Chapel Hill Town Center

Alternative Transportation Level of Service

Master's Project
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April 14, 2004

CHAPEL HILL TOWN CENTER
ALTERNATIVE TRANSPORTATION LEVEL OF SERVICE

by

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A Masters Project submitted to the faculty
of the University of North Carolina at Chapel Hill
in partial fulfillment of the requirements
for the degree of Master of Regional Planning
in the Department of City and Regional Planning.

Chapel Hill

2004

Approved by:

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ADVISOR

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EXECUTIVE SUMMARY

There are two main objectives addressed in this paper. The first objective is to show how various level of service models that have been developed for pedestrian, bicycle, and transit facilities compare with each other. The second is to use these level of service models to determine the level of service provided for alternative transportation modes in the Chapel Hill Town Center and use the results to show locations in need of facility or service improvements.

Level of service (LOS) is a concept used to illustrate the service being provided by a given transportation facility. The service can be graded on a letter grade scale from A to F (A being best and F being worst). Many different methods and approaches to level of service have been discussed in scholarly literature. Traditionally, level of service has been measured as a function of the volume of users on a facility and the capacity of the facility—this concept is usually applied to highways, but capacity-based methods of measuring level of service have been developed for many modes of transportation, including the pedestrian, bicycle, and transit modes. This capacity-based approach to level of service has come under criticism lately for not adequately measuring the quality of service being provided and for focusing on mobility instead of accessibility. New level of service measures have been developed that incorporate physical characteristics of destinations and the environment into pedestrian and bicycle level of service and incorporate transit service quality measures into transit level of service. Several of these models are examined in this paper, and applied to a portion of Downtown Chapel Hill in order to find similarities and differences between the models, potential flaws in their application, and to begin looking for ways to integrate the models.

There are five models used in this analysis. For pedestrian facilities, the Pedestrian Level Of Service (PLOS) model and Fruin method are used to determine level of service. The PLOS method was developed by Sprinkle Consulting and uses a regression model based on certain sidewalk, roadway, and environmental characteristics to determine level of service. The Fruin method comes from the *Highway Capacity Manual* and is based on a volume-to-capacity ratio for a sidewalk facility. The Bicycle Level Of Service (BLOS) model and Bicycle Compatibility Index (BCI) model are used to measure bicycle level of service. The BLOS model was developed by Sprinkle (as a companion to the PLOS model discussed above); it uses a regression formula based on roadway and environmental characteristics to determine level of service. The BCI method was developed by the Federal Highway Administration as a tool to determine the compatibility of motor vehicle and bicycle traffic on a given roadway—in doing so, the BCI also provides a measure of the quality of bicycle service along a given road segment (or level of service). Transit Level Of Service (TLOS), a model developed by the Florida Department of Transportation to measure transit level of service based on service frequency and hours of transit service, is used to measure transit level of service.

The models discussed above are applied to a study area in the Town Center area of Chapel Hill, North Carolina. In general, the models produced a varied picture of the quality of transportation services in this study area. The results of the Fruin method showed level of service “A” throughout the

study area, while the PLOS model found some areas with adequate pedestrian facilities and others with failing level of service grades. The BLOS and BCI results showed many of the same deficient facilities in terms of bicycle accommodation, but also contained important differences. The BCI results appeared to be biased against narrow low-volume roads, so a new grading scale was developed to offset this effect. The TLOS analysis was done looking at service frequency in isolation and looking at service frequency and hours of service together. The results of these analyses were similar to each other, and highlighted the same problem areas. In general, except for the Fruin method, which produced very skewed results, the various models produced results that seemed reasonable in isolation and in comparison with each other.

Many road segments in the Town Center study area are found to be deficient in the results of these models. Many different mitigation strategies may be appropriately applied to improve these segments. Some of the recommended mitigation measures include the provision of new sidewalks and bicycle lanes, the addition of transit service, the retiming of transit service, and the addition or removal of on-street parking. The mitigation strategies presented in this paper are not prioritized, but it is recommended that level of service raw scores could be used to determine which improvements receive priority in implementation. The mitigation strategies presented are also only given as a suggested guideline—any actual improvements would need to be determined by the appropriate town agencies and officials.

In general, the analysis found the following areas to be most deficient in terms of current service:

Pedestrian: local side streets; areas near the UNC campus; Rosemary Street; and Hillsborough Street

Bicycle: areas near the UNC campus (especially Columbia Street); portions of Franklin, Cameron, and Rosemary Streets; and local side streets (especially narrow streets with on-street parking)

Transit: the Rosemary Street and Cameron Avenue corridors and West Franklin Street (especially westbound)

PART ONE: LEVEL OF SERVICE ANALYSES

SECTION I: INTRODUCTION

Level of Service (LOS) is a transportation concept that has been much maligned in recent years due to its questionable use in the past. Traditionally, LOS has been used to measure the mobility provided by highway facilities—usually this would be defined by either a ratio (such as volume to capacity) or a value (such as average wait time at an intersection) which could then be translated into a letter grade (from A to F) based on scales provided in the *Highway Capacity Manual*. What this produced was a method of judging the quality of transportation facilities that was skewed toward the idea that *more is better*. Over time, this capacity-based concept of LOS became so entrenched in the standard transportation planning process that similar methods were developed for computing pedestrian, bicycle, and transit LOS based on the same volume-to-capacity and dwell time characteristics.

Recently, however, new techniques for computing level of service have been developed. These new techniques look not only at volume and capacity of traffic on a facility, but also at the accessibility of facilities and the physical quality of facilities and their immediate surroundings. By using these new ways of calculating level of service in conjunction with the older capacity-based methods, it may be possible to develop a more balanced assessment of the quality of transportation facilities—especially pedestrian, bicycle, and transit facilities, where reaching vehicle or facility capacity tends to be less prominent as a determining factor in trip quality.

This paper utilizes a selection of LOS measures that have been developed for pedestrian, bicycle, and transit facilities. These methods are applied to the Town Center of Chapel Hill, a small city in central North Carolina. Chapel Hill's Town Center is an example of the type of area where pedestrian, bicycle, and transit quality are especially important: the area has a scarce amount of available parking for vehicles, is adjacent to a university campus (where there is likely to be more use of alternative transportation modes), and the area is characterized by stores and other land uses that are only directly accessible by foot. For this area to remain economically vibrant, the town must be willing to invest in improvements to pedestrian, bicycle, and transit facilities and services in this area. The LOS calculations generated by this process are intended to provide policymakers with guidance on the areas that need the most improvement and what types of improvement measures might be necessary.

SECTION II: LITERATURE REVIEW

Level of Service Concept:

In order to determine the quality of existing and planned transportation facilities it is necessary to operationalize the various factors that influence this and measure them in an objective way. One way to do this is through the concept of "Level of Service," or LOS. The LOS concept was developed by highway engineers in the 1950s as a method of measuring the level of mobility provided by a certain facility (FDOT, 2002). In transportation parlance, mobility is defined by how much traffic is able to move through a facility (capacity); accessibility, on the other hand, is defined by how easy or difficult it is for vehicles to move between the transportation facility and the land uses and development that surround the facility (Meyer and Miller, 2001). Traditional methods for

computing LOS have focused on mobility, at the expense of accessibility. One focus of this paper is to utilize LOS methodologies that are focused more on physical quality and accessibility of transportation facilities rather than the traditional capacity/mobility focus.

Level of Service is a concept that is well documented in planning and engineering literature. Generally, LOS is determined as a function of capacity and volume. Meyer and Miller (2001) define level of service as "a measure that describes performance conditions in terms of operational characteristics of interest to users, for example, speed and travel time, freedom to maneuver, and comfort and convenience." This concept of level of service can be applied to any mode of transportation. Level of service is typically measured on a scale from A to F (similar to letter grades in school, with A being best and F being worst). Facility capacity is often the dominant feature in determining level of service (as determined using the Transportation Research Board's *Highway Capacity Manual*), but need not be. Level of service is only one measure of transportation system performance, and is not a comprehensive measure; however, LOS analyses can be very useful in finding deficiencies in a transportation system (Meyer and Miller, 2001).

Automobile level of service is almost always computed using the methods outlined in the *Highway Capacity Manual*, the standard methodological guide in the United States for level of service computations (FDOT, 2002). This guidebook is focused primarily on the capacity of facilities, as its name suggests. Conceptually, capacity is the maximum number of vehicles (or users) that can physically use a transportation facility at a given time. Capacity is computed as a function of vehicle density, vehicle speed, and vehicle flow. As a result of this capacity/demand-oriented approach (as opposed to a quality or accessibility approach) to computing level of service, the *Highway Capacity Manual* focuses entirely on physical roadway characteristics (such as number of lanes, lane width, and presence of on-street parking) and use characteristics (existing vehicle volumes and turning movements and projected figures) as determinant factors (TRB, 2000). Another method for computing automobile LOS, presented by Meyer and Miller, which is a simplified version of the method presented in the *Highway Capacity Manual*, is based on traffic volumes and a series of other characteristics that are combined into a classification system—in this case the classifications are a simplified proxy for facility capacity and the analysis consists of a simple volume-to-capacity ratio (Meyer and Miller, 2001).

An important consequence of using a capacity/demand approach to determine level of service is that mobility is prioritzed and accessibility is ignored as a measure of service quality. Mobility is a measure of how easily a user can move through a facility; accessibility, on the other hand, measures how easily a user can reach a destination using a facility. By ignoring accessibility, traditional level of service methodologies do not accurately represent the true level of service being provided, especially since facilities that provide lower mobility likely provide higher accessibility in many cases (Levine and Garb, 2002).

For modes of transportation other than private automobiles (for which the *Highway Capacity Manual* method, though flawed, is generally used), there is less agreement among transportation planners and engineers as to an acceptable

approach for computing level of service. The Transportation Research Board has developed a *Transit Capacity and Quality of Service Manual* (TCQSM) that outlines many different methods of computing LOS for transit services based on capacity/mobility, accessibility, and quality measures (Kittelson, 1999). Some authors suggest that characteristics of the built urban environment (Jaskiewicz) or the social or policy environment of a place (Hoehner et al., 2003) are also factors that influence the level of service that a person perceives oneself as receiving from a particular non-automobile facility. Many other factors can also be considered in computing level of service. Perhaps the larger argument is that capacity is not an adequate approach for determining level of service for pedestrian, bicycle, and transit facilities. On these facilities, capacity (the maximum number of persons or vehicles that can use the available space at a given time) is usually not close to being reached or exceeded—instead, some authors argue that other factors (both qualitative and quantitative) should be examined with regard to the *quality* of service being provided (Kittelson, 1999). Nevertheless, the *Highway Capacity Manual* does contain methods for calculating level of service for pedestrian, bicycle, and transit facilities based on a capacity approach (TRB, 2000).

Level of Service Models for Pedestrian, Bicycle, and Transit Facilities:

Recently, there has been a new focus on walking and bicycling both as modes of transportation and as healthy physical activities. Recent attention has been focused on increasing physical activity, and incorporating this activity into everyday activities (such as travel) is seen as one way to do this (Hoehner et al., 2003). Many different instruments have been developed, which attempt to quantify a level of service for these active transportation modes. Many of these are environmental audit instruments. Pikora et al. developed the Systematic Pedestrian and Cycling Environmental Scan (SPACES) audit instrument, which involved surveyors filling out a worksheet about the physical characteristics of the pedestrian and bicycle facilities and the adjacent streets (width, slope, speed, permeability, etc.), personal safety, traffic safety, aesthetic qualities (streetscape and views), and access to destinations such as parks, schools, and shops (Pikora et al., 2002).

Emery et al. studied the effectiveness of two other instruments for measuring level of service. Their pedestrian facility instrument considered sidewalk presence, material, condition, and width; roadway traffic volume, speed, and number of lanes; lighting; buffer width; and presence of ramps. The bicycle facility instrument that the authors tested was based on roadway characteristics (including traffic volume, speed, frequency of curves, grades, number of lanes, presence of turn lanes, presence of bike lanes or paths, etc.) only (Emery et al., 2003).

A more aggregate approach to categorizing the quality of pedestrian facilities was taken in Portland, Oregon. In developing Portland's Land Use, Transportation, and Air Quality (LUTRAQ) transportation demand model, planners developed the "Pedestrian Environmental Factor" (PEF). The PEF was calculated at the spatial level of the traffic analysis zone, rather than the route segment (as above). Four factors were considered in determining the PEF for a zone: ease of street crossings; sidewalk continuity; grid versus curvilinear streets; and topography (1000 Friends of Oregon, 1993). This

approach has the advantage of being very simple to calculate, but it is less helpful in determining localized deficiencies.

Jaskiewicz has developed a method of computing pedestrian level of service based on the quality of the trip. In his analysis, trip quality is largely a result of the built environment of which the pedestrian facility is a part. Jaskiewicz proposes nine environmental characteristics that contribute to trip quality: enclosure/definition of the pedestrian or street space; completeness/connectivity of pedestrian path network; articulation of buildings adjacent to pedestrian spaces; variation and complexity of open spaces; presence of building overhangs or awnings over sidewalks and variation in roof lines of buildings; presence of a buffer between pedestrians and the street; presence of shade trees; transparency between public and private spaces; and the physical conditions of streets and sidewalks. These attributes are scored and combined into a level of service measure (Jaskiewicz).

Another way to look at pedestrian level of service is to consider the utility one derives from a particular pedestrian facility or connection. Muraleetharan et al. developed a method for determining level of service based on utility—the method uses measurements of facility width and separation, obstruction, pedestrian flow rate, number of bicycle passing and opposing movements on a sidewalk, space available at corners, characteristics of street crossings, number of turning vehicles, and pedestrian delay. These factors are weighted based on the relative utility one receives from them, and combined into a level of service measurement (Muraleetharan et al., 2004).

Level of Service Methods Used in This Paper:
The next several paragraphs desribe the methods that are used in this paper to determine level of service, and how these methods were derived.

Sprinkle Consulting "Pedestrian Level of Service" (PLOS) Method
In Florida, the State Department of Transportation (FDOT) uses a methodology for computing pedestrian level of service that is based on four major physical characteristics of the street and sidewalk space: presence of a sidewalk and lateral separation from street; motor vehicle volume; traffic speed; and driveway access frequency (spatial) and traffic volume (Landis et al., 2001). This PLOS method, which was developed by Sprinkle Consulting, has been refined since it was first developed—the most recent revision is that which is presented in Florida's level of service handbook. The PLOS model was developed based on a pedestrian facility quality survey performed by citizens on a road course in Pensacola, Florida. The results of the survey were analyzed using regression and a model of pedestrian facility quality in terms of certain physical and environmental charcteristics was developed (FDOT, 2002). A later study attempted to add two other factors, presence of other pedestrians and presence of buildings against the edge of a sidewalk, but was not able to find a conclusive relation between these factors and the perceived quality of pedestrian facilities as received through a survey instrument. This later study also showed that the FDOT level of service method could be integrated with the capacity-oriented level of service method outlined in the *Highway Capacity Manual*—the researchers found that the capacity approach generally provides a better estimate in

cases where the volume and density of pedestrian traffic are very high, while the FDOT method is more applicable on facilities with less foot traffic (Steiner et al., 2002).

This method is focused primarily on physical characteristics of the roadway and sidewalk environment and provides a simple method for computing level of service along a segment of the road/path network. This method was chosen over the environmental audit methods because it is more objective and more easily converted into a level of service measure (as opposed to a measure of quality relative to other audited segments). The utility methods are not being used because they are very complicated and apply mainly to very heavily traveled pedestrian paths—very few areas in the Town Center fit that description, if any.

The basic equation that this method utilizes is (FDOT, 2002):

$$PLOS = -1.2276\ln(W_{ol}+W_l+f_p*\%OSP+f_b*W_b+f_{sw}*W_s) +0.0091(Vol_{15}/L)+0.0004*SPD^2+6.0468$$

(for English units)

where,

W_{ol} = width of outside lane of traffic (including on-street parking as part of outside lane)
W_l = width of marked shoulder or marked bicycle lane
f_p = on-street parking coefficient or factor (always equals 0.2)
%OSP = percent of segment with on-street parking
f_b = sidewalk buffer factor
W_b = width of buffer between street and sidewalk
f_{sw} = sidewalk coefficient or factor (equals 6-0.3*W_s)
W_s = width of sidewalk
Vol_{15} = volume of directional motor traffic in peak 15-minute period
L = number of directional through lanes
SPD = average speed of motor vehicle traffic

Highway Capacity Manual (Fruin) Pedestrian Level of Service Method

The *Highway Capacity Manual* method *will* be calculated in addition to the FDOT methodology in some parts of the Town Center (at available pedestrian count locations in business district). This will provide useful information about the capacity of the sidewalks in the most central part of the study area, and determine whether there is a need for additional sidewalk capacity there. It also provides a counter-point from which to analyze the pedestrian level of service being provided in Chapel Hill.

The Fruin methodology is defined by the following equation (TRB, 2000):

$$\text{Pedestrian unit flow rate} = V_{15} / (15 * W_e)$$

where,

V_{15} = peak 15-minute flow rate (persons per 15-minutes)
W_e = effective width of sidewalk

The flow rate generated by the equation above is used to determine a level of service grade for a pedestrian facility.

Sprinkle Consulting "Bicycle Level of Service" (BLOS) Method

Sprinkle Consulting also developed a Bicycle Level of Service (BLOS) method for the Florida Department of Transportation. This method is similar to the PLOS method described above, but it is focused more on the presence and quality of bicycle facilities and the characteristics of motor

vehicle traffic that bicycles must come into contact with (volume, speed, and number of heavy trucks). The various data are combined into an LOS score based on a regression model in a manner similar to that used for the pedestrian LOS model (FDOT, 2002).

This method is similar to the Sprinkle PLOS methodology described above, in that it is based on physical characteristics of the road and bicycle facility (if any). This particular method includes a factor on roadway condition, which is a variable not included in the BCI method (discussed below). Other factors include motor vehicle traffic volume and speed, effective outside lane width, and amount of truck traffic.

Bicycle Level of Service is defined by this model as (FDOT, 2002):

$$BLOS = 0.507 \ln(Vol_{15}/L)+0.199*SP_t*(1+10.38*HV)^2 +7.066*(1/PR_5)^2-0.005*W_e^2+0.760$$

where,

Vol_{15} = volume of directional traffic in 15-minute peak period
L = total number of through lanes
SP_t = effective speed limit ($1.1199 \ln(SP_p-20)+0.8103$, SP_p = posted speed)
HV = percent heavy trucks
PR_5 = FHWA 5-point surface condition rating
W_e = average effective width of outside lane (lane width less obstructions)

Federal Highway Administration "Bicycle Compatibility Index" (BCI) Method

The Federal Highway Administration (FHWA) has developed a Bicycle Compatibility Index (BCI) that serves as a measure of quality for different roads in terms of bicycle traffic. It is similar to the aforementioned FDOT pedestrian and bicycle level of service methods, in that it primarily focuses on physical characteristics of the road, such as the presence of bicycle lanes or the volume of automobile and truck traffic, and combines them into a measure of facility quality that is not based entirely on capacity. The specific factors included in this method are: presence of a bicycle lane; bicycle lane width; curb lane width; curb lane volume; other lane (same direction) volume; speed of traffic; presence of parking lane; residential versus "other" roadside development types; truck volumes; parking turnover; and right-turn volumes (FHWA, 1998). While the FDOT and FHWA methods of computing bicycle level of service examine similar characteristics of the bicyclist's environment, the two models do not weight these criteria the same, and could produce very different results.

This method was chosen for reasons similar to the FDOT pedestrian level of service method—this method is objective and provides a level of service measure that is applicable in any situation. This method is different from the Sprinkle BLOS method in that it accounts for the presence of a bicycle lane, the traffic volume in lanes other than the outside lane, and the presence, occupancy, and turnover of on-street parking. The *Highway Capacity Manual* method for computing bicycle level of service is not being considered here because there are no known locations in the Chapel Hill Town Center where bicycle congestion is known to be an issue (unlike the potential pedestrian congestion that could exist in some locations).

The BCI uses the following equation to compute level of service (FHWA, 1998):

BCI = 3.67-0.966*BL-0.410*BLW-
0.498*CLW+0.002*CLV+0.0004*OLV
+0.022*SPD+0.506*PKG-0.264*AREA+AF

where,

BL = presence of bike lane (no=0, yes=1)
BLW = bicycle lane width (meters)
CLW = curb lane width (meters)
CLV = curb lane volume (peak hour)
OLV = other lane(s) volume in same direction (peak hour)
SPD = 85th percentile of speed
PKG = presence of parking lane occupied more than 30% (no=0, yes=1)
AREA = type of development (residential=1, other=0)
AF = truck volume factor + parking turnover factor + right turn volume factor

Florida Dept. of Transportation "Transit Level of Service" (TLOS) Method

Traditionally, the non-capacity method for computing transit level of service involved computing the number of persons (or area, households, or businesses) within a specified "walking distance" (usually defined as ¼ mile) of transit routes and stops (Rodriguez, 2004). The TCQSM suggests, however, that one should examine many different aspects of transit availability and quality in determining level of service (Kittelson, 1999). The Florida Department of Transportation (FDOT) uses a sophisticated method for determining transit level of service (TLOS) at the system, route, and stop levels. FDOT's method is built upon the framework set up in the federal *Transit Capacity and Quality of Service Manual*, which suggests measuring transit accessibility by service frequency, hours of service, and service coverage. This TLOS method takes these factors and uses a free downloadable computer program, GIS, and spreadsheets to compute level of service based on availability of transit within a walking distance (based on a walking network), given vehicle headways, and projected wait times for individual routes and stops (Ryus et al., 2000). This method allows transit agencies to examine accessibility of service, but there are two important factors that are not addressed in the TLOS method: whether routes connect origins and destinations well, and whether transit customers are comfortable and safe on their trips. An ideal method would examine these factors in addition to accessibility and availability factors.

The transit level of service in the Chapel Hill Town Center will be determined using a form of the Florida Department of Transportation's TLOS methodology. This method is a more accurate representation of transit accessibility than the typical ¼ mile buffer around bus routes or stops that defines a service area. The full version of the TLOS software is a somewhat burdensome program to use and requires a great deal of data that is not always immediately available to the public; however, the program (which is downloadable for free on the internet at http://www.dot.state.fl.us/transit/Pages/transitlevelofservicesoftware.htm) comes with a spreadsheet that allows for a simplified calculation of level of service for route segments and stops (this spreadsheet does not allow for a level of service estimate at the level of the city or neighborhood, as the full software does). This spreadsheet has few data requirements—it is possible to use the program knowing only the scheduled arrival and departure times of buses (which can be determined from a schedule book).

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The TLOS route segment spreadsheet allows a user to input the names of stops along a street segment, the routes operating along that segment (or portions of it), and the times that buses are scheduled to stop at the stops along the segment. A macro built into the spreadsheet then calculates the number of minutes during the day that a stop has service available to it (based on user-defined maximum wait times at stops, walking distances, environmental characteristics, and the use of straight-line or network-based buffers). Level of service can be computed two different ways using this spreadsheet because the user defines the time duration of the calculations. If the user only calculates TLOS for a portion of the day (i.e. during the time of service), the program defines a letter grade based on the frequency of service guidelines in the *Transit Capacity and Quality of Service Manual*, shown below (Kittelson, 2001 and 1999).

LOS*	TLOS Score (% time served)	Headways (from TCQSM)
A	> 50%	< 10 minutes
B	35.7% - 50%	10 – 14 minutes
C	25% - 35.7%	15 – 20 minutes
D	16.7% - 25%	21 – 30 minutes
E	8.3% - 16.7%	31 – 60 minutes
F	< 8.3%	> 60 minutes

*assumes 5 minute maximum wait time

On the other hand, if the user defines the calculation period as exactly 24 hours, the LOS grade is determined jointly by frequency and hours of service. This is dome by simply multiplying the TLOS score standards (in terms of percent time served) together to create a joint standard. For example the "A" standard for headways is less than 10 minutes and the standard for hours of service is greater than 19 hours. 10 minute headways, assuming 5 minute wait times, mean that a location is served 50% of the time. Being served 19 hours out of 24 is being served 79% of the time. 79 percent of 50% is 39.6%--so any TLOS score over 39.6% would receive a grade of "A." The table below summarizes the standards for 24-hour TLOS grading (Kittelson, 2001 and 1999).

LOS	TLOS Score	Headways (TCQSM)	Hrs. Served (TCQSM)
A	> 39.6%	< 10 minutes	19 – 24 hours
B	25.3% - 39.6%	10 – 14 minutes	17 – 18 hours
C	14.6% - 25.3%	15 – 20 minutes	14 – 16 hours
D	8.4% - 14.6%	21 – 30 minutes	12 – 13 hours
E	1.4% - 8.4%	31 – 60 minutes	4 – 11 hours
F	< 1.4%	> 60 minutes	0 – 3 hours

For the sake of simplicity in calculating TLOS, this was calculated without defining values for the environment surrounding stops (which would have included pedestrian facility quality and job and population density around stops). These environmental data affect the weighting of the scores—without them all stops are weighted equally.

Summary of Literature Review:

In general, there are two major categories of level of service methods: those that are based on travel demand and facility capacity, and those based on other factors (which could include accessibility, environmental quality, safety, and other factors). There has been much written about different methods that could be used to determine pedestrian, bicycle,

and transit levels of service, but there is no clear consensus on which methods are best, and which conditions they are best used in. The rest of this paper focuses on the use of the PLOS, BLOS, TLOS, BCI, and Fruin methodologies of computing level of service that are presented above. These methods, with the exception of Fruin, have been identified as potential ways to measure level of service based on non-capacity-based criteria. The Fruin method serves as a counter-example of the type of result generated by a capacity approach to pedestrian level of service.

The following sections of this paper describe the results generated by applying the models discussed above to determine level of service in Chapel Hill, North Carolina. Section III outlines the methodology used in performing the analyses. Section IV presents the findings concerning level of service in Chapel Hill. Section V outlines conclusions that can be drawn from the Chapel Hill findings regarding the relative usefulness of the various level of service models.

SECTION III: METHODOLOGY

This project involves computing level of service for the various modes of transportation in the Town Center area of Chapel Hill. Automobile level of service is already being computed at major intersections as part of the town's Mobility Report Card study. The levels of service for other modes of transportation are calculated using several of the methods outlined in the above literature review. It is not the intent of this paper to propose a new methodology for determining level of service—as a result, existing methodologies have been chosen for measuring level of service for transit, pedestrian, and bicycle facilities. The methods used are desribed below.

Chapel Hill is a small city in the Piedmont region of central North Carolina. It is a part of the Durham Metropolitan Area and the larger Research Triangle region (Raleigh-Durham-Chapel Hill). Chapel Hill's Town Center (the official name of the downtown area) is essentially the area around two streets (Franklin and Rosemary) that run parallel to each other. The University of North Carolina's main campus is at the eastern end of the Town Center, and the town's boundary with the Town of Carrboro marks the western edge (see figure 3.1). For the purposes of this analysis, a study area was defined that extended one block back from the south side of Franklin Street and from the north side of Rosemary Street. The study area extended from Hillsborough Street/Raleigh Street at the eastern end of the Town Center to the town's western boundary (at Merritt Mill Road). The streets in this study area were broken into segments (which generally went from one intersection to the next intersection, with a few exceptions). These segments are shown in Figure 3.2. The sources of data used in these analyses are listed below:

Data Type	Data Source Name	Source
GIS Parcel Data	P-owasa.shp (Dec. 2003)	Town of Chapel Hill
Aerial Photographs	Orthophotos (March 2003)	Town of Chapel Hill
Vehicle & Pedestrian Counts	Mobility Report Card, Nov. 2001	Town of Chapel Hill
GIS Bus Stop Data	Busstops-stateplane.shp (June 2003)	Town of Chapel Hill

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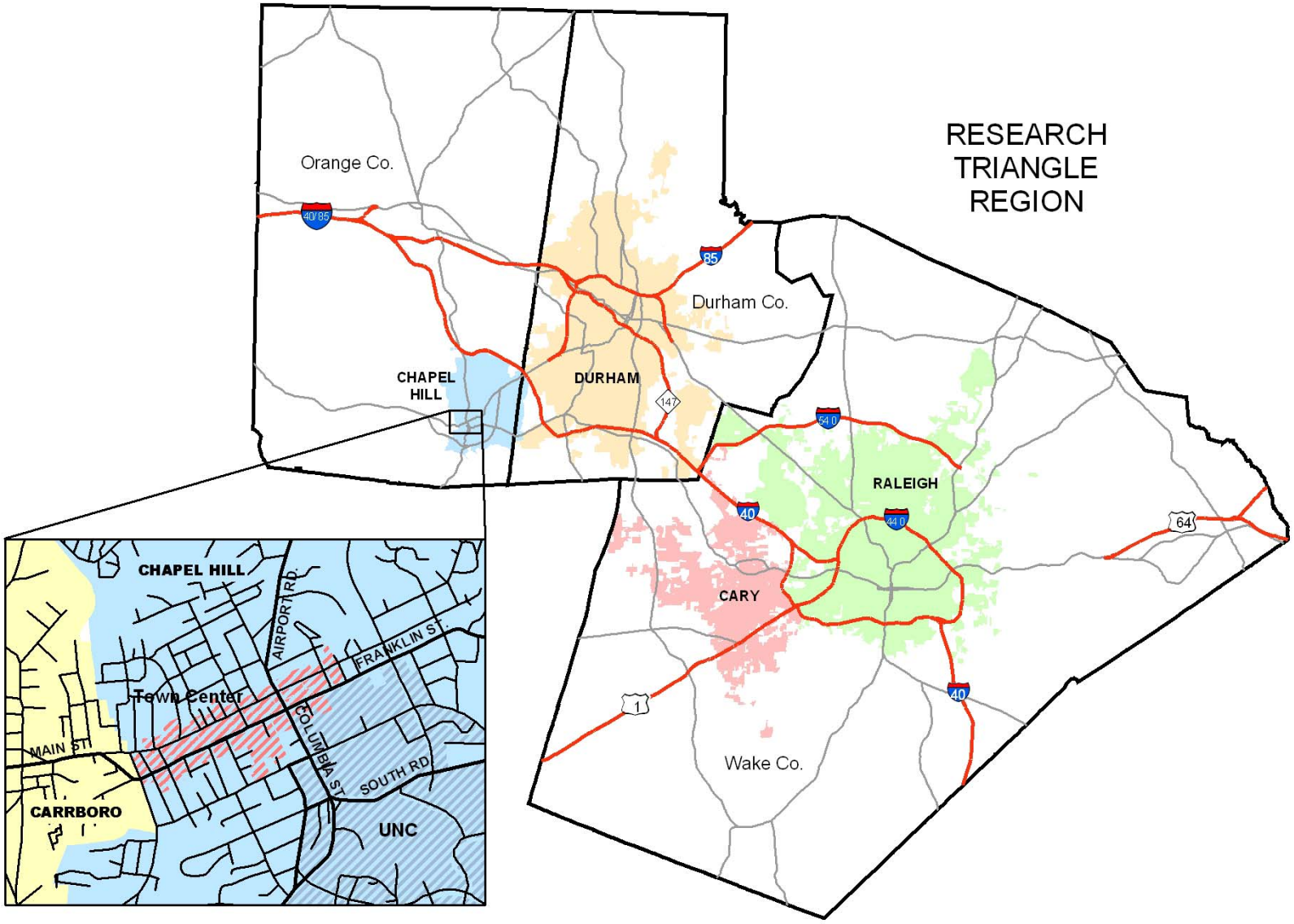

Figure 3.1—Triangle Regional Map

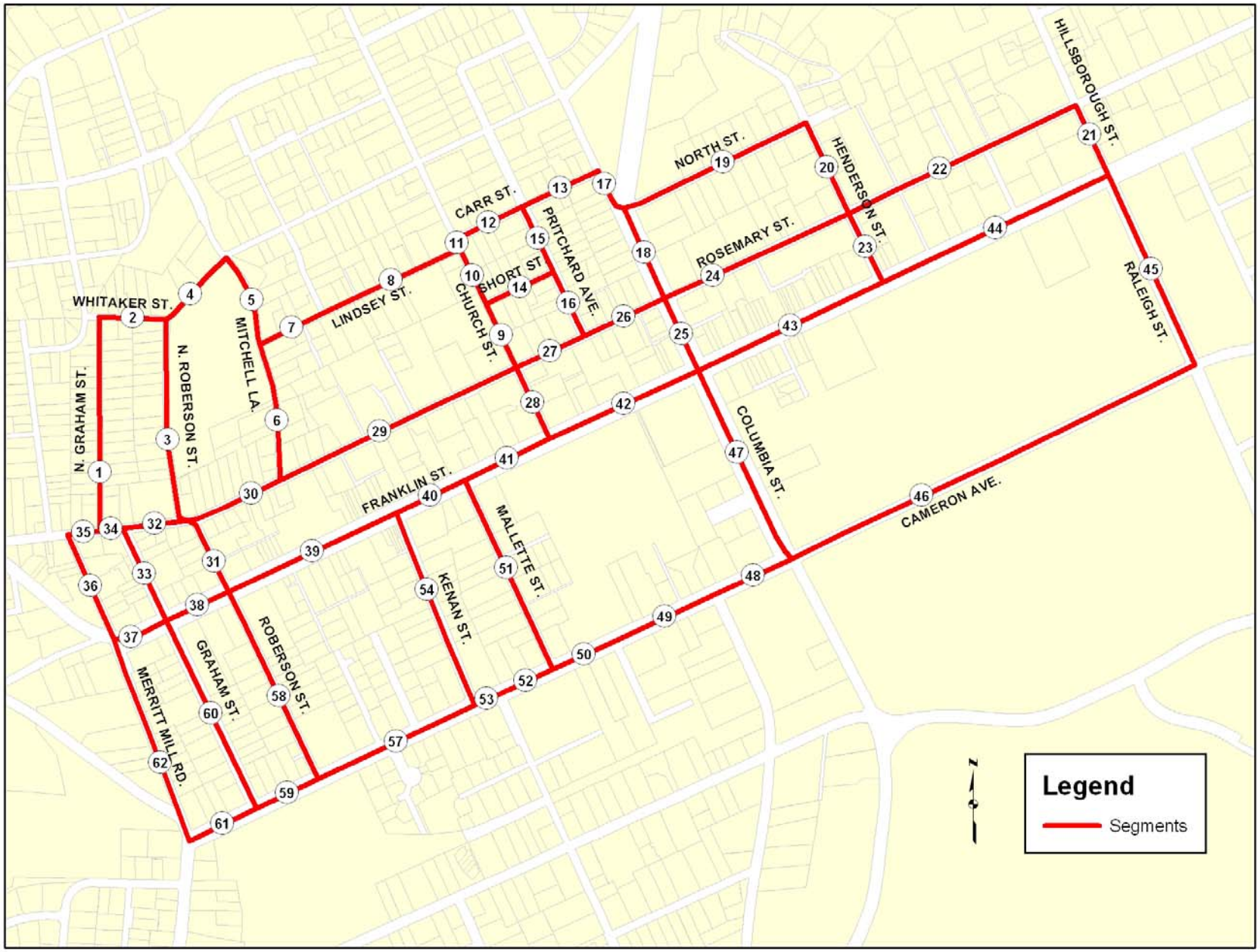

Figure 3.2—Chapel Hill Town Center Road Segments

Chapel Hill Town Center: Alternative Transportation Level of Service

For the pedestrian and bicycle level of service calculations it is necessary to know the amount of traffic on the road segment that the pedestrian or bicyclist would be traveling along. This information is not readily available for most of the street segments within the Chapel Hill Town Center, so it became necessary to compute a projected level of traffic for these streets. This was done using the Institute of Transportation Engineers' *Trip Generation, Sixth Edition* to project the number of trips entering and exiting each parcel along a given segment (ITE, 1997) and combine these into an aggregate number of trips entering and exiting parcels on each segment. These data were then aggregated with others on neighboring segments and projected traffic levels were generated for each segment. A detailed explanation of the traffic projection process used for this paper can be found in Appendix A.

In an effort to compare different methods of computing level of service, two different methods have been used for each mode of travel being studied. For pedestrian level of service, the "PLOS" method developed by Sprinkle Consulting and used in Florida is compared with the capacity-based "Fruin" method, which is the method presented in the *Highway Capacity Manual*. For bicycle level of service Sprinkle Consulting's "BLOS" calculation is compared with the Federal Highway Administration's "BCI" calculation. Finally, for transit level of service, a simplified version of Florida's "TLOS" method is used, but there are two different methods of calculation within this method – one is based only on frequency of service, while the other is based on frequency and hours of service (two LOS concepts discussed in the *Transit Capacity and Quality of Service Manual*). The steps taken to apply these methods are discussed in detail below.

Sprinkle Consulting "Pedestrian Level of Service" (PLOS) Method:

This level of service calculation method was performed on both sides of all road segments within the Town Center study area. Level of Service grades were given based on the following scale (defined in the PLOS instructions):

LOS Grade	PLOS Score
A	< 1.5
B	1.5 – 2.5
C	2.5 – 3.5
D	3.5 – 4.5
E	4.5 – 5.5
F	> 5.5

In performing this analysis, measurements of features were made based on aerial photographs that were taken in March 2003. These photographs, available from the Town of Chapel Hill, were imported into a GIS program, which allowed for individual features in the photographs to be measured. In some parts of the analysis, it was necessary to make simplifying assumptions about the values used in the calculation. The first assumption is that on segments with variable characteristics, the value used is one that represents an average portion of the segment (the mode of the characteristics). For example, if a segment were to have a sidewalk that was 4 feet wide for 60% of the segment length and 5 feet wide for the other 40% of the length, then the value used in the calculation would be 4 feet. Additional assumptions were also made with regard to certain segments and data categories—these are addressed in Appendix B.

***Highway Capacity Manual* (Fruin) Pedestrian Level of Service Method:**

The Fruin method requires information on the number of pedestrians using a facility—this information was only available for a limited number of locations within the Town Center, so these are the only locations the analysis was performed on. These locations are representative of many different environmental conditions, so the conclusions of the analysis should be applicable to the similar segments elsewhere within the study area.

In this method, the assumed capacity of a sidewalk is 23 persons/minute/foot (width). The effective width of a sidewalk is the sidewalk width less the width of obstructions and less 1.5 feet if flush with a fence or object line, 2 feet if flush with a building face, and 3 feet if flush with window displays. A level of service grade is assigned according to the following scale (defined in the *Highway Capacity Manual*):

LOS	Space (ft2/p)	Flow (p/min/ft)	Speed (ft/s)	V/C ratio
A	> 60	< 5	> 4.25	< 0.21
B	40 – 60	5 – 7	4.17 – 4.25	0.21 – 0.31
C	24 – 40	7 – 10	4.00 – 4.17	0.31 – 0.44
D	15 – 24	10 – 15	3.75 – 4.00	0.44 – 0.65
E	8 – 15	15 – 23	2.50 – 3.75	0.65 – 1.0
F	< 8	variable	< 2.50	variable

Assumptions had to be made for this LOS method as well. Since only 12-hour pedestrian counts were available from existing data sources, to determine V_{15} we assumed that 20% of trips during the 12-hour period were made during the peak hour, that half of the trips on each segment were on each side of the segment, and that one quarter of peak hour trips equals V_{15}.

Sprinkle Consulting "Bicycle Level of Service" (BLOS) Method:

Values for variables in the BLOS calculation were derived by examining and measuring features on aerial photos of the Town Center area. BLOS was calculated for all road segments within the Town Center, and level of service grades were determined based on the table below. The grading scale for the BLOS is the same as for the PLOS:

LOS Grade	BLOS Score
A	< 1.5
B	1.5 – 2.5
C	2.5 – 3.5
D	3.5 – 4.5
E	4.5 – 5.5
F	> 5.5

Several assumptions needed to be made in order to carry out the BLOS calculation. These are described in Appendix D, which outlines the results of the calculations for the Chapel Hill Town Center.

Federal Highway Administration "Bicycle Compatibility Index" (BCI) Method:

The Bicycle Compatibility Index was calculated for all segments within the Town Center. Data for these calculations were also obtained from aerial photography. The assumptions

necessary in carrying out these calculations are in Appendix E with the results of the calculations. LOS grades for this method are based on the following scale (from the BCI instructions):

LOS Grade	BCI Score
A	< 1.50
B	1.51 – 2.30
C	2.31 – 3.40
D	3.41 – 4.40
E	4.41 – 5.30
F	> 5.30

After completing the calculations, it was determined that the grading scale above was inadequate for explaining bicycle level of service on minor side streets. Almost all side streets received very low grades under the initial grading scale for the BCI method, due to the relatively low weight the BCI places on traffic volume and the high weight it places on lane width and the presence of bicycle lanes (which are generally not found on minor streets). For this reason, a modified grading scale (presented below) was developed for low-volume residential streets. In the analysis Franklin, Columbia, Rosemary, Cameron, Merritt Mill, Raleigh, and Hillsborough Streets are defined as high-volume—all others are considered low-volume. This discussed in more detail in the Findings section below. This grading scale was developed somewhat arbitrarily, but with the original data used in developing the BCI it might be possible to generate a less arbitrary revised grading scale for low-volume roads.

BCI Grade	Low-volume Score	High-volume (original) Score
A	< 2.0	< 1.50
B	2.01-3.0	1.51-2.30
C	3.01-4.0	2.31-3.40
D	4.01-5.0	3.41-4.40
E	5.01-6.0	4.41-5.30
F	> 6.0	>5.30

Florida Dept. of Transportation "Transit Level of Service" (TLOS) Method:

The route segment spreadsheet described in the literature review above was used to determine the 24-hour and time-of-service level of service grades for transit stops in the Town Center. Scheduled bus times were based on those published in the *Chapel Hill Transit Spring 2004 Route Guide*. The TLOS results generated for each stop were then transferred into GIS and maps were created to show the highest level of service (at a single stop) within a ¼ mile walk of all locations within the study area.

SECTION IV: FINDINGS

Pedestrian Facilities

The two methods utilized for calculating pedestrian level of service yielded widely divergent results. The Fruin method paints a picture of excellence in Chapel Hill's pedestrian environment—in fact, all of the locations for which the Fruin method was applied received an LOS grade of "A." The PLOS model, on the other hand, provides a more varied picture—grades ranged from "A" to "E," with most facilities

falling in the middle of the range ("B" or "C"). The Fruin method, being a capacity-based method, bases its LOS grades entirely on the volume of pedestrian traffic and the capacity of a pedestrian facility. The PLOS method, however, bases its LOS grades on characteristics of the pedestrian environment, and it paints a very different picture of facility quality. The PLOS is really a measure of facility quality, whereas the Fruin measure is actually just looking at facility adequacy. The inputs and results of the PLOS calculations are presented in Appendix B; the Fruin calculations are found in Appendix C.

Figure 4.1 displays the results of the PLOS analysis in a graphic form. From this map, it appears that much of the Town Center's streets received a pedestrian level of service grade of B or C. The Town of Chapel Hill does not currently have minimum standards for pedestrian LOS, but one potential standard could be a minimum PLOS of "B" on both sides of major streets (streets with high vehicle and pedestrian traffic, such as Franklin, Rosemary, Columbia, Merritt Mill, Raleigh, Hillsborough, and Cameron) and a minimum of "B" on at least one side of a minor street (generally a residential street with low traffic, such as Graham, Kenan, and Pritchard). Unlike standards for highway LOS, which are often set low, it is important to set a high standard for pedestrian facilities in this part of Chapel Hill—this PLOS method of computing level of service is based on different factors than those used in highway LOS calculations (not so biased toward volume and capacity). Additionally, walking is an important mode of transportation in the Town Center due to the presence of the University and the scarcity of parking in the area. Using this standard, the following streets and street segments would be found deficient, with lower grades indicating a greater need for improvement:

Street	Segment(s)	PLOS
Cameron Ave.	North side, from Pittsboro to Raleigh	C
	North side, from Ransom to Mallette	C
Church St.	From Short to Lindsey	C/D
Columbia St.	Both sides, from Rosemary to North	C
	East side, from Cameron to Franklin	C
Franklin St.	South side, from Merritt Mill to Graham	C
	Both sides, from Columbia to Henderson	C
	North side, from Henderson to Hillsborough	C
Hillsborough St.	Both sides, from Franklin to Rosemary	C/E
Kenan St.	From Cameron to Franklin	C
Merritt Mill Rd.	Both sides, from Cameron to Franklin	C/D
Raleigh St.	Both sides, from Cameron to Franklin	C
Rosemary St.	South side, from Merritt Mill to Graham	C
	North side, from Mitchell to Pritchard	C
	Both sides, from Columbia to Hillsborough	C/D

This is only a partial picture, however, because of a specific flaw in the PLOS methodology—like most level of service models, the PLOS model was developed primarily for use on arterial highways, so in some cases the assumptions built into the model do not make sense on local residential streets. One assumption that causes particular problems is that PLOS assumes pedestrians do not walk in the street—they always walk beside the road (either on a sidewalk or on the grass). Experience tells us, however, that many people walk in the

Chapel Hill Town Center: Alternative Transportation Level of Service

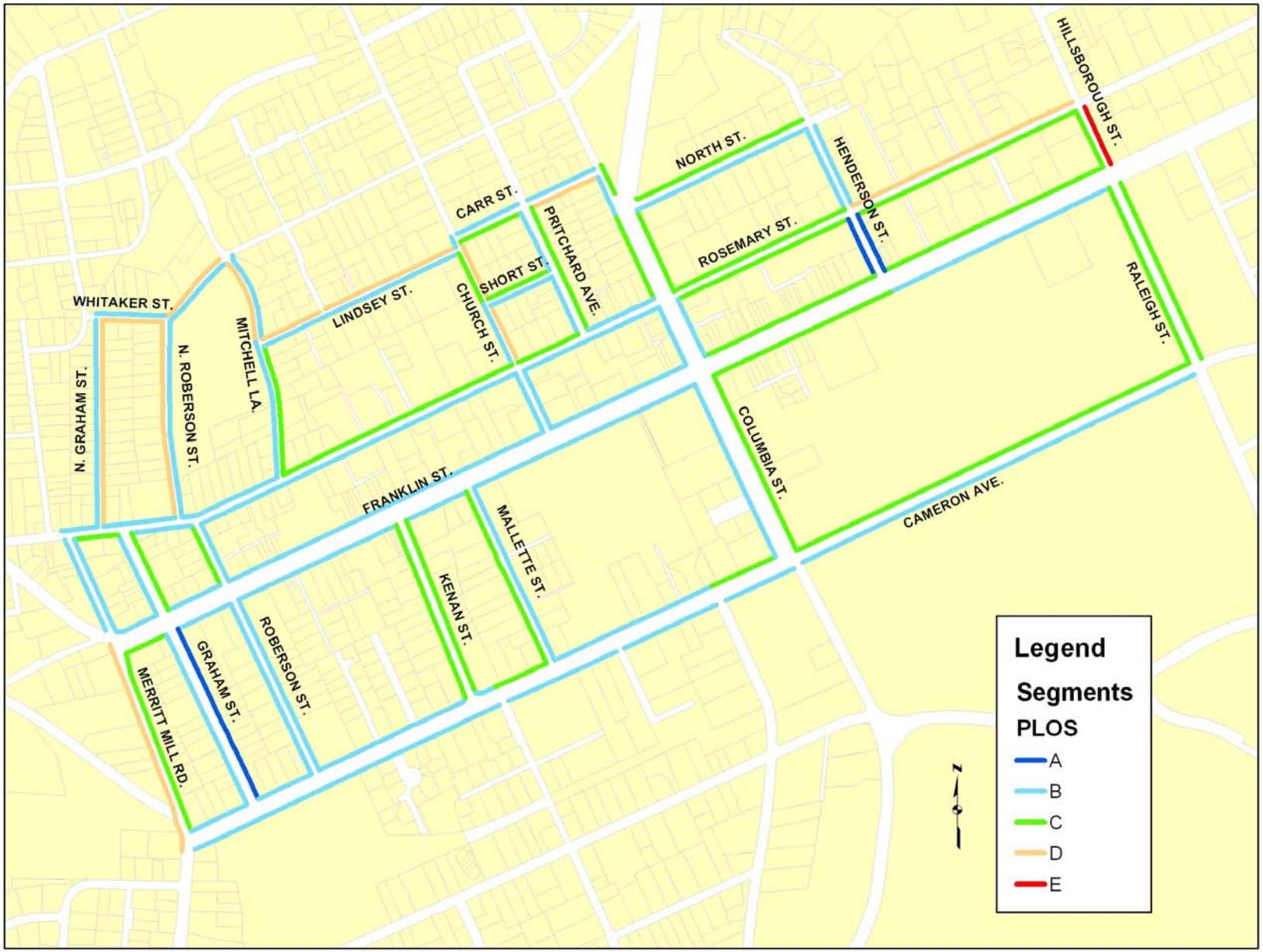

Figure 4.1—Pedestrian Level of Service (PLOS method)

street on low-volume roads. This would probably not have a large bearing on the results of the PLOS calculations if it were not for the question of on-street parking acting as a buffer between motor vehicle traffic and pedestrians. Since the PLOS model assumes the cars always act as a buffer, high grades are given to some side streets where, in fact, on-street parking acts as a impediment to walking and creates a less safe pedestrian environment (pedestrians are forced to walk further into the street). This problem occurs on several streets in the Town Center study area. For this analysis we will assume that on streets where there is no sidewalk, and there is on-street parking, both sides of the street should have an LOS grade that is close to that found on the side of the street that does not have on-street parking. Given this, the following streets and segments also have deficiencies:

Street	Segment(s)	PLOS Grade
Carr St.	From Church to N. Columbia	C/D
Lindsey St.	From Mitchell to Church	D
N. Graham St.	From Rosemary to Whitaker	D
Pritchard Ave.	From Rosemary to Carr	C
Short St.	From Church to Pritchard	C
Whitaker St.	From N. Graham to N. Roberson	D

The Fruin analysis, which was conducted on the locations in the Town Center study area for which there were recent pedestrian volume counts (2002), produced a result of "all-A's" for pedestrian facilities in the area (Figure 4.2 displays the locations for which this analysis was performed and Appendix C shows the Fruin method and calculations in detail). The Fruin method is a capacity-based method and assumes that the primary determinant of quality service in the pedestrian environment is the ability to move through that environment with as little impedance as possible. So, in Chapel Hill's Town Center, where pedestrian flows are steady, but certainly not crush flows, every pedestrian facility will score an A (flow is uninterrupted). Clearly, this has little utility for determining the quality of the pedestrian environment in this situation of examining residential and commercial streetfronts—the method seems better suited to determining adequacy of pedestrian facilities at airports, stadiums, and schools, where one would expect very large crowds at certain peak times.

It should be noted that there is a methodological flaw in using aerial photos to determine sidewalk widths—obstructions such as poles and parking meters do not show up in the photos, so the effective width of a sidewalk may actually be lower than that reflected here (hence LOS scores may be artificially inflated somewhat).

Several mitigation measures could be taken to improve pedestrian facilities in the Chapel Hill Town Center so they might reach the standards set above for PLOS grades. One way to improve pedestrian level of service on many of the side streets would be to simply provide a sidewalk (based on the guidelines above, a sidewalk on one side of the street would likely be enough for most low-traffic roads to meet the "B" standard). Sidewalk improvements could be prioritized based on their PLOS grades and raw scores (higher raw scores indicate more pressing needs). On the larger streets, however (with the exception of the east side of Hillsborough Street, which is very much in need of a new sidewalk), most of the

Chapel Hill Town Center: Alternative Transportation Level of Service

Figure 4.2—Fruin Analysis Locations

low PLOS scores tend to be caused by narrow sidewalks, the lack of buffers (physical buffers or on-street parking), and high traffic volumes. Necessary mitigation on these facilities may be harder to determine or implement than on the side streets—it should still be examined however. Appendix G provides an examination of the potential effects of mitigation measures on the deficient segments listed above.

Bicycle Facilities

The two methods used for examining bicycle level of service also produced different results, but there is an overall trend that is apparent in the results—bicycle level of service is worst in the areas immediately surrounding the University of North Carolina campus. This is a very important finding, because anecdotal evidence would suggest that bicycle ridership is probably highest in these very same areas. It may be in the interest of the Town of Chapel Hill to improve bicycle facilities in these areas and the others outlined below.

The results of the Sprinkle Consulting BLOS method portray a relatively safe bicycling environment in much of the Chapel Hill Town Center. Most areas north and west of the intersection of Franklin and Columbia Streets (the de facto center of town) received a score of at least "C." Areas around the edge of the UNC campus, however, received grades of "D" and "E" for the large part. Figure 4.3 shows the BLOS grades received by each road segment in the study area. These grades are given in each direction (since bicycle traffic flows in the same direction as motor vehicle traffic, on the right-hand side of the street). Appendix D displays the inputs and raw scores for each segment. Listed below are the segments that received scores of "D" or "E," signifying the locations most in need of mitigation:

Street	Segment(s)	BLOS
Cameron Ave.	Westbound, from Wilson to Mallette	D
	Both directions, from Pittsboro to Raleigh	D
Columbia St.	Both directions, from Cameron to North	D/E
Franklin St.	Eastbound, from Merritt Mill to Graham	D
	Westbound, from Henderson to Church	D
	Both directions, from Henderson to Raleigh	D
Hillsborough St.	Both directions, from Franklin to Rosemary	D
Merritt Mill Rd.	Southbound, from Franklin to Cameron	D
Raleigh St.	Both directions, from Cameron to Franklin	D
Rosemary St.	Both directions, from Henderson to Hillsborough	D

These results generally show lower scores on roads with high traffic volumes and narrow outside lanes. Locations with on-street parking also generally have lower scores than those without on-street parking (because this parking is an obstruction and potential hazard to bicycle traffic, especially if there is high parking turnover). None of these road segments contain striped bicycle lanes, which also leads to the lower scores.

The Federal Highway Administration's BCI method produced a similar pattern of results to the BLOS method, but generally with lower grades. The BCI results are presented graphically in Figure 4.4, and detailed calculations can be found in Appendix E. The BCI also found the most deficient areas to be those near the university campus, but found the Town Center to be more deficient overall (only Rosemary Street and a few residential streets have consistently passing scores, and no segments in the study area received a BCI grade of "A").

Chapel Hill Town Center: Alternative Transportation Level of Service

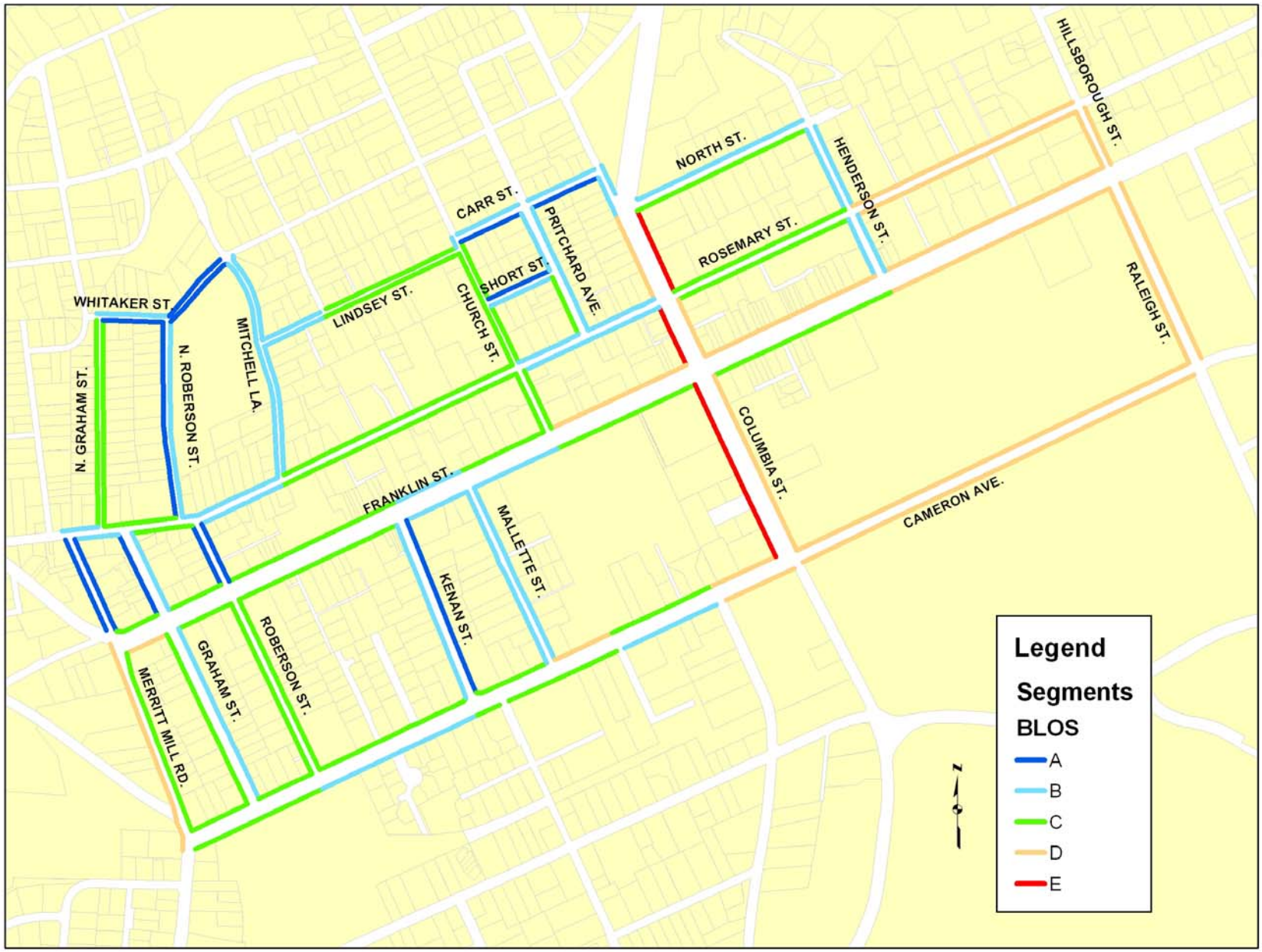

Figure 4.3—Bicycle Level of Service (BLOS method)

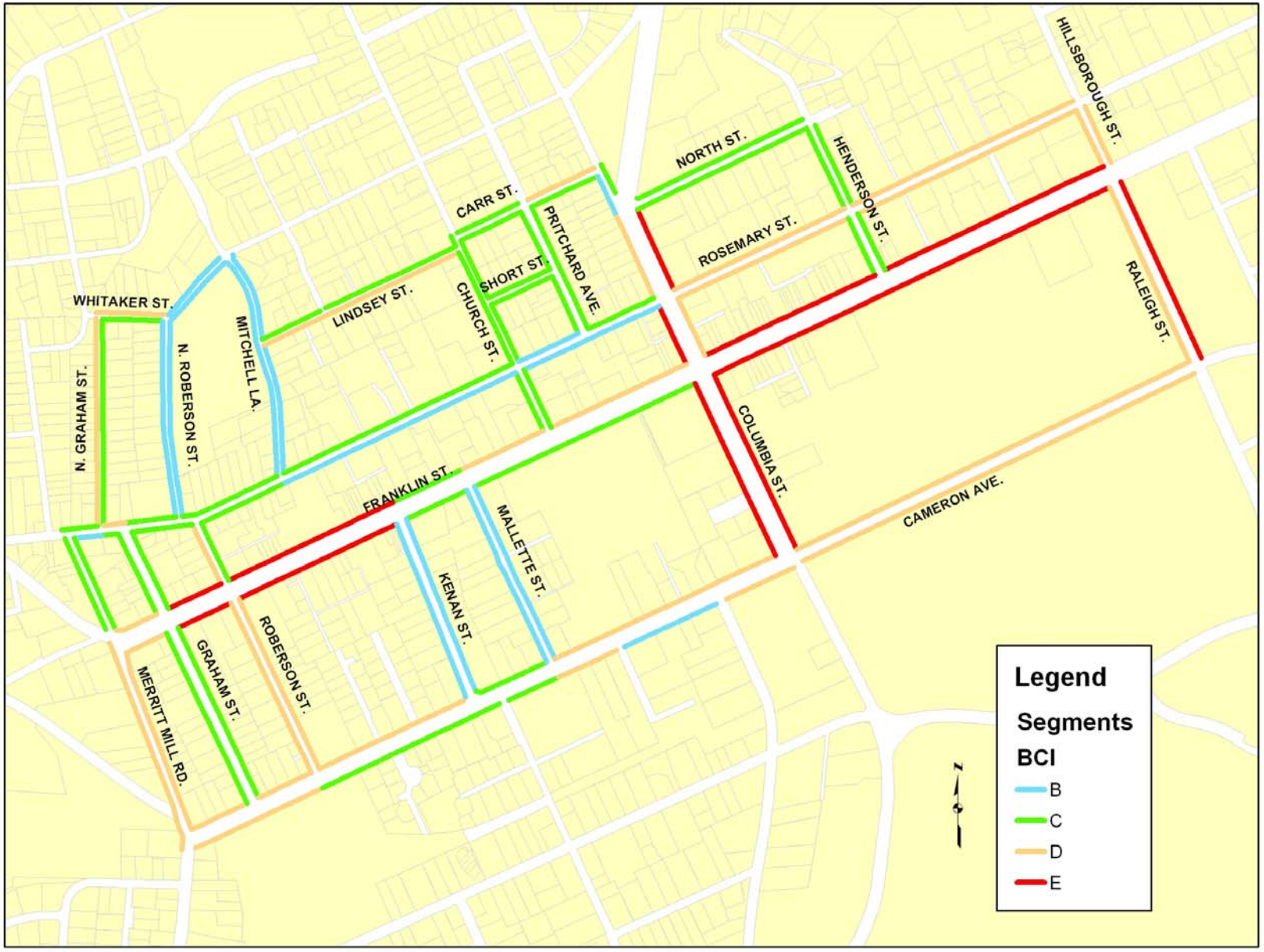

Figure 4.4—Bicycle Level of Service (BCI method)

Chapel Hill Town Center: Alternative Transportation Level of Service

The original BCI results were heavily influenced by the weighting of the factors in the BCI model—this model includes more input factors than the BLOS model, which would suggest that it might be a more accurate representation of actual conditions, but in fact the BCI model seems to have results that are very suspect. It is hard to believe that a low-volume side street such as Lindsey Street could receive a level of service grade of D, which is what occurred in the original BCI calculations (which can be seen in Appendix E)—this is caused by the heavy weight that the BCI model gives to the width of the roadway (many of these side streets are narrow). This points at the same issue we noted in the section above with the PLOS model; these level of service methods were created primarily for use on arterial highways, not on side streets. The results of the BCI model have some utility—they point to locations that could certainly be improved in terms of the bicycling environment—but they are not as useful as the BLOS results for determining mitigation priorities because of the skewed results of the analysis.

Due to the skewed results the BCI model generated for side streets, another grading scale for these low-volume roads was developed. This scale is presented in the methodology section above. In general, the low-volume road BCI grading scale that was developed simply increases the acceptable BCI score for each corresponding letter grade. This was determined to be a simpler, albeit less methodologically-sound, method of modifying the BCI than attempting to modify the BCI equation itself. The list of road segments that do not meet an acceptable BCI grade of "C" after adjusting the grades on low-volume roads is presented below.

Street	Segment(s)	BCI
Cameron Ave.	Both directions, from Merritt Mill to Roberson	D
	Westbound, from Kenan to Roberson	D
	Both directions, from Mallette to Wilson	D
	Westbound, from Pittsboro to Wilson	D
	Both directions, from Pittsboro to Raleigh	D
Carr St.	Westbound, from N. Columbia to Pritchard	D
Columbia St.	Both directions, from Cameron to North	D/E
Franklin St.	Both directions, from Merritt Mill to Kenan	D/E
	Westbound, from Columbia to Mallette	D
	Both directions, from Columbia to Raleigh	E
Hillsborough St.	Both directions, from Franklin to Rosemary	D
Lindsey St.	Eastbound, from Mitchell to Church	D
Merritt Mill Rd.	Both directions, from Cameron to Franklin	D
N. Graham St.	Southbound, from Whitaker to Rosemary	D
Raleigh St.	Both directions, from Cameron to Franklin	D/E
Roberson St.	Both directions, from Cameron to Franklin	D
	Southbound, from Rosemary to Franklin	D
Rosemary St.	Westbound, from Graham to N. Graham	D
	Both directions, from Columbia to Hillsborough	D
Whitaker St.	Westbound, from N. Roberson to N. Graham	D

In most cases, especially around the University campus, mitigation measures for bicycle level of service would involve the creation of striped bicycle lanes or wide outside lanes. Either of these strategies would provide some improvement in

the bicycle level of service of a specific facility, but in both the BLOS and BCI calculation methods, striped bicycle lanes and/or striped shoulders for bicycle use receive more weight than wide outside lanes (producing a better LOS grade). The effects of potential mitigation strategies are outlined in Appendix G.

Transit Facilities

As a baseline determination of level of service, a simple ¼ mile buffer analysis for each bus stop in the Town Center was performed. As can be seen in Figure 4.5, the entire study area is within ¼ mile of a bus stop—traditionally, a determination of the quality of bus service in an area would stop at this point. Based on this simple spatial accessibility analysis alone, the Chapel Hill Town Center appears to have excellent transit service.

As stated in the methodology section above, there are two methods available for computing transit level of service using the route segment worksheet in the TLOS software. A 24-hour level of service can be determined based on service frequency and hours of service standards in the TCQSM. An operation-period level of service can also be determined based only on service frequency during the hours that a route is in service. The two methods produce similar, but slightly different results; calculations and inputs for these analyses are in Appendix F. Figure 4.6 displays the 24-hour TLOS scores by stop location—Figure 4.7 displays the best 24-hour TLOS score within a ¼ mile distance of any location in the Town Center.

The following corridors and stop locations do not meet a minimum standard of a 24-hour TLOS of "C:"

Cameron Avenue (west of Columbia Street)
Rosemary Street (entire length)
Hillsborough Street
Merritt Mill Road
Mitchell Lane
Raleigh Street at Arboretum (northbound only)

An examination of the 24-hour TLOS accessibility map (Figure 4.7) reveals that service coverage is actually very good in the Town Center, however. While some corridors, such as Cameron Avenue and Rosemary Street, may not have good service along the corridor, there is good service nearby (on Franklin and Columbia Streets). Almost all of the Town Center study area falls within ¼ mile of a transit stop with a TLOS of "B" or better—only the far northwest corner of the study area has poor accessibility to good transit service.

The operation-time TLOS analysis produced similar results. Figures 4.8 and 4.9 present the results in a graphic form. The corridor and stop locations that do not meet a minimum standard of TLOS "C" are identical—the accessibility map is almost identical to the map for the 24-hour TLOS/accessibility. The main difference between the two methods is in determining the level of service along Franklin Street and Raleigh Street—the operation-time analysis shows that during the time buses operate along Franklin Street, the frequency of service is not as good in the westbound direction as in the eastbound direction. Information such as this could be useful in shifting bus schedules to maximize headway efficiency in this corridor.

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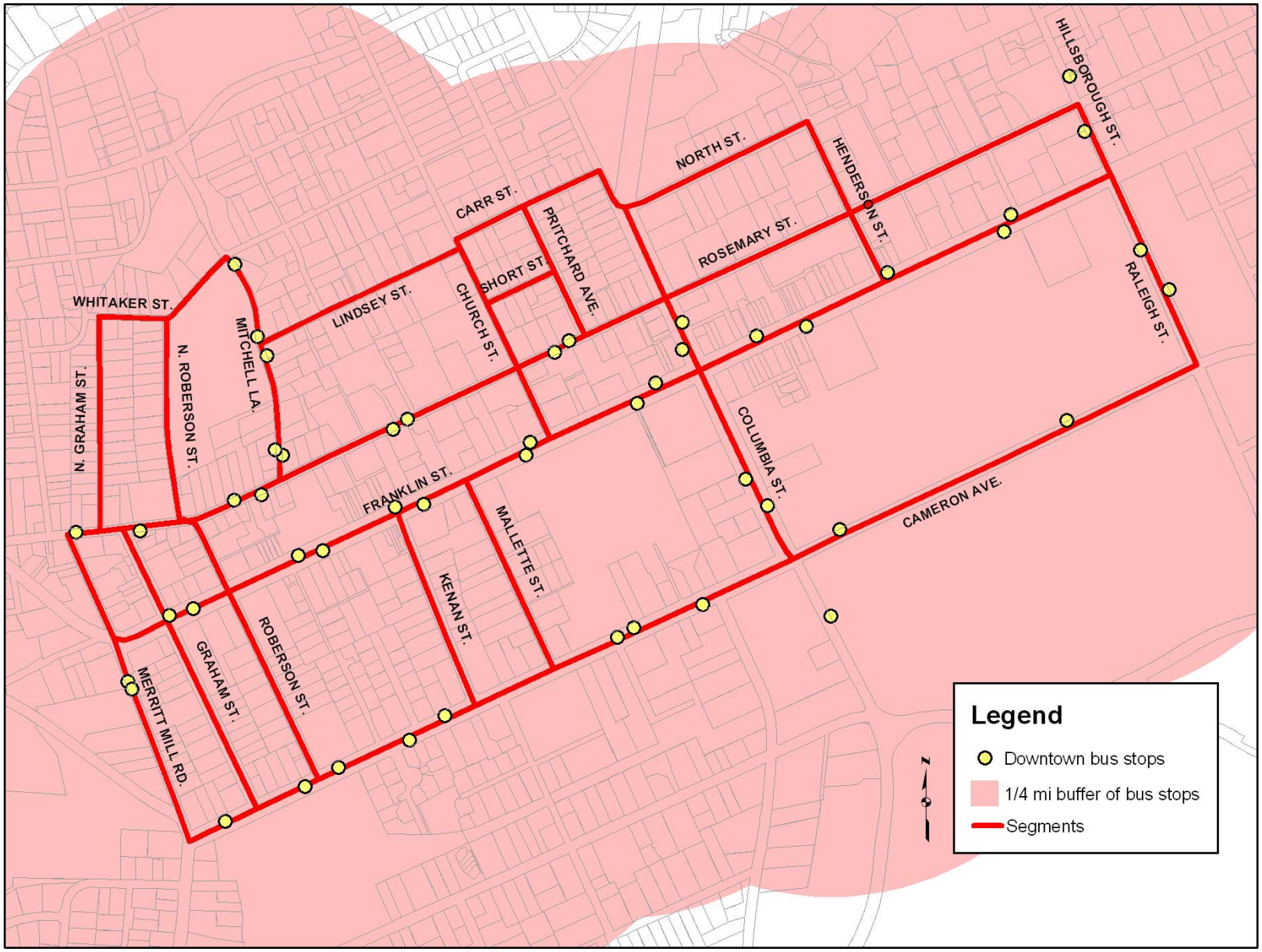

Figure 4.5—Traditional Transit Analysis (1/4 mile buffer)

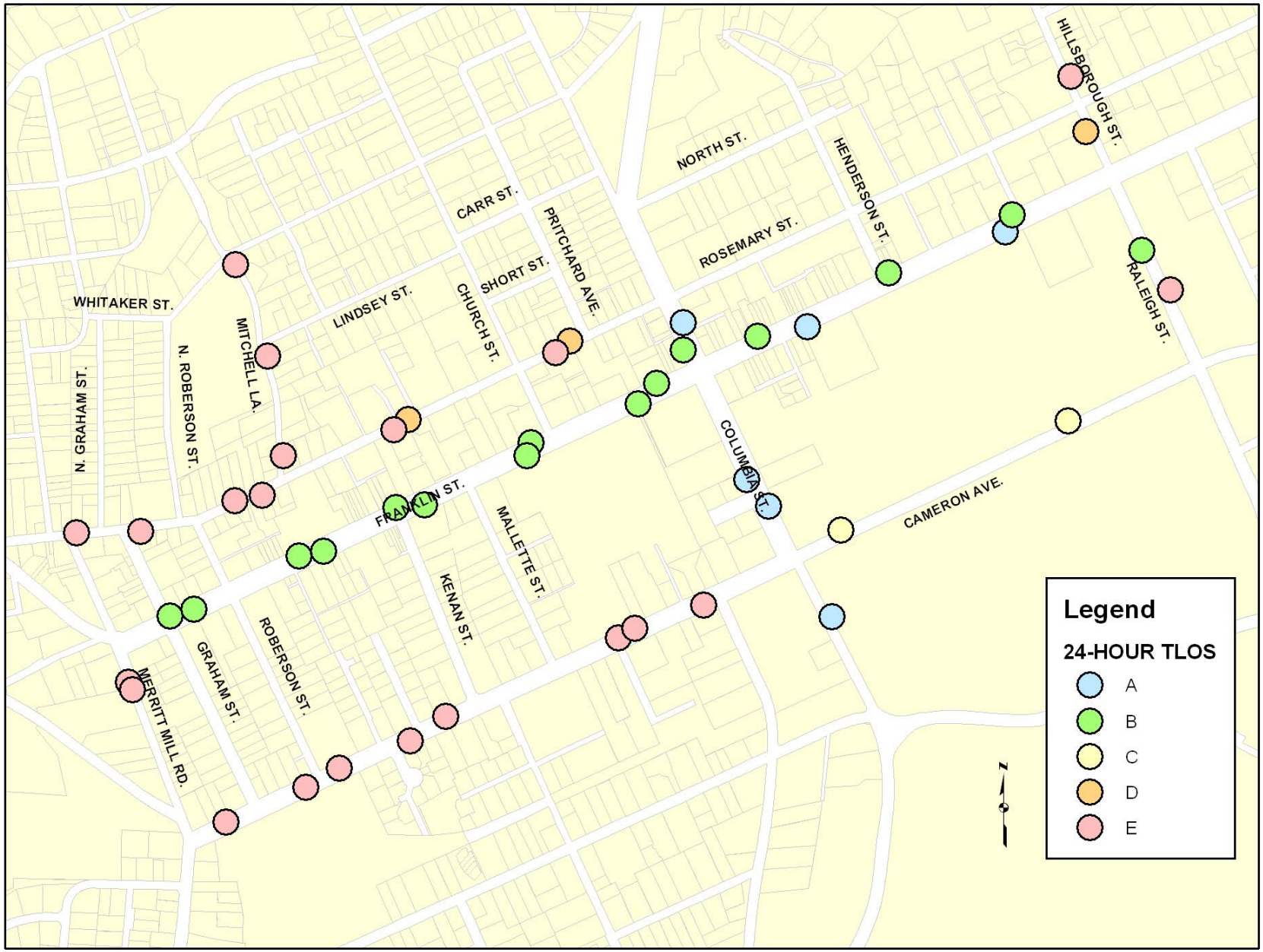

Figure 4.6—24 hour TLOS by stop location

Chapel Hill Town Center: Alternative Transportation Level of Service

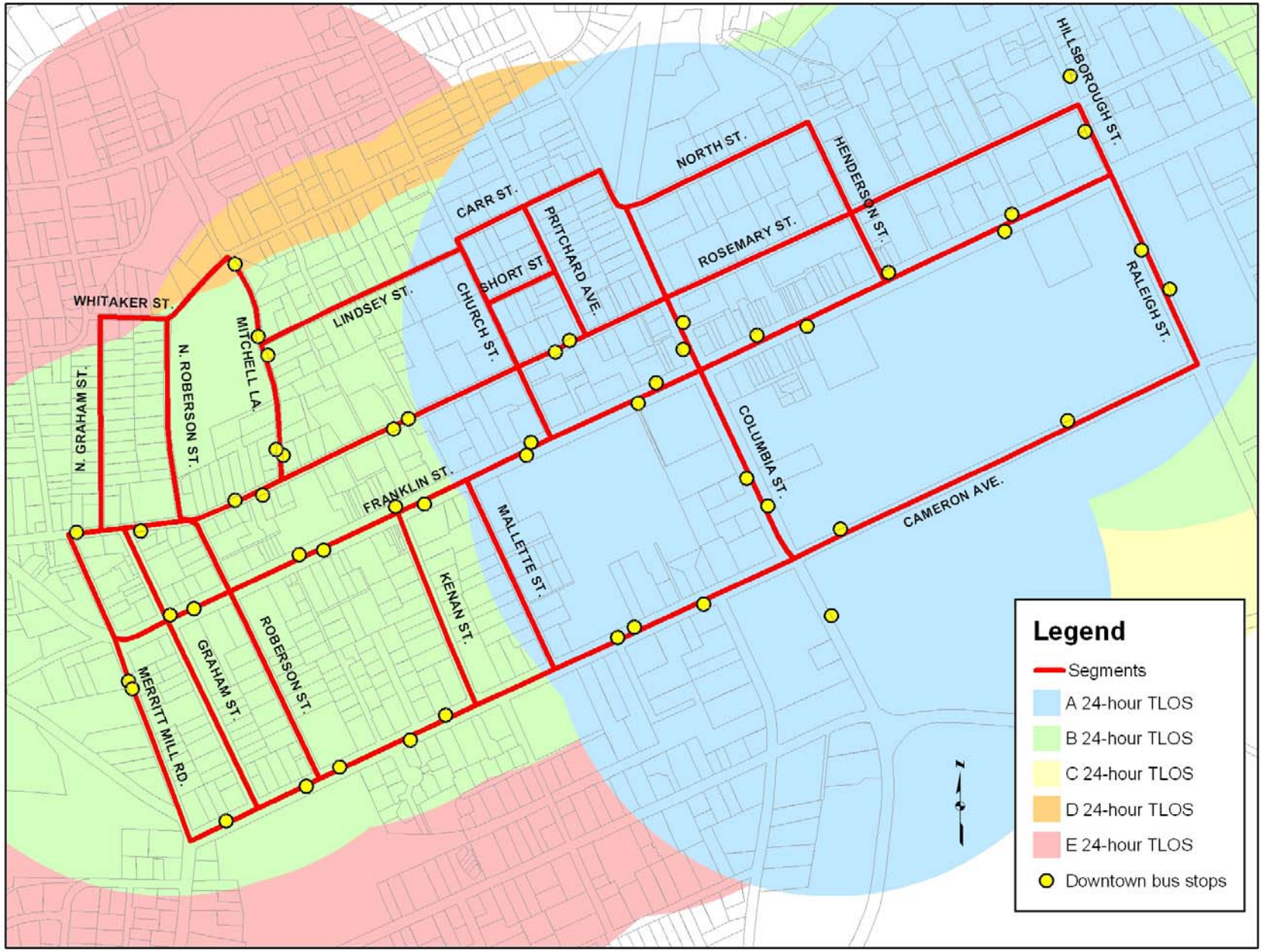

Figure 4.7—Best 24 hour TLOS within 1/4 mile of location

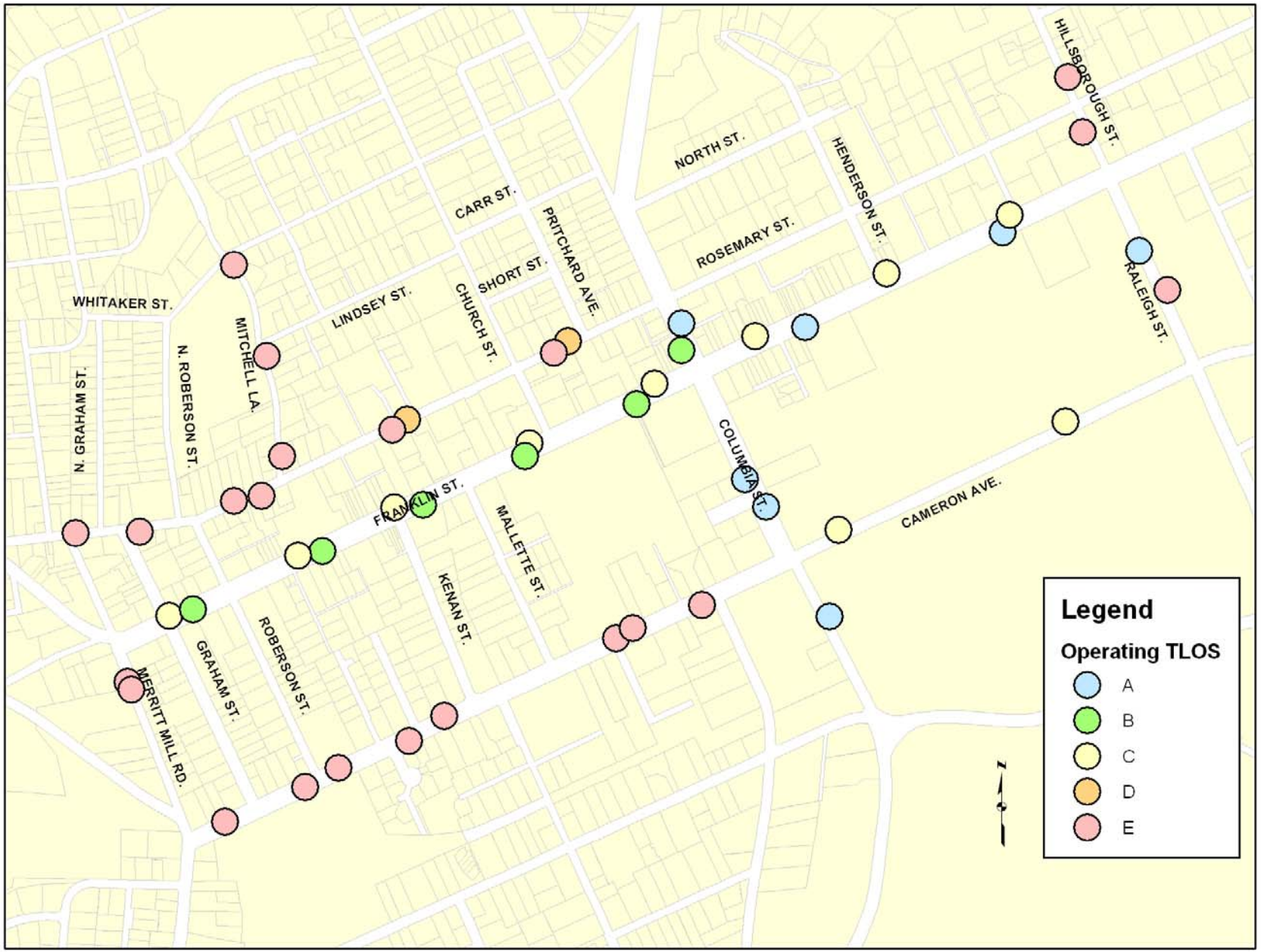

Figure 4.8—Operating TLOS by stop location

Chapel Hill Town Center: Alternative Transportation Level of Service

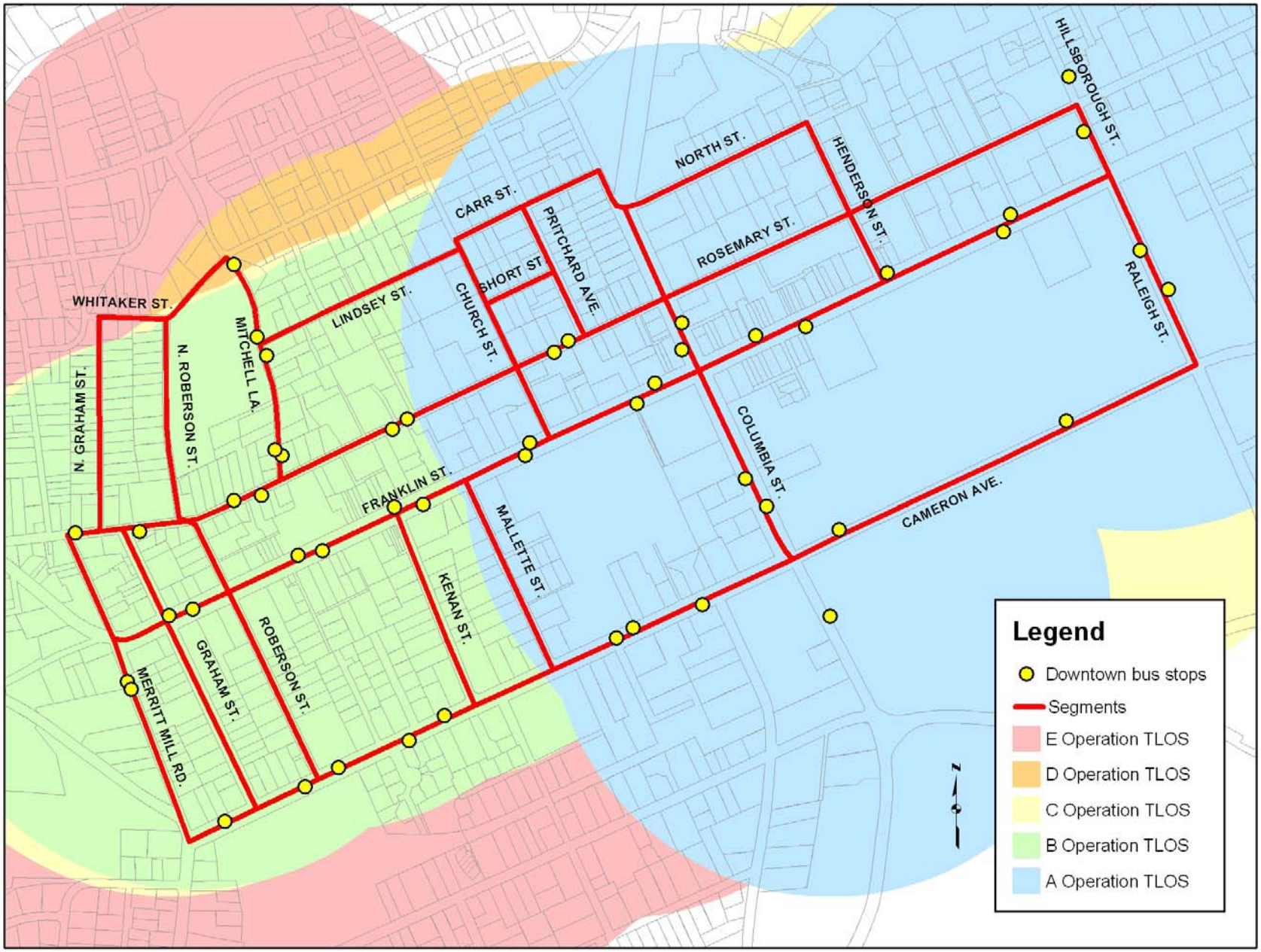

Figure 4.9—Best Operating TLOS within 1/4 mile of location

Mitigation strategies for transit service could include two major initiatives. Service along West Franklin Street could be improved in the Town Center to bring the western part of the study area within walking distance of stops with TLOS "A," as much of the eastern part of the study area is. Additionally, service improvements could be made along the Rosemary and Cameron corridors—while these areas are within walking distance of better service along Franklin Street, service to stops along these important corridors to the University and Town Center is extremely low ("D" and "E"). These service improvements could be accomplished potentially be rerouting existing routes, retiming existing routes, extending routes (spatial and temporal), or adding new routes. Stop coverage in the Town Center is adequate, though, so it is not necessary to extend service to new corridors that do not currently have service. An alternative to providing better service along Rosemary Street and Cameron Avenue would be to provide information about the higher-quality service along Franklin Street at bus stops in these low-service corridors—Franklin Street is within walking distance of both of these streets and this is a viable low-cost alternative to improving service in these secondary corridors.

SECTION V: CONCLUSION

Pedestrian, bicyclist, and transit service quality vary widely across the Chapel Hill Town Center. Levels of service vary from A to E in all modes of transportation. Chapel Hill has some locations with excellent service (for example, pedestrian LOS along Henderson Street or transit LOS along Columbia Street) and others with very poor levels of service (such as bicycle LOS along Columbia Street). There is certainly an opportunity for the town to improve conditions in these areas, and several potential mitigation efforts have been outlined here.

These mitigation strategies include the addition of sidewalks and bicycle lanes, the addition or removal of on-street parking, the spatial and temporal addition of transit service, and other physical improvements (see Appendix G for more detailed information on suggested mitigation measures, including specific recommendations for individual locations). Many of these mitigation measures, which are designed to allow a segment to reach a passing grade in one of the level of service methods, are at odds with mitigation measures suggested by other level of service models—for example, a PLOS grade can be improved by adding on-street parking but a BLOS grade is improved by removing the parking. While it is possible to continue adjusting mitigation strategies in each model so the strategy suggested in one does not conflict with that of another model, it would be useful to have a standard method for combining the various models (across the different modes of travel) to ensure that the needs of users in each mode can be met by a proposed mitigation measure. This type of model integration would also allow for a holistic approach to prioritizing improvement projects (since roadway, bicycle, and pedestrian improvements to roadways tend to be made simultaneously).

Level of service can be a very useful conceptual technique for quantifying the quality of a transportation facility. LOS does have its drawbacks as a quality measure, though—depending on what characteristics are used to determine level of service, the results can be very biased or skewed. Traditionally, LOS has been used to describe the flow of motor vehicle traffic and level of congestion on roads. Here, however, this concept has

been successfully applied in a way that determines service quality for modes of transportation other than private motor vehicles. These methods are not based on capacity and traffic flow, as the highway LOS methods are, but instead on environmental characteristics, accessibility, and other diverse measures of service quality rather than simply ease of use. Whether these methods adequately capture all the variables that affect the quality of a transportation facility is debatable, but they do at least get beyond the simple traditional notion of demand/capacity-based level of service.

The level of service models used in this analysis were developed for many purposes. The BLOS, BCI, PLOS, and Fruin methods were developed largely to determine the adequacy of pedestrian and bicycle facilities along arterial highways and other main roads, similar to the *Highway Capacity Manual* method of calculating automobile LOS (which is generally applied to major streets as part of the metropolitan planning process). The TLOS route spreadsheet method determines the adequacy of transit service frequency and hours of service (although the full TLOS method also accounts for environmental factors such as the sidewalk network and density of residents and employees in an area). Necessarily, these methods are not able to account for *all* factors that influence the quality of service on a given transportation facility. The differences in LOS scores derived from the different methods used in this analysis show that there is some need for integration of factors and methods to determine a standard method for computing level of service for alternative transportation facilities. While beyond the scope of this paper, future research could be done to determine whether additional factors could be added to these calculations, as well as determine how to integrate these various methods and the factors used in each method. Each method produces useful information, but the question left unanswered is how to interpret the results of these models in relation to each other.

Without the benefit of a combined level of service model, it becomes necessary to decide which of the existing models that were studied serve as the best guides. Without doubt, unless being applied in a location with extremely high pedestrian volumes, the PLOS model provides a more accurate and detailed picture of pedestrian level of service than the Fruin model—the key piece that is missing from the PLOS, however, is demand. The BLOS and BCI models produce relatively similar results, but the BLOS results were more in line with the expected results than the BCI results in this analysis—the BCI does allow for more flexibility in determining mitigation strategies, however, due to its broader range of input variables. Finally, the two TLOS methods used produced similar results and are equally suitable—which model to use in a particular case would depend on whether providing service at all hours was deemed locally important (24-hour analysis) or not (operation time analysis).

The results of these analysis will be very useful to the Town of Chapel Hill as it determines what transportation improvements to undertake in the Town Center area. These level of service grades can be used in combination with the motor vehicle, bicyclist, and pedestrian volumes and highway level of service analyses that are currently being performed as part of the town's "Mobility Report Card" process. Taken together, these resources provide a picture of the state of the town's transportation system and a stepping-off point from which to make funding and programming decisions.

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PART TWO: APPENDICES

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APPENDIX A: TRAFFIC GENERATION

Since there are not recent traffic counts available for every road segment within the Town Center study area, traffic volumes were estimated for these segments. These estimates are based on expected trip generation and attraction rates for the various land use types throughout the study area (based on the Institute of Transportation Engineers' *Trip Generation, Sixth Edition*). 2001 traffic volumes were available for a few selected segments in the study area, and from these locations, volumes were dispersed out across the rest of the study area. This appendix provides details on the methodology used to generate these traffic numbers.

An important note must be made at this point: these traffic numbers are estimates only, and may be based on faulty reasoning. Many assumptions had to be made in order to arrive at the results presented here, and while every attempt was made to approximate the real world conditions as much as possible in making these assumptions, these numbers are not a fully accurate substitute for actual traffic counts. With that stated, however, the traffic volumes on many of the side streets are very low, and the effect of this traffic on the level of service scores is also very low. It may not be worth the time and resources to perform traffic counts on these low-volume roads. It is the author's opinion that a traffic estimation method such as the one presented here may be considered a reasonable approximation of real world conditions.

Method:

Using a parcel GIS layer and aerial photographs provided by the Town of Chapel Hill, land uses and physical characteristics of buildings were determined for each parcel within the study area (all the parcels fronting on road segments within the study area). Once these data were compiled, the expected numbers of trips entering and exiting each parcel were calculated (using the values in the *Trip Generation* handbook). Figure A-1 shows the number of trips entering and exiting each parcel and the land use codes and variables used. Figures A-2 and A-3 show the parcel numbers that match those in Figure A-1. Several assumptions were made in the course of this process, which are listed below:

- All uses that appeared to be houses (based on the aerial photos and parcel data) were coded as single-family homes unless specifically denoted otherwise in the parcel data.
- All parcels that did not contain a building (even if there was a parking lot in the parcel) were coded as vacant—a decision was made not to count parking lots as trip origins and destinations, even though they are in reality, because it would be impossible to determine which parking lots people would use to access which land use. All trips were assumed to begin or end at the front door of a land use instead.
- In some cases the building area values given in the parcel data seemed extremely inaccurate (or were missing) - in these cases, building areas were calculated by measuring the building footprint on the aerial photos and multiplying by the number of stories in the building.
- For fraternities, sororities, and single-room occupancy

apartments, the "apartment" land use category was assigned—number of residents (or beds) was assumed to approximate the number of units (numbers of residents in greek housing were obtained from the town).

- Trips entering and exiting were rounded to the nearest integer for all land uses except single-family homes. Since these homes' trips are based on the number of units (and there is only one unit per parcel), these values were left as fractions.
- In most cases, since variable sizes were very small, average rates were used to determine the number of trips generated rather than the regression equation given in *Trip Generation*. In a few cases, where there were large input variables involved, the regression equations were used.

After determining the number of trips entering and exiting a parcel it was possible to begin assigning trips to certain streets. To simplify this process, the peak direction of traffic was determined for each road segment (for the PM peak hour—the hour for which the generated trips are representative). This was determined based on an assumption that most traffic in the afternoon peak hour is being dispersed outward from the downtown and UNC campus area. Figure A-4 shows the assumed peak direction of peak hour traffic for the road segments in the study area.

Given the direction of the peak flow of traffic on each segment, the generated trips were divided into two groups. Trips exiting commercial or institutional uses and those entering residential uses were assumed to be traveling in the peak direction. Those exiting residential uses or entering commercial/institutional uses were assumed to travel in the off-peak direction. This assumption was made because of the earlier assumption that the peak direction of traffic was that which led away from the downtown area. Figure A-5 shows the number of trips entering and exiting each segment and their direction of travel based on these assumptions.

External zones were also established for dead-end residential areas adjacent to the study area (traffic from these areas would feed into the study area). These zones were in Northside, Spring Lane, Friendly Lane, Cobb Terrace, Ransom Street, and Cameron Glen. Each parcel in these zones was assumed to contain a single family home, and numbers of trips being generated were determined. These were fed into the study area network at the location nearest to each parcel (most likely point of entry to system).

Given the information in Figure A-5 and the known traffic volumes at a few key locations, traffic was assigned based on the most direct route between that location and the center of downtown (the corner of Franklin and Columbia Streets). Figure A-6 shows the results of this—because different traffic numbers would exist at each end of a road segment (due to trips being added or subtracted along the segment), the higher set of numbers is given. On segments where a traffic volume is known (from the 2001 *Mobility Report Card*), this is the given value.

Chapel Hill Town Center: Alternative Transportation Level of Service

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
1	Jiffy Lube	s/s franklin	3 bays	15	8	7	37	1428	quick lubrication vehicle shop
2	Elks Lodge	e/s merritt mill	1122 sf	1	1	0	62	903	church
3	vacant	e/s merritt mill					62		
4	Store	e/s merritt mill	1092 sf	3	1	2	62	1225	specialty retail
5	Second Bapt Ch	e/s merritt mill	2042 sf	1	1	0	62	903	church
6	sf house	e/s merritt mill	1 unit	1.01	0.6464	0.3636	62	265	single family detached house
7	sf house	e/s merritt mill	1 unit	1.01	0.6464	0.3636	62	265	single family detached house
8	sf house	e/s merritt mill	1 unit	1.01	0.6464	0.3636	62	265	single family detached house
9	vacant	e/s merritt mill					62		
10	sf house	e/s merritt mill	1 unit	1.01	0.6464	0.3636	62	265	single family detached house
11	sf house	e/s merritt mill	1 unit	1.01	0.6464	0.3636	62	265	single family detached house
12	vacant	n/s cameron					61		
13	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	61	265	single family detached house
14	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	61	265	single family detached house
15	sf house	w/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
16	sf house	w/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
17	sf house	w/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
18	sf house	w/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
19	sf house	w/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
20	sf house	w/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
21	sf house	w/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
22	vacant	w/s graham					60		
23	Funeral Home	w/s graham	2850 sf	2	1	1	60	903	church
24	sf house	w/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
25	vacant	w/s graham					60		
26	Papa John's	w/s graham	1600 sf	4	2	2	60	1225	specialty retail
27	news & observer	s/s franklin	3650 sf	5	1	4	38	1054	general office
28	orange co skills dev ctr	s/s franklin	2251 sf	3	0	3	38	1054	general office
29	orange co skills dev ctr	s/s franklin	9593 sf	14	2	12	38	1054	general office
30	vacant	w/s roberson					58		
31	sf house	w/s roberson	1 unit	1.01	0.6464	0.3636	58	265	single family detached house
32	sf house	w/s roberson	1 unit	1.01	0.6464	0.3636	58	265	single family detached house
33	vacant	w/s roberson					58		
34	sf house	w/s roberson	1 unit	1.01	0.6464	0.3636	58	265	single family detached house
35	sf house	w/s roberson	1 unit	1.01	0.6464	0.3636	58	265	single family detached house
36	sf house	w/s roberson	1 unit	1.01	0.6464	0.3636	58	265	single family detached house
37	sf house	w/s roberson	1 unit	1.01	0.6464	0.3636	58	265	single family detached house
38	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	59	265	single family detached house
39	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	59	265	single family detached house

Figure A-1: Trip generation by parcel (green cells denote calculated values)

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
40	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	59	265	single family detached house
41	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	59	265	single family detached house
42	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	59	265	single family detached house
43	sf house	e/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
44	sf house	e/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
45	sf house	e/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
46	sf house	e/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
47	sf house	e/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
48	sf house	e/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
49	sf house	e/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
50	sf house	e/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
51	sf house	e/s graham	1 unit	1.01	0.6464	0.3636	60	265	single family detached house
52	the courtyard	s/s franklin	3834 sf	6	1	5	39	1054	general office
53	vacant	e/s roberson					58		
54	vacant	e/s roberson					58		
55	vacant	e/s roberson					58		
56	sf house	e/s roberson	1 unit	1.01	0.6464	0.3636	58	265	single family detached house
57	sf house	e/s roberson	1 unit	1.01	0.6464	0.3636	58	265	single family detached house
58	sf house	e/s roberson	1 unit	1.01	0.6464	0.3636	58	265	single family detached house
59	south roberson apts	e/s roberson	13 units	8	5	3	58	302	apartment
60	sf house	w/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
61	sf house	w/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
62	sf house	w/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
63	sf house	w/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
64	sf house	w/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
65	sf house	w/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
66	sf house	w/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
67	sf house	e/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
68	sf house	e/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
69	sf house	e/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
70	sf house	e/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
71	sf house	e/s basnight	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
72	sf house	w/s cameron lane	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
73	vacant	w/s cameron lane					57		
74	sf house	w/s cameron lane	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
75	sf house	w/s cameron lane	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
76	sf house	w/s cameron lane	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
77	sf house	w/s cameron lane	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
78	sf house	e/s cameron lane	1 unit	1.01	0.6464	0.3636	57	265	single family detached house

Figure A-1 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
79	sf house	e/s cameron lane	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
80	sf house	e/s cameron lane	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
81	sf house	e/s cameron lane	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
82	vacant	e/s cameron lane					57		
83	sf house	e/s cameron lane	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
84	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	57	265	single family detached house
85	sf house	w/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
86	apartments	w/s kenan	8 units	5	3	2	54	302	apartment
87	sf house	w/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
88	sf house	w/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
89	sf house	w/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
90	sf house	w/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
91	sf house	w/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
92	sf house	w/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
93	sf house	w/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
94	sf house	w/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
95	stores	s/s franklin	5035 sf	13	6	7	39	1225	specialty retail
96	patio loco	s/s franklin	1536 sf	12	8	4	39	1359	quality restaurant
97	mcdonalds	s/s franklin	2160 sf	56	29	27	39	1397	fast food restaurant, no drive thru
98	411 west	s/s franklin	798 sf	6	4	2	39	1359	quality restaurant
99	411 west	s/s franklin	2530 sf	19	13	6	39	1359	quality restaurant
100	vacant	s/s franklin					39		
101	vacant	s/s franklin					39		
102	yates motors	s/s franklin	1104 sf	3	1	2	39	1444	new car sales
103	sf house	n/s yates	1 unit	1.01	0.6464	0.3636	39	265	single family detached house
104	sf house	n/s yates	1 unit	1.01	0.6464	0.3636	39	265	single family detached house
105	sf house	s/s yates	1 unit	1.01	0.6464	0.3636	39	265	single family detached house
106	sf house	s/s yates	1 unit	1.01	0.6464	0.3636	39	265	single family detached house
107	sf house	s/s yates	1 unit	1.01	0.6464	0.3636	39	265	single family detached house
108	vacant	s/s yates					39		
109	vacant	e/s mcdade					39		
110	sf house	e/s mcdade	1 unit	1.01	0.6464	0.3636	39	265	single family detached house
111	vacant	e/s mcdade					39		
112	vacant	w/s mcdade					39		
113	vacant	w/s mcdade					39		
114	vacant	w/s mcdade					39		
115	vacant	w/s mcdade					39		
116	sf house	w/s mcdade	1 unit	1.01	0.6464	0.3636	39	265	single family detached house
117	vacant	w/s mcdade					39		

Figure A-1 continued

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
118	store	s/s franklin	1100 sf	3	1	2	39	1225	specialty retail
119	restaurant	s/s franklin	1494 sf	11	7	4	39	1359	quality restaurant
120	vacant	s/s franklin					39		
121	bus station	s/s franklin	abandoned	0	0	0	40		
122	dead mule club	s/s franklin	1000 sf	12	8	4	40	1424	drinking place
123	visart video	s/s franklin	3320 sf	41	19	22	40	1648	video rental store
124	chapel hill herald	w/s mallette	2994 sf	5	1	4	51	1054	general office
125	sf house	w/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
126	sf house	w/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
127	sf house	w/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
128	sf house	w/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
129	sf house	w/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
130	sf house	w/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
131	sf house	w/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
132	sf house	w/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
133	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	52	265	single family detached house
134	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	52	265	single family detached house
135	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	52	265	single family detached house
136	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	53	265	single family detached house
137	sf house	e/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
138	sf house	e/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
139	sf house	e/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
140	sf house	e/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
141	sf house	e/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
142	sf house	e/s kenan	1 unit	1.01	0.6464	0.3636	54	265	single family detached house
143	panera bread	s/s franklin	3284 sf	86	44	42	41	1397	fast food restaurant, no drive thru
144	sf house	e/s mallette	3 units	3.03	1.9392	1.0908	51	265	single family detached house
145	sf house	e/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
146	sf house	e/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
147	sf house	e/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
148	sf house	e/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
149	sf house	e/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
150	sf house	e/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
151	sf house	e/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
152	sf house	e/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
153	sf house	e/s mallette	1 unit	1.01	0.6464	0.3636	51	265	single family detached house
154	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	50	265	single family detached house
155	office building	n/s cameron	2152 sf	3	1	2	49	1054	general office
156	nc hillel	n/s cameron	2865 sf	2	1	1	49	903	church

Figure A-1 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
157	sf house	n/s cameron	1 unit	1.01	0.6464	0.3636	49	265	single family detached house
158	kappa sigma	n/s cameron	27 residents	17	11	6	49	302	apartment
159	zeta psi	n/s cameron	11 residents	7	5	2	49	302	apartment
160	kappa alpha	n/s cameron	24 residents	15	10	5	48	302	apartment
161	phi gamma delta	n/s cameron	25 residents	16	11	5	48	302	apartment
162	delta kappa epsilon	w/s columbia	20 residents	12	8	4	47	302	apartment
163	vacant fraternity	s/s frat court	0 residents	0	0	0	47	302	apartment
164	alpha epsilon pi	s/s frat court	0 residents	0	0	0	47	302	apartment
165	sigma alpha epsilon	w/s frat court	15 residents	9	6	3	47	302	apartment
166	pi kappa alpha	n/s frat court	0 residents	0	0	0	47	302	apartment
167	sigma chi	n/s frat court	27 residents	17	11	6	47	302	apartment
168	beta house	w/s columbia	24 residents	15	10	5	47	302	apartment
169	university baptist church	w/s columbia	48150 sf	32	17	15	47	903	church
170	university square/granville towers	s/s franklin	113400 sf com/1321 residents	1113	675	438	42	1225, 302	specialty retail/apartment
171	vacant	e/s columbia					47		
172	first union/top of the hill	s/s franklin	5699 sf	15	6	9	43	1225	specialty retail
173	gap	s/s franklin	4000 sf	10	4	6	43	1225	specialty retail
174	asia café	s/s franklin	1666 sf	44	22	22	43	1397	fast food restaurant, no drive thru
175	the library	s/s franklin	2860 sf	33	22	11	43	1424	drinking place
176	subway	s/s franklin	2400 sf	63	32	31	43	1397	fast food restaurant, no drive thru
177	university florist	s/s franklin	1248 sf	3	1	2	43	1225	specialty retail
178	franklin square	s/s franklin	6500 sf	17	7	10	43	1225	specialty retail
179	university offices	s/s franklin	defer to 189	0	0	0	43	896	university/college
180	university offices	s/s franklin	defer to 189	0	0	0	43	896	university/college
181	vacant	s/s franklin					43		
182	vacant	s/s franklin					43		
183	vacant	s/s franklin					43		
184	vacant	s/s franklin					43		
185	coffee shop	s/s franklin	1500 sf	11	7	4	43	1359	quality restaurant
186	julians	s/s franklin	2700 sf	7	3	4	43	1225	specialty retail
187	schoolkids records	s/s franklin	1600 sf	4	2	2	43	1225	specialty retail
188	university united methodist church	s/s franklin	51475 sf	34	18	16	43	903	church
189	university of north carolina	n/s cameron	827 employees	721	209	512	46	896	university/college
190	chapel of the cross	s/s franklin	16134 sf	11	6	5	44	903	church
191	chi omega	n/s franklin	43 residents	27	18	9	44	302	apartment
192	sigma sigma sigma	n/s franklin	31 residents	19	13	6	44	302	apartment
193	alpha tau omega	n/s franklin	22 residents	14	9	5	44	302	apartment
194	pi beta phi	w/s hillsborough	37 residents	23	15	8	21	302	apartment
195	holy trinity lutheran church	s/s rosemary	8220 sf	5	3	2	22	302	apartment

Figure A-1 continued

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
196	sf house	n/s franklin		1.01	0.6464	0.3636	44	265	single family detached house
197	university offices	n/s franklin	32 employees	28	8	20	44	896	university/college
198	kappa delta	n/s franklin	37 residents	23	15	8	44	302	apartment
199	village apartments	n/s franklin	40 units	25	17	8	44	302	apartment
200	sf house	s/s rosemary		1.01	0.6464	0.3636	22	265	single family detached house
201	tau epsilon phi	s/s rosemary	21 residents	13	9	4	22	302	apartment
202	sf house	s/s rosemary		1.01	0.6464	0.3636	22	265	single family detached house
203	university presbyterian church	n/s franklin	11551 sf	8	4	4	44	903	church
204	mcalisters deli	n/s franklin	3211 sf	84	43	41	44	1397	fast food restaurant, no drive thru
205	linda's	n/s franklin	1817 sf	21	14	7	44	1424	drinking place
206	hector's/east end	n/s franklin	2834 sf	33	22	11	44	1424	drinking place
207	zydeco	e/s henderson	2044 sf	24	16	8	23	1424	drinking place
208	lucy's	e/s henderson	1232 sf	14	9	5	23	1424	drinking place
209	post office/court house	n/s franklin	7500 sf	81	41	40	43	1125	post office
210	w oody's	n/s franklin	4674 sf	54	36	18	43	1424	drinking place
211	w entw orth & sloan	n/s franklin	5891 sf	15	6	9	43	1225	specialty retail
212	w achovia bank	n/s franklin	3612 sf	152	76	76	43	1653	w alk in bank
213	franklin street pizza & pasta	n/s franklin	3225 sf	84	43	41	43	1397	fast food restaurant, no drive thru
214	strong's coffee/sutton's/bandito's	n/s franklin	2500 sf	27	16	11	43	1378	high turnover sit dow n restaurant
215	rathskellar	n/s franklin	1350 sf	15	9	6	43	1378	high turnover sit dow n restaurant
216	players	n/s franklin	1071 sf	12	8	4	43	1424	drinking place
217	aladdin's deli	n/s franklin	2520 sf	66	34	32	43	1397	fast food restaurant, no drive thru
218	first citizens bank	n/s franklin	2571 sf	108	54	54	43	1653	w alk in bank
219	store	n/s franklin	750 sf	2	1	1	43	1225	specialty retail
220	store	n/s franklin	1560 sf	4	2	2	43	1225	specialty retail
221	bank of america building	n/s franklin	112450 sf	205	35	170	43	1054	general office
222	store	n/s franklin	3048 sf	8	3	5	43	1225	specialty retail
223	store	n/s franklin	3250 sf	8	3	5	43	1225	specialty retail
224	cold stone creamery	n/s franklin	1618 sf	18	11	7	43	1378	high turnover sit dow n restaurant
225	peppers pizza	n/s franklin	3000 sf	33	20	13	43	1378	high turnover sit dow n restaurant
226	varsity theater	n/s franklin	6804 sf	26	17	9	43	728	movie theater w ith matinee
227	sephora	n/s franklin	3500 sf	9	4	5	43	1225	specialty retail
228	pita pit	n/s franklin	1460 sf	38	19	19	43	1397	fast food restaurant, no drive thru
229	kerr drug	n/s franklin	7670 sf	59	29	30	43	1616	pharmacy w ithout drive thru
230	miami subs	n/s franklin	3055 sf	80	41	39	43	1397	fast food restaurant, no drive thru
231	laughing turtle home	n/s franklin	2984 sf	8	3	5	43	1225	specialty retail
232	spanky's/starbucks	n/s franklin	4000 sf	43	26	17	43	1378	high turnover sit dow n restaurant
233	sakura express	e/s columbia	1925 sf	50	26	24	25	1397	fast food restaurant, no drive thru
234	vacant	s/s rosemary					24		

Figure A-1 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
235	vacant	s/s rosemary					24		
236	vacant	s/s rosemary					24		
237	parking garage	s/s rosemary		0	0	0	24		
238	tini's tapas/ben & jerry's/jersey mike's	n/s franklin	5400 sf	141	72	69	42	1397	fast food restaurant, no drive thru
239	bruegger's bagels	n/s franklin	2400 sf	63	32	31	42	1397	fast food restaurant, no drive thru
240	new york pizza/yogurt pump	n/s franklin	2440 sf	64	33	31	42	1397	fast food restaurant, no drive thru
241	caribou coffee/kinko's	n/s franklin	6585 sf	17	7	10	42	1225	specialty retail
242	he's not here	n/s franklin	2000 sf	23	15	8	42	1424	drinking place
243	allen funeral home	n/s franklin	5250 sf	3	2	1	42	903	church
244	mcfarling's exxon	n/s franklin	2350 sf	8	4	4	42	1433	automobile care center
245	vacant	n/s franklin					42		
246	vacant	n/s franklin					42		
247	vacant	n/s franklin					42		
248	vacant	s/s rosemary					27		
249	vacant	s/s rosemary					27		
250	vacant	s/s rosemary					27		
251	vacant	s/s rosemary					26		
252	investors' title	s/s rosemary	1517 sf	2	0	2	26	1054	general office
253	vacant	s/s rosemary					26		
254	vacant	s/s rosemary					26		
255	vacant	w/s columbia					25		
256	investors' title	w/s columbia	5854 sf	9	2	7	25	1054	general office
257	investors' title	w/s columbia	2064 sf	3	1	2	25	1054	general office
258	23 building	n/s franklin	10327 sf	27	12	15	41	1225	specialty retail
259	fgi/bw 3	n/s franklin	10500 sf	114	68	46	41	1378	high turnover sit dow n restaurant
260	unc offices	n/s franklin	5308 sf	8	1	7	41	1054	general office
261	franklin street cycles	n/s franklin	6000 sf	16	7	9	41	1225	specialty retail
262	w icked burrito	n/s franklin	2448 sf	64	33	31	41	1397	fast food restaurant, no drive thru
263	vacant	n/s franklin					40		
264	shopping center	n/s franklin	17848 sf	46	20	26	40	1225	specialty retail
265	trail shop	n/s franklin	3165 sf	8	3	5	40	1225	specialty retail
266	vacant	n/s franklin					40		
267	ham's	n/s franklin	3786 sf	28	19	9	40	1359	quality restaurant
268	franklin suites	n/s franklin	10800 sf	16	3	13	40	1054	general office
269	bookstore	n/s franklin	1725 sf	4	2	2	39	1225	specialty retail
270	store	n/s franklin	2044 sf	5	2	3	39	1225	specialty retail
271	office building	n/s franklin	5703 sf	8	3	5	39	1054	general office
272	store	n/s franklin	976 sf	3	1	2	39	1225	specialty retail
273	store	n/s franklin	651 sf	2	1	1	39	1225	specialty retail

Figure A-1 continued

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
274	store	n/s franklin	224 sf	1	0	1	39	1225	specialty retail
275	store	n/s franklin	1407 sf	4	2	2	39	1225	specialty retail
276	store	n/s franklin	2233 sf	6	3	3	39	1225	specialty retail
277	university offices	n/s franklin	182 employees	160	46	114	39	896	university/college
278	w est end w ine bar	n/s franklin	2080 sf	24	16	8	39	1424	drinking place
279	uniquities	n/s franklin	1000 sf	3	1	2	39	1225	specialty retail
280	store	n/s franklin	1817 sf	5	2	3	39	1225	specialty retail
281	store	n/s franklin	1817 sf	5	2	3	39	1225	specialty retail
282	carolina brew ery	n/s franklin	4575 sf	34	23	11	39	1359	quality restaurant
283	old gas station	n/s franklin	2513 sf	8	4	4	39	1433	automobile care center
284	first baptist church	e/s roberson	8006 sf	5	3	2	31	903	church
285	vacant	s/s rosemary					30		
286	vacant	s/s rosemary					30		
287	vacant	s/s rosemary					30		
288	vacant	s/s rosemary					30		
289	vacant	s/s rosemary					30		
290	store	s/s rosemary	3340 sf	9	4	5	30	1225	specialty retail
291	store	s/s rosemary	4800 sf	12	5	7	30	1225	specialty retail
292	store	s/s rosemary	1980 sf	5	2	3	30	1225	specialty retail
293	vacant	s/s rosemary					30		
294	vacant	s/s rosemary					29		
295	medical office	s/s rosemary	3396 sf	5	1	4	29	1054	general office
296	apartments	s/s rosemary	20 units	13	9	4	29	302	apartment
297	store	s/s rosemary	2000 sf	5	2	3	29	1225	specialty retail
298	vacant	s/s rosemary					29		
299	office building	s/s rosemary	1200 sf	2	0	2	29	1054	general office
300	nc pharmaceutical association	w /s church	4200 sf	6	1	5	28	1054	general office
301	chapel hill tire	w /s roberson	3230 sf	11	6	5	31	1433	automobile care center
302	store	n/s franklin	5124 sf	13	6	7	38	1225	specialty retail
303	italian restaurant	n/s franklin	2205 sf	58	30	28	38	1397	fast food restaurant, no drive thru
304	dai chinese restaurant	n/s franklin	909 sf	24	12	12	38	1397	fast food restaurant, no drive thru
305	store	e/s graham	4560 sf	12	5	7	33	1225	specialty retail
306	tar heel taxi	e/s graham	1517 sf	2	0	2	33	1054	general office
307	sf house	e/s graham		1.01	0.6464	0.3636	33	265	single family detached house
308	store	e/s graham	1200 sf	3	1	2	33	1225	specialty retail
309	store	s/s rosemary	2188 sf	6	3	3	32	1225	specialty retail
310	vacant	s/s rosemary					32		
311	sf house	w /s roberson		1.01	0.6464	0.3636	31	265	single family detached house
312	sf house	w /s roberson		1.01	0.6464	0.3636	31	265	single family detached house

Figure A-1 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
313	sf house	w/s roberson		1.01	0.6464	0.3636	31	265	single family detached house
314	sf house	w/s roberson		1.01	0.6464	0.3636	31	265	single family detached house
315	passport motors	n/s franklin	1276 sf	4	2	2	38	1433	automobile care center
316	crooks corner	n/s franklin	1836 sf	14	9	5	38	1359	quality restaurant
317	vacant	e/s merritt mill					36		
318	empow erment inc.	w/s graham	3809 sf	6	1	5	33	1054	general office
319	abundant life center	e/s merritt mill	3000 sf	2	1	1	36	903	church
320	vacant	e/s merritt mill					36		
321	abundant life center	s/s rosemary	3554 sf	2	1	1	35	903	church
322	sf house	s/s rosemary		1.01	0.6464	0.3636	34	265	single family detached house
323	vacant	w/s graham					33		
324	vacant	w/s graham					33		
325	queen of sheba	w/s graham	1002 sf	8	5	3	33	1359	quality restaurant
326	knotts funeral home	w/s graham	2743 sf	2	1	1	33	903	church
327	store	w/s graham	1602 sf	4	2	2	33	1225	specialty retail
328	sf house	n/s rosemary		1.01	0.6464	0.3636	34	265	single family detached house
329	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
330	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
331	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
332	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
333	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
334	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
335	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
336	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
337	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
338	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
339	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
340	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
341	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
342	sf house	e/s graham		1.01	0.6464	0.3636	1	265	single family detached house
343	sf house	s/s w hitaker		1.01	0.6464	0.3636	2	265	single family detached house
344	sf house	s/s w hitaker		1.01	0.6464	0.3636	2	265	single family detached house
345	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
346	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
347	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
348	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
349	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
350	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
351	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house

Figure A-1 continued

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
352	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
353	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
354	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
355	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
356	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
357	sf house	w/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
358	st. joseph christian church	n/s rosemary	1178 sf	1	0	1	32	903	church
359	sf house	n/s rosemary		1.01	0.6464	0.3636	32	265	single family detached house
360	hargraves community center	e/s roberson	16600 sf	29	10	19	3	795	community recreation center
361	sf house	w/s mitchell		1.01	0.6464	0.3636	6	265	single family detached house
362	sf house	w/s mitchell		1.01	0.6464	0.3636	6	265	single family detached house
363	sf house	w/s mitchell		1.01	0.6464	0.3636	6	265	single family detached house
364	vacant	w/s mitchell					6		
365	vacant	w/s mitchell					6		
366	vacant	w/s mitchell					6		
367	vacant	n/s rosemary					30		
368	vacant	n/s rosemary					30		
369	sf house	n/s rosemary		1.01	0.6464	0.3636	30	265	single family detached house
370	vacant	n/s rosemary					30		
371	mama dip's	n/s rosemary	5225 sf	39	26	13	30	1359	quality restaurant
372	vacant	n/s rosemary					30		
373	vacant	n/s rosemary					30		
374	sf house	n/s rosemary		1.01	0.6464	0.3636	30	265	single family detached house
375	sf house	e/s roberson		1.01	0.6464	0.3636	3	265	single family detached house
376	vacant	n/s rosemary					29		
377	tate real estate	n/s rosemary	1556 sf	2	0	2	29	1054	general office
378	vacant	n/s rosemary					29		
379	vacant	n/s rosemary					29		
380	vacant	n/s rosemary					29		
381	vacant	n/s rosemary					29		
382	vacant	n/s rosemary					29		
383	apartments	amity court	6 units	4	3	1	29	302	apartment
384	breadmen's	n/s rosemary	6307 sf	47	31	16	29	1359	quality restaurant
385	vacant	n/s rosemary					29		
386	vacant	n/s rosemary					29		
387	vacant	n/s rosemary					29		
388	sf house	n/s rosemary		1.01	0.6464	0.3636	29	265	single family detached house
389	rosemary apartments	n/s rosemary	80 units (80000 sf)	53	36	17	29	302	apartment
390	the fountains	n/s rosemary	31 units (31500 sf)	20	13	7	29	302	apartment

Figure A-1 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
391	pantana bob's	n/s rosemary	785 sf	9	6	3	29	1424	drinking place
392	chancellors square	w/s church	51 units	34	23	11	9	302	apartment
393	welsh court condos	w/s church	5 units	3	2	1	10	302	apartment
394	sf house	w/s church		1.01	0.6464	0.3636	10	265	single family detached house
395	lindsey street apartmemts	s/s lindsey	9 units	6	4	2	8	302	apartment
396	sf house	s/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
397	sf house	s/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
398	sf house	s/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
399	sf house	s/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
400	sf house	s/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
401	sf house	s/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
402	sf house	s/s lindsey		1.01	0.6464	0.3636	7	265	single family detached house
403	sf house	s/s lindsey		1.01	0.6464	0.3636	7	265	single family detached house
404	sf house	s/s lindsey		1.01	0.6464	0.3636	7	265	single family detached house
405	sf house	s/s lindsey		1.01	0.6464	0.3636	7	265	single family detached house
406	sf house	e/s mitchell		1.01	0.6464	0.3636	6	265	single family detached house
407	sf house	e/s mitchell		1.01	0.6464	0.3636	6	265	single family detached house
408	sf house	e/s mitchell		1.01	0.6464	0.3636	6	265	single family detached house
409	sf house	e/s mitchell		1.01	0.6464	0.3636	6	265	single family detached house
410	sf house	s/s lindsey		1.01	0.6464	0.3636	7	265	single family detached house
411	vacant	e/s mitchell					6		
412	sf house	e/s mitchell		1.01	0.6464	0.3636	6	265	single family detached house
413	sf house	e/s mitchell		1.01	0.6464	0.3636	6	265	single family detached house
414	vacant	e/s mitchell					6		
415	vacant	e/s mitchell					6		
416	los potrillos	n/s rosemary	1520 sf	11	7	4	27	1359	quality restaurant
417	office building	n/s rosemary	1178 sf	2	0	2	27	1054	general office
418	sf house	n/s rosemary		1.01	0.6464	0.3636	27	265	single family detached house
419	café la residence	n/s rosemary	1140 sf	9	6	3	27	1359	quality restaurant
420	sf house	w/s pritchard		1.01	0.6464	0.3636	16	265	single family detached house
421	sf house	w/s pritchard		1.01	0.6464	0.3636	16	265	single family detached house
422	sf house	w/s pritchard		1.01	0.6464	0.3636	16	265	single family detached house
423	sf house	s/s short		1.01	0.6464	0.3636	14	265	single family detached house
424	sf house	s/s short		1.01	0.6464	0.3636	14	265	single family detached house
425	sf house	s/s short		1.01	0.6464	0.3636	14	265	single family detached house
426	sf house	s/s short		1.01	0.6464	0.3636	14	265	single family detached house
427	sf house	n/s short		1.01	0.6464	0.3636	14	265	single family detached house
428	sf house	n/s short		1.01	0.6464	0.3636	14	265	single family detached house
429	sf house	n/s short		1.01	0.6464	0.3636	14	265	single family detached house

Figure A-1 continued

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
430	sf house	n/s short		1.01	0.6464	0.3636	14	265	single family detached house
431	sf house	w/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
432	sf house	w/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
433	sf house	w/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
434	sf house	w/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
435	sf house	w/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
436	sf house	s/s carr		1.01	0.6464	0.3636	12	265	single family detached house
437	sf house	s/s carr		1.01	0.6464	0.3636	12	265	single family detached house
438	sf house	s/s carr		1.01	0.6464	0.3636	12	265	single family detached house
439	sf house	e/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
440	sf house	e/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
441	sf house	e/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
442	sf house	e/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
443	sf house	e/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
444	sf house	e/s pritchard		1.01	0.6464	0.3636	15	265	single family detached house
445	sf house	e/s pritchard		1.01	0.6464	0.3636	16	265	single family detached house
446	vacant	e/s pritchard					16		
447	sf house	e/s pritchard		1.01	0.6464	0.3636	16	265	single family detached house
448	office building	e/s pritchard	1208 sf	2	0	2	16	1054	general office
449	office building	n/s rosemary	1419 sf	2	0	2	26	1054	general office
450	vacant	n/s rosemary					26		
451	vacant	n/s rosemary					26		
452	syd's	n/s rosemary	1250 sf	3	1	2	26	1225	specialty retail
453	vacant	n/s rosemary					26		
454	vacant	n/s rosemary					26		
455	interfaith council shelter	n/s rosemary	46 beds (website)	27	14	13	26	555	motel
456	vacant	w/s columbia					18		
457	joseph's styling	w/s columbia	1260 sf	3	1	2	18	1225	specialty retail
458	sf house	w/s columbia		1.01	0.6464	0.3636	18	265	single family detached house
459	sf house	w/s columbia		1.01	0.6464	0.3636	18	265	single family detached house
460	sf house	w/s columbia		1.01	0.6464	0.3636	18	265	single family detached house
461	sf house	w/s columbia		1.01	0.6464	0.3636	18	265	single family detached house
462	sf house	w/s columbia		1.01	0.6464	0.3636	17	265	single family detached house
463	sf house	w/s columbia		1.01	0.6464	0.3636	17	265	single family detached house
464	sf house	w/s columbia		1.01	0.6464	0.3636	17	265	single family detached house
465	sf house	s/s carr		1.01	0.6464	0.3636	13	265	single family detached house
466	page building	e/s columbia	6050 sf	9	2	7	18	1054	general office
467	office building	e/s columbia	6000 sf	9	2	7	18	1054	general office
468	rbc centura bank	n/s rosemary	2772 sf	152	76	76	24	1666	drive in bank

Figure A-1 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
469	vacant	n/s rosemary					24		
470	vacant	n/s rosemary					24		
471	bb&t bank	n/s rosemary	2623 sf	110	55	55	24	1653	w alk in bank
472	office building	n/s rosemary	3360 sf	5	1	4	24	1054	general office
473	chapel hill realty	n/s rosemary	2970 sf	4	1	3	24	1054	general office
474	treehouse/hell/bub o'malley's	n/s rosemary	11700 sf	135	89	46	24	1424	drinking place
475	vacant	w /s henderson					20		
476	lambda chi alpha	w /s henderson	24 residents	15	10	5	20	302	apartment
477	sf house	w /s henderson		1.01	0.6464	0.3636	20	265	single family detached house
478	sf house	s/s north		1.01	0.6464	0.3636	19	265	single family detached house
479	sf house	s/s north		1.01	0.6464	0.3636	19	265	single family detached house
480	sf house	s/s north		1.01	0.6464	0.3636	19	265	single family detached house
481	sf house	s/s north		1.01	0.6464	0.3636	19	265	single family detached house
482	zeta tau alpha	s/s north	30 residents	19	13	6	19	302	apartment
483	sf house	s/s north		1.01	0.6464	0.3636	19	265	single family detached house
484	sf house	s/s north		1.01	0.6464	0.3636	19	265	single family detached house
485	sf house	s/s north		1.01	0.6464	0.3636	19	265	single family detached house
486	vacant	n/s rosemary					35		
487	sf house	n/s rosemary		1.01	0.6464	0.3636	35	265	single family detached house
488	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
489	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
490	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
491	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
492	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
493	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
494	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
495	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
496	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
497	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
498	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
499	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
500	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
501	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
502	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
503	sf house	w /s graham		1.01	0.6464	0.3636	1	265	single family detached house
504	sf house	n/s w hitaker		1.01	0.6464	0.3636	2	265	single family detached house
505	sf house	n/s w hitaker		1.01	0.6464	0.3636	2	265	single family detached house
506	sf house	n/s w hitaker		1.01	0.6464	0.3636	2	265	single family detached house
507	vacant	n/s w hitaker					2		

Figure A-1 continued

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
508	sf house	n/s w hitaker		1.01	0.6464	0.3636	2	265	single family detached house
509	3 sf houses	w /s roberson		3.03	1.9392	1.0908	4	265	single family detached house
510	sf house	w /s roberson		1.01	0.6464	0.3636	4	265	single family detached house
511	sf house	w /s roberson		1.01	0.6464	0.3636	4	265	single family detached house
512	sf house	e/s mitchell		1.01	0.6464	0.3636	5	265	single family detached house
513	sf house	e/s mitchell		1.01	0.6464	0.3636	5	265	single family detached house
514	sf house	n/s lindsey		1.01	0.6464	0.3636	7	265	single family detached house
515	sf house	n/s lindsey		1.01	0.6464	0.3636	7	265	single family detached house
516	sf house	n/s lindsey		1.01	0.6464	0.3636	7	265	single family detached house
517	sf house	n/s lindsey		1.01	0.6464	0.3636	7	265	single family detached house
518	sf house	n/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
519	sf house	n/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
520	vacant	n/s lindsey					8		
521	sf house	n/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
522	vacant	n/s lindsey					8		
523	sf house	n/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
524	sf house	n/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
525	sf house	n/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
526	vacant	n/s lindsey					8		
527	sf house	n/s lindsey		1.01	0.6464	0.3636	8	265	single family detached house
528	sf house	w /s church		1.01	0.6464	0.3636	11	265	single family detached house
529	sf house	n/s carr		1.01	0.6464	0.3636	12	265	single family detached house
530	sf house	n/s carr		1.01	0.6464	0.3636	12	265	single family detached house
531	sf house	w /s pritchard		1.01	0.6464	0.3636	12	265	single family detached house
532	sf house	n/s carr		1.01	0.6464	0.3636	13	265	single family detached house
533	sf house	n/s carr		1.01	0.6464	0.3636	13	265	single family detached house
534	sf house	n/s carr		1.01	0.6464	0.3636	13	265	single family detached house
535	sf house	n/s carr		1.01	0.6464	0.3636	13	265	single family detached house
536	sf house	n/s carr		1.01	0.6464	0.3636	13	265	single family detached house
537	sf house	n/s carr		1.01	0.6464	0.3636	13	265	single family detached house
538	5 sf houses	n/s north		5.05	3.232	1.818	19	265	single family detached house
539	sf house	n/s north		1.01	0.6464	0.3636	19	265	single family detached house
540	sf house	n/s north		1.01	0.6464	0.3636	19	265	single family detached house
541	sf house	n/s north		1.01	0.6464	0.3636	19	265	single family detached house
542	sf house	n/s north		1.01	0.6464	0.3636	19	265	single family detached house
543	sf house	n/s north		1.01	0.6464	0.3636	19	265	single family detached house
544	sf house	n/s north		1.01	0.6464	0.3636	19	265	single family detached house
545	vacant	n/s north					19		
546	sf house	w /s henderson		1.01	0.6464	0.3636	20	265	single family detached house

Figure A-1 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
547	sf house	e/s henderson		1.01	0.6464	0.3636	20	265	single family detached house
548	w omen's center	e/s henderson	1440 sf	2	0	2	20	1054	general office
549	office building	n/s rosemary	5000 sf	7	1	6	22	1054	general office
550	bell south	n/s rosemary	23000 sf	34	6	28	22	1054	general office
551	sf house	n/s rosemary		1.01	0.6464	0.3636	22	265	single family detached house
552	alpha chi omega	n/s rosemary	43 residents	27	18	9	22	302	apartment
553	sf house	n/s rosemary		1.01	0.6464	0.3636	22	265	single family detached house
554	3 sf houses	n/s rosemary		3.03	1.9392	1.0908	22	265	single family detached house
555	holy trinity lutheran church	n/s rosemary	4390 sf	3	2	1	22	903	church
556	sf house	n/s rosemary		1.01	0.6464	0.3636	22	265	single family detached house
557	sf house	n/s rosemary		1.01	0.6464	0.3636	22	265	single family detached house
558	sf house	n/s rosemary		1.01	0.6464	0.3636	22	265	single family detached house
559	sf house	e/s hillsborough		1.01	0.6464	0.3636	21	265	single family detached house
560	sf house	e/s hillsborough		1.01	0.6464	0.3636	21	265	single family detached house
561	sf house	e/s hillsborough		1.01	0.6464	0.3636	21	265	single family detached house
562	university of north carolina	e/s raleigh st	25 employees	22	6	16	45	896	university/college
563	university of north carolina	s/s cameron	1742 employees	1058	307	751	46	896	university/college
564	carolina inn	s/s cameron	184 rooms (w ebsite)	131	64	67	48	505	hotel
565	sigma phi epsilon	s/s cameron	34 residents	21	14	7	49	302	apartment
566	vacant	s/s cameron					49		
567	church/5 sf houses	s/s cameron	2700 sf church	7.05	4.232	2.818	49	903, 265	church/single family detached house
568	sf house	s/s cameron		1.01	0.6464	0.3636	49	265	single family detached house
569	sf house	s/s cameron		1.01	0.6464	0.3636	50	265	single family detached house
570	vacant	s/s cameron					50		
571	sf house	s/s cameron		1.01	0.6464	0.3636	50	265	single family detached house
572	chi psi	s/s cameron	35 residents	22	15	7	52	302	apartment
573	sf house	s/s cameron		1.01	0.6464	0.3636	53	265	single family detached house
574	vacant	s/s cameron					57		
575	sf house	s/s cameron		1.01	0.6464	0.3636	57	265	single family detached house
576	sf house	s/s cameron		1.01	0.6464	0.3636	57	265	single family detached house
577	sf house	s/s cameron		1.01	0.6464	0.3636	57	265	single family detached house
578	sf house	s/s cameron		1.01	0.6464	0.3636	57	265	single family detached house
579	sf house	s/s cameron		1.01	0.6464	0.3636	57	265	single family detached house
580	sf house	s/s cameron		1.01	0.6464	0.3636	57	265	single family detached house
581	sf house	s/s cameron		1.01	0.6464	0.3636	57	265	single family detached house
582	unc pow er plant	s/s cameron	54 employees	23	5	18	59	92	light industrial
583	sf house	s/s cameron		1.01	0.6464	0.3636	61	265	single family detached house
584	hunt electrical supply	w /s merritt mill	5000 sf	13	6	7	62	1225	specialty retail
585	sf house	w /s merritt mill		1.01	0.6464	0.3636	62	265	single family detached house

Figure A-1 continued

Location No.	Name	Address	Factor	Trips	Entering	Exiting	Segment	TGH Page	LU Type
586	sf house	w/s merritt mill		1.01	0.6464	0.3636	62	265	single family detached house
587	sf house	w/s merritt mill		1.01	0.6464	0.3636	62	265	single family detached house
588	office building	w/s merritt mill	4600 sf	7	1	6	62	1054	general office
589	cc dickson warehouse	w/s merritt mill	6057 sf	3	1	2	62	200	warehouse
590	store	w/s merritt mill	1030 sf	3	1	2	62	1225	specialty retail
591	al's garage	w/s merritt mill	2290 sf	8	4	4	62	1433	automobile care center
592	st. paul's ame church	w/s merritt mill	2420 sf	2	1	1	36	903	church
593	vacant	w/s merritt mill					36		
594	odd fellow's lodge	w/s merritt mill	1250 sf	1	1	0	36	903	church
595	vacant	w/s merritt mill					36		

How to read this table:
Location No. = parcel number (as found in figures A-2 and A-3)
Name = name or description of building
Address = side and name of street
Factor = variable used to determine trips (variable X in *Trip Generation* handbook)
Trips = total trips generated
Entering = number of trips entering parcel
Exiting = number of trips exiting parcel
Segment = number of road segment traffic enters and exits from
TGH Page = page in *Trip Generation, Sixth Edition* that contains trip generation formula for this land use
LU Type = land use type used for this parcel (based on land use types in *Trip Generation* handbook)

Figure A-1 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

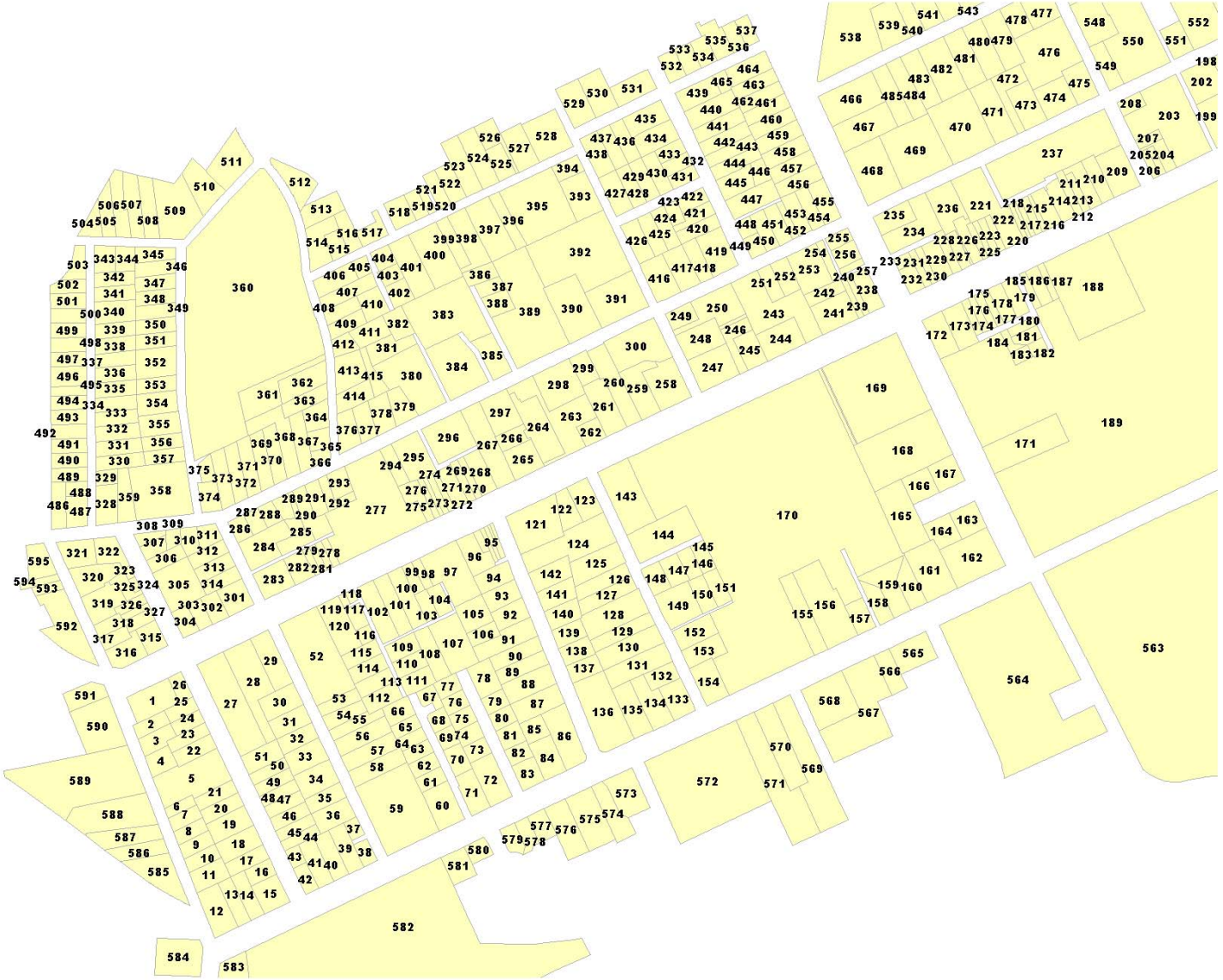

Figure A-2: Parcel numbers (western portion)

Figure A-3: Parcel numbers (eastern portion)

Chapel Hill Town Center: Alternative Transportation Level of Service

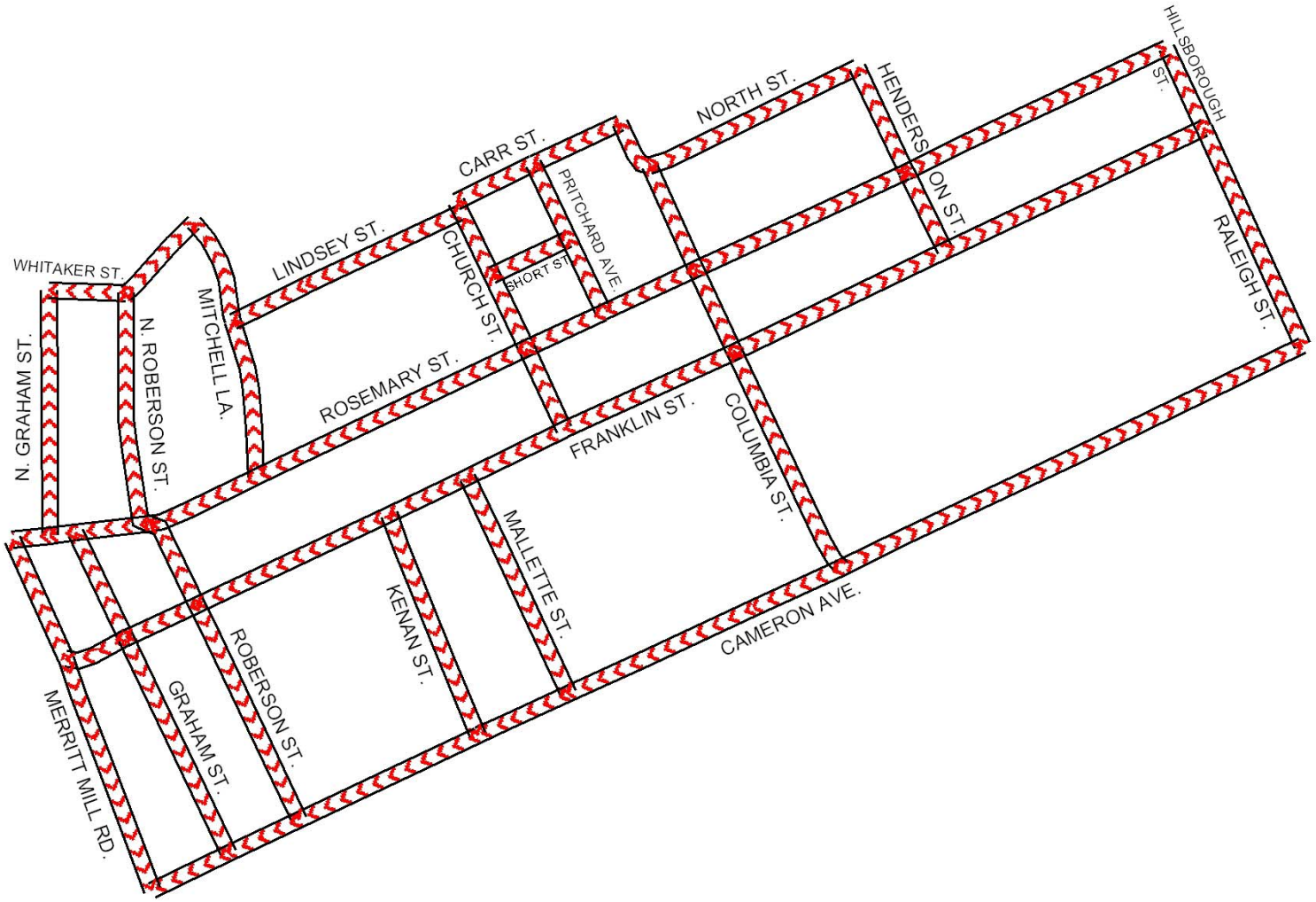

Figure A-4: Direction of PM Peak Traffic

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Chapel Hill Town Center: Alternative Transportation Level of Service

SEGMENT	PEAK-DIR SUBTRACT	PEAK-DIR ADD	PEAK-DIR TOTAL	NON-PEAK SUBTRACT	NON-PEAK ADD	NON-PEAK TOTAL
	RESIDENTIAL ENTERING	COMMERCIAL EXITING		COMMERCIAL ENTERING	RESIDENTIAL EXITING	
1	19	0	-19	0	11	11
2	4	0	-4	0	2	2
3	9	19	10	10	5	-5
4	3	0	-3	0	2	2
5	1	0	-1	0	1	1
6	6	0	-6	0	3	3
7	6	0	-6	0	3	3
8	12	0	-12	0	7	7
9	23	0	-23	0	11	11
10	3	0	-3	0	1	1
11	1	0	-1	0	0	0
12	4	0	-4	0	2	2
13	5	0	-5	0	3	3
14	5	0	-5	0	3	3
15	7	0	-7	0	4	4
16	3	2	-1	0	2	2
17	2	0	-2	0	1	1
18	3	16	13	5	1	-4
19	25	0	-25	0	13	13
20	12	2	-10	0	6	6
21	17	0	-17	0	9	9
22	33	37	4	12	17	5
23	0	13	13	25	0	-25
24	0	184	184	222	0	-222
25	0	33	33	29	0	-29
26	14	6	-8	1	13	12
27	1	9	8	13	0	-13
28	0	5	5	1	0	-1
29	62	30	-32	40	29	-11
30	1	28	27	37	1	-36

Figure A-5: Directional trips entering and exiting (by segment)

SEGMENT	PEAK-DIR SUBTRACT	PEAK-DIR ADD	PEAK-DIR TOTAL	NON-PEAK SUBTRACT	NON-PEAK ADD	NON-PEAK TOTAL
	RESIDENTIAL ENTERING	COMMERCIAL EXITING		COMMERCIAL ENTERING	RESIDENTIAL EXITING	
31	3	7	4	9	1	-8
32	1	4	3	3	0	-3
33	1	22	21	15	0	-15
34	1	0	-1	0	1	1
35	1	1	0	1	0	-1
36	0	2	2	3	0	-3
37	0	7	7	8	0	-8
38	0	73	73	62	0	-62
39	5	223	218	178	3	-175
40	0	79	79	72	0	-72
41	0	150	150	165	0	-165
42	549	322	-227	291	270	-21
43	0	735	735	661	0	-661
44	73	88	15	97	36	-61
45	0	16	16	6	0	-6
46	0	1263	1263	516	0	-516
47	35	15	-20	17	18	1
48	85	0	-85	0	77	77
49	36	3	-33	2	19	17
50	2	0	-2	0	1	1
51	13	4	-9	1	10	9
52	17	0	-17	0	8	8
53	1	0	-1	0	1	1
54	13	0	-13	0	7	7
57	19	0	-19	0	11	11
58	11	0	-11	0	6	6
59	3	18	15	5	2	-3
60	11	3	-8	3	6	3
61	2	0	-2	0	1	1
62	5	23	18	16	3	-13

Figure A-5 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

SEGMENT	EB OR SB TRAFFIC	WB OR NB TRAFFIC
1	35 (SB)	62 (NB)
2	2 (EB)	4 (WB)
3	5 (SB)	10 (NB)
4	6 (EB)	3 (WB)
5	9 (SB)	14 (NB)
6	12 (SB)	20 (NB)
7	3 (EB)	6 (WB)
8	27 (EB)	49 (WB)
9	72 (SB)	134 (NB)
10	61 (SB)	111 (NB)
11	33 (SB)	59 (NB)
12	2 (EB)	4 (WB)
13	5 (EB)	9 (WB)
14	3 (EB)	5 (WB)
15	12 (SB)	21 (NB)
16	17 (SB)	27 (NB)
17	32 (SB)	58 (NB)
18	852 (SB)	1070 (NB)
19	25 (EB)	13 (WB)
20	13 (SB)	22 (NB)
21	352 (SB)	436 (NB)
22	280 (EB)	362 (WB)
23	25 (SB)	22 (NB)
24	288 (EB)	362 (WB)
25	610 (SB)	745 (NB)
26	139 (EB)	105 (WB)
27	123 (EB)	78 (WB)
28	72 (SB)	134 (NB)
29	134 (EB)	78 (WB)
30	158 (EB)	53 (WB)

SEGMENT	EB OR SB TRAFFIC	WB OR NB TRAFFIC
31	8 (SB)	4 (NB)
32	169 (EB)	60 (WB)
33	15 (SB)	21 (NB)
34	184 (EB)	81 (WB)
35	149 (EB)	18 (WB)
36	3 (SB)	2 (NB)
37	909 (EB)	795 (WB)
38	904 (EB)	796 (WB)
39	848 (EB)	734 (WB)
40	680 (EB)	529 (WB)
41	617 (EB)	459 (WB)
42	544 (EB)	665 (WB)
43	1302 (EB)	1302 (WB)
44	1308 (EB)	1363 (WB)
45	538 (SB)	657 (NB)
46	358 (EB)	437 (WB)
47	817 (SB)	999 (NB)
48	354 (EB)	1061 (WB)
49	388 (EB)	474 (WB)
50	371 (EB)	441 (WB)
51	9 (SB)	9 (NB)
52	370 (EB)	439 (WB)
53	356 (EB)	412 (WB)
54	13 (SB)	7 (NB)
57	355 (EB)	411 (WB)
58	11 (SB)	6 (NB)
59	343 (EB)	399 (WB)
60	8 (SB)	3 (NB)
61	343 (EB)	399 (WB)
62	298 (SB)	227 (NB)

Yellow areas indicate segments for which actual counts were available (2001).

Figure A-6: Traffic volume on each segment

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APPENDIX B: PLOS ANALYSIS

How to read these tables:
Segment = segment number
Direction = direction of motor traffic on that side of street
Wol = width of outside lane (feet)
Wl = width of paved shoulder or bicycle lane (feet)
fp = on-street parking factor
%OSP = percent of segment with on-street parking
fb = buffer factor
Wb = width of buffer (feet)
fsw = sidewalk factor
Ws = width of sidewalk (feet)
Vol15 (OL) = 15-minute peak period volume in outside lane
L = number of lanes
SPD = average speed of traffic
PLOS = calculated pedestrian level of service score
PLOS Grade = calculated level of service grade

Assumptions and Methodological Notes:

- On roads without striped lanes, Wol was assumed to equal half the total pavement width
- The PLOS method assumes that any parking lane (striped or unstriped) is part of the outside lane for calculating width
- Values given are the estimated average value for the segment—in cases where there is variation in values throughout a segment, they are the values of the most representative portion
- On Segment 18 southbound, Vol15 (OL) is that traffic which would turn right onto Rosemary Street (the outside lane on the entire length of this segment is the right turn lane)
- On Columbia and Franklin streets, where there are planter boxes, bus shelters, and other objects between the sidewalk and street, these are considered to be buffers
- 15-minute peak period traffic volume is assumed to be 1/4 of peak hour (PM) volume
- On roads with more than one lane in each direction, traffic is distributed evenly among the lanes (except on Segment 18 southbound, where the outside lane is the right turn lane—in this case, the through (non-turning) traffic is distributed among the other two southbound lanes)
- The buffer factor is assumed to be equal to 1.5 when there are objects (such as trees, planter boxes, etc.) in the buffer and equal to 1 in all other cases—this assumption is based on a recommendation in the FDOT *Level of Service Handbook*
- Speed is assumed to be 9 miles per hour over the posted speed limit—this is based on an assumption stated in the Bicycle Compatibility Index instructions that the 85th percentile of traffic speed is 15 kilometers per hour over the posted speed limit
- On Segment 53 eastbound, both lanes combined (the through and turn lanes) are counted as one outside lane

Segment	Direction	Wol	Wl	fp	%OSP	fb	Wb	fsw	Ws	Vol15(OL)	L	SPD	PLOS	PLOS Grade
1	SB	10.5	0	0.2	100	1	0	6	0	8.75	2	34	2.393224	B
1	NB	10.5	0	0.2	0	1	0	6	0	15.5	2	34	3.763702	D
2	EB	9.5	0	0.2	0	1	0	6	0	0.5	2	34	3.750064	D
2	WB	9.5	0	0.2	100	1	0	6	0	1	2	34	2.363623	B
3	SB	11	0	0.2	0	1	0	6	0	1.25	2	34	3.576919	D
3	NB	11	0	0.2	0	1	2	4.5	5	2.5	2	34	2.149992	B
4	EB	11	0	0.2	0	1	0	3.9	7	1.5	2	34	2.047696	B
4	WB	11	0	0.2	0	1	0	6	0	0.75	2	34	3.572369	D
5	SB	11.5	0	0.2	0	1	0	6	0	2.25	2	34	3.53145	D
5	NB	11.5	0	0.2	0	1	4	4.5	5	3.5	2	34	2.075549	B
6	SB	12.5	0	0.2	0	1	0	4.5	5	3	2	34	2.171955	B
6	NB	12.5	0	0.2	0	1	0	6	0	5	2	34	3.454116	C
7	EB	10	0	0.2	100	1	0	6	0	0.75	2	34	2.340715	B
7	WB	10	0	0.2	0	1	0	6	0	1.5	2	34	3.696197	D
8	EB	10	0	0.2	100	1	0	6	0	6.75	2	34	2.395315	B
8	WB	10	0	0.2	0	1	0	6	0	12.25	2	34	3.794022	D
9	SB	10	0	0.2	0	1	0	4.05	6.5	18	2	34	2.262839	B
9	NB	10	0	0.2	0	1	0	6	0	33.5	2	34	3.987397	D
10	SB	10	0	0.2	0	1	0	4.8	4	15.25	2	34	2.505845	C
10	NB	10	0	0.2	0	1	0	6	0	27.75	2	34	3.935072	D
11	SB	10	0	0.2	0	1	0	4.5	5	8.25	2	34	2.310705	B
11	NB	10	0	0.2	0	1	0	6	0	14.75	2	34	3.816772	D
12	EB	12	0	0.2	0	1	0	6	0	0.5	2	34	3.463279	C
12	WB	12	0	0.2	100	1	0	6	0	1	2	34	2.263763	B
13	EB	11.5	0	0.2	0	1	0	6	0	1.25	2	34	3.52235	D
13	WB	11.5	0	0.2	100	1	0	6	0	2.25	2	34	2.29447	B
14	EB	12	0	0.2	100	1	0	6	0	0.75	2	34	2.261488	B
14	WB	12	0	0.2	0	1	0	6	0	1.25	2	34	3.470104	C
15	SB	13	0	0.2	100	1	0	6	0	3	2	34	2.244187	B
15	NB	13	0	0.2	0	1	0	6	0	5.25	2	34	3.408243	C
16	SB	13	0	0.2	100	1	0	6	0	4.25	2	34	2.255562	B
16	NB	13	0	0.2	0	1	0	6	0	6.75	2	34	3.421893	C
17	SB	13	0	0.2	0	1	0	4.5	5	8	2	34	2.200042	B
17	NB	13	0	0.2	0	1	0	6	0	14.5	2	34	3.492418	C
18	SB	13.5	0	0.2	0	1	4	4.8	4	26.25	5	44	2.637306	C
18	NB	12	0	0.2	0	1.5	6	4.2	6	133.75	5	44	3.332959	C
19	EB	12	0	0.2	100	1	0	6	0	6.25	2	34	2.311538	B
19	WB	12	0	0.2	0	1	0	6	0	3.25	2	34	3.488304	C
20	SB	16	0	0.2	100	1	2	4.5	5	3.25	2	34	1.50237	B
20	NB	9	0	0.2	0	1	2	4.65	4.5	5.5	2	34	2.307593	B

Figure B-1: PLOS Calculations and Values

Chapel Hill Town Center: Alternative Transportation Level of Service

Segment	Direction	Wol	Wl	fp	%OSP	fb	Wb	fsw	Ws	Vol15(OL)	L	SPD	PLOS	PLOS Grade
21	SB	12	0	0.2	0	1	0	4.5	5	88	3	34	2.963118	C
21	NB	11	0	0.2	0	1	0	6	0	109	3	34	4.557444	E
22	EB	11	0	0.2	0	1	4	4.2	6	70	2	34	2.611609	C
22	WB	11	0	0.2	0	1	0	6	0	90.5	2	34	4.389094	D
23	SB	19	0	0.2	100	1	0	4.35	5.5	6.25	2	34	1.481425	A
23	NB	19	0	0.2	100	1	0	4.2	6	5.5	2	34	1.449975	A
24	EB	12	0	0.2	0	1	0	4.5	5	72	3	34	2.817518	C
24	WB	13	0	0.2	0	1	0	3	10	90.5	3	34	2.715501	C
25	SB	17	0	0.2	100	1.5	9	4.2	6	76.25	5	34	1.891522	B
25	NB	10.5	0	0.2	0	1.5	12	3.6	8	93.125	5	34	2.386944	B
26	EB	19	0	0.2	0	1	4	4.5	5	34.75	2	34	2.138801	B
26	WB	18	0	0.2	0	1	0	4.5	5	26.25	2	34	2.204357	B
27	EB	20	0	0.2	0	1	4	4.65	4.5	30.75	2	34	2.118014	B
27	WB	19	0	0.2	0	1	0	6	0	19.5	2	34	3.072057	C
28	SB	11	0	0.2	0	1.5	7	4.2	6	18	2	34	1.95442	B
28	NB	11	0	0.2	0	1	5	4.8	4	33.5	2	34	2.44251	B
29	EB	19	0	0.2	0	1	4	4.8	4	33.5	2	34	2.219855	B
29	WB	19	0	0.2	13	1	0	6	0	19.5	2	34	2.914612	C
30	EB	19	0	0.2	0	1	3	4.5	5	39.5	2	34	2.209307	B
30	WB	19	0	0.2	29	1	0	4.5	5	13.25	2	34	1.895523	B
31	SB	17	0	0.2	32	1	0	6	0	2	2	34	2.657101	C
31	NB	10	0	0.2	0	1	6.5	4.8	4	1	2	34	2.129445	B
32	EB	14	0	0.2	0	1	0	4.2	6	42.25	3	34	2.390007	B
32	WB	12	0	0.2	0	1	4	4.5	5	15	3	34	2.164152	B
33	SB	20	0	0.2	28	1	0	4.35	5.5	3.75	2	34	1.752644	B
33	NB	18	0	0.2	23	1	0	6	0	5.25	2	34	2.72938	C
34	EB	18	0	0.2	0	1	0	6	0	46	3	34	3.37958	C
34	WB	10	0	0.2	0	1	2.5	4.5	5	20.25	3	34	2.32893	B
35	EB	18	0	0.2	0	1	0	6	0	37.25	3	34	3.299955	C
35	WB	9.5	0	0.2	0	1	2	4.5	5	4.5	3	34	2.22119	B
36	SB	10	0	0.2	0	1	2	4.8	4	0.75	2	29	2.166568	B
36	NB	11	0	0.2	0	1	6	4.8	4	0.5	2	29	1.981821	B
37	EB	11	0	0.2	0	1.5	10	3.75	7.5	113.625	5	29	2.517472	C
37	WB	11	0	0.2	0	1.5	13	4.05	6.5	99.375	5	29	2.328038	B
38	EB	17	0	0.2	23	1.5	10	3.6	8	113	4	29	2.279491	B
38	WB	17	0	0.2	45	1.5	15	3.9	7	99.5	4	29	1.975477	B
39	EB	19	0	0.2	32	1.5	6.5	3.9	7	106	4	29	2.272452	B
39	WB	19	0	0.2	71	1.5	12	3.3	9	91.75	4	29	1.825016	B
40	EB	19	0	0.2	0	1.5	10	4.05	6.5	85	4	29	2.123851	B
40	WB	17	0	0.2	0	1.5	14	3.3	9	66.125	4	29	1.810498	B

Figure B-1 continued

Segment	Direction	Wol	Wl	fp	%OSP	fb	Wb	fsw	Ws	Vol15(OL)	L	SPD	PLOS	PLOS Grade
41	EB	18	0	0.2	0	1.5	4.5	3.75	7.5	77.125	5	29	2.214006	B
41	WB	8.5	0	0.2	0	1.5	15	3.6	8	57.375	5	29	1.883194	B
42	EB	18	0	0.2	0	1.5	5	3.3	9	68	5	29	2.078142	B
42	WB	11	0	0.2	0	1.5	13	4.2	6	83.125	5	29	2.20471	B
43	EB	18	0	0.2	40	1.5	15	3	10	162.75	4	29	2.508085	C
43	WB	20	0	0.2	77	1.5	5.5	3.6	8	162.75	4	29	2.606541	C
44	EB	17	0	0.2	100	1.5	19	3	10	163.5	4	29	2.274267	B
44	WB	9	0	0.2	0	1.5	19	3.6	8	170.375	4	29	2.784825	C
45	SB	11	0	0.2	0	1	0	3.3	9	134.5	2	34	3.183384	C
45	NB	19	0	0.2	50	1	0	3.6	8	164.25	2	34	3.023516	C
46	EB	12	0	0.2	0	1.5	10.5	3	10	89.5	2	34	2.344353	B
46	WB	12	0	0.2	0	1.5	9	3.3	9	109.25	2	34	2.579517	C
47	SB	9	0	0.2	0	1.5	13	3.45	8.5	101.75	5	34	2.454235	B
47	NB	11	0	0.2	0	1.5	13	3	10	124.875	5	34	2.609158	C
48	EB	12	0	0.2	0	1.5	13	3.9	7	88.5	4	34	2.313133	B
48	WB	10	0	0.2	0	1.5	10	3.9	7	132.625	4	34	2.858479	C
49	EB	22	0	0.2	0	1.5	13	4.2	6	97	2	34	2.235728	B
49	WB	22	0	0.2	51	1.5	9	4.2	6	118.5	2	34	2.356414	B
50	EB	23	0	0.2	100	1.5	13	3.9	7	92.75	2	34	1.83199	B
50	WB	23	0	0.2	100	1.5	13	4.5	5	110.25	2	34	2.058676	B
51	SB	12	0	0.2	0	1	0	6	0	2.25	2	34	3.479204	C
51	NB	12	0	0.2	0	1	0	4.65	4.5	2.25	2	34	2.240155	B
52	EB	18	0	0.2	0	1.5	13	3.6	8	92.5	2	34	2.202162	B
52	WB	17	0	0.2	0	1.5	13	4.5	5	109.75	2	34	2.50234	C
53	EB	17	0	0.2	0	1.5	14	3.9	7	89	2	34	2.188969	B
53	WB	17	0	0.2	0	1.5	10	3.9	7	103	2	34	2.434689	B
54	SB	12	0	0.2	0	1	0	6	0	3.25	2	34	3.488304	C
54	NB	12	0	0.2	0	1	0	6	0	1.75	2	34	3.474654	C
57	EB	23	0	0.2	13	1.5	12	4.5	5	88.75	2	34	2.171746	B
57	WB	23	0	0.2	100	1.5	13	4.5	5	102.75	2	34	1.990426	B
58	SB	14	0	0.2	100	1	0	6	0	2.75	2	34	2.205265	B
58	NB	14	0	0.2	100	1	3.5	4.8	4	1.5	2	34	1.566078	B
59	EB	23	0	0.2	100	1.5	10	4.5	5	85.75	2	34	1.9025	B
59	WB	23	0	0.2	100	1.5	9	4.8	4	99.75	2	34	2.105372	B
60	SB	18	0	0.2	100	1	0	6	0	2	2	34	2.061899	B
60	NB	18	0	0.2	100	1	4.5	4.65	4.5	0.75	2	34	1.421659	A
61	EB	23	0	0.2	50	1	3	4.5	5	85.75	2	34	2.294388	B
61	WB	23	0	0.2	50	1	7.5	4.95	3.5	99.75	2	34	2.436035	B
62	SB	9	0	0.2	0	1	0	6	0	74.5	2	29	4.363837	D
62	NB	9	0	0.2	0	1	0	4.8	4	56.75	2	29	2.800273	C

Figure B-1 continued

APPENDIX C: FRUIN ANALYSIS

How to read these tables:
Location = location of pedestrian count/analysis
Segment = street segment this location lies on
12 hour count = 12-hour pedestrian count at location (2001)
Side of Street = side of street being analyzed
We = effective width (feet)
V15 = 15-minute peak period traffic volume
Qp = pedestrian flow rate (determinant of level of service)
LOS = level of service grade

Assumptions and Methodological Notes:

- Since only 12-hour pedestrian counts were available, it was assumed that 20% of pedestrian traffic during the 12 hours was representative of the PM peak hour—this was then divided by four to find the 15-minute peak period pedestrian volume
- The 15-minute peak period volumes were divided evenly between the two sides of a street segment for analysis
- Along Franklin and Columbia Streets, where there are objects within the sidewalk (such as planter boxes), the widths of these objects were subtracted when computing the effective width of sidewalks
- According to the directions in the Fruin methodology, 1.5 feet were subtracted from effective width for an adjacent object line, 2 feet were subtracted for an adjacent building face, and 3 feet were subtracted for an adjacent window display

LOCATION	SEGMENT	12 HR COUNT	SIDE OF STREET	We (ft)	V15	Qp	LOS
CAMERON AVE AT PITTSBORO ST	49	3085	SOUTH SIDE	5	77.125	1.0283	A
	49	3085	NORTH SIDE	5	77.125	1.0283	A
CAMERON AVENUE AT ROBERSON ST	57	662	SOUTH SIDE	5	16.55	0.2207	A
	57	662	NORTH SIDE	5	16.55	0.2207	A
COLUMBIA ST AT FRAT COURT	47	7040	EAST SIDE	9.5	176	1.2351	A
	47	7040	WEST SIDE	8	176	1.4667	A
COLUMBIA ST AT ROSEMARY ST	25	1139	EAST SIDE	8	28.475	0.2373	A
	25	1139	WEST SIDE	6	28.475	0.3164	A
FRANKLIN ST AT CARIBOU COFFEE	42	2304	SOUTH SIDE	6	57.6	0.64	A
	42	2304	NORTH SIDE	8	57.6	0.48	A
FRANKLIN ST AT CHURCH ST	41	2960	SOUTH SIDE	8	74	0.6167	A
	41	2960	NORTH SIDE	6	74	0.8222	A
FRANKLIN ST AT COFFEE SHOP	43	8890	SOUTH SIDE	8	222.25	1.8521	A
	43	8890	NORTH SIDE	8	222.25	1.8521	A
FRANKLIN ST AT HENDERSON ST	43	6670	SOUTH SIDE	10	166.75	1.1117	A
	43	6670	NORTH SIDE	10	166.75	1.1117	A
FRANKLIN ST AT HILLSBOROUGH/RALEIGH ST	44	1368	SOUTH SIDE	6	34.2	0.38	A
	44	1368	NORTH SIDE	3.5	34.2	0.6514	A
FRANKLIN ST AT KENAN ST	40	1302	SOUTH SIDE	5.5	32.55	0.3945	A
	40	1302	NORTH SIDE	7	32.55	0.31	A
FRANKLIN ST AT COLUMBIA ST	43	9635	SOUTH SIDE	8	240.875	2.0073	A
	43	9635	NORTH SIDE	8	240.875	2.0073	A
ROSEMARY ST WEST OF COLUMBIA ST	26	692	SOUTH SIDE	5	17.3	0.2307	A
	26	692	NORTH SIDE	5	17.3	0.2307	A
ROSEMARY ST AT HILLSBOROUGH ST	22	1071	SOUTH SIDE	7	26.775	0.255	A
	22	1071	NORTH SIDE	7	26.775	0.255	A
ROSEMARY ST AT UNC PARKING LOTS	29	1510	SOUTH SIDE	4	37.75	0.6292	A
	29	1510	NORTH SIDE	4	37.75	0.6292	A

Figure C-1: Fruin Calculations and Values

APPENDIX D: BLOS ANALYSIS

How to read these tables:
Segment = number of road segment
Direction = direction of traffic being examined
Wol = width of outside lane (including shoulder)
Vol15 (OL) = 15-minute peak period traffic volume
SPD = average speed of motor traffic
SPp = posted speed limit
SPt = effective speed limit (as defined in BLOS instructions)
HV = heavy truck traffic (as percentage)
PR5 = FHWA 5-point grade for road surface quality
We = effective width of outside lane (Wol less obstructions)
BLOS = calculated level of service score
BLOS Grade = calculated level of service grade

Assumptions and Methodological Notes:

- SPt was modified for roads with a posted speed limit of 20 miles per hour—in the equation to compute SPt, 18 was substituted for 20 on these segments
- On roads without striped parking lanes, the effective width was defined as the width of the outside lane, less 10 times the percent on-street parking (average parking lane width being assumed as 10 feet)
- PR5 was defined as 2.5 on undesirable roads (those in need of major repairs), 3.5 on typical roads, and 4.5 on desirable roads (those in excellent condition)—this was in accordance with a recommendation in the FDOT *Level of Service Handbook*
- HV is assumed to be 1% on signalized streets and 1.5% on major city roadways (arterials), in accordance with simplifications recommended in the FDOT *Level of Service Handbook*

Segment	Direction	Wol	Vol15(OL)	SPD	SPp	SPt	HV	PR5	We	BLOS	BLOS Grade
1	SB	10.5	8.75	34	25	2.612709518	0	3.5	0.5	2.955205747	C
1	NB	10.5	15.5	34	25	2.612709518	0	3.5	10.5	2.695101413	C
2	EB	9.5	0.5	34	25	2.612709518	0	3.5	9.5	1.0540699	A
2	WB	9.5	1	34	25	2.612709518	0	3.5	0	1.856745521	B
3	SB	11	1.25	34	25	2.612709518	0.01	3.5	11	1.478418548	A
3	NB	11	2.5	34	25	2.612709518	0.01	3.5	11	1.829844168	B
4	EB	11	1.5	34	25	2.612709518	0	3.5	11	1.45731633	A
4	WB	11	0.75	34	25	2.612709518	0	3.5	11	1.10589071	A
5	SB	11.5	2.25	34	25	2.612709518	0	3.5	11.5	1.60663714	B
5	NB	11.5	3.5	34	25	2.612709518	0	3.5	11.5	1.830646346	B
6	SB	12.5	3	34	25	2.612709518	0	3.5	12.5	1.632491951	B
6	NB	12.5	5	34	25	2.612709518	0	3.5	12.5	1.891480542	B
7	EB	10	0.75	34	25	2.612709518	0	3.5	0	1.71089071	B
7	WB	10	1.5	34	25	2.612709518	0	3.5	10	1.56231633	B
8	EB	10	6.75	34	25	2.612709518	0	3.5	0	2.824883571	C
8	WB	10	12.25	34	25	2.612709518	0	3.5	10	2.627047171	C
9	SB	10	18	34	25	2.612709518	0.01	3.5	10	2.935703248	C
9	NB	10	33.5	34	25	2.612709518	0.01	3.5	10	3.250638305	C
10	SB	10	15.25	34	25	2.612709518	0	3.5	10	2.738107329	C
10	NB	10	27.75	34	25	2.612709518	0	3.5	10	3.041626092	C
11	SB	10	8.25	34	25	2.612709518	0	3.5	10	2.426623613	B
11	NB	10	14.75	34	25	2.612709518	0	3.5	10	2.721205764	C
12	EB	12	0.5	34	25	2.612709518	0	3.5	12	0.7853199	A
12	WB	12	1	34	25	2.612709518	0	3.5	2	1.836745521	B
13	EB	11.5	1.25	34	25	2.612709518	0	3.5	11.5	1.308629301	A
13	WB	11.5	2.25	34	25	2.612709518	0	3.5	1.5	2.25663714	B
14	EB	12	0.75	34	25	2.612709518	0	3.5	2	1.69089071	B
14	WB	12	1.25	34	25	2.612709518	0	3.5	12	1.249879301	A
15	SB	13	3	34	25	2.612709518	0	3.5	3	2.368741951	B
15	NB	13	5.25	34	25	2.612709518	0	3.5	13	1.852467155	B
16	SB	13	4.25	34	25	2.612709518	0	3.5	3	2.545333445	C
16	NB	13	6.75	34	25	2.612709518	0	3.5	13	1.979883571	B
17	SB	13	8	34	25	2.612709518	0	3.5	13	2.066022382	B
17	NB	13	14.5	34	25	2.612709518	0	3.5	13	2.367538886	B
18	SB	13.5	26.25	44	35	3.84304542	0.015	2.5	13.5	3.657470673	D
18	NB	12	133.75	44	35	3.84304542	0.015	2.5	12	4.674272016	E
19	EB	12	6.25	34	25	2.612709518	0	3.5	2	2.765864323	C
19	WB	12	3.25	34	25	2.612709518	0	3.5	12	1.734323604	B
20	SB	16	3.25	34	25	2.612709518	0.01	3.5	6	2.38786285	B
20	NB	9	5.5	34	25	2.612709518	0.01	3.5	9	2.42959205	B

Figure D-1: BLOS Calculations and Values

Chapel Hill Town Center: Alternative Transportation Level of Service

Segment	Direction	Wol	Vol15(OL)	SPD	SPp	SPt	HV	PR5	We	BLOS	BLOS Grade
21	SB	12	88	34	25	2.612709518	0.01	3.5	12	3.520294532	D
21	NB	11	109	34	25	2.612709518	0.01	3.5	11	3.743798144	D
22	EB	11	70	34	25	2.612709518	0.01	2.5	11	4.073015528	D
22	WB	11	90.5	34	25	2.612709518	0.01	2.5	11	4.203240815	D
23	SB	19	6.25	34	25	2.612709518	0.01	3.5	9	2.494403569	B
23	NB	19	5.5	34	25	2.612709518	0.01	3.5	9	2.42959205	B
24	EB	12	72	34	25	2.612709518	0.015	3.5	12	3.479525572	C
24	WB	13	90.5	34	25	2.612709518	0.015	3.5	13	3.470468224	C
25	SB	17	76.25	34	25	2.612709518	0.015	2.5	7	4.537346353	E
25	NB	10.5	93.125	34	25	2.612709518	0.015	2.5	10.5	4.332458461	D
26	EB	19	34.75	34	25	2.612709518	0.015	3.5	19	2.025182893	B
26	WB	18	26.25	34	25	2.612709518	0.015	3.5	18	2.067962506	B
27	EB	20	30.75	34	25	2.612709518	0.015	3.5	20	1.768182077	B
27	WB	19	19.5	34	25	2.612709518	0.015	3.5	19	1.732255984	B
28	SB	11	18	34	25	2.612709518	0.01	3.5	11	2.830703248	C
28	NB	11	33.5	34	25	2.612709518	0.01	3.5	11	3.145638305	C
29	EB	19	33.5	34	25	2.612709518	0.015	2.5	19	2.560353061	C
29	WB	19	19.5	34	25	2.612709518	0.015	2.5	17.7	2.524549657	C
30	EB	19	39.5	34	25	2.612709518	0.015	3.5	19	2.090140291	B
30	WB	19	13.25	34	25	2.612709518	0.015	3.5	16.1	2.045292609	B
31	SB	17	2	34	25	2.612709518	0.01	3.5	13.8	1.369510388	A
31	NB	10	1	34	25	2.612709518	0.01	3.5	10	1.470284767	A
32	EB	14	42.25	34	25	2.612709518	0.015	3.5	14	2.949263257	C
32	WB	12	15	34	25	2.612709518	0.015	3.5	12	2.684237302	C
33	SB	20	3.75	34	25	2.612709518	0.01	3.5	17.2	1.161214978	A
33	NB	18	5.25	34	25	2.612709518	0.01	3.5	15.7	1.578556402	B
34	EB	18	46	34	25	2.612709518	0.015	3.5	18	2.352377038	B
34	WB	10	20.25	34	25	2.612709518	0.015	3.5	10	3.05639033	C
35	EB	18	37.25	34	25	2.612709518	0.015	3.5	18	2.245405386	B
35	WB	9.5	4.5	34	25	2.612709518	0.015	3.5	9.5	2.34257309	B
36	SB	10	0.75	29	20	1.586555528	0.01	3.5	10	1.075632238	A
36	NB	11	0.5	29	20	1.586555528	0.01	3.5	11	0.765061428	A
37	EB	11	113.625	29	20	1.586555528	0.015	3.5	11	3.553093552	D
37	WB	11	99.375	29	20	1.586555528	0.015	3.5	11	3.485154041	C
38	EB	17	113	29	20	1.586555528	0.015	3.5	14.7	3.074847075	C
38	WB	17	99.5	29	20	1.586555528	0.015	3.5	12.5	3.309541376	C
39	EB	19	106	29	20	1.586555528	0.015	3.5	15.8	2.874675071	C
39	WB	19	91.75	29	20	1.586555528	0.015	3.5	11.9	3.341628666	C
40	EB	19	85	29	20	1.586555528	0.015	3.5	19	2.205935638	B
40	WB	17	66.125	29	20	1.586555528	0.015	3.5	17	2.438625724	B

Figure D-1 continued

Segment	Direction	Wol	Vol15(OL)	SPD	SPp	SPt	HV	PR5	We	BLOS	BLOS Grade
41	EB	18	77.125	29	20	1.586555528	0.015	3.5	18	2.341643184	B
41	WB	8.5	57.375	29	20	1.586555528	0.015	3.5	8.5	3.450413045	C
42	EB	18	68	29	20	1.586555528	0.015	2.5	18	2.831545531	C
42	WB	11	83.125	29	20	1.586555528	0.015	2.5	11	3.948370292	D
43	EB	18	162.75	29	20	1.586555528	0.015	3.5	14	3.360264598	C
43	WB	20	162.75	29	20	1.586555528	0.015	3.5	12.3	3.583814598	D
44	EB	17	163.5	29	20	1.586555528	0.015	3.5	7	4.097595637	D
44	WB	9	170.375	29	20	1.586555528	0.015	3.5	9	3.958478409	D
45	SB	11	134.5	34	25	2.612709518	0.01	4.5	11	3.622499761	D
45	NB	19	164.25	34	25	2.612709518	0.01	4.5	11	3.723811269	D
46	EB	12	89.5	34	25	2.612709518	0.01	3.5	12	3.52886375	D
46	WB	12	109.25	34	25	2.612709518	0.01	3.5	12	3.629959656	D
47	SB	9	101.75	34	25	2.612709518	0.015	2.5	9	4.523616567	E
47	NB	11	124.875	34	25	2.612709518	0.015	2.5	11	4.427447335	D
48	EB	12	88.5	34	25	2.612709518	0.015	3.5	12	3.584138144	D
48	WB	10	132.625	34	25	2.612709518	0.015	3.5	10	4.009231328	D
49	EB	22	97	34	25	2.612709518	0.01	3.5	22	1.869663233	B
49	WB	22	118.5	34	25	2.612709518	0.01	3.5	16.9	2.963115638	C
50	EB	23	92.75	34	25	2.612709518	0.01	3.5	13	3.421947972	C
50	WB	23	110.25	34	25	2.612709518	0.01	3.5	13	3.509579278	D
51	SB	12	2.25	34	25	2.612709518	0.01	3.5	12	1.661426387	B
51	NB	12	2.25	34	25	2.612709518	0.01	3.5	12	1.661426387	B
52	EB	18	92.5	34	25	2.612709518	0.01	3.5	18	2.64557955	C
52	WB	17	109.75	34	25	2.612709518	0.01	3.5	17	2.907274729	C
53	EB	17	89	34	25	2.612709518	0.01	3.5	17	2.801023407	C
53	WB	17	103	34	25	2.612709518	0.01	3.5	17	2.875092364	C
54	SB	12	3.25	34	25	2.612709518	0	3.5	12	1.734323604	B
54	NB	12	1.75	34	25	2.612709518	0	3.5	12	1.420470725	A
57	EB	23	88.75	34	25	2.612709518	0.01	3.5	21.7	1.890147245	B
57	WB	23	102.75	34	25	2.612709518	0.01	3.5	13	3.473860286	C
58	SB	14	2.75	34	25	2.612709518	0	2.5	4	2.843370856	C
58	NB	14	1.5	34	25	2.612709518	0	2.5	4	2.536060004	C
59	EB	23	85.75	34	25	2.612709518	0.01	3.5	13	3.382162863	C
59	WB	23	99.75	34	25	2.612709518	0.01	3.5	13	3.458836965	C
60	SB	18	2	34	25	2.612709518	0.01	2.5	8	2.555454061	C
60	NB	18	0.75	34	25	2.612709518	0.01	2.5	8	2.05817363	B
61	EB	23	85.75	34	25	2.612709518	0.01	3.5	18	2.607162863	C
61	WB	23	99.75	34	25	2.612709518	0.01	3.5	18	2.683836965	C
62	SB	9	74.5	29	20	1.586555528	0.01	3.5	9	3.502062205	D
62	NB	9	56.75	29	20	1.586555528	0.01	3.5	9	3.364085466	C

Figure D-1 continued

APPENDIX E: BCI ANALYSIS

How to read these tables:

Segment = number of segment being analyzed
Direction = direction of traffic being analyzed
BL = presence of bicycle lane (0 = no, 1 = yes)
BLW = width of bicycle lane (meters)
CLW = width of curb (outside) lane (feet and meters)
CLV (PH) = peak hour traffic volume in curb lane
Dir. L = number of lanes traveling this direction
OLV (PH) = peak hour traffic volume in other lanes (same direction)
SPD = 85th percentile of speed of traffic (km/hour)
PKG = presence of on-street parking (0 = no, 1 = yes)
AREA = neighboring land uses (1 = residential, 0 = other)
HV = percent heavy trucks on road
HCLTV = volume of trucks in curb lane in peak hour
ft = truck volume factor
fp = parking turnover factor
HRTV = number of right turns from curb lane in peak hour (driveways only—not intersections)
frt = right turn volume factor
BCI = calculated level of service score
Grade = calculated level of service grade

Assumptions and Methodological Notes:

- On streets with unstriped on-street parking, assume the width of the parking lane is 8 feet (the parking lane does not count toward the lane width in the BCI method)
- 85th percentile of speed is assumed to be 15 km/hour over the posted speed limit
- In computing HRTV, the assigned values are the number of trips entering residential parcels on the side of the street with the peak direction of traffic and the number of trips entering non-residential parcels in the non-peak direction
- Since there are no parking time limits in Chapel Hill's Town Center, the parking factor is 0—other factors are defined based on the tables provided in the BCI guidebook

Two sets of tables are presented here. The first set (Figure E-1)shows the original grades derived using the standard BCI grading scale. The second set (Figure E-2) shows the final grades after adjusting the low-volume roads to the new grading scale.

Segment	Direction	BL	BLW (m)	CLW (ft)	CLW (m)	CLV (PH)	Dir. L	OLV (PH)	SPD (km/h)	PKG	AREA	HV	HCLTV	ft	fp	HRTV	frt	BCI	Grade
1	SB	0	0	6.5	1.9812	35	1	0	55	1	1	0	0	0	0	0	0	4.2053624	D
1	NB	0	0	6.5	1.9812	62	1	0	55	0	1	0	0	0	0	9	0	3.7533624	D
2	EB	0	0	5.5	1.6764	2	1	0	55	0	1	0	0	0	0	0	0	3.7851528	D
2	WB	0	0	5.5	1.6764	4	1	0	55	1	1	0	0	0	0	3	0	4.2951528	D
3	SB	0	0	11	3.3528	5	1	0	55	0	1	0.01	0.05	0	0	0	0	2.9563056	C
3	NB	0	0	11	3.3528	10	1	0	55	0	1	0.01	0.1	0	0	1	0	2.9663056	C
4	EB	0	0	11	3.3528	6	1	0	55	0	1	0	0	0	0	0	0	2.9583056	C
4	WB	0	0	11	3.3528	3	1	0	55	0	1	0	0	0	0	0	0	2.9523056	C
5	SB	0	0	11.5	3.5052	9	1	0	55	0	1	0	0	0	0	0	0	2.8884104	C
5	NB	0	0	11.5	3.5052	14	1	0	55	0	1	0	0	0	0	1	0	2.8984104	C
6	SB	0	0	12.5	3.81	12	1	0	55	0	1	0	0	0	0	0	0	2.74262	C
6	NB	0	0	12.5	3.81	20	1	0	55	0	1	0	0	0	0	4	0	2.75862	C
7	EB	0	0	6	1.8288	3	1	0	55	1	1	0	0	0	0	0	0	4.2172576	D
7	WB	0	0	6	1.8288	6	1	0	55	0	1	0	0	0	0	3	0	3.7172576	D
8	EB	0	0	6	1.8288	27	1	0	55	1	1	0	0	0	0	0	0	4.2652576	D
8	WB	0	0	6	1.8288	49	1	0	55	0	1	0	0	0	0	5	0	3.8032576	D
9	SB	0	0	10	3.048	72	1	0	55	0	1	0.01	0.72	0	0	0	0	3.242096	C
9	NB	0	0	10	3.048	134	1	0	55	0	1	0.01	1.34	0	0	0	0	3.366096	C
10	SB	0	0	10	3.048	61	1	0	55	0	1	0	0	0	0	0	0	3.220096	C
10	NB	0	0	10	3.048	111	1	0	55	0	1	0	0	0	0	0	0	3.320096	C
11	SB	0	0	10	3.048	33	1	0	55	0	1	0	0	0	0	0	0	3.164096	C
11	NB	0	0	10	3.048	59	1	0	55	0	1	0	0	0	0	0	0	3.216096	C
12	EB	0	0	8	2.4384	2	1	0	55	0	1	0	0	0	0	0	0	3.4056768	D
12	WB	0	0	8	2.4384	4	1	0	55	1	1	0	0	0	0	2	0	3.9156768	D
13	EB	0	0	7.5	2.286	5	1	0	55	0	1	0	0	0	0	0	0	3.487572	D
13	WB	0	0	7.5	2.286	9	1	0	55	1	1	0	0	0	0	4	0	4.001572	D
14	EB	0	0	8	2.4384	3	1	0	55	1	1	0	0	0	0	0	0	3.9136768	D
14	WB	0	0	8	2.4384	5	1	0	55	0	1	0	0	0	0	3	0	3.4116768	D
15	SB	0	0	9	2.7432	12	1	0	55	1	1	0	0	0	0	0	0	3.7798864	D
15	NB	0	0	9	2.7432	21	1	0	55	0	1	0	0	0	0	4	0	3.2918864	C
16	SB	0	0	9	2.7432	17	1	0	55	1	1	0	0	0	0	0	0	3.7898864	D
16	NB	0	0	9	2.7432	27	1	0	55	0	1	0	0	0	0	1	0	3.3038864	C
17	SB	0	0	13	3.9624	32	1	0	55	0	0	0	0	0	0	0	0	2.9707248	C
17	NB	0	0	13	3.9624	58	1	0	55	0	0	0	0	0	0	0	0	3.0227248	C
18	SB	0	0	13.5	4.1148	105	3	747	71	0	0	0.015	1.575	0	0	1	0	3.6916296	D
18	NB	0	0	12	3.6576	535	2	535	71	0	0	0.015	8.025	0	0	0	0	4.6945152	E
19	EB	0	0	8	2.4384	25	1	0	55	1	1	0	0	0	0	18	0	3.9576768	D
19	WB	0	0	8	2.4384	13	1	0	55	0	1	0	0	0	0	0	0	3.4276768	D
20	SB	0	0	8	2.4384	13	1	0	55	1	1	0.01	0.13	0	0	0	0	3.9336768	D
20	NB	0	0	9	2.7432	22	1	0	55	0	1	0.01	0.22	0	0	1	0	3.2938864	C

Figure E-1: Original BCI Calculations and Values

Chapel Hill Town Center: Alternative Transportation Level of Service

Segment	Direction	BL	BLW (m)	CLW (ft)	CLW (m)	CLV (PH)	Dir. L	OLV (PH)	SPD (km/h)	PKG	AREA	HV	HCLTV	ft	fp	HRTV	frt	BCI	Grade
21	SB	0	0	12	3.6576	352	1	0	55	0	1	0.01	3.52	0	0	0	0	3.4985152	D
21	NB	0	0	11	3.3528	436	1	0	55	0	1	0.01	4.36	0	0	2	0	3.8183056	D
22	EB	0	0	11	3.3528	280	1	0	55	0	1	0.01	2.8	0	0	13	0	3.5063056	D
22	WB	0	0	11	3.3528	362	1	0	55	0	1	0.01	3.62	0	0	9	0	3.6703056	D
23	SB	0	0	11	3.3528	25	1	0	55	1	0	0.01	0.25	0	0	0	0	3.7663056	D
23	NB	0	0	11	3.3528	22	1	0	55	1	0	0.01	0.22	0	0	0	0	3.7603056	D
24	EB	0	0	12	3.6576	288	1	0	55	0	0	0.015	4.32	0	0	0	0	3.6345152	D
24	WB	0	0	13	3.9624	362	1	0	55	0	0	0.015	5.43	0	0	222	0	3.6307248	D
25	SB	0	0	9	2.7432	305	2	305	55	1	0	0.015	4.575	0	0	3	0	4.7518864	E
25	NB	0	0	10.5	3.2004	372.5	2	372.5	55	0	0	0.015	5.5875	0	0	0	0	4.1802008	D
26	EB	0	0	19	5.7912	139	1	0	55	0	0	0.015	2.085	0	0	0	0	2.2739824	B
26	WB	0	0	18	5.4864	105	1	0	55	0	0	0.015	1.575	0	0	0	0	2.3577728	C
27	EB	0	0	20	6.096	123	1	0	55	0	0	0.015	1.845	0	0	0	0	2.090192	B
27	WB	0	0	19	5.7912	78	1	0	55	0	0	0.015	1.17	0	0	1	0	2.1519824	B
28	SB	0	0	11	3.3528	72	1	0	55	0	0	0.01	0.72	0	0	1	0	3.3543056	C
28	NB	0	0	11	3.3528	134	1	0	55	0	0	0.01	1.34	0	0	0	0	3.4783056	D
29	EB	0	0	19	5.7912	134	1	0	55	0	0	0.015	2.01	0	0	3	0	2.2639824	B
29	WB	0	0	11	3.3528	78	1	0	55	0	0	0.015	1.17	0	0	50	0	3.3663056	C
30	EB	0	0	19	5.7912	158	1	0	55	0	0	0.015	2.37	0	0	11	0	2.3119824	C
30	WB	0	0	11	3.3528	53	1	0	55	0	0	0.015	0.795	0	0	1	0	3.3163056	C
31	SB	0	0	9	2.7432	8	1	0	55	1	0	0.01	0.08	0	0	6	0	4.0358864	D
31	NB	0	0	10	3.048	4	1	0	55	0	0	0.01	0.04	0	0	0	0	3.370096	C
32	EB	0	0	14	4.2672	169	1	0	55	0	0	0.015	2.535	0	0	3	0	3.0929344	C
32	WB	0	0	12	3.6576	60	1	0	55	0	0	0.015	0.9	0	0	1	0	3.1785152	C
33	SB	0	0	12	3.6576	15	1	0	55	0	0	0.01	0.15	0	0	9	0	3.0885152	C
33	NB	0	0	10	3.048	21	1	0	55	0	0	0.01	0.21	0	0	1	0	3.404096	D
34	EB	0	0	18	5.4864	184	1	0	55	0	0	0.015	2.76	0	0	0	0	2.5157728	C
34	WB	0	0	10	3.048	81	1	0	55	0	0	0.015	1.215	0	0	1	0	3.524096	D
35	EB	0	0	18	5.4864	149	1	0	55	0	1	0.015	2.235	0	0	1	0	2.1817728	B
35	WB	0	0	9.5	2.8956	18	1	0	55	0	1	0.015	0.27	0	0	1	0	3.2099912	C
36	SB	0	0	10	3.048	3	1	0	47	0	1	0.01	0.03	0	0	2	0	2.928096	C
36	NB	0	0	11	3.3528	2	1	0	47	0	1	0.01	0.02	0	0	0	0	2.7743056	C
37	EB	0	0	11	3.3528	454.5	2	454.5	47	0	0	0.015	6.8175	0	0	8	0	4.1251056	D
37	WB	0	0	11	3.3528	397.5	2	397.5	47	0	0	0.015	5.9625	0	0	0	0	3.9883056	D
38	EB	0	0	9	2.7432	452	2	452	47	0	0	0.015	6.78	0	0	3	0	4.4226864	E
38	WB	0	0	9	2.7432	398	2	398	47	1	0	0.015	5.97	0	0	0	0	4.7990864	E
39	EB	0	0	11	3.3528	424	2	424	47	1	0	0.015	6.36	0	0	70	0	4.5579056	E
39	WB	0	0	11	3.3528	367	2	367	47	1	0	0.015	5.505	0	0	0	0	4.4211056	E
40	EB	0	0	19	5.7912	340	2	340	47	0	0	0.015	5.1	0	0	27	0	2.6359824	C
40	WB	0	0	17	5.1816	264.5	2	264.5	47	0	0	0.015	3.9675	0	0	0	0	2.7583632	C

Figure E-1 continued

Segment	Direction	BL	BLW (m)	CLW (ft)	CLW (m)	CLV (PH)	Dir. L	OLV (PH)	SPD (km/h)	PKG	AREA	HV	HCLTV	ft	fp	HRTV	frt	BCI	Grade
41	EB	0	0	18	5.4864	308.5	2	308.5	47	0	0	0.015	4.6275	0	0	44	0	2.7121728	C
41	WB	0	0	8.5	2.5908	229.5	2	229.5	47	0	0	0.015	3.4425	0	0	0	0	3.9645816	D
42	EB	0	0	18	5.4864	272	2	272	47	0	0	0.015	4.08	0	0	675	0.1	2.7245728	C
42	WB	0	0	11	3.3528	332.5	2	332.5	47	0	0	0.015	4.9875	0	0	0	0	3.8323056	D
43	EB	0	0	10	3.048	651	2	651	47	1	0	0.015	9.765	0	0	0	0	5.254496	E
43	WB	0	0	12	3.6576	651	2	651	47	1	0	0.015	9.765	0	0	537	0.1	5.0509152	E
44	EB	0	0	9	2.7432	654	2	654	47	1	1	0.015	9.81	0	0	0	0	5.1494864	E
44	WB	0	0	9	2.7432	681.5	2	681.5	47	0	1	0.015	10.2225	0.1	0	91	0	4.8094864	E
45	SB	0	0	11	3.3528	538	1	0	55	0	0	0.01	5.38	0	0	0	0	4.2863056	D
45	NB	0	0	11	3.3528	657	1	0	55	1	0	0.01	6.57	0	0	0	0	5.0303056	E
46	EB	0	0	12	3.6576	358	1	0	55	0	0	0.01	3.58	0	0	0	0	3.7745152	D
46	WB	0	0	12	3.6576	437	1	0	55	0	0	0.01	4.37	0	0	209	0	3.9325152	D
47	SB	0	0	9	2.7432	408.5	2	408.5	55	0	0	0.015	6.1275	0	0	17	0	4.4942864	E
47	NB	0	0	11	3.3528	499.5	2	499.5	55	0	0	0.015	7.4925	0	0	0	0	4.4091056	E
48	EB	0	0	12	3.6576	354	1	0	55	0	1	0.015	5.31	0	0	0	0	3.5025152	D
48	WB	0	0	10	3.048	530.5	2	530.5	55	0	1	0.015	7.9575	0	0	21	0	4.371296	D
49	EB	0	0	22	6.7056	388	1	0	55	0	1	0.01	3.88	0	0	0	0	2.0526112	B
49	WB	0	0	14	4.2672	474	1	0	55	1	1	0.01	4.74	0	0	17	0	3.9449344	D
50	EB	0	0	15	4.572	371	1	0	55	1	1	0.01	3.71	0	0	0	0	3.587144	D
50	WB	0	0	15	4.572	441	1	0	55	1	1	0.01	4.41	0	0	1	0	3.727144	D
51	SB	0	0	12	3.6576	9	1	0	55	0	1	0.01	0.09	0	0	5	0	2.8125152	C
51	NB	0	0	12	3.6576	9	1	0	55	0	1	0.01	0.09	0	0	0	0	2.8125152	C
52	EB	0	0	18	5.4864	370	1	0	55	0	1	0.01	3.7	0	0	0	0	2.6237728	C
52	WB	0	0	17	5.1816	439	1	0	55	0	1	0.01	4.39	0	0	2	0	2.9135632	C
53	EB	0	0	17	5.1816	356	1	0	55	0	1	0.01	3.56	0	0	0	0	2.7475632	C
53	WB	0	0	17	5.1816	412	1	0	55	0	1	0.01	4.12	0	0	1	0	2.8595632	C
54	SB	0	0	12	3.6576	13	1	0	55	0	1	0	0	0	0	9	0	2.8205152	C
54	NB	0	0	12	3.6576	7	1	0	55	0	1	0	0	0	0	0	0	2.8085152	C
57	EB	0	0	15	4.572	355	1	0	55	0	1	0.01	3.55	0	0	0	0	3.049144	C
57	WB	0	0	15	4.572	411	1	0	55	1	1	0.01	4.11	0	0	15	0	3.667144	D
58	SB	0	0	6	1.8288	11	1	0	55	1	1	0	0	0	0	4	0	4.2332576	D
58	NB	0	0	6	1.8288	6	1	0	55	1	1	0	0	0	0	0	0	4.2232576	D
59	EB	0	0	15	4.572	343	1	0	55	1	1	0.01	3.43	0	0	5	0	3.531144	D
59	WB	0	0	15	4.572	399	1	0	55	1	1	0.01	3.99	0	0	3	0	3.643144	D
60	SB	0	0	10	3.048	8	1	0	55	1	1	0.01	0.08	0	0	5	0	3.620096	D
60	NB	0	0	10	3.048	3	1	0	55	1	1	0.01	0.03	0	0	0	0	3.610096	D
61	EB	0	0	15	4.572	343	1	0	55	1	1	0.01	3.43	0	0	0	0	3.531144	D
61	WB	0	0	15	4.572	399	1	0	55	1	1	0.01	3.99	0	0	1	0	3.643144	D
62	SB	0	0	9	2.7432	298	1	0	47	0	1	0.01	2.98	0	0	2	0	3.6698864	D
62	NB	0	0	9	2.7432	227	1	0	47	0	1	0.01	2.27	0	0	3	0	3.5278864	D

Figure E-1 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

Segment	Direction	BL	BLW (m)	CLW (ft)	CLW (m)	CLV (PH)	Dir. L	OLV (PH)	SPD (km/h)	PKG	AREA	HV	HCLTV	ft	fp	HRTV	frt	BCI	Grade
1	SB	0	0	6.5	1.9812	35	1	0	55	1	1	0	0	0	0	0	0	4.2053624	D
1	NB	0	0	6.5	1.9812	62	1	0	55	0	1	0	0	0	0	9	0	3.7533624	C
2	EB	0	0	5.5	1.6764	2	1	0	55	0	1	0	0	0	0	0	0	3.7851528	C
2	WB	0	0	5.5	1.6764	4	1	0	55	1	1	0	0	0	0	3	0	4.2951528	D
3	SB	0	0	11	3.3528	5	1	0	55	0	1	0.01	0.05	0	0	0	0	2.9563056	B
3	NB	0	0	11	3.3528	10	1	0	55	0	1	0.01	0.1	0	0	1	0	2.9663056	B
4	EB	0	0	11	3.3528	6	1	0	55	0	1	0	0	0	0	0	0	2.9583056	B
4	WB	0	0	11	3.3528	3	1	0	55	0	1	0	0	0	0	0	0	2.9523056	B
5	SB	0	0	11.5	3.5052	9	1	0	55	0	1	0	0	0	0	0	0	2.8884104	B
5	NB	0	0	11.5	3.5052	14	1	0	55	0	1	0	0	0	0	1	0	2.8984104	B
6	SB	0	0	12.5	3.81	12	1	0	55	0	1	0	0	0	0	0	0	2.74262	B
6	NB	0	0	12.5	3.81	20	1	0	55	0	1	0	0	0	0	4	0	2.75862	B
7	EB	0	0	6	1.8288	3	1	0	55	1	1	0	0	0	0	0	0	4.2172576	D
7	WB	0	0	6	1.8288	6	1	0	55	0	1	0	0	0	0	3	0	3.7172576	C
8	EB	0	0	6	1.8288	27	1	0	55	1	1	0	0	0	0	0	0	4.2652576	D
8	WB	0	0	6	1.8288	49	1	0	55	0	1	0	0	0	0	5	0	3.8032576	C
9	SB	0	0	10	3.048	72	1	0	55	0	1	0.01	0.72	0	0	0	0	3.242096	C
9	NB	0	0	10	3.048	134	1	0	55	0	1	0.01	1.34	0	0	0	0	3.366096	C
10	SB	0	0	10	3.048	61	1	0	55	0	1	0	0	0	0	0	0	3.220096	C
10	NB	0	0	10	3.048	111	1	0	55	0	1	0	0	0	0	0	0	3.320096	C
11	SB	0	0	10	3.048	33	1	0	55	0	1	0	0	0	0	0	0	3.164096	C
11	NB	0	0	10	3.048	59	1	0	55	0	1	0	0	0	0	0	0	3.216096	C
12	EB	0	0	8	2.4384	2	1	0	55	0	1	0	0	0	0	0	0	3.4056768	C
12	WB	0	0	8	2.4384	4	1	0	55	1	1	0	0	0	0	2	0	3.9156768	C
13	EB	0	0	7.5	2.286	5	1	0	55	0	1	0	0	0	0	0	0	3.487572	C
13	WB	0	0	7.5	2.286	9	1	0	55	1	1	0	0	0	0	4	0	4.001572	D
14	EB	0	0	8	2.4384	3	1	0	55	1	1	0	0	0	0	0	0	3.9136768	C
14	WB	0	0	8	2.4384	5	1	0	55	0	1	0	0	0	0	3	0	3.4116768	C
15	SB	0	0	9	2.7432	12	1	0	55	1	1	0	0	0	0	0	0	3.7798864	C
15	NB	0	0	9	2.7432	21	1	0	55	0	1	0	0	0	0	4	0	3.2918864	C
16	SB	0	0	9	2.7432	17	1	0	55	1	1	0	0	0	0	0	0	3.7898864	C
16	NB	0	0	9	2.7432	27	1	0	55	0	1	0	0	0	0	1	0	3.3038864	C
17	SB	0	0	13	3.9624	32	1	0	55	0	0	0	0	0	0	0	0	2.9707248	B
17	NB	0	0	13	3.9624	58	1	0	55	0	0	0	0	0	0	0	0	3.0227248	C
18	SB	0	0	13.5	4.1148	105	3	747	71	0	0	0.015	1.575	0	0	1	0	3.6916296	D
18	NB	0	0	12	3.6576	535	2	535	71	0	0	0.015	8.025	0	0	0	0	4.6945152	E
19	EB	0	0	8	2.4384	25	1	0	55	1	1	0	0	0	0	18	0	3.9576768	C
19	WB	0	0	8	2.4384	13	1	0	55	0	1	0	0	0	0	0	0	3.4276768	C
20	SB	0	0	8	2.4384	13	1	0	55	1	1	0.01	0.13	0	0	0	0	3.9336768	C
20	NB	0	0	9	2.7432	22	1	0	55	0	1	0.01	0.22	0	0	1	0	3.2938864	C

Figure E-2: Adjusted BCI Calculations and Values

Segment	Direction	BL	BLW (m)	CLW (ft)	CLW (m)	CLV (PH)	Dir. L	OLV (PH)	SPD (km/h)	PKG	AREA	HV	HCLTV	ft	fp	HRTV	frt	BCI	Grade
21	SB	0	0	12	3.6576	352	1	0	55	0	1	0.01	3.52	0	0	0	0	3.4985152	D
21	NB	0	0	11	3.3528	436	1	0	55	0	1	0.01	4.36	0	0	2	0	3.8183056	D
22	EB	0	0	11	3.3528	280	1	0	55	0	1	0.01	2.8	0	0	13	0	3.5063056	D
22	WB	0	0	11	3.3528	362	1	0	55	0	1	0.01	3.62	0	0	9	0	3.6703056	D
23	SB	0	0	11	3.3528	25	1	0	55	1	0	0.01	0.25	0	0	0	0	3.7663056	C
23	NB	0	0	11	3.3528	22	1	0	55	1	0	0.01	0.22	0	0	0	0	3.7603056	C
24	EB	0	0	12	3.6576	288	1	0	55	0	0	0.015	4.32	0	0	0	0	3.6345152	D
24	WB	0	0	13	3.9624	362	1	0	55	0	0	0.015	5.43	0	0	222	0	3.6307248	D
25	SB	0	0	9	2.7432	305	2	305	55	1	0	0.015	4.575	0	0	3	0	4.7518864	E
25	NB	0	0	10.5	3.2004	372.5	2	372.5	55	0	0	0.015	5.5875	0	0	0	0	4.1802008	D
26	EB	0	0	19	5.7912	139	1	0	55	0	0	0.015	2.085	0	0	0	0	2.2739824	B
26	WB	0	0	18	5.4864	105	1	0	55	0	0	0.015	1.575	0	0	0	0	2.3577728	C
27	EB	0	0	20	6.096	123	1	0	55	0	0	0.015	1.845	0	0	0	0	2.090192	B
27	WB	0	0	19	5.7912	78	1	0	55	0	0	0.015	1.17	0	0	1	0	2.1519824	B
28	SB	0	0	11	3.3528	72	1	0	55	0	0	0.01	0.72	0	0	1	0	3.3543056	C
28	NB	0	0	11	3.3528	134	1	0	55	0	0	0.01	1.34	0	0	0	0	3.4783056	C
29	EB	0	0	19	5.7912	134	1	0	55	0	0	0.015	2.01	0	0	3	0	2.2639824	B
29	WB	0	0	11	3.3528	78	1	0	55	0	0	0.015	1.17	0	0	50	0	3.3663056	C
30	EB	0	0	19	5.7912	158	1	0	55	0	0	0.015	2.37	0	0	11	0	2.3119824	C
30	WB	0	0	11	3.3528	53	1	0	55	0	0	0.015	0.795	0	0	1	0	3.3163056	C
31	SB	0	0	9	2.7432	8	1	0	55	1	0	0.01	0.08	0	0	6	0	4.0358864	D
31	NB	0	0	10	3.048	4	1	0	55	0	0	0.01	0.04	0	0	0	0	3.370096	C
32	EB	0	0	14	4.2672	169	1	0	55	0	0	0.015	2.535	0	0	3	0	3.0929344	C
32	WB	0	0	12	3.6576	60	1	0	55	0	0	0.015	0.9	0	0	1	0	3.1785152	C
33	SB	0	0	12	3.6576	15	1	0	55	0	0	0.01	0.15	0	0	9	0	3.0885152	C
33	NB	0	0	10	3.048	21	1	0	55	0	0	0.01	0.21	0	0	1	0	3.404096	C
34	EB	0	0	18	5.4864	184	1	0	55	0	0	0.015	2.76	0	0	0	0	2.5157728	C
34	WB	0	0	10	3.048	81	1	0	55	0	0	0.015	1.215	0	0	1	0	3.524096	D
35	EB	0	0	18	5.4864	149	1	0	55	0	1	0.015	2.235	0	0	1	0	2.1817728	B
35	WB	0	0	9.5	2.8956	18	1	0	55	0	1	0.015	0.27	0	0	1	0	3.2099912	C
36	SB	0	0	10	3.048	3	1	0	47	0	1	0.01	0.03	0	0	2	0	2.928096	C
36	NB	0	0	11	3.3528	2	1	0	47	0	1	0.01	0.02	0	0	0	0	2.7743056	C
37	EB	0	0	11	3.3528	454.5	2	454.5	47	0	0	0.015	6.8175	0	0	8	0	4.1251056	D
37	WB	0	0	11	3.3528	397.5	2	397.5	47	0	0	0.015	5.9625	0	0	0	0	3.9883056	D
38	EB	0	0	9	2.7432	452	2	452	47	0	0	0.015	6.78	0	0	3	0	4.4226864	E
38	WB	0	0	9	2.7432	398	2	398	47	1	0	0.015	5.97	0	0	0	0	4.7990864	E
39	EB	0	0	11	3.3528	424	2	424	47	1	0	0.015	6.36	0	0	70	0	4.5579056	E
39	WB	0	0	11	3.3528	367	2	367	47	1	0	0.015	5.505	0	0	0	0	4.4211056	E
40	EB	0	0	19	5.7912	340	2	340	47	0	0	0.015	5.1	0	0	27	0	2.6359824	C
40	WB	0	0	17	5.1816	264.5	2	264.5	47	0	0	0.015	3.9675	0	0	0	0	2.7583632	C

Figure E-2 continued

Chapel Hill Town Center: Alternative Transportation Level of Service

Segment	Direction	BL	BLW (m)	CLW (ft)	CLW (m)	CLV (PH)	Dir. L	OLV (PH)	SPD (km/h)	PKG	AREA	HV	HCLTV	ft	fp	HRTV	frt	BCI	Grade
41	EB	0	0	18	5.4864	308.5	2	308.5	47	0	0	0.015	4.6275	0	0	44	0	2.7121728	C
41	WB	0	0	8.5	2.5908	229.5	2	229.5	47	0	0	0.015	3.4425	0	0	0	0	3.9645816	D
42	EB	0	0	18	5.4864	272	2	272	47	0	0	0.015	4.08	0	0	675	0.1	2.7245728	C
42	WB	0	0	11	3.3528	332.5	2	332.5	47	0	0	0.015	4.9875	0	0	0	0	3.8323056	D
43	EB	0	0	10	3.048	651	2	651	47	1	0	0.015	9.765	0	0	0	0	5.254496	E
43	WB	0	0	12	3.6576	651	2	651	47	1	0	0.015	9.765	0	0	537	0.1	5.0509152	E
44	EB	0	0	9	2.7432	654	2	654	47	1	1	0.015	9.81	0	0	0	0	5.1494864	E
44	WB	0	0	9	2.7432	681.5	2	681.5	47	0	1	0.015	10.2225	0.1	0	91	0	4.8094864	E
45	SB	0	0	11	3.3528	538	1	0	55	0	0	0.01	5.38	0	0	0	0	4.2863056	D
45	NB	0	0	11	3.3528	657	1	0	55	1	0	0.01	6.57	0	0	0	0	5.0303056	E
46	EB	0	0	12	3.6576	358	1	0	55	0	0	0.01	3.58	0	0	0	0	3.7745152	D
46	WB	0	0	12	3.6576	437	1	0	55	0	0	0.01	4.37	0	0	209	0	3.9325152	D
47	SB	0	0	9	2.7432	408.5	2	408.5	55	0	0	0.015	6.1275	0	0	17	0	4.4942864	E
47	NB	0	0	11	3.3528	499.5	2	499.5	55	0	0	0.015	7.4925	0	0	0	0	4.4091056	E
48	EB	0	0	12	3.6576	354	1	0	55	0	1	0.015	5.31	0	0	0	0	3.5025152	D
48	WB	0	0	10	3.048	530.5	2	530.5	55	0	1	0.015	7.9575	0	0	21	0	4.371296	D
49	EB	0	0	22	6.7056	388	1	0	55	0	1	0.01	3.88	0	0	0	0	2.0526112	B
49	WB	0	0	14	4.2672	474	1	0	55	1	1	0.01	4.74	0	0	17	0	3.9449344	D
50	EB	0	0	15	4.572	371	1	0	55	1	1	0.01	3.71	0	0	0	0	3.587144	D
50	WB	0	0	15	4.572	441	1	0	55	1	1	0.01	4.41	0	0	1	0	3.727144	D
51	SB	0	0	12	3.6576	9	1	0	55	0	1	0.01	0.09	0	0	5	0	2.8125152	B
51	NB	0	0	12	3.6576	9	1	0	55	0	1	0.01	0.09	0	0	0	0	2.8125152	B
52	EB	0	0	18	5.4864	370	1	0	55	0	1	0.01	3.7	0	0	0	0	2.6237728	C
52	WB	0	0	17	5.1816	439	1	0	55	0	1	0.01	4.39	0	0	2	0	2.9135632	C
53	EB	0	0	17	5.1816	356	1	0	55	0	1	0.01	3.56	0	0	0	0	2.7475632	C
53	WB	0	0	17	5.1816	412	1	0	55	0	1	0.01	4.12	0	0	1	0	2.8595632	C
54	SB	0	0	12	3.6576	13	1	0	55	0	1	0	0	0	0	9	0	2.8205152	B
54	NB	0	0	12	3.6576	7	1	0	55	0	1	0	0	0	0	0	0	2.8085152	B
57	EB	0	0	15	4.572	355	1	0	55	0	1	0.01	3.55	0	0	0	0	3.049144	C
57	WB	0	0	15	4.572	411	1	0	55	1	1	0.01	4.11	0	0	15	0	3.667144	D
58	SB	0	0	6	1.8288	11	1	0	55	1	1	0	0	0	0	4	0	4.2332576	D
58	NB	0	0	6	1.8288	6	1	0	55	1	1	0	0	0	0	0	0	4.2232576	D
59	EB	0	0	15	4.572	343	1	0	55	1	1	0.01	3.43	0	0	5	0	3.531144	D
59	WB	0	0	15	4.572	399	1	0	55	1	1	0.01	3.99	0	0	3	0	3.643144	D
60	SB	0	0	10	3.048	8	1	0	55	1	1	0.01	0.08	0	0	5	0	3.620096	C
60	NB	0	0	10	3.048	3	1	0	55	1	1	0.01	0.03	0	0	0	0	3.610096	C
61	EB	0	0	15	4.572	343	1	0	55	1	1	0.01	3.43	0	0	0	0	3.531144	D
61	WB	0	0	15	4.572	399	1	0	55	1	1	0.01	3.99	0	0	1	0	3.643144	D
62	SB	0	0	9	2.7432	298	1	0	47	0	1	0.01	2.98	0	0	2	0	3.6698864	D
62	NB	0	0	9	2.7432	227	1	0	47	0	1	0.01	2.27	0	0	3	0	3.5278864	D

Figure E-2 continued

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APPENDIX F: TLOS ANALYSIS

How to read these tables:

Stop Name = name of bus stop being analyzed
Direction = direction of travel of bus serving stop
TLOS (24 hr.) = calculated TLOS score for 24-hour period (percent of time stop is served given 5-minute wait time)
TLOS (time of service) = calculated TLOS score only for pe riod during which bus stop is served (percent of time stop is served given 5-minute wait time)
TLOS Grade = calculated level of service grades (for both 24-hour and time of service analyses)

Figure F-2 shows a sample section of the route segment spreadsheet used to calculate transit level of service.

STOP NAME	DIRECTION	TLOS (24 HR.)	TLOS GRADE	TLOS (TIME OF SERVICE)	TLOS GRADE
CAMERON AVE AT ROBERSON ST	EAST	6.90%	E	11%	E
CAMERON AVE AT CAMERON GLEN	EAST	6.90%	E	11%	E
CAMERON AVE AT WILSON ST	EAST	6.90%	E	11%	E
CAMERON AVE AT PITTSBORO ST	EAST	6.90%	E	11%	E
CAMERON AVE AT NEW EAST	WEST	18.80%	C	33.30%	C
CAMERON AVE AT SWAIN HALL	WEST	18.80%	C	33.30%	C
CAMERON AVE AT GRANVILLE TOWERS	WEST	5.90%	E	11%	E
CAMERON AVE AT KENAN ST	WEST	5.90%	E	11%	E
CAMERON AVE AT ROBERSON ST	WEST	5.90%	E	11%	E
CAMERON AVE AT RAILROAD TRACKS	WEST	5.90%	E	11%	E
COLUMBIA ST AT SITTERSON HALL	NORTH	56.50%	A	74%	A
COLUMBIA ST AT ABERNETHY HALL	NORTH	53.50%	A	73.10%	A
COLUMBIA ST AT ROSEMARY ST	NORTH	44%	A	54.30%	A
COLUMBIA ST AT FRANKLIN ST	SOUTH	31.20%	B	47.10%	B
COLUMBIA ST AT FRAT COURT	SOUTH	44.30%	A	58.70%	A
FRANKLIN ST AT GRAHAM ST	EAST	28.60%	B	37.90%	B
FRANKLIN ST AT UNC BUILDING #440	EAST	28.40%	B	37.60%	B
FRANKLIN ST AT KENAN ST	EAST	28.40%	B	37.60%	B
FRANKLIN ST AT CHURCH ST	EAST	28.40%	B	37.60%	B
FRANKLIN ST AT COLUMBIA ST	EAST	28.40%	B	37.60%	B
FRANKLIN ST AT COFFEE SHOP	EAST	41.40%	A	61.40%	A
FRANKLIN ST AT PICKARD LANE	EAST	41.40%	A	61.40%	A
FRANKLIN ST AT PICKARD LANE	WEST	25.40%	B	31.50%	C
FRANKLIN ST AT HENDERSON ST	WEST	25.40%	B	31.50%	C
FRANKLIN ST AT VARSITY THEATER	WEST	25.40%	B	31.50%	C
FRANKLIN ST AT COLUMBIA ST	WEST	28.20%	B	35%	C
FRANKLIN ST AT CHURCH ST	WEST	28.20%	B	35%	C
FRANKLIN ST AT KENAN ST	WEST	28.20%	B	35%	C
FRANKLIN ST AT UNC BUILDING #440	WEST	28.20%	B	35%	C
FRANKLIN ST AT GRAHAM ST	WEST	28.20%	B	35%	C
MERRITT MILL RD AT FRANKLIN ST	NORTH	2.80%	E	12.70%	E
MERRITT MILL RD AT FRANKLIN ST	SOUTH	2.80%	E	12.90%	E
MITCHELL LA AT ROSEMARY ST	NORTH	5.90%	E	11.80%	E
MITCHELL LA AT LINDSEY ST	NORTH	5.90%	E	11.80%	E
MITCHELL LA AT MCDADE ST	NORTH	5.90%	E	11.80%	E
RALEIGH ST AT ARBORETUM	NORTH	6.90%	E	14%	E

Figure F-1: TLOS Results

Chapel Hill Town Center: Alternative Transportation Level of Service

STOP NAME	DIRECTION	TLOS (24 HR.)	TLOS GRADE	TLOS (TIME OF SERVICE)	TLOS GRADE
HILLSBOROUGH ST AT ROSEMARY ST	NORTH	6.90%	E	14%	E
HILLSBOROUGH ST AT ROSEMARY ST	SOUTH	12%	D	14.90%	E
RALEIGH ST AT ARBORETUM	SOUTH	32.80%	B	50.80%	A
ROSEMARY ST AT GRAHAM ST	EAST	6.60%	E	13.80%	E
ROSEMARY ST AT MITCHELL LANE	EAST	6.60%	E	13.80%	E
ROSEMARY ST AT BREADMEN'S	EAST	6.60%	E	13.80%	E
ROSEMARY ST AT TOWN LOT #5	EAST	6.60%	E	13.80%	E
ROSEMARY ST AT PRITCHARD AVE	WEST	14.40%	D	24.50%	D
ROSEMARY ST AT BREADMEN'S	WEST	14.40%	D	24.50%	D
ROSEMARY ST AT MAMA DIP'S	WEST	8%	E	13.50%	E
ROSEMARY ST AT SUNSET DR	WEST	8%	E	13.50%	E

Figure F-1 continued

Copy	Routes	Start Point	Mitchell La at Rosemary St	Mitchell La at Lindsey St	Mitchell La at McDade St
Stop Data		Distance	0.02	0.11	0.20
		Ped LOS L	A	A	A
		Ped LOS R	A	A	A
		Pop Density	1	1	1
		Job Density	1	1	1
	A	0:00	0:02	0:02	0:03
	A	7:02	7:04	7:04	7:05
	A	7:42	7:44	7:44	7:45
	A	8:22	8:24	8:24	8:25
	A	9:07	9:09	9:09	9:10
	A	9:42	9:44	9:44	9:45
	A	10:02	10:04	10:04	10:05
	A	11:02	11:04	11:04	11:05
	A	12:22	12:24	12:24	12:25
	A	13:42	13:44	13:44	13:45
	A	14:22	14:24	14:24	14:25
	A	15:02	15:04	15:04	15:05
	A	15:42	15:44	15:44	15:45
	A	16:22	16:24	16:24	16:25
	A	17:02	17:04	17:04	17:05
	A	17:47	17:49	17:49	17:50
	A	18:22	18:24	18:24	18:25
	A	19:02	19:04	19:04	19:05

		Mitchell La at Rosemary St	Mitchell La at Lindsey St	Mitchell La at McDade St
Time	23:59			
Minutes Served		85	85	85
% Time Served		5.9%	5.9%	5.9%
% Area Served		97.8%	97.8%	97.8%
Ped Factor		100.0%	100.0%	100.0%
	TLOS	5.9%	5.9%	5.9%
Start	0:00	7:04	7:04	7:05
End	23:59	7:44	7:44	7:45
Minutes	1440	8:24	8:24	8:25
		9:09	9:09	9:10
Calc. TLOS		9:44	9:44	9:45
		10:04	10:04	10:05
		11:04	11:04	11:05
		12:24	12:24	12:25
		13:44	13:44	13:45
		14:24	14:24	14:25
		15:04	15:04	15:05
		15:44	15:44	15:45
		16:24	16:24	16:25
		17:04	17:04	17:05
		17:49	17:49	17:50
		18:24	18:24	18:25
		19:04	19:04	19:05

Figure F-2: Example Section of Route Segment Spreadsheet

APPENDIX G: RECOMMENDED MITIGATION

The following pages contain tables that show the values used to recalculate level of service using each method given certain mitigation measures. Measures were chosen within each method to cause each segment to reach a passing score ("B" in the PLOS, or "C" in the BLOS and BCI). The mitigation measures recommended for a segment within one method may conflict with those of another—the integration of these models to determine the optimal mitigation measures across methods would be very time consuming and would be beyond the scope of this paper. However, it is our intent to provide ideas on how to improve pedestrian and bicycle facilities in this section. Determining how to select and prioritize these measures is largely a policy decision that must be left up to the Chapel Hill Town Council—however, it may be appropriate to use LOS scores to determine the severity of a situation (and therefore the priority each suggested improvement should take).

Transit mitigation measures are not presented here, because a recalculation of TLOS scores given certain improvements was not performed. It would be difficult to determine what resources the Town has at its disposal to address any deficiencies in transit service, and in general transit service decisions tend to be made based on policy. In general, we find that transit service is relatively good in the Chapel Hill Town Center. Service along West Franklin would need improvement in order to bring it up to the same level of service as Columbia Street and East Franklin Street. Some improvements could also be made along Cameron Avenue and Rosemary Street, although these improvements are less pressing due to the proximity of West Franklin Street, which has better service.

The mitigation recommendations presented here are only intended to be a starting-point in the town's efforts to improve pedestrian and bicycle facilities—in no way do they represent the only possible way to reach a passing level of service. These recommendations also presume that the standards set in this paper for level of service ("B" for PLOS and "C" for BLOS and BCI) are reasonable—this is not a standard that has been adopted by the Town.

Segment	Direction	Wol	Wl	fp	%OSP	fb	Wb	fsw	Ws	Vol15(OL)	L	SPD	PLOS	Grade	Change
1	SB	10.5	0	0.2	100	1	0	4.5	5	8.75	2	34	1.7149	B	new 5' sidew alk
2	WB	9.5	0	0.2	100	1	0	4.5	5	1	2	34	1.6678	B	new 5' sidew alk
7	EB	10	0	0.2	100	1	0	4.5	5	0.75	2	34	1.6537	B	new 5' sidew alk
8	EB	10	0	0.2	100	1	0	4.5	5	6.75	2	34	1.7083	B	new 5' sidew alk
10	SB	10	0	0.2	0	1	0	4.5	5	15.25	2	34	2.3744	B	w iden sidew alk to 5'
12	WB	12	0	0.2	100	1	0	4.5	5	1	2	34	1.6101	B	new 5' sidew alk
13	WB	11.5	0	0.2	100	1	0	4.5	5	2.25	2	34	1.6328	B	new 5' sidew alk
14	EB	12	0	0.2	100	1	0	4.5	5	0.75	2	34	1.6078	B	new 5' sidew alk
15	SB	13	0	0.2	100	1	0	4.5	5	3	2	34	1.606	B	new 5' sidew alk
16	SB	13	0	0.2	100	1	0	4.5	5	4.25	2	34	1.6174	B	new 5' sidew alk
18	SB	13.5	0	0.2	0	1	6	4.5	5	26.25	5	44	2.4717	B	6' buffer and 5' sidew alk
18	NB	20	0	0.2	100	1.5	15	3	10	133.75	5	44	2.4807	B	10' sidew alk, 15' buffer w / trees, w iden street by 8' for added parking lane
19	WB	12	0	0.2	0	1	0	4.5	5	3.25	2	34	2.1919	B	new 5' sidew alk (parts already exist)
21	SB	12	0	0.2	0	1.5	9	4.2	6	88	3	34	2.4905	B	9' buffer w / trees and 6' sidew alk
21	NB	11	0	0.2	0	2	12	4.2	6	109	3	34	2.4708	B	12' buffer (incl. w all) and 6' sidew alk
22	EB	11	0	0.2	0	2	4	4.2	6	70	2	34	2.4952	B	construct w all in buffer
22	WB	11	0	0.2	0	1.5	8	3.6	8	90.5	2	34	2.4869	B	8' buffer w / trees and 8' sidew alk
24	EB	12	0	0.2	100	1	0	4.5	5	72	3	34	2.2562	B	add on-street parking (w hole length) - currently 40' roadw ay
24	WB	13	0	0.2	100	1	0	3	10	90.5	3	34	2.2466	B	add on-street parking (w hole length) - currently 40' roadw ay
27	WB	19	0	0.2	75	1	0	6	0	19.5	2	34	2.3577	B	add on-street parking to 3/4 of length - currently 40' roadw ay
29	WB	19	0	0.2	75	1	0	6	0	19.5	2	34	2.3577	B	add on-street parking to 3/4 of length - currently 40' roadw ay
34	EB	18	0	0.2	100	1	0	6	0	46	3	34	2.4623	B	add on-street parking (w hole length) - currently 18' lane
35	EB	18	0	0.2	100	1	0	6	0	37.25	3	34	2.3827	B	add on-street parking (w hole length) - currently 18' lane
37	EB	11	0	0.2	0	1.5	10	3.45	8.5	113.625	5	29	2.4906	B	8.5' sidew alk
43	EB	18	0	0.2	50	1.5	15	3	10	162.75	4	29	2.4772	B	add on-street parking to 1/2 of length - parking space exists
43	WB	20	0	0.2	100	1.5	8	3.6	8	162.75	4	29	2.4726	B	8' buffer, 8' sidew alk, and add on-street parking (w hole length) - space exists
44	WB	17	0	0.2	100	1.5	12	3.6	8	170.375	4	29	2.4973	B	8' sidew alk, 12' buffer w / trees, w iden street by 8' for added parking lane
45	SB	11	0	0.2	0	2	16	2.4	12	134.5	2	34	2.4865	B	12' sidew alk and 16' buffer (incl. w all)
45	NB	19	0	0.2	50	2	16	2.4	12	164.25	2	34	2.4826	B	12' sidew alk and 16' buffer (incl. w all)
46	WB	12	0	0.2	0	2	9	3.3	9	109.25	2	34	2.4833	B	construct w all in buffer
47	NB	11	0	0.2	33	1.5	13	3	10	124.875	5	34	2.4821	B	add on-street parking to 1/3 of length - currently 50' roadw ay
48	WB	10	0	0.2	0	2	16	3	10	132.625	4	34	2.4661	B	10' sidew alk and 16' buffer (incl. w all)
52	WB	17	0	0.2	0	1.5	13	4.2	6	109.75	2	34	2.4474	B	w iden sidew alk to 6'
54	NB	12	0	0.2	0	1	0	4.5	5	1.75	2	34	2.1782	B	new 5' sidew alk (parts already exist)
62	SB	9	0	0.2	0	1.5	7	4.5	5	74.5	2	29	2.4728	B	new 5' sidew alk w ith 7 buffer w / trees
62	NB	9	0	0.2	0	1	0	3.9	7	56.75	2	29	2.4903	B	w iden sidew alk to 7'

Figure G-1: PLOS Mitigation

Chapel Hill Town Center: Alternative Transportation Level of Service

Segment	Direction	Wol	Vol15(OL)	SPD	SPp	SPt	HV	PR5	We	BLOS	Grade	Change
18	SB	13.5	26.25	44	35	3.84304542	0.015	4.5	13.5	2.875848944	C	resurface street
18	NB	12	133.75	44	20	1.586555528	0.015	4.5	12	3.292891395	C	lower speed limit to 20 mph and resurface street
21	SB	12	88	34	25	2.612709518	0.01	4.5	12	3.292416477	C	resurface street
21	NB	11	109	34	20	1.586555528	0.01	4.5	11	3.26712237	C	lower speed limit to 20 mph and resurface street
22	EB	11	70	34	25	2.612709518	0.01	4.5	11	3.2913938	C	resurface street
22	WB	11	90.5	34	25	2.612709518	0.01	4.5	11	3.421619087	C	resurface street
25	SB	17	76.25	34	20	1.586555528	0.015	4.5	7	3.482980225	C	lower speed limit to 20 mph and resurface street
25	NB	10.5	93.125	34	20	1.586555528	0.015	4.5	10.5	3.278092333	C	lower speed limit to 20 mph and resurface street
37	EB	11	113.625	29	20	1.586555528	0.015	4.5	11	3.325215497	C	resurface street
42	WB	11	83.125	29	20	1.586555528	0.015	4.5	11	3.166748564	C	resurface street
43	WB	20	162.75	29	20	1.586555528	0.015	4.5	12.3	3.355936543	C	resurface street
44	EB	17	163.5	29	20	1.586555528	0.015	4.5	11.5	3.453467582	C	narrow parking lane to 6.5 ft and resurface street
44	WB	9	170.375	29	20	1.586555528	0.015	4.5	11.5	3.474350354	C	widen outside lane to 11.5 ft
45	SB	11	134.5	34	20	1.586555528	0.01	4.5	11	3.373702042	C	lower speed limit to 20 mph
45	NB	19	164.25	34	20	1.586555528	0.01	4.5	11	3.47501355	C	lower speed limit to 20 mph
46	EB	12	89.5	34	25	2.612709518	0.01	4.5	12	3.300985695	C	resurface street
46	WB	12	109.25	34	25	2.612709518	0.01	4.5	12	3.402081601	C	resurface street
47	SB	9	101.75	34	20	1.586555528	0.015	4.5	9	3.46925044	C	lower speed limit to 20 mph and resurface street
47	NB	11	124.875	34	20	1.586555528	0.015	4.5	11	3.373081207	C	lower speed limit to 20 mph and resurface street
48	EB	12	88.5	34	25	2.612709518	0.015	4.5	12	3.356260089	C	resurface street
48	WB	10	132.625	34	20	1.586555528	0.015	4.5	10.5	3.457358873	C	lower speed limit to 20 mph, resurface, and widen outside lane to 10.5 ft
50	WB	23	110.25	34	25	2.612709518	0.01	4.5	13	3.281701223	C	resurface street
62	SB	9	74.5	29	20	1.586555528	0.01	4.5	9	3.27418415	C	resurface street

Figure G-2: BLOS Mitigation

Segment	Direction	BL	BLW (m)	CLW (ft)	CLW (m)	CLV (PH)	Dir. L	OLV (PH)	SPD (km/h)	PKG	AREA	HV	HCLTV	ft	fp	HRTV	frt	BCI	Grade
1	SB	0	0	6.5	1.9812	35	1	0	55	0	1	0	0	0	0	0	0	3.6993624	C
		remove on-street parking																	
2	WB	0	0	5.5	1.6764	4	1	0	55	0	1	0	0	0	0	3	0	3.7891528	C
		remove on-street parking																	
7	EB	0	0	6	1.8288	3	1	0	55	0	1	0	0	0	0	0	0	3.7112576	C
		remove on-street parking																	
8	EB	0	0	6	1.8288	27	1	0	55	0	1	0	0	0	0	0	0	3.7592576	C
		remove on-street parking																	
13	WB	0	0	7.5	2.286	9	1	0	55	0	1	0	0	0	0	4	0	3.495572	C
		remove on-street parking																	
18	SB	1	1.2192	9.5	2.8956	105	3	747	71	0	0	0.015	1.575	0	0	1	0	2.8329192	C
		stripe 4' of curb lane as bicycle lane																	
18	NB	1	0.9144	12	3.6576	535	2	535	71	0	0	0.015	8.025	0	0	0	0	3.3536112	C
		add 3' bicycle lane/striped shoulder																	
21	SB	0	0	13	3.9624	352	1	0	55	0	1	0.01	3.52	0	0	0	0	3.3467248	C
		widen curb lane to 13' (from 12')																	
21	NB	1	0.6096	9	2.7432	436	1	0	55	0	1	0.01	4.36	0	0	2	0	2.9059504	C
		stripe 2' of curb lane as striped shoulder/bicycle lane																	
22	EB	1	0.6096	9	2.7432	280	1	0	55	0	1	0.01	2.8	0	0	13	0	2.5939504	C
		stripe 2' of curb lane as striped shoulder/bicycle lane																	
22	WB	1	0.6096	9	2.7432	362	1	0	55	0	1	0.01	3.62	0	0	9	0	2.7579504	C
		stripe 2' of curb lane as striped shoulder/bicycle lane																	
24	EB	1	0.9144	9	2.7432	288	1	0	55	0	0	0.015	4.32	0	0	0	0	2.7489824	C
		stripe 3' of curb lane as bicycle lane/striped shoulder																	
24	WB	1	1.2192	9	2.7432	362	1	0	55	0	0	0.015	5.43	0	0	222	0	2.7720144	C
		stripe 4' of curb lane as bicycle lane																	
25	SB	1	0.9144	9	2.7432	305	2	305	55	0	0	0.015	4.575	0	0	3	0	2.9049824	C
		add 3' bicycle lane/striped shoulder, remove on-street parking																	
25	NB	1	0.9144	9	2.7432	372.5	2	372.5	55	0	0	0.015	5.5875	0	0	0	0	3.0669824	C
		add 1.5' of pavement for bicycle lane, stripe additional 1.5' of curb lane as bicycle lane																	
31	SB	0	0	9	2.7432	8	1	0	55	0	0	0.01	0.08	0	0	6	0	3.5298864	C
		remove on-street parking																	
34	WB	1	0.9144	9	2.7432	81	1	0	55	0	0	0.015	1.215	0	0	1	0	2.3349824	C
		add 2' of pavement for bicycle lane, stripe additional 1' of curb lane for bicycle lane																	
37	EB	1	0.6096	9	2.7432	454.5	2	454.5	47	0	0	0.015	6.8175	0	0	8	0	3.2127504	C
		stripe 2' of curb lane as striped shoulder/bicycle lane																	
37	WB	1	0.6096	9	2.7432	397.5	2	397.5	47	0	0	0.015	5.9625	0	0	0	0	3.0759504	C
		stripe 2' of curb lane as striped shoulder/bicycle lane																	

Figure G-3: BCI Mitigation

Chapel Hill Town Center: Alternative Transportation Level of Service

Segment	Direction	BL	BLW (m)	CLW (ft)	CLW (m)	CLV (PH)	Dir. L	OLV (PH)	SPD (km/h)	PKG	AREA	HV	HCLTV	ft	fp	HRTV	frt	BCI	Grade
38	EB	1	1.2192	9	2.7432	452	2	452	47	0	0	0.015	6.78	0	0	3	0	2.9568144	C
		add 4' bicycle lane (can fit in existing pavement w ith removal of parking across street)																	
38	WB	1	1.2192	9	2.7432	398	2	398	47	0	0	0.015	5.97	0	0	0	0	2.8272144	C
		remove on-street parking and restripe for 4' bicycle lane																	
39	EB	1	1.2192	11	3.3528	424	2	424	47	0	0	0.015	6.36	0	0	70	0	2.5860336	C
		remove on-street parking and restripe for 4' bicycle lane																	
39	WB	1	1.2192	11	3.3528	367	2	367	47	0	0	0.015	5.505	0	0	0	0	2.4492336	C
		remove on-street parking and restripe for 4' bicycle lane																	
41	WB	1	0.9144	8.5	2.5908	229.5	2	229.5	47	0	0	0.015	3.4425	0	0	0	0	2.6236776	C
		add 3' bicycle lane/striped shoulder																	
42	WB	1	0.6096	9	2.7432	332.5	2	332.5	47	0	0	0.015	4.9875	0	0	0	0	2.9199504	C
		stripe 2' of curb lane as striped shoulder/bicycle lane																	
43	EB	1	1.2192	10	3.048	651	2	651	47	0	0	0.015	9.765	0	0	0	0	3.282624	C
		remove on-street parking and restripe for 4' bicycle lane																	
43	WB	1	1.2192	12	3.6576	651	2	651	47	0	0	0.015	9.765	0	0	537	0.1	3.0790432	C
		remove on-street parking and restripe for 4' bicycle lane																	
44	EB	1	1.2192	9	2.7432	654	2	654	47	0	1	0.015	9.81	0	0	0	0	3.1776144	C
		remove on-street parking and restripe for 4' bicycle lane																	
44	WB	1	1.2192	9	2.7432	681.5	2	681.5	47	0	1	0.015	10.2225	0.1	0	91	0	3.3436144	C
		add 4' bicycle lane (can fit in existing pavement w ith removal of parking across street)																	
45	SB	1	1.2192	11	3.3528	538	1	0	55	0	0	0.01	5.38	0	0	0	0	2.8204336	C
		add 4' bicycle lane (can fit in existing pavement w ith removal of parking across street)																	
45	NB	1	1.2192	11	3.3528	657	1	0	55	0	0	0.01	6.57	0	0	0	0	3.0584336	C
		remove on-street parking and restripe for 4' bicycle lane																	
46	EB	1	0.9144	9	2.7432	358	1	0	55	0	0	0.01	3.58	0	0	0	0	2.8889824	C
		stripe 3' of curb lane as bicycle lane/striped shoulder																	
46	WB	1	0.9144	9	2.7432	437	1	0	55	0	0	0.01	4.37	0	0	209	0	3.0469824	C
		stripe 3' of curb lane as bicycle lane/striped shoulder																	
47	SB	1	0.9144	9	2.7432	408.5	2	408.5	55	0	0	0.015	6.1275	0	0	17	0	3.1533824	C
		add 3' bicycle lane/striped shoulder																	
47	NB	1	0.9144	9	2.7432	499.5	2	499.5	55	0	0	0.015	7.4925	0	0	0	0	3.3717824	C
		add 1' of pavement for bicycle lane, stripe additional 2' of curb lane as bicycle lane																	
48	EB	1	0.9144	9	2.7432	354	1	0	55	0	1	0.015	5.31	0	0	0	0	2.6169824	C
		stripe 3' of curb lane as bicycle lane/striped shoulder																	
48	WB	1	0.9144	9	2.7432	530.5	2	530.5	55	0	1	0.015	7.9575	0	0	21	0	3.1821824	C
		add 2' of pavement for bicycle lane, stripe additional 1' of curb lane for bicycle lane																	
49	WB	1	1.2192	10	3.048	474	1	0	55	1	1	0.01	4.74	0	0	17	0	3.086224	C
		stripe 4' of curb lane as bicycle lane																	

Figure G-3 continued

Segment	Direction	BL	BLW (m)	CLW (ft)	CLW (m)	CLV (PH)	Dir. L	OLV (PH)	SPD (km/h)	PKG	AREA	HV	HCLTV	ft	fp	HRTV	frt	BCI	Grade
50	EB	1	1.2192	11	3.3528	371	1	0	55	1	1	0.01	3.71	0	0	0	0	2.7284336	C
		stripe 4' of curb lane as bicycle lane																	
50	WB	1	1.2192	11	3.3528	441	1	0	55	1	1	0.01	4.41	0	0	1	0	2.8684336	C
		stripe 4' of curb lane as bicycle lane																	
57	WB	1	1.2192	11	3.3528	411	1	0	55	1	1	0.01	4.11	0	0	15	0	2.8084336	C
		stripe 4' of curb lane as bicycle lane																	
58	SB	0	0	6	1.8288	11	1	0	55	0	1	0	0	0	0	4	0	3.7272576	C
		remove on-street parking																	
58	NB	0	0	6	1.8288	6	1	0	55	0	1	0	0	0	0	0	0	3.7172576	C
		remove on-street parking																	
59	EB	1	1.2192	11	3.3528	343	1	0	55	1	1	0.01	3.43	0	0	5	0	2.6724336	C
		stripe 4' of curb lane as bicycle lane																	
59	WB	1	1.2192	11	3.3528	399	1	0	55	1	1	0.01	3.99	0	0	3	0	2.7844336	C
		stripe 4' of curb lane as bicycle lane																	
61	EB	1	1.2192	11	3.3528	343	1	0	55	1	1	0.01	3.43	0	0	0	0	2.6724336	C
		stripe 4' of curb lane as bicycle lane																	
61	WB	1	1.1291	11	3.3528	399	1	0	55	1	1	0.01	3.99	0	0	1	0	2.8213746	C
		stripe 4' of curb lane as bicycle lane																	
62	SB	1	0.9144	9	2.7432	298	1	0	47	0	1	0.01	2.98	0	0	2	0	2.3289824	C
		add 3' bicycle lane/striped shoulder																	
62	NB	1	0.9144	9	2.7432	227	1	0	47	0	1	0.01	2.27	0	0	3	0	2.1869824	B
		add 3' bicycle lane/striped shoulder																	

Figure G-3 continued