, and they then interact with cars that are turning left onto East Mallard Creek Church Road. It would greatly improve pedestrian safety, as well as traffic flow, if pedestrians remained on the east side of Mary Alexander Road until they crossed East Mallard Creek Church Road. They could then cross the very low-traffic volume on Bonnie Cone Lane to reach the Flats at Mallard Creek Apartments.

It appears that a primary reason pedestrians cross Mary Alexander Road before they cross East Mallard Creek Church Road is because there is not a sidewalk on the east side of Bonnie Cone Lane. There is a sidewalk on East Mallard Creek Church Road, but it ends as one proceeds northward on Bonnie Cone Lane. In contrast, there is a sidewalk on the west side of Bonnie Cone Lane that leads directly to the Flats at Mallard Creek Apartment.

Adding a sidewalk on the east side of Bonnie Cone Lane and providing a clear path for students to cross Bonnie Cone Lane to the Flats at East Mallard Creek Apartments would help mitigate this problem. It would also be helpful to remove the crosswalk and pedestrian signal on the west side of the Mary Alexander at East Mallard Creek Church Road. This would again encourage pedestrians to stay on the east side of Mary Alexander until they crossed East Mallard Creek Church Road, which would help prevent delays to the traffic turning left onto East Mallard Creek Church Road. This would not only remove a congestion point at the exit from campus, it would also improve pedestrian safety.

Recommendation: The task force recommends the following improvements at the intersection of East Mallard Creek Church Road and Mary Alexander Road. The task force acknowledges that these would have to be Charlotte Department of Transportation projects.

- Installation of traffic-detection sensors and the creation of a protected left turn arrow from Mary Alexander to East Mallard Creek Church Road.
- Creation of a dual-left turn lane from Mary Alexander to East Mallard Creek Church Road.
- Encourage pedestrians to stay on the east side of Mary Alexander until they have crossed East Mallard Creek Church Road. This can be done by:
 - Creation of a sidewalk along the eastern side of Bonnie Cone Lane along with a crosswalk to help students get to the Flats at East Mallard Creek Apartments.
 - Removal of the crosswalk and pedestrian signal on the west side of the Mary Alexander/East Mallard Creek Church Road intersection.

2.2. Medium Term

The task force identified four areas that could be addressed in a two to four-year period. Each is discussed below in order of the priority assigned to it by the task force. In several of the cases the work itself would not take that long but would have to be done either in conjunction with or by either the Charlotte Department of Transportation or the North Carolina Department of Transportation.

- John Kirk Road Realignment –The task force strongly feels that the proposed plan for the John Kirk Realignment is a top priority and needs to move forward. The current intersection of John Kirk Road and Van Landingham Road has significant operational issues and is a safety concern. This is one of the main entrance/exit points for the East Decks, and significant delays occur exiting the parking areas through this point. At times traffic backs up from this intersection all the way back to the Mary Alexander/Van Landingham Road traffic circle, which then creates a cascading congestion problem throughout the eastern side of campus.

Recommendation: The task force recommends continuing with this realignment project.

- Improve the CRI Road Infrastructure – The CRI road infrastructure is incomplete. Phillips Road is the only road that connects CRI with the rest of campus. Although there are two exits from the CRI Campus onto North Tryon Street, main campus traffic is still bottlenecked while attempting to exit through the CRI Campus because there is only one way to get to the North Tryon Street exists. With several more buildings proposed on the CRI campus, additional traffic on CRI would put a significant burden on the exit at North Tryon Street at Institute Circle. Currently traffic during the evening peak periods routinely back through the traffic circle, essentially stopping the flow of traffic in this area. While some of the queues can be attributed to the construction on North Tryon Street, an additional access point would help disperse traffic, especially those coming from the main campus to exit onto North Tryon Street.

Through the years there have been a number of proposals for improvements to the CRI road network, which are discussed below.

- CRI North Road – There have been previous proposals to create a CRI North Road connection from North Tryon Street to Cameron Boulevard. These proposals have typically suggested that such a road would parallel the CATS light rail line, although other routes could be constructed. In addition to providing another route into and out of the university in general, if the road were tied into Snyder Road it would allow for a more direct route from the main campus to both North Tryon Street and the CRI Campus. This would allow traffic to avoid the curving, indirect path that Phillips Road takes around Richardson Stadium.
- Integration with CMC-University Roads – Currently the CRI road network does not integrate with the CMC-University road network. There have been preliminary plans developed in the past to connect Snyder Road to Green Acres Road on the CMC campus. Doing this would allow access to another exit point onto North Tryon Street as well as

both vehicular, bike, and pedestrian flow between the two institutions. This integration was endorsed in the 2015 University City Master Plan.

Recommendation: The task force recommends that the university continue to develop a robust road infrastructure in the CRI area. This would include developing one or more roads from the main campus road network to the CRI network, and providing at least one more exit onto North Tryon Street from that network.

- Develop a regional Traffic Impact Study – Over the past several years, events such as campus growth, the completion of I-485, the widening of I-85 into Cabarrus County, and the addition of multiple large apartment complexes near the university have created major changes in the road system near campus. This is changing commuting patterns for students, faculty, and staff. The addition of light rail over the next eighteen months will further change these patterns. Congestion on campus is frequently caused by problems in the road network that surrounds campus such as the signals on University City Boulevard becoming unsynchronized when trains cross at the Back Creek Church intersection.

Fixing these problems will require investment and buy-in from both the Charlotte Department of Transportation and the North Carolina Department of Transportation. Although this is likely to be a long-term issue, the task force feels that the first step in securing that commitment and buy-in is to work with these agencies to develop a regional Traffic Impact Study. This study would examine the sources of traffic in and around the university and will determine need for improvements to the off-campus road network near campus.

Recommendation: The task force recommends that the university pro-actively engage with CDOT and NCDOT to begin the development of a traffic impact study for the university area.

- Fretwell Transit Area – As discussed later in this report, PaTS is planning to adjust the campus bus routes. The proposed set of routes would result in all campus routes at some point passing along Mary Alexander from the Mary Alexander/Van Landingham Road traffic circle to the Mary Alexander/Craver Road intersection. This and the Student Union will be the only points on campus where all of the transit lines come together, so it is a natural place to put a “hub” where riders can change bus lines.

One concern that the task force identified was that buses might be delayed in this area because of frequent congestion problems stemming from students using the Friday and Fretwell loading docks as informal drop-off/pick-up zones. In looking at it closely, the task force realized that this area is used so extensively as a drop-off zone because it is the only place where a main road near the academic core of campus is coupled with a paved area wide enough for turning around a car. The task force came to the conclusion that there is a need for a drop off zone in this area, and it is wiser to design the area to accommodate drop offs rather than to ignore the need. Further, the task force also felt that if there were a designated drop off area at Fretwell it would reduce the incidences of people being dropped off in the Mary Alexander/Van Landingham traffic circle.

When combined with a central point for the campus transit system, this area could develop into a transit “hub” for the campus. The task force notes that from this point a rider could get on the red-line bus for a nearly direct five to seven-minute ride to CRI with only a minimal number of stops. There are a couple of other reasons this is a good location for such a hub. First, there is enough land on the north side of Fretwell to support what would essentially be a large bus lane. Second, there is already a coffee shop there that can provide services to students waiting on transportation.

Recommendation: The task force recommends that the university consider developing a combined transport hub and drop-off zone on the north side of Fretwell.

2.3. Long Term

The task force identified two areas for improvement that would most likely take five or more years to happen. Both are discussed below in order of the priority assigned to it by the task force. Even more so than with the short and medium-term suggestions, the task force recognizes implementation of these will require the cooperation and approval of other state and local agencies.

- East Mallard Creek Church Road Extension – This project, which is already in process, will make a major difference in the congestion around the university, especially with respect to congestion on University City Boulevard. It will extend East Mallard Creek Church Road to the east side of University City Boulevard. Currently, a bridge is under construction for the rail line that runs parallel to University City Boulevard. East Mallard Creek Church Road will run under that bridge so that traffic can flow even when trains are running. Back Creek Church Road will no longer empty into University City Boulevard but will terminate before the railroad tracks. All traffic that currently uses Back Creek Church Road will be directed to the new East Mallard Creek Church Road intersection.

This is critically important for congestion on University City Boulevard and onto campus. In theory, all of the traffic lights on University City Boulevard are coordinated to encourage an even flow of traffic. When a train approaches the Back Creek Church Road crossing, however, the traffic light at the Back Creek Church Road intersection with University City Boulevard goes into an override mode to prevent traffic from attempting to cross onto Back Creek Church Road. It stays in this mode until the train has cleared the crossing. It then takes at least two complete light cycles for the system to re-coordinate with the other lights on University City Boulevard. At peak traffic times, this is enough time for a cascade of traffic to build up on University City Boulevard all the way back to the university’s entrances. Currently roughly 30 trains a day pass through this intersection, and that number is projected to increase.

Construction on the East Mallard Creek Church Road Extension will be disruptive to the campus area. East Mallard Creek Church Road will have to be lowered from its current grade, and this will be a major project. Once it is complete – which should be in about five years – traffic on University City Boulevard should flow much better than it does now.

Recommendation – The project is already underway, but it is a long term project. The task force

recommends that the university use all opportunities to push for the project to be sped up and completed quickly. The task force also recommends that the university engage with CDOT to re-evaluate the timing and synchronization of lights on University City Boulevard at the end of this project.

- Bonnie Cone Lane Extension – Traffic leaving the university toward either I-485 or Cabarrus County must use either North Tryon Street or University City Boulevard. For those drivers that use North Tryon Street, regardless of how they leave campus they currently must pass through the intersection of North Tryon Street and East Mallard Creek Church Road. This intersection is a consistent problem at rush hour, and with projected growth of Cabarrus County and of the university, it seems likely that this will continue to be a problematic intersection.

The task force noted that Bonnie Cone Lane could be extended from its current terminus just to the north of East Mallard Creek Church Road to North Tryon Street north of the North Tryon Street/East Mallard Creek Church Road intersection. The road could be built around Kirk Farm Park. Although rights of way would have to be acquired, all of the land is currently undeveloped. This would provide another way for traffic exiting the university to get to North Tryon Street without using East Mallard Creek Church Road.

Recommendation – The task force recommends that the university conduct a feasibility study for a Bonnie Cone Lane Extension to North Tryon Street.

3. Parking

Parking and campus traffic congestion are intrinsically linked. As part of a big campus with large, episodic influxes of faculty, staff, students, and visitors, entrances to parking areas will naturally tend to be key congestion points in the campus traffic system. A November, 2015 Transportation survey by PaTS showed that 90% of faculty and staff and 48% of students commute to campus by automobile and have parking permits. In addition, a little over half of the campus resident students purchase parking permits. The survey found that 12% of faculty and staff, as well as 4% of students reported using their cars to move from one area of the main campus to another. Anecdotal evidence points to additional sources of parking-related congestion, including:

- Commuters bypassing open parking more remote locations to search for parking in more convenient locations closer to the center of campus; and
- Students using visitor parking as short-term parking or as a substitute for purchasing a student parking pass.

Given these potential issues, the task force examined a number of ways to modify campus parking procedures to reduce congestion. This included changing how residential parking was allocated, restricting individuals to parking only to specific zones, changing the pricing structure of parking to create incentives for people to park remotely, and changing visitor parking pricing. Each of these options is discussed in the sub-sections that follow. Before examining these options, however, it is important to discuss the current campus parking system to establish a baseline for comparing potential changes.

3.1. The Current Parking System

Parking on campus is administered by Parking and Transportation Services (PaTS). Generally, to park on campus a vehicle must have a parking permit unless the vehicle is parked in a metered or visitor space. For the 2015-2016 academic year, PaTS issued 22,568 parking passes. As shown in Table 1, the bulk of permits are commuter permits, followed by faculty/staff and residential permits.

Table 1. Parking Permits Types and Number

Permit Type	Number Issued	Primary Users
Center City	448	Student
Commuter Full Week	9,907	Student
Commuter Two-Day a Week	1,348	Student
Dining Services	105	Staff
Discount	220	Faculty, Staff, and Student
Residential	3,069	Student
Faculty/Staff	3,436	Faculty and Staff
Faculty/Staff Reserved Spaces	32	Faculty and Staff
Temporary Faculty/Staff	414	Faculty and Staff
Emeritus Faculty	159	Retired Faculty
Greek	288	Student
Night	901	Student
Service Permit	126	Contractors
Temporary	2,095	Various
Special	20	Board of Trustees, UNC System, etc.

Source: Parking and Transportation Services

The current system is a relatively open system, with uniform pricing across the campus. Once a person has purchased a parking pass, they are able to park in any lot on campus that permits that classification of pass.¹ Except for those that buy discounted spaces in two remote lots, most parkers have access to multiple parking lots or decks. In general, a parking permit costs \$450 per year. There are, however, a few notable exceptions. For example, approximately 1,591 faculty and staff permit holders pay an additional \$150 per year to gain access to gated premium lots. As a second example, the 1,341 students that purchase two-day commuter passes only pay \$330 per year for their day-restricted permit.

There are 14,017 parking spaces on campus, with the distribution of spaces given in Table 2.

Table 2. Parking Spaces by Type

Faculty/Staff	1,940
Resident/Commuter	3,475
Commuter	5,078
Resident	1,242
Metered	78
Reserved	380
Motorcycle	9
Disability	412
Visitor	1,192
Discounted	211

Source: Parking and Transportation Services

As is the case at virtually any institution, the number of permits sold exceeds the number of physical spaces under the reasonable assumption that not all permits are in use at all times. Indeed, as Table 3 shows, the campus always has significant numbers of open parking spaces.

Table 3. Average Available Parking Spaces at Various Times of Day

Type	10:00 am	12:00 pm	2:00 pm	4:00 pm	6:00 pm
Student	2,408	2,173	2,671	3,777	5,254
Faculty/Staff	621	584	617	904	1,495
Visitor/Metered	716	622	668	773	948
Disabled	271	253	260	296	350
Discount	182	176	196	225	268
Reserved	112	113	109	125	148
Total Available Spaces	4,310	3,921	4,521	6,100	8,463

Source: Parking and Transportation Services. Note that data are for the main campus and Monday through Thursday Only

A slightly different way of looking at the issue is to look at the parking space occupancy rate at various times of day. Table 4 shows this rate for each class of space as well as the campus as a total.

Table 4. Average Percentage Occupancy for Parking Spaces at Various Times of Day

Type	10:00 am	12:00 pm	2:00 pm	4:00 pm	6:00 pm
Student	75.15	77.57	72.44	61.03	45.78

¹ Note that almost all lots labeled for students also permit faculty/staff usage.

Faculty/Staff	67.87	69.19	68.08	53.23	22.66
Visitor/Metered	43.67	51.06	47.44	39.18	25.41
Disabled	33.58	37.99	36.27	27.45	14.22
Discount	38.93	41.14	34.23	24.50	10.37
Reserved	55.02	54.80	56.40	50.00	40.80
All Spaces on Campus	68.88	71.69	67.36	55.96	38.90

Source: Parking and Transportation Services. Note that data are for the main campus and Monday through Thursday Only

A straightforward observation is that in general there is more than adequate parking on campus at all times of day and for all classes of parking permit. Even at the peak times, the campus as a whole has approximately 30% more spaces available than there are cars on campus.

Although there is adequate parking on campus, it is very much the case that not all parking spaces are equally valued by users of those spaces. The demand for parking spaces close to the academic core of campus is significantly higher than the demand for parking in more distant locations. This can be seen most easily by looking at the availability of parking spaces in the two large decks located at the edges of campus – the CRI Deck and the North Deck. Note that the CRI Deck has 1,341 spaces, and North Deck has 1,171 spaces. With a combined capacity of 2,512 spaces, these two decks contain 18% of the total parking on campus, but as shown in Table 5, these two decks alone account for 40% or more of the open parking spaces on campus at peak times. Indeed, as also shown in Table 5 combining the open spaces in the CRI and North decks with the available open spaces in the two discounted lots, we find that they combine to be more than half of the available open parking spaces on campus at peak times.

Table 5. Open Parking Spaces: CRI Deck, North Deck, Remote Lots, and Campus

Location	10:00 AM	12:00 PM	2:00 PM	4:00 PM	6:00 PM
CRI Deck	1,043	969	1,046	1,049	1,237
North Deck	861	867	855	884	902
Discounted lots	182	176	196	225	268
Combined	1,903	2,011	2,024	2,232	2,139
Campus	4,310	3,921	4,521	6,100	8,463
Percentage of Open Parking Spaces on Campus	44.16%	51.30%	44.76%	36.60%	25.27%

Source: Parking and Transportation Services. Note that data are for Monday through Thursday Only

The data in Table 5 contain a number of important implications for campus congestion. First, it clearly shows that while there are always many spaces available on campus, they are not distributed evenly throughout campus. This supports the notion that commuters place greater value on parking close to the inner core of campus than parking on the edges. This would also be consistent with the observed behavior of commuters searching close-in lots looking for available spaces. A second implication is that when faculty, staff, or students need to go to the CRI, they know with certainty that parking is available there. This makes it much more attractive for people that are normally in the core of campus to simply drive to CRI when they need to be there, especially if they can do so toward the end of their day on campus. This increases intra-campus congestion.

The most important implication of the relatively low usage of the CRI and North decks, however, is that they present the best parking-related opportunity for relieving campus congestion. Both decks can be accessed from off-campus without having to engage substantially with the campus road network. If the University can get usage of those decks up to 80% or higher, it is an opportunity to remove 1,600 or more cars from the campus road network. It would also relieve pressure on the main entrance and John Kirk entrances to the campus. Later sub-sections present recommendations for increasing their usage.

3.2 Visitor Parking

Visitor parking is a significant challenge on campus. The purpose of visitor parking is to provide short term, fee-based parking for non-university affiliated people who are on campus. There is a clear need for such parking as virtually every university unit has visitors. As shown in Table 2 there are 1,192 visitor parking spaces on campus.

As shown in Table 3, on average there are between 600 and 750 empty visitor spaces. The task force notes, however, that looking simply at averages may not fully capture visitor usage because many visitors to the campus are very short term in nature and may easily be missed during a survey. Plus, the campus must have visitor parking capacity that is sufficient to handle surges of visitor demand – such as at the beginning of academic terms when parents come to campus to help their children adjust to campus life.

There is anecdotal evidence that a significant number of visitor spaces are not being used by true visitors to the university but rather are being used as short-term convenience parking by students. Certainly there is a strong perception among faculty and staff members who work in the traditional academic core of campus that the vast majority of people using visitor parking in East Deck 1 are, in fact, students.

This issue was not directly addressed in the previously mentioned 2015 PaTS transit survey, but follow up emails were sent to participants who answered that they commute by car but do not have a permit. This was approximately 12% of commuter students and 7% of faculty/staff. Their responses to the follow-up survey showed that about half reported using visitor parking, and the other half reported that they parked off-campus or were dropped off.

The current visitor parking rules and parking rates, relative to those charged to commuter students, do create incentives for some groups of students to use visitor parking as short-term parking. Note that visitor parking is priced at \$1/half-hour up to a maximum of \$10/day. Some examples where students have incentives to use visitor parking are listed in the bullet points below.

- The Office of Institutional Research reports that there were 835 undergraduate students in the fall 2015 semester and 820 in the spring 2016 semester that were enrolled solely in a 3-hour, 1 day per week class. These classes actually span 2 hours and 45 minutes so it is likely a student could park in visitor parking for 3 hours or less. To park in visitor parking for 3 hours would cost \$6/week, so these students in a 16-week semester would spend \$96. There is no cheaper parking option for them on campus. Students taking only one three-hour class have a strong incentive to solely use visitor parking.
- The Office of Institutional Research further reports that there were another approximately 270 undergraduate students in the fall 2015 semester and 618 students in the spring semester 2016 that had classes only one day per week. These students all were enrolled in 4 or more credit

hours. The maximum parking fee for visitor parking is \$10/day. Even if the student parked in a visitor space all day on the day they came (which not all would), over the course of a 16-week semester they would pay at most \$160 in visitor parking fees. This is marginally less expensive than buying the least expensive commuter pass, the two day a week commuter permit for \$165, for the semester. Given that visitor parking tends to be closer and more convenient to the core of campus, once again students have a strong incentive to use visitor parking.

- Currently the university only offers two and five-day commuter parking passes. The Office of Institutional Research reported that approximately 3,083 commuter students had classes three days a week in the fall 2015 semester and 3,001 in the spring 2016 semester. If these students purchase a full year, five-day per week parking permit, the cost is essentially \$225/semester. If they purchase a two day a week parking permit, the cost is \$165/semester. If the student only had one, two-day per week class on the “third” day of their schedule, that class would last for one hour and fifteen minutes, meaning that a student could reasonably expect to be in the visitor spot for as little as 90 minutes, for a cost of \$3. Over a 16-week semester they would pay \$48 in visitor parking fees, bringing their total parking costs to \$213, which is less costly than purchasing a 5 day per week pass. Again, these students have a strong incentive to park in visitor parking.

There are three major problems with students using visitor parking. The most obvious problem is that while there is more than ample visitor parking on average, in a given location at a given moment it is possible students using visitor spots might prevent a visitor to the university from having a place to park. The second problem is that visitor parking tends to be located in the most congested areas of campus, so having students use visitor parking increases congestion in those areas. Third, students parking in visitor parking may very well be leading the university to over-estimate the demand for parking by visitors, and hence to over-allocate visitor spaces. These are spaces that could otherwise be used for student, faculty/staff or other parking, and they are some of the most desirable and valuable spots on campus.

It is also the case that when students use visitor parking they have a financial incentive to minimize their time on campus. This may contribute to students cutting class early, arriving to class late, or not engaging with student support services on campus. This could potentially affect academic outcomes for these students.

The task force debated a number of ways to solve the problem. Potential solutions included an outright ban on students parking in visitor spaces, dramatically raising the price of visitor parking so that student usage was simply not economic, or dramatically reducing the number of spaces allocated to visitors. Each of these was rejected for various reasons. For example, the task force felt that banning students from using visitor parking would be extremely costly to implement in practice. Monitoring and enforcement would be costly, and it would be difficult to identify student-associated vehicles if they were not registered on campus.

In the end the task force felt there were two approaches to deal with this issue. The first approach is to recognize that there is a need for short-term parking, especially for commuter students. Students could be allowed to purchase online day-passes for the commuter lots. This would help get them to an appropriate lot while still allowing them to purchase parking only when they need it.

The second approach was for the university to implement a two-tiered pricing structure for visitor parking. Under this approach the base visitor parking rate would be set at a relatively high rate, and a rate that was heavily weighted to discourage short stays, for example, setting the rate to be \$10 for the first hour with \$5 per hour afterwards to a maximum rate of \$25/day. This sort of rate would remove any financial incentive for a student to use visitor parking. Legitimate visitors to the university, however, would be able to have their parking ticket validated so that they paid the same rate they pay now - \$1/half-hour to a maximum rate of \$10/day. In addition, units on campus would still be able to purchase prepaid visitor parking passes to use as they do now. Task force members from Parking and Transportation Services noted that over the next year new equipment which will be installed in parking decks would make implementing such as system feasible.

Recommendation: The task force recommends that the university implement a two-tier pricing structure for visitor parking and develop a product for occasional car-commuters to utilize non-visitor parking areas.

3.3. Location Based Pricing

As noted in the discussion of remote deck parking, it is manifestly evident that students, faculty, and staff do not view all parking spaces as being equally valuable. Currently all non-visitor parking, with the exception of lots 27 and 6a, is priced the same at a flat \$450 per year. In essence this means that the parking spaces that are most valued by users – i.e. the ones nearest to the core of camps- are underpriced relative to the demand for those spaces, while those that are least valued by users are overpriced relative to their demand.

Mispricing parking spots results in two effects. First, drivers compete for the most valued spaces through non-price means – mostly by driving around looking for open spaces in the close-in lots. This is an inefficient use of people’s time, exacerbates campus congestion problem, and increases the environmental problems associated with driving. Second, the least valued spaces sit empty. Thus, the North and CRI Decks as well as Lot 5 are frequently not very full even when more parking structures in the core of campus are full.

The basic solution to this problem is to correctly price parking on the campus. More desirable spaces should cost more to use than less-desirable spaces. The university already does this to a very limited extent in two cases. First, the university charges faculty and staff an additional premium of \$150 per year to park in certain gated lots. Second, for certain athletics events such as football and basketball games, parking passes to lots are allocated based on contribution levels to the 49er Club, with donors that give more money being assigned to lots closer to the venue.

A similar program could be implemented for all parking, whereby the university charges a higher rate for parking in the core of campus and a reduced rate on the periphery. One obvious step in this direction is to reduce the price of parking in the CRI and North decks. A more complete process would be to couple this with increasing the price of parking in the core of campus. These are discussed in the next two sub-sections.

3.3.1. Remote Deck Parking

As noted above, the CRI and North decks are significantly underutilized. These decks represent the best opportunity to reduce campus congestion. The CRI Deck has direct access from Highway 29, and the

North Deck has relatively easy access from East Mallard Creek Church Road via Mary Alexander Road. If the university can get a substantial fraction of students, faculty, and staff to park in those decks, and only in those decks, it would reduce congestion at all other entrances.

That these decks are underutilized strongly indicates that these lots are not viewed by the campus community as being as desirable as lots which are closer to the core of campus. The task force recommends that these two decks be treated as remote parking, with a heavily discounted price. As is the case with remote lots 6a and 27, people who purchased “remote deck” parking would be restricted to the specific deck to which they purchased a permit.

The task force believes that reducing the cost of parking in these decks will attract significant numbers of commuters to the decks. Should that not be the case, however, another option open to the university would be to simply require all first-year commuter students to park in remote parking locations.

In discussing this recommendation, the task force considered a number of concerns and potential problems. While the task force ultimately felt that each of these could be overcome it did feel that it was important to point out the concerns and the task force’s thoughts on them. They are presented in the bullet list below.

- Although the CRI and North decks are underutilized today, there are approximately 300 cars per day that park in each deck. There was a concern that reducing the parking rate for these decks would result in a windfall for those commuters. While this is true, the task force felt that this was not a terribly big issue because these commuters would not be buying the same product they get now. Currently their parking passes allow them to park at any appropriate lot across campus. Under the reduced parking program, they would be restricted to parking only in the remote deck to which they purchased a pass.
- People who work in the CRI might be perceived to be able to take advantage of the reduced price option than people that work in the core of campus. This might be the case, but again, the parking pass they would be purchasing would be much more restricted than traditional parking passes. Further, this can be mitigated to a great degree if the campus transit system can offer rapid, consistent transportation to and from the core of campus from these decks.
- Reducing the cost of parking in these decks would most likely result in a net reduction in revenue to PaTS if no offsetting action were taken. Table 6 below demonstrates the maximum potential impact on PaTS revenue if the price for a permit were set to the levels currently set for Lot 6A and Lot 27. Please note that this table assumes that the two parking decks will be at 80% capacity and that every person parking in those decks would have otherwise purchased a pass for \$450.

Table 6. Maximum Potential Effect of Reduced Fees for North and CRI Deck Parking

This table assumes that each person buying a reduced fee would otherwise have purchased a full-cost permit. It assumes that these decks would be at 80% capacity.

Reduced Fee	Spaces Available in CRI and North Deck	Percentage Sold	Dollar Reduction in Revenue to PaTS	Percentage Change in PaTS Revenue
\$340	2512	80%	\$221,056	-2.028%
\$210	2512	80%	\$482,304	-4.425%

- Another concern is the possibility that the reduced pricing would induce some faculty, staff, or students who currently do not drive to campus to begin driving to campus. This could result in the decks filling up with new parkers without significantly displacing parking in the center core of campus. Although the task force did not think this was very likely to happen, it did feel obligated to mention this potential outcome.
- The North Deck exit onto Cameron Road does not have a signal to permit easy left turns. At the relatively low volumes that exist today, this is not a problem. Should that deck become used at 80% or higher capacity, however, it is likely that significant backups within the deck would occur as drivers waited to make a left onto Cameron Road. Having the majority of drivers make a right onto Cameron would not help campus congestion. As a result, a traffic signal or other traffic management system would have to be installed at the exit from the North Deck onto Cameron Road.
- Finally, the task force noted that the construction of the new Science Building, coupled with the subsequent movement of Facilities Management personnel toward the northern part of campus might change the relative demand for the North Deck anyway. Should that happen, of course, discount pricing could be stopped.

The biggest concern of the task force was the effect of discounted parking permits on PaTS revenue. Currently PaTS revenue exceeds its operating expense by approximately \$2.5 million. Those excess revenues are used to build reserves for the purpose of fully funding, developing, and building future parking (driven by either increased parking demand or the likely loss of existing parking due to construction of new campus buildings and infrastructure), as well as providing additional services such as campus transit, car-sharing, and bicycle programs. PaTS clearly needs to build and maintain reserves for future growth, and this plan likely would reduce the ability of PaTS to build reserves as quickly. The task force presents additional plans later which, when combined with this proposal, would keep PaTS revenue-neutral.

Recommendation: The task force recommends that North and CRI decks be priced as reduced-cost parking options. This may be done in conjunction with location-based pricing. Should the reduction in price not be sufficient to attract many commuters to the remote decks, the task force recommends that first-year commuter students be required to park in remote parking locations.

3.3.2. Campus Core Parking

Treating the CRI and North decks as remote parking will likely draw more commuters to those facilities, and this will help with campus congestion. Beyond those decks, however, there are still parking areas which are more or less desirable than others, and a comprehensive solution would involve differential pricing of those facilities as well. This would further reduce congestion while also at least partially subsidizing the reduced cost of parking in the remote areas.

One approach would be to raise the price of parking for Faculty/Staff and Students in the two Cone Decks, West Deck, East Deck 1, and lots 7, 7a, 15, 18, and 19 while simultaneously lowering the cost in the CRI and North decks and maintaining the current pricing in all other locations. This would essentially

create three zones of parking – in-close premium parking, moderate distance “regular” parking, and discounted remote parking. With these particular lots designated as premium, the number of discounted spaces and premium spaces would be roughly equal. Raising the price of the premium spaces by as much as the discount on the discount spaces, would potentially keep PaTS revenue neutral.

The task force acknowledges that a challenge with this approach is the effect it might have on lower-paid employees whose primary work site is in the core of campus. They may feel they are being “priced out” of their position, or simply resent that others are more easily able to afford the higher parking prices. The task force noted, however, that under the pricing structure proposed above the Union Deck remains a “regular” priced structure. This means that there remains at least one large parking area close to the center of campus at the current pricing levels.

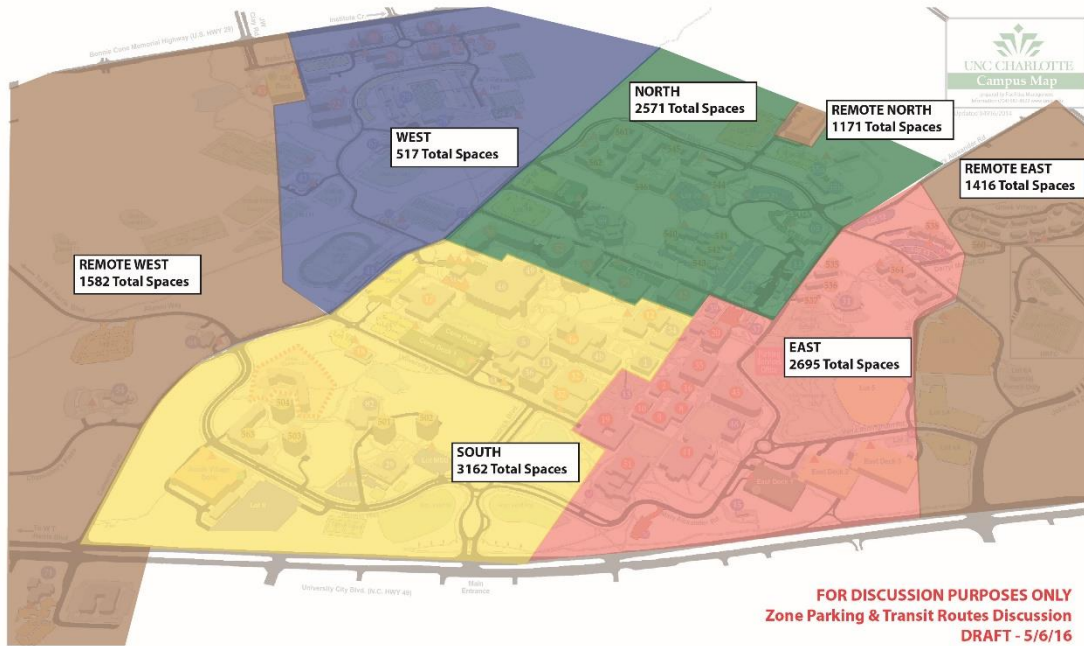
A second challenge for this proposal is making sure employees who work in the core of campus and who are required to be on campus during early mornings or after sunset have a safe and reliable transit option to their worksite. Some Cone Center employees, for example, are required to be on duty as early as 6:00 am, currently before the campus transit system begins operations for the day. There would have to be some form of transit available to them if they park in remote parking areas.

Recommendation: The task force recommends that the university implement the location-based pricing structure discussed above.

3.4 Zoned Parking

Many campuses rely upon a zoned parking system. Under this system the campus is divided into a relatively small number of zones, and parking passes are issued by zone. A person buys a permit for a given zone, and that allows them to park in any lot within that zone. Figure 3 shows one potential zone system for the campus. Under this system the campus would be divided into seven zones, four regular zones (north, south, east and west) and three remote zones (remote north, remote east, and remote west.) The major advantage to this system is that it prevents people from parking in different parts of campus and so removes any reason for drivers to move their car between zones.

Figure 3 – Potential Zoned Campus Parking Map



ZONE	Res	Com	Res/Com	Fac/Staff	Reduced	Visitor	TOTAL
N	459	1123	454	348	0	187	2571
S	300	843	1101	516	0	402	3162
E	140	1962	0	443	0	150	2695
W	0	331	0	186	0	0	517
RN	0	0	1171	0	0	0	1171
RE	324	378	603	0	111	0	1416
RW	0	441	60	440	187	454	1582
TOTAL	1223	5078	3389	1933	298	1193	13114

In addition to preventing people from using their cars to move from one side of campus to the other, there are other advantages to a zone system. It is relatively easy to enforce, and zones can change year to year as new parking comes online. There are, however, several challenges to a zone system, which are listed in the bullet points below.

- Within each zone there are still parking spaces which are relatively more and less attractive. Commuters within each zone might still have an incentive to drive around to search for “better” parking and ignore open parking. This could result in there being no real change in the overall level of congestion.
- It is likely that some zones will be more desirable for some people than others. With fixed numbers of parking spaces in each zone there will have to be a mechanism within each administrative and academic unit to determine who is assigned the better zones as this could have implications for faculty hiring and retention. Quite likely there will be waiting lists for the more desirable zones, and college deans and other administrators will have to have input into who is assigned the best zones. Implementing this system will be challenging.
- Construction, road work, and other factors could cause one zone to temporarily lose spaces or gain population. This might require employees or students to be involuntarily moved into less desirable zones.

- The campus has a culture of faculty/staff having parking that is apart from students. A zone system will change that culture and there is a high probability that faculty and staff will resist that change. Maintaining premium gated access to decks and lots will ameliorate resistance, but it is still likely to be perceived as highly negative by faculty and staff.

Recommendation: The task force recommends zoned parking be implemented, but only if location-based pricing is found to be infeasible.

3.5. Premium Parking

The campus has a history of premium parking. Currently there are gated faculty/staff lots that require payment of a \$150 premium above the cost of a faculty/staff parking permit to access. There are also a handful of reserved parking spots on the campus. If the campus were to adopt the recommendation of the task force to offer discounted remote parking in the CRI and North decks, one potential way to offset revenue losses is to offer additional premium parking options.

The task force identified two potential premium parking options. The first is to differentiate the cost of gate access in different regions of campus. For example, the cost of gated access to the Cone Decks and East Deck 1 could be raised to \$200 per year, while keeping the cost of gated access in the Union Deck at \$150/year. The advantage of this system is that it spreads the cost across a large number of users while still allowing people to have gated access at the old rate albeit in a less desirable location.

The second approach is to allow faculty and staff to purchase reserved parking for a very substantial premium. The cost of a reserved spot would most likely be in the range of \$1,250 to \$1,500 per year. The main advantage of this structure is that each reserved parking spot could heavily subsidize discounted remote parking. Note that with the prices listed above, each reserved spot sold would generate between \$650 and \$900 dollars per year over a regular faculty/staff permit. Assuming discounted spots are sold at a discount of \$100 relative to regular pricing, each reserved spot sold would allow between 6 and 9 discounted permits to be sold while keeping PaTS revenue neutral. A second advantage is that reserved spot holders would *only* be allowed to park in their reserved spot, thus preventing them from using their cars for cross-campus transit and reducing congestion.

There are down-sides to selling reserved spots, however. The first is that a reserved spot can only be used by one person, i.e. it reduces the ability of the spot to be turned over. Given the availability of parking on campus this might not be a critical issue currently, but if the number of reserved spots sold were large enough it could become an issue.

The second, and most serious, concern raised by members of the task force, however, is that allowing reserved spaces to be sold could be seen as an elitist policy that would allow higher-paid employees (or wealthier students if they were allowed to purchase them) of the university to have a benefit that the less well-off could not afford. While to some degree this already exists with the gated premium access system, it is most likely the case that reserved spaces would be purchased by a much smaller segment of the employee population. Further, the reserved spaces themselves would be a visible and constant reminder of the policy. If such a program were instigated, it would have to be accompanied by a major initiative to demonstrate how reserve parking spots subsidize reduced rate parking.

Recommendation: After careful study and debate, the task force determined that implementing a reserved parking system would likely have little effect on campus congestion and would create additional logistical problems. As a result, the task force does not recommend implementing a reserved system.

3.6. Resident Parking

There are approximately 3,000 spaces on the campus that are allocated to students and staff that live in on-campus housing. Many of these parking lots, such as lots 16, 20, and 21, are in or very near the core of campus. Initially the task force considered proposals to move student housing parking to either edge lots or the CRI or North Deck. PaTS has evidence that students in housing do not use their cars much during the week. The lots could be returned to student use on the weekends, and this would allow PaTS to sell additional parking spaces that were close to the core of campus.

Such a plan would be helpful if the goal is to provide additional close-in parking without having to build new parking facilities, or to increase the usage of the decks without using a discount parking system. Such a system would, however, most likely significantly increase campus congestion, and especially increase it in the core of campus. To see this, consider that under the current system there are several thousand resident-housing cars parked in the center of campus and they virtually never move during the academic day. If those cars were moved to the edge of campus, they would be replaced with faculty, staff, or commuter-student parking. Those cars would move a lot during the day, and this would increase congestion on campus.

Recommendation: The Task Force recommends retaining the current residential housing parking system.

Figure 5
Proposed Green Line Route

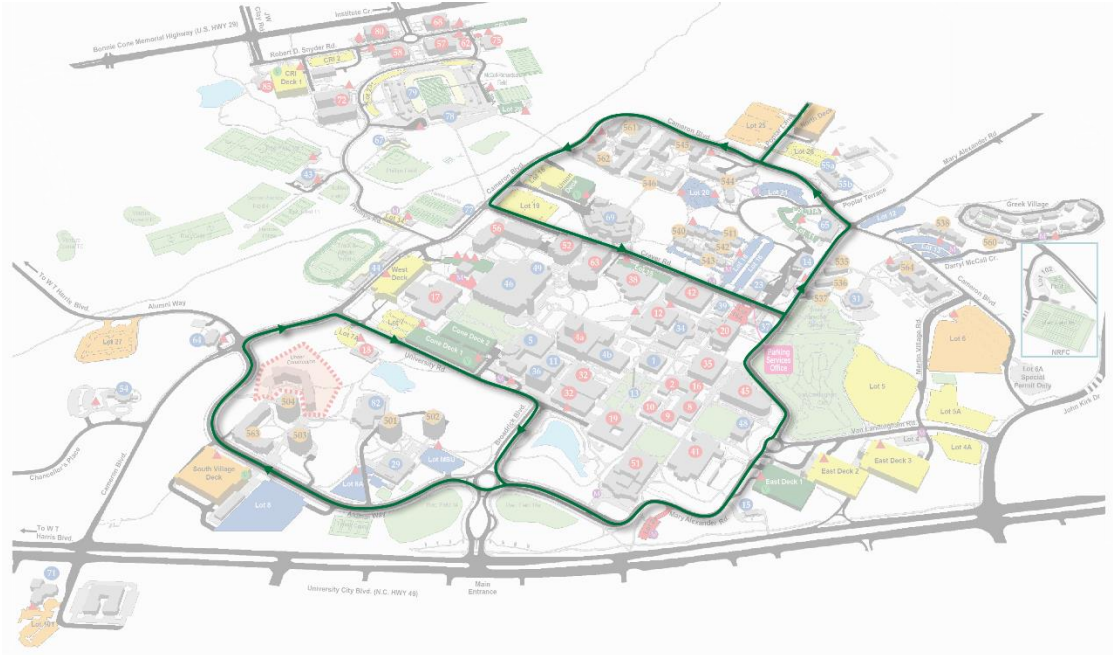
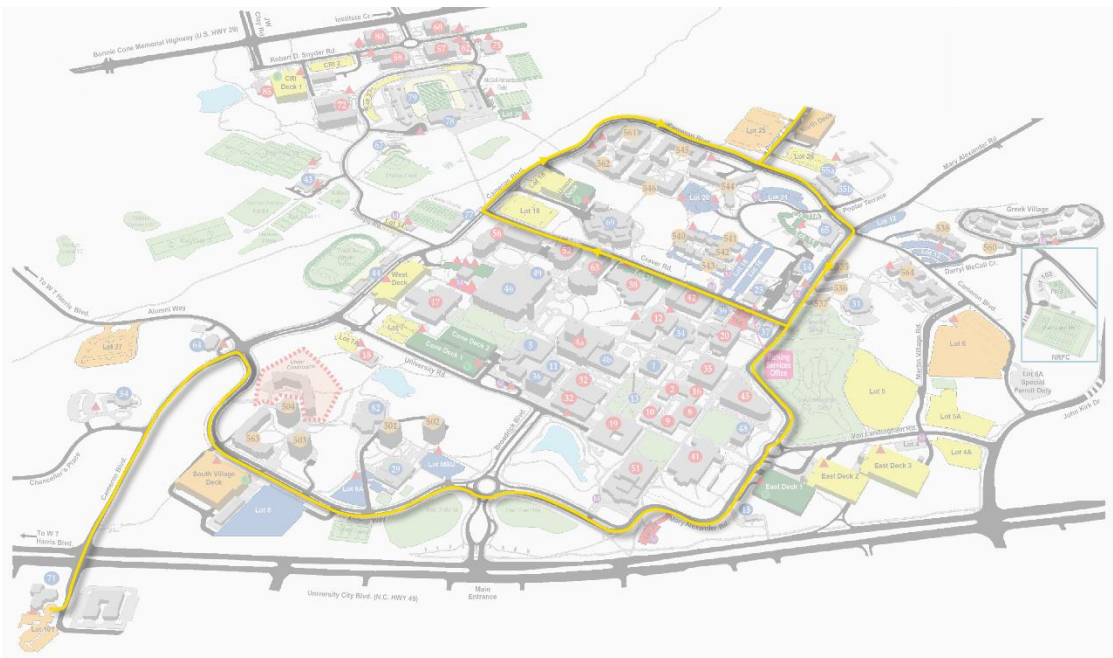


Figure 6
Proposed Gold Line Route



For most of campus, the green and gold routes are reverse-route mirrors of each other. This should allow passengers to select the most convenient direction of travel for their particular journey. The two routes do diverge at South Village. The green route will loop around South Village, providing service to the Cone Center area, while the gold route will cross University City Boulevard and stop at the UNC Charlotte Foundation Building.

The red route largely remains unchanged, but as noted elsewhere, with the proposed closure of Craver Road and the recent completion of the Phillips Road realignment, the time to get from Fretwell to EPIC should be on the order of five to six minutes.

Recommendation: The task force recommends that the proposed changes to the bus route system be implemented.

4.2. Transportation and Transit Services Hubs

Part of an all-encompassing transportation system on campus is the need for each transportation mode to connect to each other. Currently, there are connectivity gaps between apartment complex shuttles, campus shuttles, para-transit service and local bus service. For example, students riding in to campus on an apartment shuttle get dropped off at East Deck 2, but then have to walk to the Fretwell Hall area to transfer to a campus shuttle. Apartment complex shuttles were mandated to only drop off at East Deck 2 in an effort to cut down on inner-campus vehicular congestion (too many buses through the inner-core of campus provided extensive congestion). Also, as the demand for more frequent shuttle service grows due to an ever-expanding campus, light rail, etc., there will be a need for an area that will act as a “transportation hub” where the campus community can go to catch any of the campus routes, apartment routes or city bus routes to get them to where they need to go.

Recommendation: Construct a transportation hub in the center of campus. Provide transportation-related customer service that might otherwise reside in separate places for bus, train, bike, parking, car-share, taxi, disability services, etc. A hub can support short “spoke” shuttle routes to provide more frequent service to popular outlying areas (e.g. train station, large parking deck, remote parking, campus residential village). One possible location for a transportation hub would be north of Fretwell Hall and east of McEniry Hall. Another potential site could be something in the vicinity of the Student Union, perhaps in coordination with the construction of the new Health and Wellness Center to be built on parking lot 19.

4.3. In-house Transit System

UNC Charlotte currently contracts with the Charlotte Area Transit System (CATS) to provide weekday campus shuttle service. This arrangement has caused a number of challenges in CATS being able to meet the demands and expectations of the campus environment. Because of this, the campus community has been slow to embrace campus transit as a primary form of mobility while on campus. Along with these challenges, the addition of light rail will increase demand for a more robust, reliable, and flexible service for riders to reach their campus destinations.

As previously discussed, any program to create incentives to park automobiles in outlying parking areas will also increase the demand for more frequent and reliable shuttle service in order to make these remote parking options attractive. Barriers to improving the current shuttle service to meet these needs include: limitations of current contracts (hours, dependability, seasonality, vehicle size, driver qualifications); a lack of coordination across all forms of bus transportation and related multi-modal combinations; and the lack of flexibility in changing shuttle operations as-needed as the needs of campus rapidly change. These rapid changes include: expanding modes of transportation (train, bike, walk, private shuttle -- many related to shifting housing patterns), campus construction which impacts current routes or shifts shuttle demand to different geographic locations, and ever-changing service expectations.

Recommendation: The Task Force recommends providing a campus-run transit service which can be university-branded and provide reliable and flexible service - eliminating the need for restricting contracts and the inability to quickly modify service as demand dictates. This level of service would give the campus community a sense of safety, reliability and convenience that would allow them to make decisions to utilize under-utilized remote parking, upcoming light rail, and execute a “park-once” philosophy, which would help to cut down on campus vehicular congestion.

4.4. Improved ADA Service

As the campus continues to grow, the need for a more robust transportation system for individuals with mobility impairments is critical. The current daytime SafeRide ADA transportation system services the inner-core portion of campus only by utilizing wheelchair ramp-equipped eight-passenger electric trams. Demand for this service continues to grow not only for transportation within the inner-core, but also outside the inner-core. Due to current vehicle limitations, the SafeRide ADA service cannot service areas such as: CRI/EPIC, Greek Village, South Village and the Foundation Building. This forces individuals with mobility impairments to often drive their personal vehicles to multiple locations around campus.

Recommendation: The task force recommends that the University procure larger para-transit vehicles that will permit SafeRide to service the entire campus for those with mobility impairments. Purchasing and operating these new vehicles would require up-front capital for equipment and also may require some modifications be made to the grounds infrastructure (sidewalks, ramps, service roads, etc.) to allow these vehicles to access certain areas of campus which 1) are not currently serviced or 2) do not currently lend themselves to vehicles larger than the current trams.

4.5. Bicycle Infrastructure

Improving the bicycle infrastructure both on and off campus should reduce the demand for cars. Increasing the number of people biking to campus reduces the number of cars on campus on a 1:1 basis. In addition, bicycle riders can avoid the most congested areas of the campus – the areas around the parking lots and decks. This further disperses traffic and helps alleviate congestion. The addition of significant amounts of both on-campus and near-campus housing has greatly enhanced the potential for bicycle commuting. To be an effective means of campus transportation, however, bicycles must have a robust support infrastructure. Such an infrastructure includes having a sufficient number and breadth of roads and other pathways that are safe for bicycles as well. It includes having wide availability of securable bicycle parking, and having clearly defined and enforced rules relating to bicycle activities on campus.

4.5.1 Bicycle Road Network

Just as with cars, there are really two road networks that affect cyclists, the on-campus and off-campus networks. Unlike with cars users, however, it is appropriate to divide cyclists into three distinct groups – those riders that use their bicycles strictly while on campus, those that take public transportation to campus and then bicycle while on campus, and those that commute to campus via bicycle. For those riders that only use their bikes for intra-campus transit or that bring their bikes to campus via public transportation, improving just the campus road network can make large improvements in their ability to get around and hence in the adoption of cycling. Indeed, improving the road network may well increase the number of intra-campus bicycle users.

Historically, increasing the number of intra-campus cyclists would most likely have only had a modest effect on overall campus congestion since the cyclists would still have had to commute to campus via car. The number of people that brought bikes to campus via the bus-based public transportation system was low. The addition of the light rail line provides a unique opportunity to increase those numbers since the Lynx system encourages people to bring bikes onto trains.

Over the past several years the campus has made significant improvements in infrastructure to support biking. For example, the campus has added 3.8 miles of bike lanes such that now 57% of the main roads on campus have bike lanes in both directions. Planned improvements will raise that to 68% by 2021. Further, just because the remaining roads do not have bike lanes does not mean that they are inappropriate or inaccessible for cyclists. If they are wide enough or if the volume of motorized vehicular traffic is low enough, the roads may well be viable for cyclists. These roads could be marked with the “sharrow” symbols (for “share the road”) to indicate to both cyclists and motorists that these roads are intended for bicyclist usage too. Adding these symbols is relatively low cost, with as little as \$25,000 needed to mark all major campus roads.

These improvements to the campus road network should make intra-campus transit cycling much more viable and prevalent, but the biggest gains for congestion will come from getting more people to commute to campus by bike. For these commuting cyclists both the off-campus road network and the interface between the off and on-campus road networks are important. In particular, the availability of appropriate roads leading to campus, and the ability to safely cross the major roads that bound campus are critical.

For cycling-commuters, however, the past two to three years have been very difficult. The various construction projects on the arterial roads that bound campus have reduced or even eliminated safe cycling routes to campus. As these projects finish, however, the results of those projects should greatly improve the access to campus for cycling commuters.

The university is fortunate to sit in the middle of a developing greenway infrastructure, and its continued development provides a tremendous opportunity to enhance the ability of even moderately-distant commuters to use bikes to get to campus. University City contains the longest segment of greenway miles in Charlotte, and completing the near-campus greenways and improving connections will provide recreational and fitness opportunities for students, faculty, and staff, in addition to congestion relief. Over the next two years the county will complete the Toby Creek Greenway, connecting residential areas to the southeast of campus, and the Barton Creek Greenway, connecting residential areas to the north of campus. A major improvement for cycling-commuters would be to complete the Multi-modal path along University City Boulevard. This would involve completing only about 0.8 miles of trail, and it is possible

that the university cost for completing the greenway along a state highway and major city road will be limited to small projects to connect with existing pathways and sidewalks.

Finally, the university should encourage the county to complete the north sections of the Cross-County Trail. This will connect even more residential areas to a greenway that will make it feasible for even more people to bike to work.

Recommendation: The task force recommends that the university continue to invest in making the on-campus road network appropriate for bicycles, with special attention given to the transition from the two light rail stations to the campus road network.

In addition, the task force recommends that the university work with the Charlotte DOT and Charlotte Parks and Recreation to complete the Multi-modal path along University City Boulevard, and that it advocate for the completion of other greenway projects that will link the university to more distant residential areas.

4.5.2. Bicycle Parking

A critical component of developing a “bike culture” on campus is the wide availability of securable bicycle parking. There is a “threshold effect” to bicycle parking – only once people become confident that they will always have a place to park near their destination will they view biking as a viable method for getting around campus.

The Sustainability Office of UNC Charlotte has been surveying bicycle parking availability and usage. These studies revealed a number of congested bicycle parking areas across the campus. Overall, the university has installed bicycle racks with a potential to park 1695 bicycles; but due to poor designs, damage, and installation errors, the estimated bicycle parking capacity of the campus is 1,033. Although the campus has added approximately one hundred new bike spaces per year in each of the past three years, these additions have been almost exactly offset by losses due to construction and breakage of existing racks. The 2007 Campus Circulation Master Plan lists industry standards for bicycle parking based on building type and occupancy (30% for housing, 18% for classroom, 5% for administration.) Based on those estimates the campus should have approximately 4,300 spaces. Thus, the campus appears to have only about one-third of the bicycle parking required to become a “bicycle-friendly” campus.

The campus has installed bicycle parking near most buildings. To address commuter-related congestion, the emphasis should be on bicycle parking at non-residential buildings. The current inventory of bicycle parking at non-residential buildings is 758 spaces: 415 in the core campus, 248 at CRI, and 118 other (e.g. parking decks, athletic facilities, etc.). With respect to the design criteria recommended in the 2007 Campus Circulation Master Plan, the CRI campus is closest to meeting the 18% of classroom seats criteria, but the campus core area has bicycle parking capacity of only 3% of classroom seating capacity. The worst conditions are in the Fretwell-Friday-McEniry-Denny area of campus, where 70 bicycle parking spaces serve over 5,100 classroom seats (ca. 1%). Bringing the campus core up to the 18% design criteria would require adding approximately 2,000 bicycle parking spaces.

The November 2015 Commuter survey allowed a response of “I have a bike on campus” to a question regarding bike rentals. Extrapolated to the full student, faculty, and staff population, the replies lead to an estimate of 2,100 bicycles on campus. While some of those bicycles will be stored at residence hall bike

racks (ca. 300 spaces), and in resident rooms and staff offices, the survey suggests that at the current level of bicycle racks, there is not a lot of capacity for adding more bicycle commuters.

Recommendation: The task force recommends adding bicycle parking in the campus core. Due to the heavy pedestrian traffic in the campus core, and to maintain the current aesthetic appeal of the campus core, new bicycle parking should emphasize locations that are near the busiest classroom buildings and dining facilities that can also be accessed from main roads with bicycle lanes. If racks are added to more interior locations, the task force recommends that they be installed in a way that complements the existing campus look and feel.

The current university bicycle parking design criteria (racks on brick paved pad) cost approximately \$280 per space; racks installed in an existing paved space cost approximately \$100/space. Co-benefits of installing bicycle racks include the avoided property damage to furnishings, trees, doorways, and building interiors. An estimate of the costs for installing 2,000 bicycle parking spaces range from \$200,000 to \$560,000.

4.5.3. Bicycle Lockers

The university has a bicycle locker program in the CRI, North and South decks and in Lot 27. Under this program faculty, staff, and students can rent lockers that provide security and weather-protection for bicycles. These lockers allow users to house securely their bicycles on campus, and presumably would allow somebody that parked in one of these remote decks to bicycle to the core of campus.

These lockers may well be useful in other parts of the campus as well. Faculty and staff in particular might be willing to use their personal bicycles for intra-campus commuting if they could be securely stored close to their work location. While some faculty and staff keep bicycles in their offices, it is almost certainly the case that the inconvenience of having a bike in an office prevents a wider usage of bikes by faculty and staff on campus.

Recommendation: The task force recommends installation of additional bicycle lockers in the core of campus.

4.5.4. Bicycle Enforcement

As biking becomes a bigger component of campus transportation, it will become more important to establish behavior norms and to regulate bicyclist behavior. Rules and policies already exist that govern issues such as where bikes can be locked and the direction that bikes must follow when on the roads. With the relatively light use of bikes on campus at present, however, enforcement has not had to be a priority. As the campus bike culture develops and the volume of bicyclists increases, however, enforcement of the rules will have to be given higher priority.

A particular concern for many members of the task force is that, unlike cars, bicycles have the ability to be ridden along non-road pathways. This has the potential to create conflicts and even collisions between bicyclists and pedestrians. As the volume of cyclists increases, the number and severity of such conflicts is likely to increase as well. It will be critical for the university to publicize and enforce the right-of-way rules and to establish social norms as to what is considered reasonable behavior while biking in heavy pedestrian areas.

Recommendation: The task force recommends that the campus place renewed emphasis on the enforcement of bicycle regulations. The task force understands that this would place increased costs on either PaTS or the Police Department, which would need to be further explored.

4.6 Pedestrian Infrastructure

There are a number of pedestrian infrastructure improvements that could also be made to enhance the appeal and safety of both walking while on campus and commuting to campus by walking. Some pedestrian safety improvements, such as those at the Mary Alexander Road intersection at East Mallard Creek Church Road, have already been discussed elsewhere. For brevity and readability those proposed improvements will not be discussed again here.

Recently the campus has made significant strides in pedestrian infrastructure improvements. Over the past two years the campus has added 1.7 miles of sidewalks and 0.6 miles of multiple-use trails. In addition, three major intersections were improved with pedestrian crossings with lighted signals. There are, however, gaps in the sidewalk and walkway network. In some places this is because of physical constraints, but in others appears to be a function of funding. The university should, where physically possible, bring all major roads up to a “Complete Streets” configuration, able to address 2-way traffic for motor vehicles, bicycles and pedestrians. About 0.8 miles of roads lack sidewalks (e.g. Poplar Terrace Drive serving student housing) and 1.4 miles of roads only have sidewalk on one side, for a total of 3.0 miles of sidewalk. Assuming that there are no physical barriers to the installation of sidewalks in these areas, a 6-foot wide brick sidewalk at \$12 per square foot would cost approximately \$1.15 Million. It should be noted that more expensive grading or boardwalks may be needed in some areas.

To encourage walking by commuters from off campus housing, the most critical improvements may be in the East Village section of campus. Pedestrians currently enter by walking in roadways and across parking lots, and make use of an unpaved gravel path across the Van Landingham Glen. These routes have multiple ADA-compliance issues. A pedestrian bridge across Van Landingham Glen was studied in 2015 after the Mary Alexander Road widening increased the grade on the gravel path to 28%. Cost estimates for this bridge were between \$1 million and \$2 million.

Recommendation: The task force recommends that the university continue to invest in the pedestrian infrastructure, with top priority being given to improving ADA access throughout campus and providing sidewalks and appropriate trails in the East Village portion of the campus.

5. Campus Operations

Campus congestion is affected by a number of factors, including university operations. Campus congestion ebbs and flows during the day, with notable peaks at 9:30 am and 5:00 pm. The task force looked at a number of options to address these significant peaks. The 5:00 pm congestion in particular looks to be the result of a confluence of three factors: the dismissal of classes at 4:45, the dismissal of office workers from the central core of campus at 5:00, and the buildup of rush-hour traffic on both highways 49 and 29 at the same time. In addition to daily congestion, the University clearly has a period of extraordinary congestion during the first week or two of the fall and spring semesters, with the fall semester in particular being highly disruptive.

To address these issues, the task force looked at a number of potential solutions including altering class schedules, employee schedules, and early-semester operations, each of which is discussed below.

5.1. Class Schedules

The university currently operates on a schedule that heavily favors two day a week classes, typically either Monday/Wednesday or Tuesday/Thursday. There are some classes that meet on Monday, Wednesday and Friday, but these are relatively few in number. As discussed below, there are a number of benefits and costs associated with the predominance of two day a week classes. One particular challenge is the timing of classes. Each class period is 75 minutes long, and the first class begins at 8:00 am. Table 7 presents the timing of two-day a week classes as they currently operate on the campus.

Table 7. Current Class Times for Two-Day a Week Classes

Period	Start	End
1	8:00 AM	9:15 AM
2	9:30 AM	10:45 AM
3	11:00 AM	12:15 PM
4	12:30 PM	1:45 PM
5	2:00 PM	3:15 PM
6	3:30 PM	4:45 PM
7	5:00 PM	6:15 PM
8	6:30 PM	7:45 PM
9	8:00 PM	9:15 PM

From a campus congestion viewpoint, the key problem is the transition from period six to period seven. Period six classes are dismissed at 4:45 pm. Because in general student parking lots are further from the center of campus than faculty/staff parking lots, this means that fairly large numbers of students are arriving at their cars at the same time that employees dismissed at 5:00 pm are arriving at their cars. The net result is that there are two waves of people that are attempting to leave campus at the same time. In addition, with the beginning of “evening” classes at 5:00 pm, there is a wave of new students that are just arriving on campus between 4:45 pm and 5:00 pm. This results in significant congestion from about 4:45 pm through 5:15 pm most days.

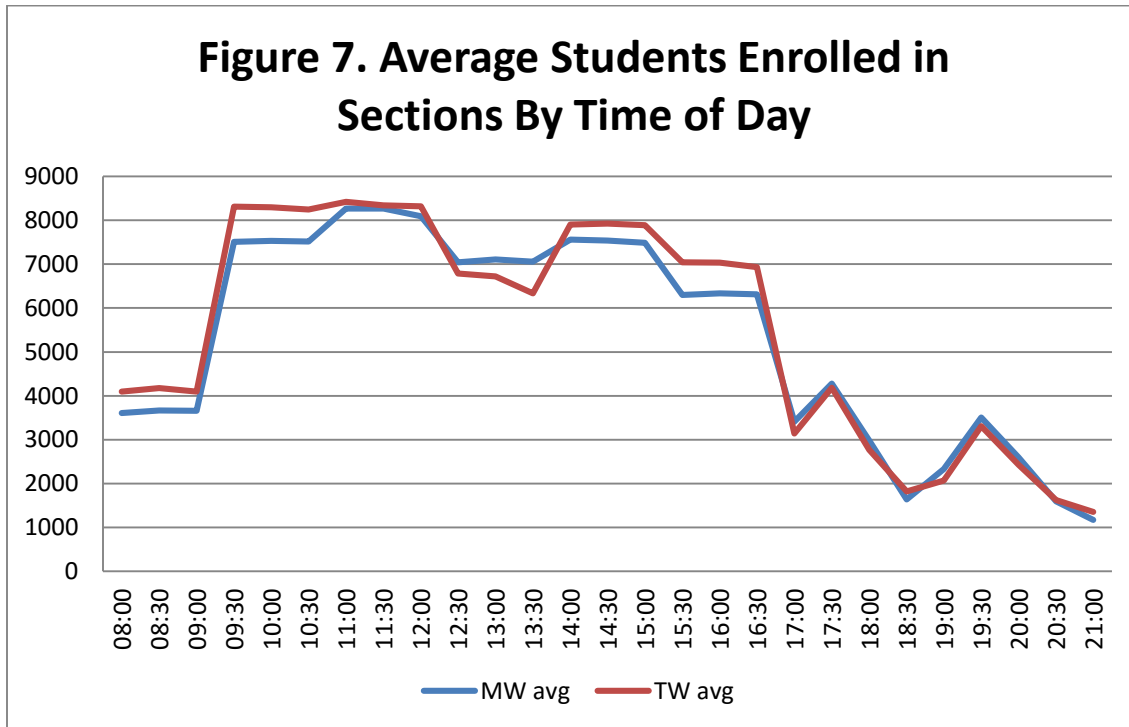
To understand the magnitude of the issue, it is worth looking at some data that was developed by the Office of Institutional Research. Table 8 presents ODS-estimated census enrollment of students in meeting at the specified times in the fall 2014 semester.

Table 8. Students Enrolled (ODS-estimated Census Enrollment) in Sections Meeting at the Indicated Times.

Time	Monday	Tuesday	Wednesday	Thursday	Friday
08:00	3247	4196	3973	3995	2781
09:00	3242	4201	4074	3989	2977
10:00	6675	8320	8390	8275	5544
11:00	7559	8328	8983	8511	5873
12:00	7430	8259	8763	8373	5347
13:00	6486	6913	7728	6528	4170
14:00	7220	8178	7905	7624	3100
15:00	7161	8151	7821	7623	2915
16:00	6155	7280	6520	6786	1391
17:00	3337	3568	3477	2707	392
18:00	2944	3203	3012	2338	62
19:00	2721	2533	1936	1608	30
20:00	2657	3188	2523	1666	10
21:00	1175	1835	1170	866	10

Source: Office of Institutional Research, ODS

Figure 7 presents the average Monday, Wednesday enrollments and Tuesday, Thursday enrollments with half-hour time intervals.



Two points become very clear from Table 8 and Figure 7. First, the number of students who take classes that begin at 9:30 am is essentially double the number of students that take classes that begin at 8:00 am. This is consistent with surveys conducted by PaTS and others that show the campus parking lots not

becoming very full until between 9:00 am and 10:00 am. Second, the number of students in classes is relatively constant from 9:30 am until 5:00 pm, at which point the number of students in classes drops to under half of the 4:00 pm enrollments. According to this data, one should expect that between 4:45 and 5:00 pm, a large number of students leave campus. This is consistent with the data in Table 3 that show that the number of student parking spaces available increases dramatically between 4:00 pm and 6:00 pm.

The problem with the data in Table 8 and Figure 7 is that they show only the net change in enrollment and does not show the aggregate arrivals and departures. For congestion purposes what is more important is the aggregate sum of departures and arrivals onto campus. Table 9 provides data that allows a better understanding of the likely student departures and arrivals onto campus.

To construct this table, the Office of Institutional Research identified two sets of students. The first was those students who live off-campus, had classes on the main campus that ended between 4:30 pm and 5:00 pm, and did not have class after 5:00 pm. These students are, in all likelihood, departing campus right at 5:00 pm. The second set of students was those who live off-campus, had a main-campus class that begins between 5:00 pm and 5:30 pm, and that did not have a class before 5:00 pm. This group of students would most likely be arriving on campus between 4:45 pm and 5:00 pm.

Based on these definitions, this table shows that number of aggregate student departures and arrivals is consistently between 3,200 and 4,050 students on Monday through Thursday between 4:45 pm and 5:00 pm. Not all of these transitions will necessarily occur via a car as some students walk, bike, or take public transportation, but, when combined with the parking data in Table 8 and Figure 7, it does seem highly probable that more than 3,000 students either arrive or depart by car right around 5:00 pm.

Table 9. Estimated Students Arriving and Departing from Campus between 4:45 pm and 5:00 pm.

Students Departing are defined as those students who have classes on the main campus ending between 4:30 pm and 5:00 pm who do not have classes after 5:00 pm and who do not live in on-campus housing. Students Arriving are defined as students who have main campus classes beginning between 5:00 pm and 5:30 pm who do not have classes before 5:00 pm and who do not live on campus.

Panel A. Fall 2015 Semester			
Day of Week	Students Departing	Students Arriving	Aggregate Transitions
Monday	2,962	754	3,716
Tuesday	3,104	774	3,878
Wednesday	3,362	678	4,040
Thursday	3,225	814	4,039
Panel B. Spring 2016 Semester			
Monday	2,599	653	3,252
Tuesday	2,962	754	3,716
Wednesday	2,986	589	3,575
Thursday	2,783	707	3,490

Source: Office of Institutional Research

The task force strongly feels that a key to reducing the severe campus congestion that happens around 5:00 pm each day is to alter the timing of the campus' transition from day to evening classes. The task

force saw two ways to do that. The first approach is to stretch out the transition longer, while the second approach is to move the transition time until after the bulk of university office workers have left for the day. Each is discussed below.

5.1.1. Stretching the Day to Evening Transition

Currently, the transition from day to evening classes occurs in a fifteen-minute window – from 4:45 pm to 5:00 pm. A relatively easy change is to build a longer break for that transition by moving the starting time for the first evening class from 5:00 pm to 5:30 pm. This would move all evening class back by 30 minutes as shown in Table 10.

Table 10. Proposed Class Schedule – Evening Classes start at 5:30 pm

Period	Start	End
1	8:00 AM	9:15 AM
2	9:30 AM	10:45 AM
3	11:00 AM	12:15 PM
4	12:30 PM	1:45 PM
5	2:00 PM	3:15 PM
6	3:30 PM	4:45 PM
7	5:30 PM	6:45 PM
8	7:00 PM	8:15 PM
9	8:30 PM	9:45 PM

There are three benefits to this approach which are listed below.

1. Day students and campus office workers will have had more time to leave the campus before the evening students begin arriving.
2. The current day schedule is not affected. This is when the bulk of on-campus classes occur, and so the change to campus operations would be relatively minimal.
3. Pushing the first evening class to 5:30 pm would make it easier for students coming from uptown to arrive on campus. Traffic on I-85 northbound from uptown as well as on University City Boulevard near campus is a significant obstacle for students attempting to make a 5:00 pm class. Although traffic is still an issue at 5:30 pm, it would give students more travel time.

There are drawbacks as well, however.

1. Day students will still be exiting the campus at the same time that office workers are exiting the campus. As shown in Table 9, the number of departing students is three to four times the number of arriving students. Having the arriving students come later will help relieve congestion, but there would likely still be noticeable congestion at 5:00 pm.
2. The ninth class period of the day will begin at 8:30 pm as opposed to the current 8:00 pm. Although there are not many classes scheduled this late, there are some and this would push the academic day later.

5.1.2. Changing Time of the Day to Evening Transition

The second approach the task force examined was a more dramatic change that would result in the campus returning to a more traditional five days a week class schedule. This would involve having courses that meet on MWF having different timing than courses that meet on TR. By carefully developing the schedule, however, the campus could insure that on every day of the week the transition from day to

evening classes occurred after 5:00 pm, so that campus office workers would largely be gone by the time the student transition occurred.

Table 11 presents proposed MWF and TR class schedules. In developing these schedules, the task force was influenced by a report of a Classroom Scheduling Committee that was commissioned by Academic Affairs, and largely consisted of Associate Deans from the colleges. That committee looked at a variety of scheduling and classroom-use issues, including the potential to returning to MWF scheduling. The committee found that there were no compelling pedagogical reasons for selecting MWF or MW class schedules. Some types of classes benefit more from MWF classes and some, such as clinical-based or student-teaching based courses, benefit more from MW classes. Ultimately the committee said that in the absence of a clear and compelling pedagogical reason, the decision should be made based on campus operations.

The Classroom Scheduling Committee did recommend, however, that if the campus moved to MWF classes, it should do so only for classes that begin before 2:00 pm. Later classes should retain a MW only schedule. Currently the campus culture is such that students are willing to enroll in late afternoon classes that meet on MW. The committee members were very skeptical that students would be willing to enroll in the same numbers for classes that had a late Friday afternoon meeting session. The concern was that this would result in a decrease in the use of classrooms in the late afternoon on Monday and Wednesday, times with currently heavy utilization. Further, the committee noted that running MWF classes in the morning and early afternoon but MW classes in the late afternoon was consistent with scheduling practices at other UNC system institutions.

The proposed schedule in Table 11 reflects these recommendations. On MWF, the class schedule begins at 8:00 am and class periods last for 50 minutes until 2:30 pm. Classes that begin at 2:30 pm or later last for one hour and fifteen minutes, and, in general, are not expected to meet on Fridays.² On Tuesday and Thursdays, classes begin at 8:30 am and last for one hour and fifteen minutes.

Table 11. Proposed Schedules with a return to Monday, Wednesday, Friday Classes.

Monday, Wednesday, Friday Schedule			Tuesday, Thursday Schedule		
Period	Start	End	Period	Start	End
1	8:00 AM	8:50 AM	1	8:30 AM	9:45 AM
2	9:05 AM	9:55 AM	2	10:00 AM	11:15 AM
3	10:10 AM	11:00 AM	3	11:30 AM	12:45 PM
4	11:15 AM	12:05 PM	4	1:00 PM	2:15 PM
5	12:20 PM	1:10 PM	5	2:30 PM	3:45 PM
6	1:25 PM	2:15 PM	6	4:00 PM	5:15 PM
7	2:30 PM	3:45 PM	7	5:30 PM	6:45 PM
8	4:00 PM	5:15 PM	8	7:00 PM	8:15 PM
9	5:30 PM	6:45 PM	9	8:30 PM	9:45 PM
10	7:00 PM	8:15 PM			
11	8:30 PM	9:45 PM			

² Departments could continue to run 50 minutes MWF classes after 2:30 pm if they elected to do so, but the next class period would still begin one hour and fifteen minutes later.

The Campus Congestion Task Force identified a number of benefits to this schedule which are discussed below.

1. The transition from day to evening classes occurs from 5:15 pm to 5:30 pm every day of the week. This gives time for office workers to leave the campus before that transition occurs.
2. Many staff members in Facilities Management work 7:00 am to 3:30 pm schedules. Under this proposed schedule they will have time to exit campus before a class time transition that begins at 3:45 pm. Under the current scheduling system, which is shown in Table 7, there is a class change that happens from 3:15 pm to 3:30 pm, meaning the Facilities Management employees and some students are exiting at the same time. This creates congestion, especially at the Mary Alexander Road and Cameron Boulevard intersection.
3. On Tuesdays and Thursdays, classes start at 8:30 am. This might help reduce congestion caused by both students and employees attempting to get to campus at 8:00 am. The task force, based on both parking availability data and enrollment data, came to the conclusion that students are likely not a major source of campus congestion at 8:00 am. Still, this schedule would allow for a straightforward natural experiment to see if students are a major contributor to early morning congestion. If it turns out that early morning congestion became markedly less on Tuesdays and Thursdays, the Monday, Wednesday, Friday schedule could be altered to have students arrive 15 minutes earlier or later than 8:00 am.
4. This schedule should result in heavier utilization of campus classrooms on Friday, and it should be the case that MW afternoon classes will remain popular and hence classroom utilization will remain strong.
5. Currently academic departments are required to schedule twenty percent of their classes to have a Friday meeting component. The most common way they meet this requirement is by scheduling classes that meet two days a week on Wednesday and Friday. When coupled with the heavy Monday and Wednesday class schedules, classroom availability on Wednesdays is a binding constraint. This schedule will result in fewer classroom scheduling conflicts on Wednesdays.
6. Unlike the schedule in Table 10, all class-change times are a consistent 15 minutes.

There are, however, a few drawbacks to this schedule.

1. One Monday, Wednesday, and Fridays the campus would have 6 class transitions before 2:30 pm. Currently, the campus has 5 class transitions before 2:30. This could result in more turnover of students in that time – which could potentially increase congestion.
2. As noted in the Committee report to Academic Affairs, MWF classes result in a slightly less efficient use of classroom space because there are more class transitions. Under a two day a week schedule, a classroom is required to be blocked off for a total of three hours, in order to meet the required two hours and thirty minutes of class time for a three credit hour course as well as thirty

minutes of class change time. Under a three day a week schedule a classroom must be blocked off for a total of three hours and fifteen minutes, again including class transition time.

3. Pushing the start of Tuesday, Thursday classes until 8:30 am results in there being one fewer class available, assuming the university is unwilling to run a class from 10:00 pm to 11:15 pm.

Recommendation: After looking carefully at the current scheduling system, and at the proposed schedules in Tables 10 and 11, the task force came to the conclusion that the schedule which would best alleviate campus congestion is the five day a week schedule listed in Table 11.

5.2. Employee Schedules

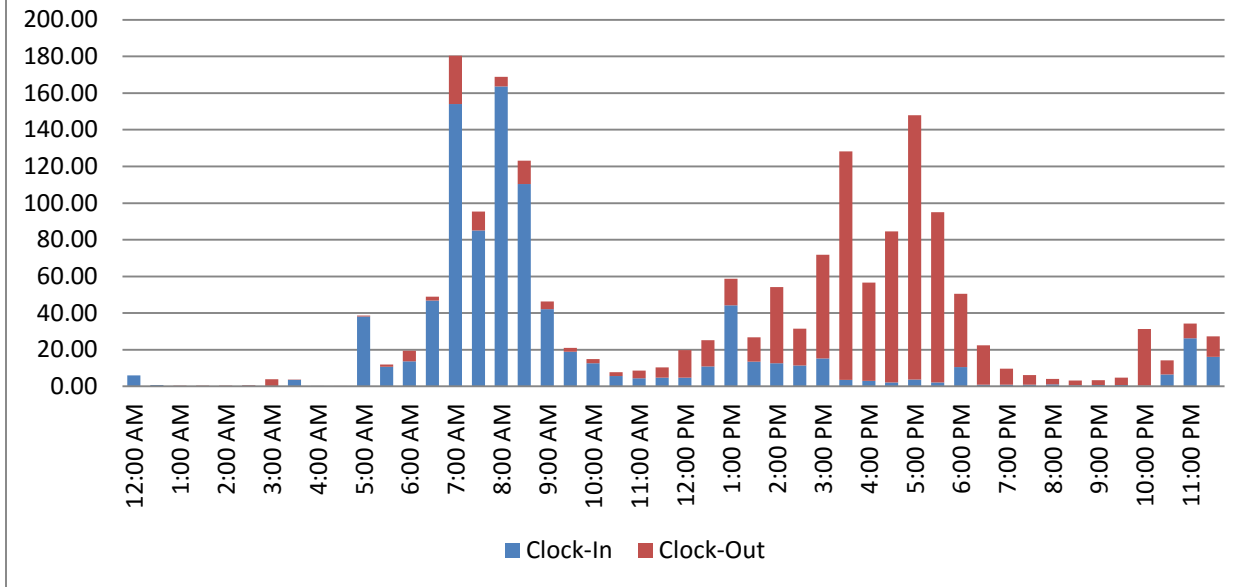
In addition to students, the other group which transitions on to and off of campus is employees. The university has between 3,200 and 3,300 full-time employees including faculty, SHRA and EHRA staff. In addition to regular university employees there are also a relatively large number of temporary employees and contractors who commute to and from campus each day.

To get a sense of the timing of employee transitions to and from the campus, the task force worked with Human Resources to gather data. In particular, the task force was able to obtain data in the Kronos system regarding the starting and stopping times of slightly more than nine hundred SHRA employees.³ While these data represent only a little less than a third of all university employees, the task force felt it was still a very good indicator of overall non-faculty trends. Of the remaining employees, more than half were faculty members, who have much more flexible schedules than other employees and who can, to a very large degree, time their arrival to and exit from campus to avoid peak congestion times.

Figure 8 presents the average number of SHRA employees who have scheduled clock-in or clock-out times in Kronos for thirty minute increments throughout the day. The blue columns represent clock-in times and the red columns are clock-out times.

³ Note that the task force only received aggregated and de-personalized data. The task force did not have access to any individual-level data.

Figure 8 - Average Aggregate Number of SHRA Employee Transitions by Time of Day



Assuming that these clock-in/clock-out data highly correlate with SHRA employee arrival and departure times, it is possible to draw the following conclusions:

- A substantial number of employees arrive on campus by 7:30 am., largely avoiding congestion with students arriving for 8:00 am classes.
- The morning employee “rush hour” is more concentrated – with the majority of employees arriving at 7:00 am, 7:30 am, or 8:00 am.
- The evening “rush-hour” is more diffuse, with substantial numbers of employees departing at 3:30 pm

It is helpful to look at the breakdown of employee arrivals and departures by employing division. For ease of readability, these data are presented in two charts. Figure 9 presents the average number of SHRA employees who have Kronos clock-in times by employing division in thirty minute increments. Figure 10 present the average number of SHRA employees who have Kronos clock-in times by employing division in thirty minute increments.

Figure 9 - Average Number of SHRA Employees with Kronos Clock-In Times by Division and Time of Day

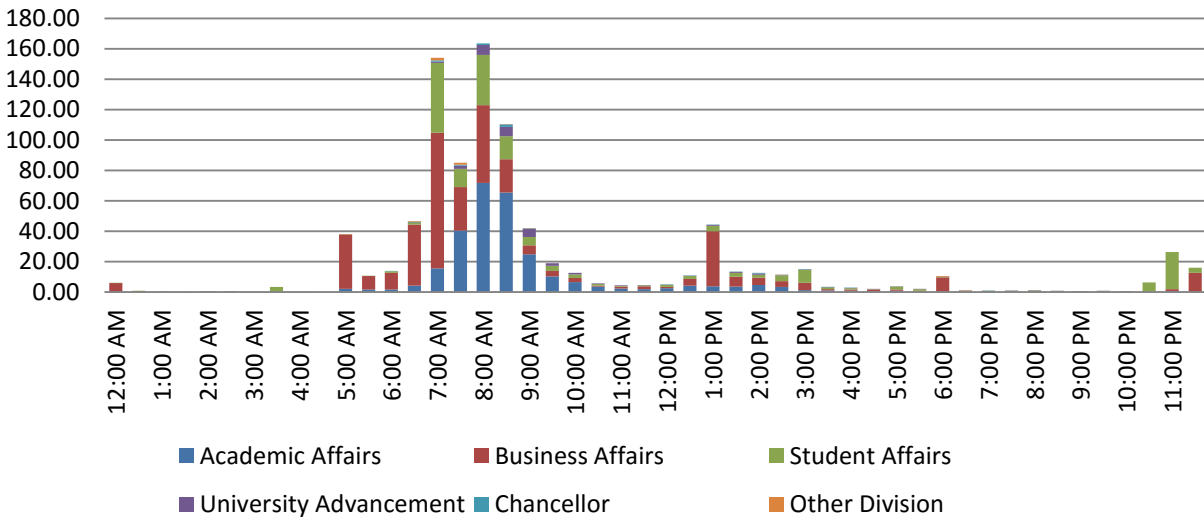
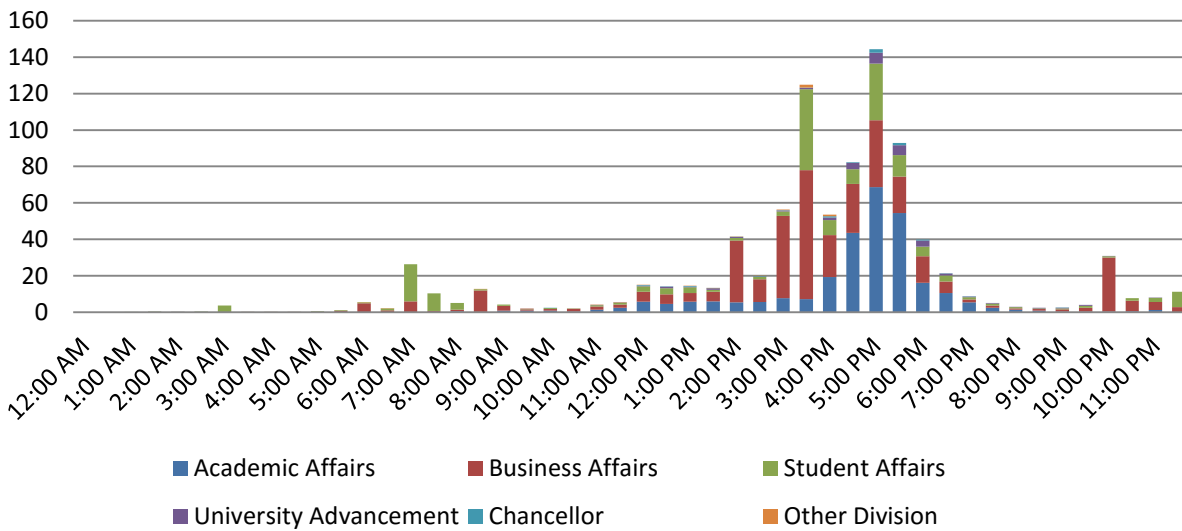


Figure 10 - Average Number of SHRA Employees with Kronos Clock-Out Times by Division and Time of Day



These two graphs demonstrate a couple of critical points. First, a substantial number of Business Affairs and Student Affairs SHRA employees arrive before or at 7:00 am each day. Employee clock-in times in

Academic Affairs is more tightly clustered around an 8:00 am start time. This is also reflected in the clock-out times in Figure 8. The bulk of Business Affairs employees have clock-out times before 4:00 pm, and the predominant departure time for Academic Affairs Employees is centered on 5:00 pm.

Under the current class scheduling system (Table 7), there is a class dismissal at 4:45 pm. To make a substantial effect on minimizing congestion, a substantial number of Academic Affairs employees would need to be dismissed at 4:00 pm or 4:15 pm, to allow these employees time to get to their cars and to exit the campus. Under the schedule proposed in Table 11, these employees could be dismissed at 4:45 pm and they would still have time to exit the campus prior to the students leaving.

In looking at the overall data, however, the task force was struck by the disparity between employee numbers and student numbers. The sheer scale of student numbers is such that the task force strongly felt that this was where the opportunities for gains were the largest. That said, the task force did recognize that there are some changes to employee schedules that could make differences at the margin, and they are presented in the recommendations below.

Recommendation: The task force recommends encouraging employees in Academic Affairs to leave 30 minutes prior to the class change that occurs nearest to 5:00 pm. If the University retains the current class schedule, this would mean encouraging these employees to leave at 4:15 pm. If the University adopted the class schedule proposed in Table 11, these employees would be encouraged to leave at 4:45 pm.

5.3. Employee Work and Transit Options

In addition to adjusting work-schedules, the task force noted that there are other changes to employee work policies and time policies that could also have some effect on congestion. Currently, the university allows some employees to telecommute to some degree. The university could encourage the expansion of telecommuting, especially for positions that are IT-related or which do not directly engage with the public.

In addition to encouraging employees to use public transportation, the university could encourage more employees to ride-share and carpool. Although this option has been available on campus for many years, the number of people taking advantage of it is relatively small. Making employees aware of the ride-share option, and perhaps subsidizing parking for employees who agree to ride-share could improve the response rate.

One challenge for some employees is that their work locations may not be close enough to campus dining options. These employees may feel that they do not have time on their lunch break to walk to a campus dining facility, eat, and walk back to their work location. Proposed improvements to the campus transit system should help with this, but it might also be beneficial to allow and publicize greater flexibility in terms of lunch times to allow employees, and especially those in more remote locations, to walk to on-campus dining.

Recommendation: The task force recommends that the university encourage greater telecommuting, increased use of ride-share, and greater flexibility with employee lunch times.

5.4. Early Semester Operations

Campus congestion is a particular challenge during the first week or two of each semester. While some aspects of this are undoubtedly a function of new students to the university being unfamiliar with campus roads, parking, and transit, there also appears to be operational issues that could be addressed to reduce the extreme early semester congestion.

5.4.1. Student Parking Pass Issuance

One significant issue is that many students wait until the semester starts to purchase parking passes. This results in two problems at the beginning of each semester. First, the students without parking passes will attempt to park in visitor parking and they quickly fill up all visitor parking spaces. This causes other students to “search” for visitor parking, greatly increasing congestion. Second, because so many students do wait until classes start to buy a pass, the lines to purchase parking passes tend to be long, especially on the first day of class. This causes some students to wait a few days longer and lengthens the duration of the early semester parking problem. Adding to the delay of students purchasing their parking permits is the fact that student financial aid typically does not get disbursed until the first day of the semester. This forces many students who use their financial aid to pay for the parking permit to wait to purchase.

Parking and Transportation Services is in the process of developing and implementing two changes to address these issues. First, PaTS intends to offer a low-cost parking option in the North Deck for the first two to three days of class for the Fall, 2016 semester. This system would use the same print-at-home parking pass system that is currently used for football parking. This will allow students to have a legal place to park for the first few days without their having to search for visitor parking. It will be critical for students to be made broadly aware of this option in order for it to have an effect.

Second, PaTS is putting in place an incentive for students to purchase their full parking pass before the semester begins. Specifically, PaTS will hold a drawing to reimburse two students for the cost of their full-year parking pass from among the students that purchase their parking passes prior to August 5th, 2016. The expectation is that this will encourage more students to purchase passes before the first day of class.

Recommendation: The task force endorses the steps PaTS will be taking for the Fall, 2016 semester. In addition, the task force further recommends that PaTS actively direct students away from visitor parking during the first week of the semester.

5.4.2. Active Gridlock Prevention

One difficult problem at the beginning of the semester is that traffic in certain parts of campus can become completely gridlocked. In particular, exiting traffic at the John Kirk/Van Landingham exit from campus can back up all the way through the Mary Alexander traffic circle, through the Broadrick Boulevard traffic circle, and onto southbound University City Boulevard. This appears to result in congestion coming “full circle” back to the intersection at John Kirk/University City Boulevard.

The two on-campus traffic circles offer the best opportunities to break this gridlock. When traffic backs up to the point that it nears total gridlock, drivers could be directed to continue following Mary Alexander to exit campus onto East Mallard Creek Church Road. Drivers who were originally intending to park in one of the East Decks could follow Mary Alexander Road to Cameron Boulevard and head east to park in Lots 5 or 6, or turn left to park in North Deck. Because of the length of Mary Alexander Road, and the

presence of traffic signals at both Cameron Boulevard and East Mallard Creek Church Road, this appears to be the best place to relieve the gridlock congestion.

It is also possible to relieve the gridlock at the Broadrick Boulevard traffic circle, although it might not be as efficient at the Mary Alexander traffic circle. At Broadrick Boulevard, drivers could be prevented from entering Mary Alexander Road and instead be directed to either continue following Broadrick Boulevard toward the decks and lots on University Road, or they could be diverted to Alumni Way and the South Village parking deck. The challenge with diverting large numbers of inbound cars toward University Road is that the decks in that area are relatively small and it is relatively easy for congestion to form there. Diverting to South Village Deck may make more sense, but doing so would likely require interrupting traffic flowing outbound on Broadrick Boulevard as it approaches the traffic circle.

Using the two traffic circles to break the gridlock on Mary Alexander/Van Landingham Roads would require stationing either police officers or PaTS employees at the two traffic circles, and coordinating them in real-time so that they would know when to divert traffic. This would be costly, but given the relatively short duration of the problem to the first two weeks of class, this should be a manageable expense.

Recommendation: The task force recommends that traffic be manually diverted at the Broadrick Road and Mary Alexander traffic circles to relieve and prevent gridlock on Mary Alexander/Van Landingham Roads from spilling onto University City Boulevard.

5.5. Centralization of State Vehicle Fleet

One contributor to campus vehicular congestion is university state-owned vehicles. These vehicles are becoming more and more prominent in the inner-core of campus, driving and parking on sidewalks, grassy common areas, and directly outside buildings. In addition, the increase in university state-owned vehicle purchases poses a large challenge when attempting to find places for these vehicles to park when not in-use.

Recommendation: The task force recommends the centralization of the University's state-owned vehicle fleet, providing the ability to screen vehicle purchases, monitor vehicle usage and standardize the fleet, making it more efficient to service. The task force also recommends instituting a central state-vehicle "pool", similar to a rental car program, but would include the same type of technology used in the car-sharing program. When an employee requires the use of a vehicle, they schedule through an automated on-line program, then access the vehicle during their reservation by tapping a card at a reader on the front windshield of the state vehicle which will open the door and permit the employee to use the vehicle. This system would also track usage by individual and department for proper billing. A system such as this would allow the campus to consolidate some of the vehicles and improve utilization rates, while also cutting down on campus congestion by lowering the number of university state-owned vehicles on campus.

5.6. Central Receiving / Deliveries

Another component to UNC Charlotte's current vehicular congestion problem is the decentralization of campus deliveries and receiving of shipments. The university's current Receiving area is inadequate for the rapidly-growing campus and is extremely challenging for larger vehicles to access. This forces deliveries to be dropped-off by the delivery company at the front doors of the campus buildings every

time there is a delivery. Many times, these delivery drivers aren't sure where to go, forcing them to unnecessarily drive around campus, adding to the congestion problems.

Recommendation: Vendors (i.e. delivery trucks) should have one point-of-contact (PoC) on campus and should only go to one campus location to make their deliveries. From there, the university could aggregate all packages/shipments and deliver to the campus buildings in a more efficient manner. This would eliminate trucks driving around campus searching for delivery locations. The PoC could direct the vehicles to the easiest route and put them in touch with the receiver. During campus events, a pre-determined route for deliveries could be implemented, eliminating any confusion or further congestion.

5.7 Centralized Motor Coach Contracting

Finally, the task force also looked at how the university handles motor coach contracting. Currently units on campus are allowed to contract individually with motor coach vendors for transportation. One result of this is that there is no coordination as to the timing or location of the arrival of these motor coaches on campus. This results in motor coaches arriving at peak hours, and frequently with little or no direction as to where to go on campus. Centralizing the contracting of motor coaches through PaTS would allow for standardization of directions and coordination around peak transit times on campus.

Recommendation: The task force recommends that all motor coach contracting be done centrally through PaTS.

6. Summary

The Campus Congestion Task Force was comprised of a wide-cross section of the campus, including students, faculty, and staff. The task force was given a very broad mandate and broad authority to examine a wide variety of campus policies, procedures and operations.

In its analysis the task force developed 34 specific recommendations that collectively will reduce campus congestion. These recommendations covered a wide range of topics and have varying degrees of implementation ease. Of these recommendations, the ones the task force felt would have the most immediate effect on campus congestion are listed below.

- Extend the right turn lane on Broadrick Boulevard completely to the Broadrick Boulevard/Mary Alexander Road traffic circle.
- Provide a protected left turn from Mary Alexander Road to East Mallard Creek Church Road.
- Move the electrical box at the entrance to East Deck 2 to improve driver visibility.
- Close Craver Road to non-official traffic between 7:30 am and 6:00 pm each weekday.
- Implement location-based pricing for campus parking.
 - Designate the CRI and North decks as remote parking, and price them as remote parking. This will encourage commuters to park there and reduce congestion in the core of campus.
 - Increase the cost to park in certain areas in the core of campus to encourage commuters to park in more distant locations.
- Revise the pricing of visitor parking on campus to remove incentives for students to use visitor parking in lieu of purchasing a parking pass.
- Provide a mechanism so that commuter students can buy a daily “on demand” parking pass to the commuter lots in a convenient way.
- Modify the campus bus routes to improve reliability and speed.
- Provide bicycle parking in the academic core of campus.
- Modify the campus class schedule so that classes which currently end at 4:45 pm would end at 5:15 pm. This can be most efficiently done by changing from the current MW class schedule to a MWF class schedule.
- Encourage staff schedules to be modified to allow staff to leave at 4:30 pm or 4:45 pm. This, coupled with class schedule changes, would help alleviate the severe congestion at 5:00 pm.