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Transit as an Alternative Mode of Transportation: A Case Study of Its Usage, Availability, Patterns and Value for Non-Commuter Trips

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Abstract

The mode of transportation a user picks impacts the environment, the social environment, and the user himself/herself. While research on alternative modes of transportation is prevalent in both the engineering and sociology fields, little attention has been given to the choices people make concerning how they run errands and other social trips, focusing instead on commuter trips. This case study examines three different shopping malls and the surrounding bus stops in order to determine the role distance plays in bus usage and the value that shopping centers place on access to local bus routes. Determination of the value and potential limitations of the current bus route design enables recommendations to be made in bus route and shopping center designs to maximize transit usage to shopping centers Recommendations aim to maximize flexibility and time on the part of the consumer, and ultimately increase visitors and sales in the shopping areas, which will ultimately boost the local economy.

Dedication or Acknowledgements

I would like to acknowledge my advisor Dr. Deogratias Eustace with the Department of Civil & Environmental Engineering & Engineering Mechanics for all of his help and support. Additionally I would like to thank Mr. John Hoff with the Dayton RTA and Mr. Chris Middleton with the Portland TriMet for the provision of data. Thank you to the University of Dayton Honors Department for the opportunity, funding, and support of this project. Finally, thank you to my family and friends for their tireless support.

UNIVERSITY of DAYTON

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Introduction

Alternative modes of transportation, or sustainable travel, are generally considered to include bicycling, walking, and transit use as alternatives to automobile usage. The mode of transportation a user picks impacts the environment, the social environment, and the user himself/herself. While research on alternative modes of transportation is prevalent in both the engineering and sociology fields, the focus is mainly on commuter trips. Little has been done in the area of transportation choice for errands and leisure activities, despite the fact that shopping, chauffeuring family members, and conducting other errands account for 46% of Americans' trips (Surface Transportation Policy Partnership (STPP), 2002). As cities continue to expand and sprawl into suburbs, travel time will continue to increase.

Transit includes public buses, commuter buses and trains, subways, streetcars, and trolleys (Hikichi and Beimborn, 2005). This study will focus on the use of public buses, as they are the most common to the Dayton, OH area. According to the American Public Transportation Association (APTA), bus ridership has increased by 17% since the early 1970s, with the average bus ride being less than five miles (APTA, 2010). While this increase may seem substantial, bus users make up only a small portion of overall trips. In 2009, only approximately 1.8% of trips made by Americans used transit services (Federal Highway Administration (FHWA), 2010). The key to further increases in ridership is to increase the distance that bus riders are willing to travel, as well as increase their frequency of use. To increase these two factors, the availability and reliability of bus services must be increased.

This study hypothesizes that locating bus stops near shopping hubs such as the Dayton Mall and The Mall at Fairfield Commons would benefit the malls, as people would be able to travel to these locations without the necessity of the car. More specifically, placement of bus stops near the mall entrances would further increase bus rider attendance in the malls. An examination of these two malls, as well as the Greene Town Center, and their proximity to bus stops was conducted in order to determine the value people place on bus transportation for their shopping trips. Furthermore, results

from this study, coupled with surveys to mall officials, helped the researcher to make recommendations on how to increase the effectiveness of the Regional Transit Authority (RTA) system in transporting customers to their shopping destinations through the application of compact design elements to the existing shopping mall sites.

Literature Review

Since 1969, the travel distance that Americans drive to go shopping has increased by 88% (STPP, 2002). Many Americans do their shopping at malls, traditionally driving to the shopping centers and parking in spacious parking lots. In 1947 the Urban Land Institute (ULI) defined a shopping center as "…a group of architecturally unified commercial establishments built on a site that is planned, developed, owned, and managed as an operating unit related by its location, size, and types of shops to the trade area that it serves. The unit provides on-site parking in definite relationship to the types and total size of the stores" (ULI, 2008). The inclusion of parking in this definition has led to the idea that a successful shopping mall includes an expansive parking area. Many local zoning codes have taken this idea even further, requiring more parking spaces than are needed. Parking, however, makes things inaccessible for travel modes other than an automobile (Porter et al., 2002). Only recently has the ULI amended their definition to include, among other requirements, the availability of off-site parking and alternative means of access as a way to decrease the on-site parking necessary (ULI, 2008). It seems that if more people were to use transit services to complete their shopping trips, less on-site parking would be needed, and malls could reduce their on-site parking in favor of smaller lots, increased retail space, or more mixed-use development.

In addition to a reduction in on-site parking at shopping malls, the use of transit provides many other advantages over automobile travel. They are high-capacity, energy-efficient vehicles even in densely traveled corridors. Private vehicles use 2x the fuel per passenger mile as public transportation and emit more carbon dioxide (Belzer and Autler, 2002). If a reduction in private vehicle usage were to occur, it could have positive effects on the environment and human health issues related to air quality, as the United States'

road transport accounts for 33% of the world's carbon dioxide emissions (Transportation Research Board (TRB), 2009). Furthermore, mass transit is much safer than automobiles. Buses have an accident rate of 12 fatalities per 100 billion passenger-miles. This record is 100 times better than that of automobiles (Garber and Hoel, 2008). Public transportation is also an essential service for school children, senior citizens, single-auto families, and those that are economically or physically prevented from driving a car (Garber and Hoel, 2008). Yet despite the advantages of public transportation services, they are often viewed negatively by the public as slower, less convenient, and less attractive than automobile transportation (Garber and Hoel, 2008).

Five D's exist that help guide the design of alternative modes of transportation: density, diversity, design, destination accessibility, and distance to transit. Of these five, density is the most commonly used measure to characterize development patterns, as higher density areas have a greater affinity for transit services. However, the higher the density, the shorter the length of the trip should be. A gross density of 4200-5600 persons per square mile is an acceptable density to support transit services (TRB, 2009). These numbers appear high when looking at the population density of Dayton, Ohio: roughly 2500 persons per square mile (city-data.com, 2013). The densities of Miami Township, home to the Dayton Mall, and the city of Beavercreek, the location of the Greene Town Center and the Mall at Fairfield Commons, have even lower population densities. Even Chicago, with a population density of 3400 people per square mile, does not fit these parameters (Demographia, 2013). Thus, it seems one should use these parameters as guidelines only, noting that the higher the population density, the more applicable a public transportation system will be.

Bus services tend to be provided in areas with lower density development (rather than rail), most likely because of the flexibility in route design and smaller capacity per trip (Currie, 2006). This makes buses the optimal choice for a lower-density city such as Dayton. While buses are often seen as less effective than rail as an alternative to automobile travel, areas of bus transit-oriented development (BTOD) accounted for more than 60% of the total reductions in vehicle kilometers traveled (when compared to rail transit-oriented development) in a study done in San Diego (Currie, 2006). Many developers are afraid of the risk associated with BTOD because the bus routes are not as

fixed as rail lines (Currie, 2006). If the bus route changes, any development in the area will lose a large portion of its clientele. However, if the area is successful, transit organizations will have little reason to move the route away from the area.

Attempts to design transit-oriented development (TOD) should focus not just on density, but on destination accessibility and distance to transit, as these factors play the largest roles in TOD design and usage. Transit ridership drops 5 rides per 100 dwelling units for every 100 feet increase above 200 feet in walking distance from the transit stop to the final destination and vice versa (Levinson and Brown-West, 1983). In Dayton the average household size is 2.3 people (city-data.com, 2013). This suggests that for every 100 feet of distance above 200 feet between the starting or ending location and the bus stop, buses will lose 5 out of 230 potential riders. Another study (Beimborn et al., 2005) suggests that people are willing to walk a maximum of one quarter mile to transit locations. Both studies suggest that to maximize ridership, bus stops should be placed as close as feasibly possible to mall entrances.

The tricky part about TOD is that transit often acts as the “inferior good” to private vehicles. The demand for transit service is large based on the supply of private vehicle access; the greater the supply of private vehicle access, the lower the demand for transit. Furthermore, service quality factors, such as frequency, coverage, and reliability, are more important than factors such as prices (Taylor and Fink, 2009). If a shopper can get in his or her car at any time of day and in any part of town and drive to a shopping mall that provides ample parking a minimal distance from the mall entrance, the shopper is more than likely going to choose to drive by car. If transit use is to be increased, the transit services will have to be made more convenient than driving an automobile.

While alterations can be made to transit routes to improve convenience and ease of travel, many design improvements can be made to shopping centers in order to increase the number of patrons that arrive by bus. Many of these design improvements can be taken from elements of compact design and new urbanism. Compact design is the development at higher population and employment densities, incorporating mixed-use development in order to decrease trip lengths and frequencies (TRB, 2009). New urbanism attempts to transform conventional styles of sprawling suburban development and promote redevelopment in already urbanized areas. It includes compact, pedestrian,

and transit-oriented development that provides a wide range of land uses in an easily-walked area with increased uses of alternative modes of transportation (Jerke et al., 2008). Many retail developers are moving towards these ideas of compact and mixed-use development, developing open-air town centers that integrate a mix of land uses with public space and pedestrian walkways. They often attempt to recreate the main streets of downtown areas in the late 1800s and early 1900s to create a social environment, rather than simply a place (ULI, 2008). As discussed earlier, compact design also attempts to encourage alternative modes of transportation by decreasing the amount of parking available and placing it behind or to the side of the buildings to encourage window shopping and easy pedestrian access (Jerke et al., 2008). Both movements can be incorporated into TOD, which seeks to incorporate a mix of land uses at various densities within a one-half mile radius of a transit stop (Dittmar and Ohland 2004).

The layout of surrounding roads and driveways can also be influenced by pedestrian/transit-oriented development, as at the heart of transit-oriented development is the pedestrian (Dittmar and Ohland 2004). Elements of compact design that can be applied to roads and driveways include roundabouts, which merge traffic slowly and reduce the chance of accidents (Jerke et al., 2008). Furthermore, many pedestrian injuries occur in the midblock crossings across multilane roads (Cavin, 2003). In fact, nearly 5000 pedestrians and cyclists die each year on U.S. roads (Gresham Smith & Partners, 2009). Since the majority of bus stops around shopping centers are located some distance from the mall entrances, customers must walk to the mall, often crossing streets to do so. In order to make these crossings safer, the crosswalk distance should be shortened, or turn radii decreased in order to slow down traffic (Gresham Smith & Partners, 2009). When considering bus ridership, one must also remember to consider the pedestrian, as many times transit-users are also pedestrians at some point en route to their final destination.

In Dayton, OH, the location of this case study, the Greater Dayton Transit Authority (RTA) is the agency that operates the transit bus services. It has routes throughout Montgomery County as well as to Wright State University and the Wright Patterson Air Force Base (Greater Dayton RTA, 2009). The RTA buses operate from 4:30 am – 1:30 am on the weekdays and 5 am – 1:30 am on the weekends. The RTA also

offers curb-to-curb para-transit services to certified individuals with disabilities upon completion of the Project Mobility application (Greater Dayton RTA, 2009). Appendix A shows the routes of the Dayton RTA system. Seven routes in the Dayton RTA's schedule make stops near the Dayton Mall at fourteen surrounding locations. Additionally, two routes make stops near The Greene Town Center at three different stop locations. However, the stop nearest to the Mall at Fairfield Commons is over one mile away and located across from the main entrance to Wright State University. The only direct transit option to the mall is on-demand service by the Greene CATS Public Transit Service. This service is more expensive than the Dayton RTA and users must make a reservation (Greene County, 2013). This leaves people who live in the surrounding area and other places within the Greater Dayton area with no access to the Mall at Fairfield Commons unless they own a car. The lack of transit services to such a large attraction isolates these individuals, as they have no way to access the mall. In turn, the Mall at Fairfield Commons is losing potential customers due to the lack of transportation services.

Furthermore, while several routes take riders near the Dayton Mall, the buses do not enter the premises, as the Dayton Mall is private property and has not given RTA approval for door-to-door services (Greater Dayton RTA, 2009). The Greater Dayton RTA has noted that 15% of its riders use the system to shop or attend social gatherings (Greater Dayton RTA, 2009). By not allowing the RTA to enter the premises, shopping malls are losing potential customers.

Methodology

This study hypothesizes that locating bus stops near shopping hubs such as the Dayton Mall, The Mall at Fairfield Commons, and The Greene Town Center would benefit the malls, as people would be able to travel to these locations without the necessity of the car. More specifically, placement of bus stops near the mall entrances would further increase bus rider attendance in the malls. An examination of these two malls and their proximity to bus stops can be conducted in order to determine the value

people place on bus transportation for their shopping trips. The Greene Town Center will also be studied as an example of mixed-use design in close proximity to transit stops.

Transit-User Traffic Counts

The distance of the nearest bus stop for each of the shopping centers was first determined. This was done by marking the locations on a Google Earth map and using the distance measuring tool to determine the distance from the mall entrances. Whichever entrance was closest to the given stop was used for the distance determination. However, this was more difficult at the Greene, as it is a collection of buildings rather than a single large building. Therefore, the distance was taken from the bus stop to the nearest intersection of pedestrian roads. The bus routes and frequency of routes were then obtained from the Dayton RTA to determine how often riders can arrive at the mall. The availability of routes plays a large role in the frequency with which RTA users will take the bus. The frequency, in turn, is one of the main determining factors in the value placed on having bus stops in close proximity to the mall.

Next, several assumptions were made before bus rider counts were conducted. The assumption was made that Saturdays are the peak shopping days and that the hours of 11am to 1pm and 4 to 5 pm would have the largest numbers of people arriving at the mall. Bus rider counts were then conducted to determine how many people using the buses take them with the shopping centers being their final destinations. However, after several counts the time period was adjusted, as it was determined that most mall traffic by customers (rather than employees) appears to be in the afternoon. Thus, the hours of study were adjusted to 3 to 6 pm. Counts of the passengers embarking and disembarking from the bus were conducted during the three hour peak time period on Saturdays throughout August, September, and October. The data sheet for these studies is included in Appendix B. Although fourteen bus stops are in close proximity to the Dayton Mall, only the six stops closest to the mall were considered. The bus stops studied near the Dayton Mall are located at the intersections of the Mall Ring and Lyons Ridge Road, Lyons Ridge Road and Kingsridge Drive, State Highway 741 and Mall Park Drive, Prestige Plaza Drive and State Route 741, Kingsridge Drive and State Route 741, and along Kingsridge Drive. Figure 1 depicts these bus stops. One should note that the bus

stop names are those given by the Dayton RTA and the actual location of the stop may vary from the name given.

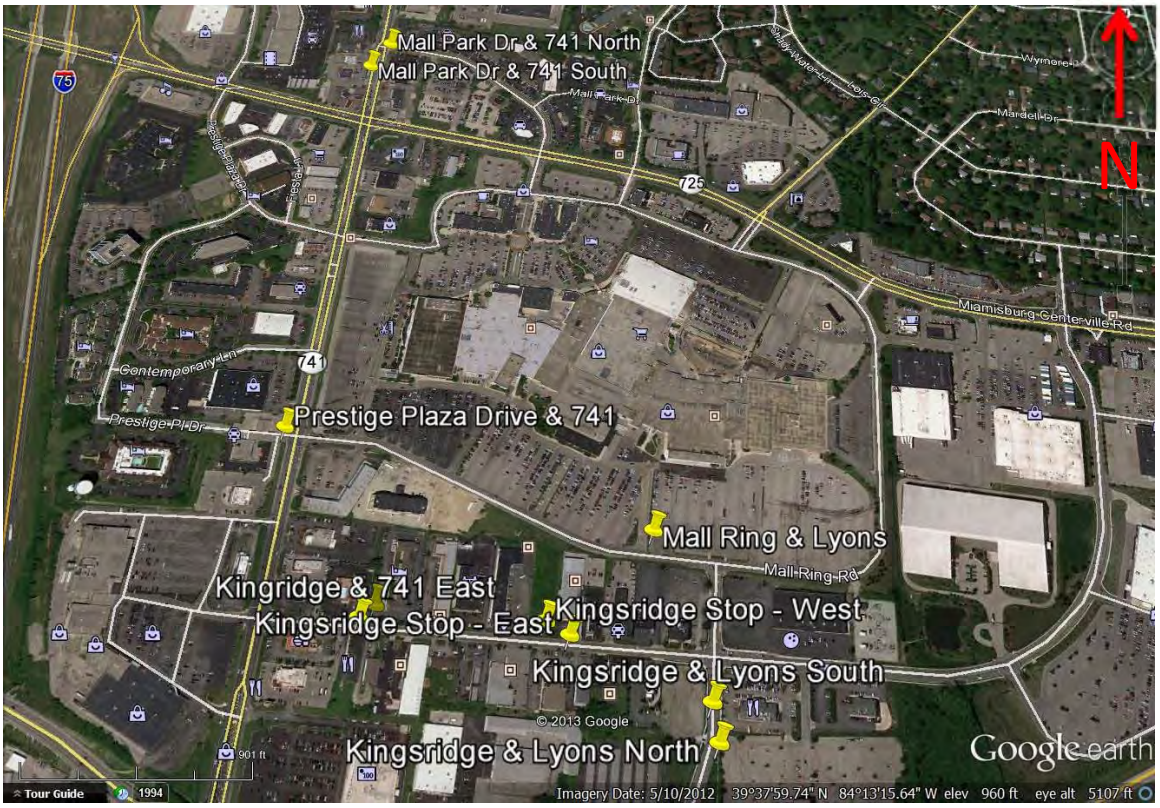

Figure 1: Location of the Bus Stops Studied around the Dayton Mall

The nearest bus stop to the Mall at Fairfield Commons is located nearly one and one half miles away near Wright State University. This location has two stops; the eastern location is at the intersection of Colonel Glenn Highway and Executive Park while the western location is located across the street at the intersection of Colonel Glenn Highway and the Main Wright State University Entrance. Figure 2 illustrates the location of these stops.

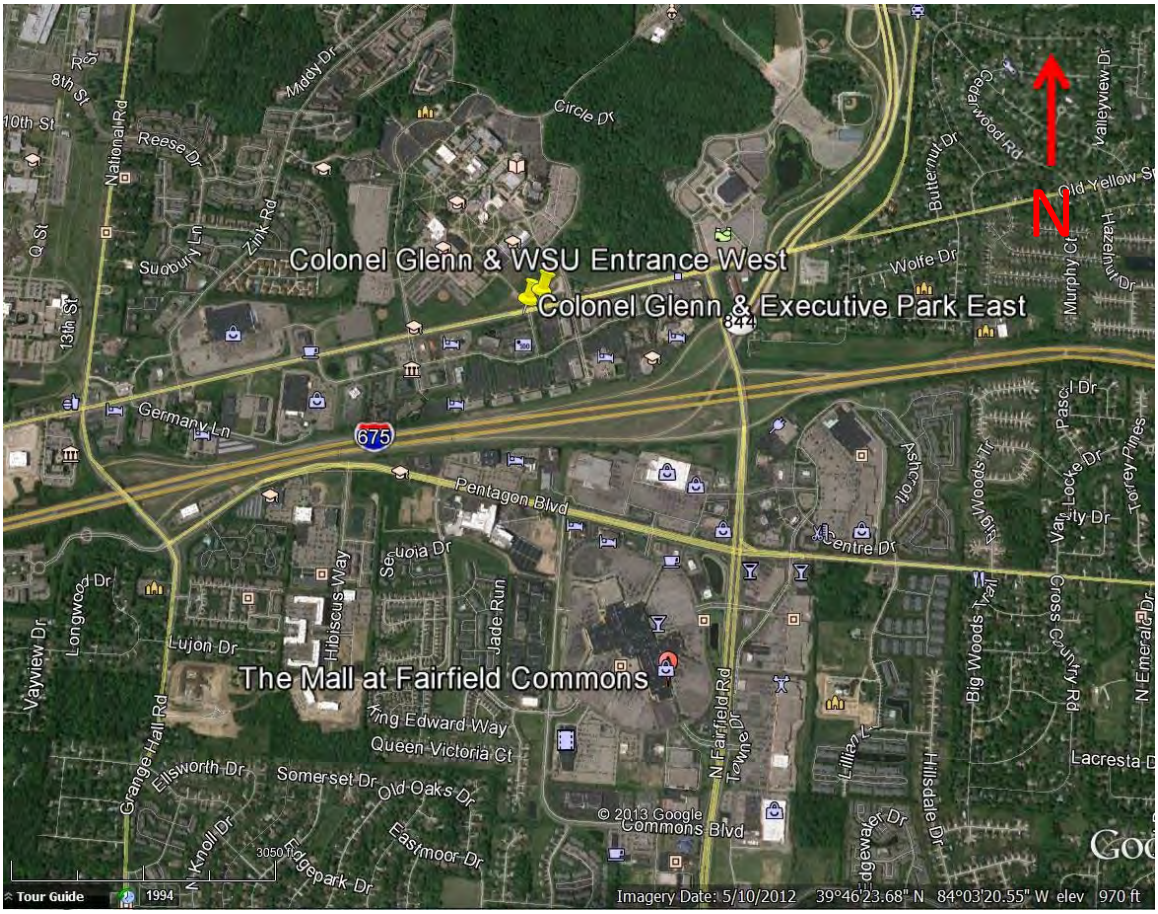

Figure 2: Location of the Bus Stops Studies around the Mall at Fairfield Commons

Finally, three locations were studied near the Greene Towne Center. These stops are at the intersections of Dorothy Lane and Stroop Road, East Stroop Road and Glengarry Drive, and Glengarry Drive and Graceland Street. The locations of these three stops are shown in Figure 3 below.

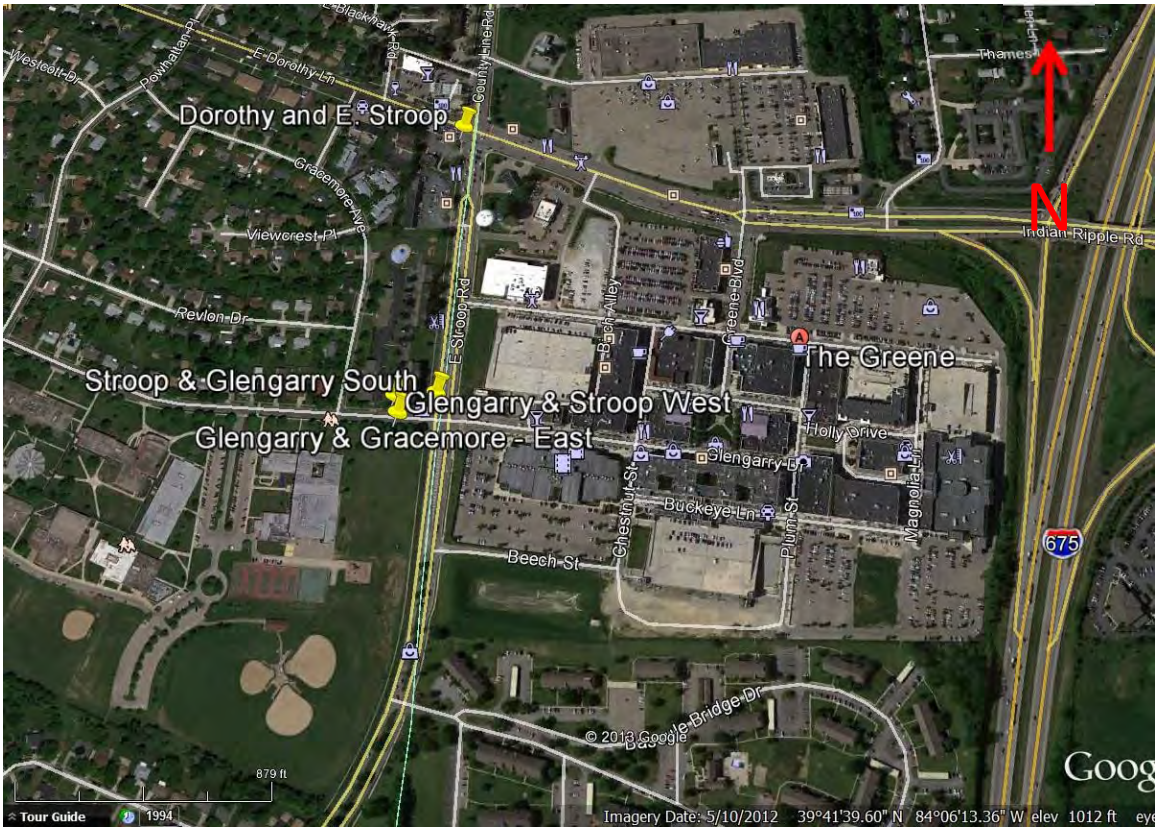

Figure 3: Location of the Bus Stops Studied around the Greene Town Center

The number of people that got off or on the bus and walked to or from the mall were counted; then the numbers were compared to average rider counts obtained from the Dayton RTA (Hoff, 2013) to determine the average daily number of mall customers using the transit system. These numbers were then compared to the average daily riders at mall locations for a transit-heavy city. For this study ridership data was gathered from Portland, Oregon for comparison. Because Portland has a population nearly five times the size of Dayton, the two sets of data cannot be directly compared. Instead a comparison factor was obtained through a ratio of the 2011 population of Dayton, OH over the 2011 population of Portland, OR. The daily average on's and off's for the Portland stops were then multiplied by the comparison factor to provide data that the Dayton RTA data could be compared to.

Mall Officials Questionnaire Survey

The author also attempted to determine the value that mall officials place on transit systems through the use of a questionnaire. The survey included questions concerning their views on public transportations systems, the value they place on the

systems, and whether they feel locating bus stops closer to the mall entrances would be an asset to their income. A survey was also sent to officials at The Greene Shopping Center with additional questions. When first built, The Greene had no bus stops near it; now bus stops are closer to the shopping center. Questions for The Greene officials centered on the value they place on RTA stops in the vicinity of the shopping center and whether they have seen an increase in attendance since the construction of the facilities. A copy of the questionnaire sent to officials at the three malls, including the additional questions for the Greene Town Center personnel, is included in Appendix C. Because the surveys do not deal with sensitive information or marginalized groups of people, an Institutional Review Board (IRB) exemption was applied for and obtained. Only a letter (see Appendix D) accompanied each survey sent out explaining the intent of the survey and the anonymity of the participants.

From the data collected from surveys and transit-user counts, general recommendations for shopping centers were made. These recommendations were based on observed user characteristics, as well as research on integrated design for alternative modes of transportation. Much of the research done on integrated design focused on compact design and transit-oriented development. However, recommendations from this study focused on what modifications can be made to existing infrastructure as well as the development of new infrastructure.

Results

Transit-User Traffic Counts

The distance bus users would have to walk to reach the mall from the bus stop was determined using Google Earth. The table below summarizes these distances.

Table 1: Distance from the Bus Stop to the Nearest Mall Entrance

Stop Location	Mall	Distance (ft).
Mall Park Drive & Lyons	Dayton Mall	475
Prestige Plaza Dr. & S.R. 741	Dayton Mall	792
Kingsridge & Lyon	Dayton Mall	1267
Kingsridge	Dayton Mall	1531
Mall Park Drive & S.R. 741	Dayton Mall	1690
Kingsridge & State Route 741	Dayton Mall	1848
Colonel Glenn & WSU Entrance	Mall at Fairfield Commons	7128

Glengarry & East Stroop	The Greene Town Center	950
Glengarry & Graceland	The Greene Town Center	950
Dorothy Lane & East Stroop	The Greene Town Center	1584

Note that these distances are only approximations and that some margin of error does exist due to the nature of the software and the locations from which the measurements were taken. Additionally, in the event that two bus stops are present for one location (on two-way roads), the farthest distance was used. For example, two stops are present at the intersection of Mall Park Drive and State Route 741; one in the north direction and one in the south direction. The stop on the side of the road traveling north is slightly farther away from the mall, thus, this was the stop used in the measurements. Aerial photos for each location can be seen in Appendix E. One should also note that these distances were measured along the nearest public walkways, usually sidewalks, and do not reflect potential shortcuts bus users may take.

The passenger sample counts that were taken at each bus stop studied reveal ridership trends for each location as well as each bus route that makes a stop near the Dayton Mall, the Mall at Fairfield Commons, or the Greene Town Center. At the Dayton Mall, route X5 is the most popular bus route. At the stop at the intersection of State Highway 741 and Prestige Plaza Drive, one of the most popular stops near the mall, an average of 61 people got off at this location in 2013 on a daily basis, with 12 getting on the bus at this location daily. One of the least popular stops surveyed near the Dayton Mall was the stop on Kingsridge Road. This is most likely due to the fact that stops are located in either direction of this stop less than one quarter of a mile away. With the exception of the X5 route, which exhibits higher numbers, the other five routes that make stops at this location all pick up or drop off less than 11 passengers per day.

Only one route makes a stop near the Mall at Fairfield Commons – Route 1. This stop is highly visited, with an average of 50 people getting on the bus and 54 people getting off at this location per day between the eastern and western routes. However, the data recorder noted that at this location the majority of the riders appear to be Wright State University students or nearby restaurant workers. Very few passengers even walked in the direction of the mall.

The Greene Town Center has three bus stops near its premises with two different routes stopping at the three stops identified. Route 12 is the more popular route to the Greene, despite only traveling south. The most popular bus stop is the one at the corner of Stroop and Glengarry which provides quick access to the Greene directly across the street from the stop. This location averages 29 people per day getting on the bus at this location and 50 people disembarking here, according to data gathered by the Dayton RTA.

While the full set of data for the passenger counts conducted in this study and a comparison of the results to those of the electronic counters on Dayton RTA buses are in included in Appendix F, the table below summarizes the number of passengers embarking and disembarking at the most popular bus stop for each mall based on the survey data.

Table 2: Most Popular Bus Stops in Survey Group

Mall	Stop ID	Direction	Ons	Offs
Dayton Mall	6017	S	20	93
Dayton Mall	7301	S	10	103
Fairfield Commons	456	W	46	13
Greene Town Center	7025	S	23	29

Note that the two bus stops for the Dayton Mall both experienced on average 113 people a day getting off or on a bus at this location. The numbers in the table above can be compared to the numbers of several bus stops near three area malls in Portland, Oregon. Portland was chosen as a city of comparison due to its public transit-friendly attitude as well as large availability and usage of public transit services.

Table 3: Bus Stop Passenger Exchanges near Malls in Portland, OR Compared to Estimates for Dayton, OH

Mall	Stop ID	Direction	Ons	Offs	Adj. Ons	Adj. Offs
Lloyd Center	8343	E	1829	2989	437	714
Lloyd Center	8374	W	2674	2138	639	511
Pioneer Place	8335	E	1085	679	259	162
Pioneer Place	8382	W	1200	1444	287	345
Pioneer Place	7586	S	479	145	114	35
Pioneer Place	7803	N	139	286	33	68

Washington Square	9649	N	257	227	61	54
Washington Square	9650	N	316	196	76	47
Washington Square	9653	S	243	382	58	91

The Portland numbers, provided by the Portland TriMet (local transit authority), are for the spring 2013 quarter. Because Portland is nearly five times the size of Dayton, an adjustment factor was used to scale down the Portland numbers to what they might be for a city the size of Dayton. One can see that even on a smaller scale, all of the bus stops near the Portland malls exceed the two Dayton stops that experience the highest number of passengers. If Dayton hopes to increase the number of people riding RTA buses, design improvements must be made in both the bus routes and shopping center layouts to encourage mass transit appeal.

Mall Officials Questionnaire Survey

Because this study looks not just at changes to bus routes, but design modifications to shopping centers, the general managers, operations directors, public relations directors, and several other members of the malls' staff were polled about their opinions on public transportation and the potential customers it can bring to their mall. However, only one survey was returned. The results are available in Appendix G. Overall the survey results from the one respondent were extremely negative, stating that buses are a hindrance to the mall and a safety hazard on the roads. The respondent also felt that if more customers arrived at the mall by bus, theft would increase and the ring roads surrounding the mall would be increasingly congested. Due to the lack of participation in the survey, the responses from the one respondent are the only views available; however, due to the overwhelmingly negative response, one should take caution in presuming that this response is the norm, and instead view the response as a data outlier.

Discussion

When designing for transit-oriented development, several factors must be kept in mind. First, at the heart of the design should be the pedestrian. When using public transportation, passengers will have to walk at some point, be that from their car or home

to the bus stop, from the bus stop to a different bus stop in order to catch a connecting bus, or from the bus stop to their final destination. Additionally, the ABCs of transit-oriented development (TOD) should be considered (Dittmar and Ohland 2004). Active streets are the first component of the design. Active streets include sidewalks, a mix of land uses, buildings oriented towards the street, small building setbacks, small blocks, large window displays, and automobile parking to the side or rear of the building. These elements seek to make an area attractive and safe for walkers while increasing the ease of walking and/or transit use, hence decreasing automobile use. Building intensity and scale is the second component of a good transit-oriented design. Buildings without many windows or entrances directly to the street do little to encourage pedestrian access. Many strong transit-oriented designs draw inspiration from historic designs and layouts of earlier decades. This may include the use of artistic facades, improvements between streets and buildings, or use of windows. Finally, careful transit integration will make a mixed-use design successful. Transit-oriented projects can be pedestrian and auto-friendly if well-designed. Making sure that the needs of the pedestrian (and transit users) are met while incorporating the right of amount of automobile parking and bus routes will ensure a successful design (Dittmar and Ohland 2004).

The current study looked at three Dayton-area malls that are served by the Dayton RTA bus service. After analyzing the existing layouts and travel demands of bus riders recommendations can be made for these mall layouts. The hope is that in examining three different malls, readers can obtain a better understanding of transit-oriented design and how it can be incorporated into future shopping center designs in all cities.

The Dayton Mall

The Dayton Mall is currently the most transit-accessible mall of the three in this study with over ten different bus stops nearby. However, the current layout of the mall is automobile-oriented. The main entrance to the mall faces State Route 725, which has no sidewalks (see Figure 4).

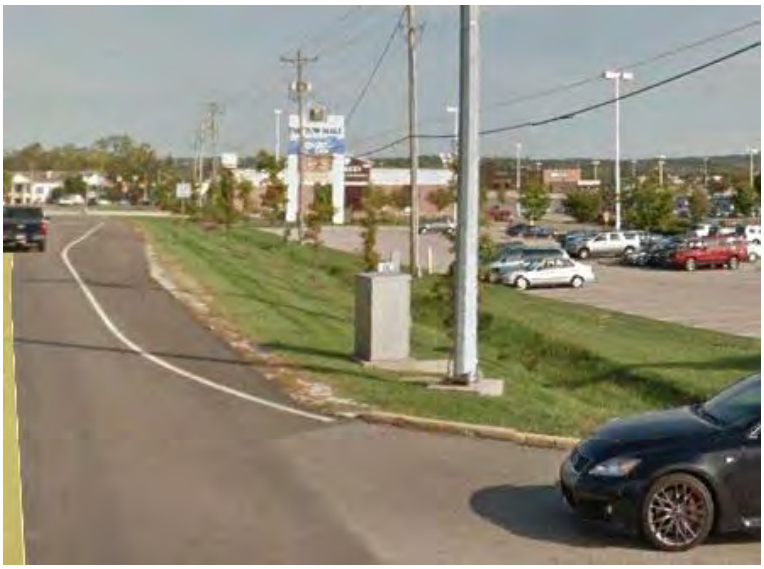

Figure 4: State Route 725 at the Main Entrance to the Dayton Mall

Several restaurants and shops are clustered in the northwest area of the site, providing a good mix of uses and encouraging patrons to visit the area to meet more than one need. However, sidewalks only connect some of these buildings (Figure 5), leaving several of the restaurants isolated by parking spaces and only connecting this area to the shopping mall in one location (Figure 6). While this area is a nice attempt at mixed-use and compact development, it becomes isolated because these ideas have not been incorporated throughout the entire mall campus.

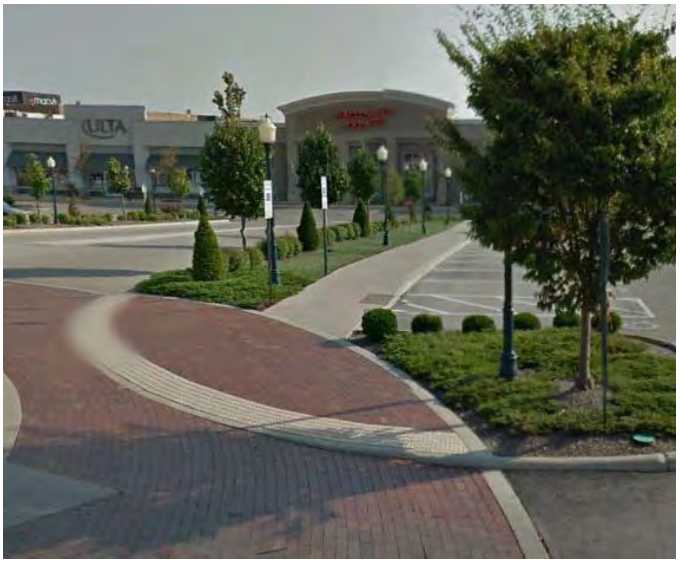

Figure 5: Connecting Sidewalk to Some of the Commercial Buildings

Figure 6: Disconnected Shopping and Dining Area

The rest of the Dayton Mall is encircled by large parking lots that prevent bus-riders from easily accessing the mall by foot. These parking lots, because they present a safety hazard to pedestrians, discourages any transportation mode other than the automobile. The position of the bus stops further demonstrates this idea. Of the numerous stops around the mall, only one stop is located on the mall's property. This stop is located off of the Mall Ring Road in the back of the property. However, even though this stop is located on mall property, it is still a lengthy walk through the parking lot to the nearest mall entrance (see Figure 7).

Figure 7: Walk from Mall Park Drive and Lyons Road Bus Stop to Nearest Mall Entrance

This walking distance presents a challenge for the elderly, disabled, and those shopping in adverse weather conditions that may ride the RTA buses. Additionally, no sidewalks are present along the Mall Ring Road or the areas leading up to the mall, including the path from the nearest bus stop to the mall. Several bus stops are present along Kingsridge Road and Lyons Road. If anyone wishes to access the mall from these stops they must walk to the intersection of Lyons and Ring Road (pictued in Figure 8) and cross from this intersection into a wide parking lot.

Figure 8: Intersection of the Mall Ring Road and Lyons Road

The crosswalk directs pedestrians into the parking lot where no designated pedestrian areas exist. This leaves them at risk for interactions with automobiles. Furthermore, if a pedestrian arriving by bus to a stop on Kingsridge Road wishes to walk to the mall on the sidewalk, they are forced to walk increased distances to cross at the only sidewalk along the Mall Ring Road. As a result, many transit-users have resorted to shortcuts through businesses' parking lots and grassed areas along Kingsridge. Again, this is a safety hazard as well as an inconvenience to both the bus passengers and the businesses they are cutting through.

If the Dayton Mall was to be redesigned, the entire building footprint should be rotated 180° to place the main entrance off of the Mall Ring Road. Additionally, the entire building should be shifted much closer to the road. A drawing of the full property layout is included in Appendix H, but a close-up of the proposed entrance can be viewed in Figure 9. The main driveway would enter the premises off of the ring road directly towards the main entrance of the mall. Located in the front of the property are several handicapped parking spaces, the focus of the available parking in this area. Directly adjacent to the main drive is a bus pull-off area, allowing the bus to easily drop off and pick up passengers without causing vehicular congestion in this area. Additionally, a crosswalk directly connects the sidwalk at the bus loading area to the sidewalk that would surround the entire mall building. Several benches are located in the grassed area adjacent to the bus stop to provide passengers a place to sit while waiting for the bus to arrive.

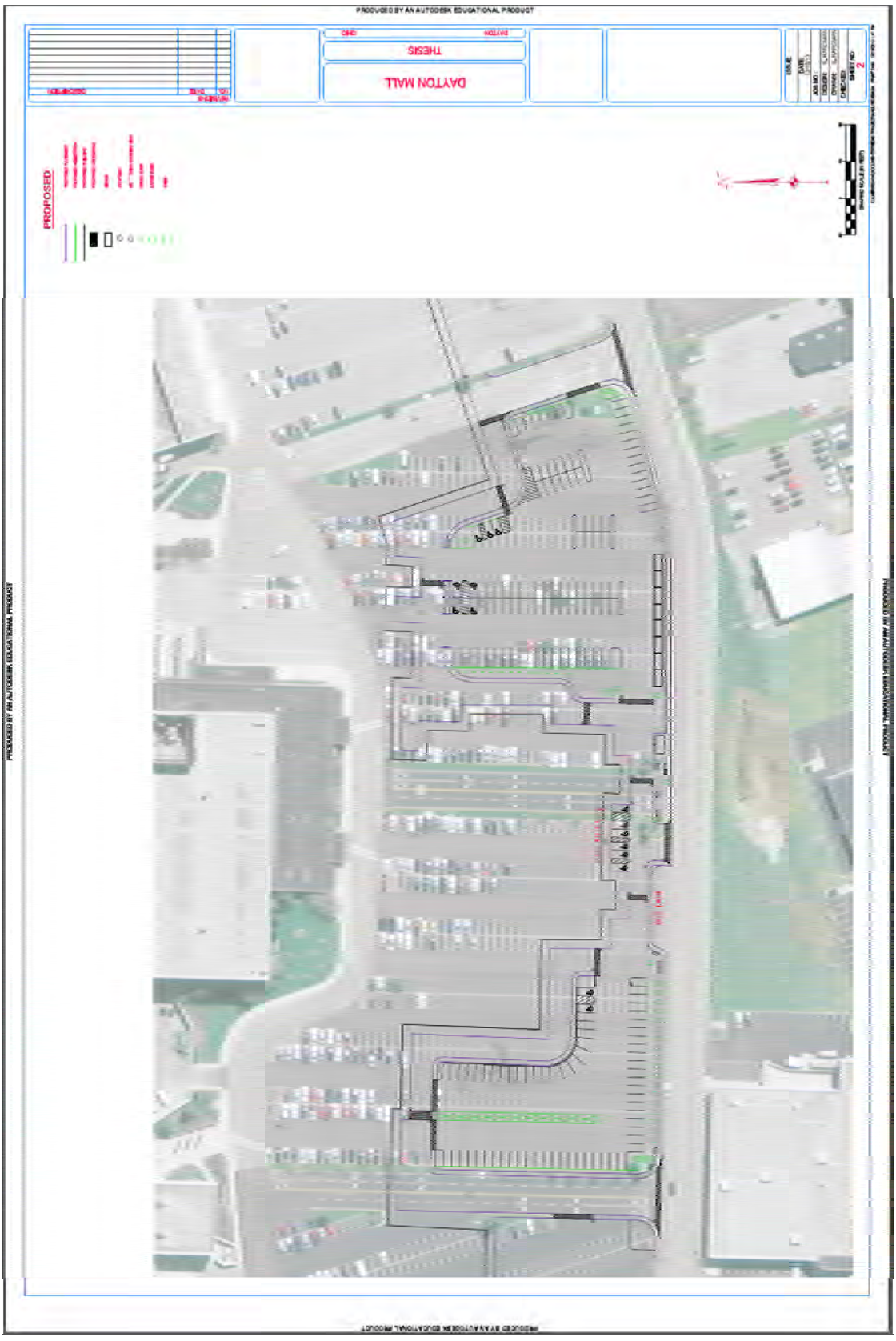

Figure 9: Proposed Front Entrance of the Dayton Mall

On the other side of the main driveway is a small grassed area for pedestrians and shoppers to mingle and rest in nice weather. Several benches and trees create the feeling of a park, while a small coffee stand makes this area an easy place to meet friends for a beverage or take a break from shopping. This area is inspired by the small sidewalk cafés popular in Europe and the historic integration of kiosks and coffee stands around sidwalks and plazas at train stations (Dittmar and Ohland 2004). Integration of transit is eased by sidewalk and plaza areas with room for kiosks, coffee stands, and other ammenities near stops and stations because the area becomes more than a waiting area (Dittmar and Ohland 2004). This area is again connected directly the mall entrance by way of a pedestrian crossing across the driveway.

Each crosswalk surrounding the mall is accompanied by a "Yield to Pedestrians" sign that makes drivers aware that pedestrians may be walking in this area. To further enhance the visibility of pedestrians, all crosswalks are paved in a different material such as cobblestone or brick. Using a different material for the crosswalk is one method of traffic calming that forces automobile traffic to slow down in these areas while increasing the visibility of the pedestrians (Porter et al. 2002). These crosswalks could even be extended out to the Mall Ring Road, where a sidewalk should be added at a minimum along one side of the entire road.

Some improvements will need to be made to the proposed back side of the mall as well. The crosswalks paved in different materials should be placed anywhere pedestrians will be crossing the driveway. Additionally, crosswalks should be accompanied by pedestrian warning signs warning drivers that pedestrians may be active in these areas. These crosswalks are particularly important near the mixed use development in the northwest corner of the property. Due to the mix of uses in this area, visitors can easily park once and walk to several destinations, including the mall itself. Crosswalks and sidewalks must connect all buildings and areas, not just select areas. Additionally, a sidewalk should be added along the mall property on State Route 725 and State Route 741 to help bus riders arriving at stops along these roads walk safely and easily to the shopping center.

With the addition of sidewalks along these two roads, crosswalks need to be added, at a minimum, at the intersection of State Routes 725 and 741. Many pedestrian

injuries occur in crossings across multilane roads that separate commercial and residential areas (Cavin, 2003). Both of these roads have four or more lanes, making pedestrian crossings long and potentially dangerous, particularly when no legal crossings are available. Pedestrians will take the shortest route available to them, and crosswalks should support these routes. Therefore, sidewalks and crosswalks should be present on connecting paths between bus stops and popular destinations such as shopping centers to encourage bus ridership and walking, as well as the safety of those using these facilities.

The majority of the parking spaces at the Dayton Mall should be located to the side and rear of the mall, as the front is devoted to bus and pedestrian traffic with only limited parking available. By placing parking to the side and rear of the mall, the streetscape can be preserved and pedestrian access is improved (Porter et al., 2002). While parking is no longer the focal point in transit-oriented development, it is still an important component. Successful transit-oriented development projects are both automobile friendly and pedestrian friendly (Dittmar and Ohland, 2004). Therefore, although parking is no longer front and center in the design, it will still make up a large part of the property. The Dayton Mall has 1,416,846 square feet of retail floor space and is located in Miami Township. The Miami Township Zoning Code states that all business and commercial establishments should provide, at a minimum, one space for every 300 square feet of floor area. This translates to a minimum of 4723 spaces, although additional spaces may be needed for office and ammenity areas. However, the Dayton Mall has in excess of 5000 spaces. The number of parking spaces should be reduced until it becomes closer to the minimum number of spaces in order to encourage alternative methods of transportation to the mall.

The easiest way to transform a mall is to rebuild it. However, many shopping centers already in existance cannot afford to be rebuilt. This does not mean that elements of transit-oriented development cannot be woven into mall renovations though. If the Dayton Mall were to be renovated, rather than rebuilt, several things should still be changed to improve both the visibility of the mall and surrounding facilities and the access for pedestrians, transit users, and automobile drivers.

The most important change that would need to be made to the Dayton Mall would be to move the bus stop closer to the mall entrance. Instead of stopping near the drive

entrance as it currently does, the bus could enter the parking area, drive down the drive aisle to pull up at the entrance, and exit via the adjacent driveway. The proposed route is depicted in Figure 10. Moving the bus stop closer to the mall entrance will greatly decrease the distance that bus passengers, particularly the handicapped and elderly, will have to walk. Decreasing the distance between the bus stop and the entrance should increase the number of people using the bus to arrive at the mall, as the farther the distance a person has to walk from the stop to their final destination, the less likely they are to ride the bus.

Figure 10: Proposed Bus Route for Dayton Mall

Another renovation that could be made to the mall campus would be the addition of sidewalks. The various elements located on the mall property are not well connected, which means very few people will be willing to walk from one area to another. The ability to move from one area to another helps to enhance the experience of the patrons. If a person wants to eat at a restaurant after shopping at the mall, the walk between the two destinations should be safe and easy in order to encourage walking, rather than driving, to the next destination. Sidewalks should extend from the intersection of the Mall

Ring Road and Lyons Road along the Mall Ring Road as well as down the main driveway towards the entrance. This allows shoppers arriving at other bus stops along Lyons or Kingsridge Drive to still walk safely and efficiently to the mall. Additionally, sidewalks should connect the mixed-use development in the northwest corner of the property to the mall and other restaurants along the northern property line. Greenspaces that include trees and benches that allow pedestrians to rest and relax could also be added in corners of the lot or even along an expanded sidewalk that currently surrounds the main mall building.

A final improvement would be to add an additional area of mixed-use development similar to the one that already exists. The front of the mall already exhibits many aspects of mixed-use development, but the back of the mall fails to appeal to anyone but those arriving by automobiles with the sole intent of going to the shopping mall. A few small restaurants or coffee shops could by added to the southeast corner fairly easily. While a portion of the parking lot would be eliminated, the mall already has more spaces than required; therefore, eliminating some of the parking spaces would not pose a large issue.

Regardless of whether the mall is renovated or rebuilt, several changes can be made to the RTA bus system to improve the efficiency and availability for passengers. The X5 route is the most used route that travels to the Dayton mall area. However, it does not drop off or pick up passengers at the Dayton Mall like routes 23, 60, and 61 do. The X5 route is a popular one because it travels directly from downtown Dayton to the mall, a route that is not easily accssible by bike or walking, and one that is, therefore, otherwise inaccessible to those who cannot drive. Because this route is the one most used by Dayton Mall shoppers, it should stop as close to the mall as possible to provide maximum convenience for the passengers. Figure 11 details the proposed X5 route overlaid on the existing route. The bus would turn left onto Lyons and enter the mall premises, drop off and pick up passengers at the mall, and then continue straight back onto Lyons Road and the existing route.

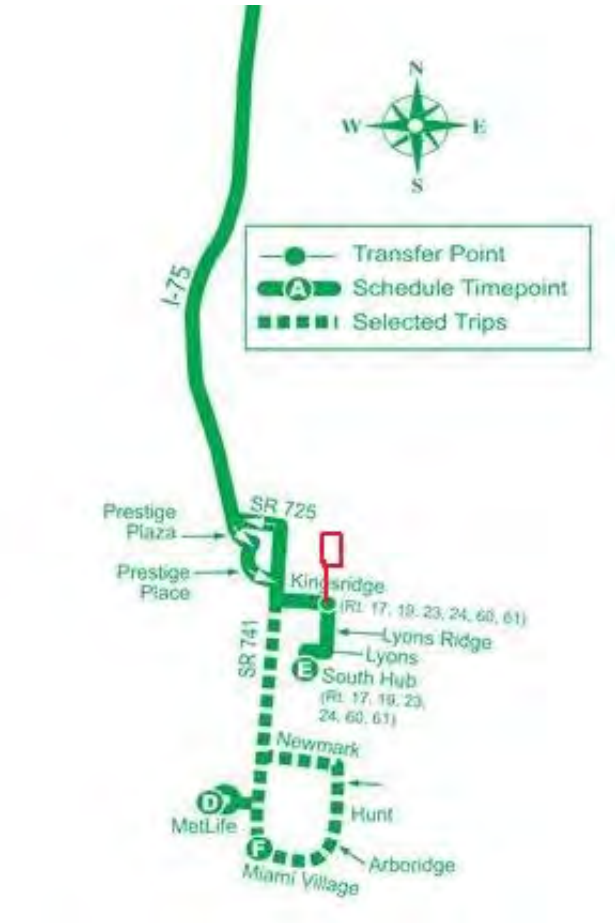

Figure 11: Proposed X5 Route

One additional change to the Dayton RTA bus routes in this area would be to eliminate the stop on Kingsridge Road. This stop has very few passengers getting on or off at this stop, particularly in the northern direction. On average only 15 people arrive or leave stop 5584 per day. Stop 7302 sees an average of 64 people per day, much higher than in the northern direction, but still low compared to many other stops in this area. Furthermore, bus stops are located further down Kingsridge Road in both directions with locations at the intersection of Kingsridge and Lyons and Kingsridge and State Route 741. The stop at Kingsridge seems superferlous if the Dayton RTA wishes to be efficient in travel time and maintenance costs.

The Mall at Fairfield Commons

The Dayton Mall is ripe for improvements that would increase bus ridership to this shopping center due to the large number of bus stops in the area. The Mall at

Fairfield Commons, in contrast, will require greater improvements with regards to the Dayton RTA due to the lack of public transportation in this area. The closest stop is over one mile away at Wright State University and is not easily accessible by foot or even bike from the mall. Furthermore, this stop is served only by one route, route 1.

The first change that should be made to this area to make it more accommodating to public transportation would be to add a sidewalk along North Fairfield Road. This road, as shown in Figure 12, is at a minimum six lanes with only a small shoulder for pedestrians.

Figure 12: North Fairfield Road Overpassing I-675.

One area resident who currently uses Dayton RTA services on a regular basis notes that walking across the North Fairfield bridge is “dangerous. People [vehicular drivers] have no respect. They speed. They throw stuff out the window at you” (Robinson, 2012). Furthermore, the Mall at Fairfield Commons is close to Wright State University. Students without cars or who do not wish to drive may need to go to the mall to complete errands. With no sidewalk or bus service between the bus stop across from the entrance to the university and the mall, the path between these two areas is dangerous and discourages pedestrian use. If no other changes were to be made to this area to improve accessibility to the mall, a sidewalk needs to be added along the length of this road, at a minium until the end of the mall property.

Several additional bus stops should be added to route 1 in the area surrounding the mall through a small extension of the current bus route. Five stops are proposed in this study for the improved maneuverability and accessibility of patrons and workers of the Mall at Fairfield Commons, as well as anyone wishing to access the other stores, restaurants, and office buildings that surround the mall property.

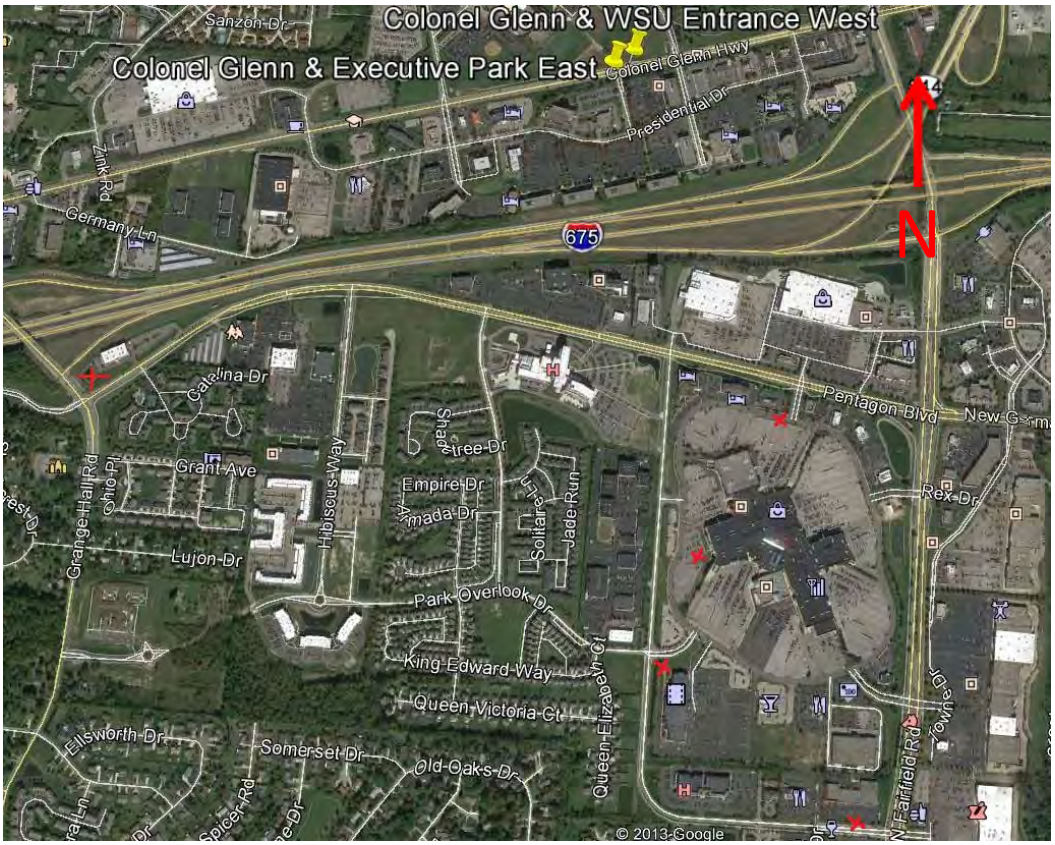

Figure 13: Proposed Bus Stops Surrounding the Mall at Fairfield Commons

The current stop is shown in Figure 13 with two pushpin symbols denoting the eastern and western directions of the route. The bus could continue traveling east along Colonel Glenn Highway before turning right onto North Fairfield Road. Because North Fairfield Road is highly trafficked, buses should refrain from stopping along this road to prevent traffic back-ups. Instead, the bus should drive south along North Fairfield Road before turning right onto Commons Boulevard, just past the mall property. The first proposed bus stop should be located near this intersection to accommodate shoppers whose final destinations are the stores and restaurants on the other east side of North Fairfield Road. Sidewalks and a crosswalk at this intersection will allow bus passengers to access the businesses on the east side of the road.

The second stop should be located further down Commons Boulevard where it intersects Park Overlook Drive and Fairfield Commons Drive. This stop would be beneficial for residents in the neighborhood located off of Park Overlook Drive or the adjacent office buildings as well as transit users wishing to arrive at the mall or movie theatre. Following this stop the bus should turn right onto Fairfield Commons Drive and then turn left to travel along the ring road surrounding the shopping mall. The location of this stop is flexible; the shortest walk for bus riders would be achieved by stopping near Macy's Department Store. However, traffic flow might be better served by having the bus stop at the stop sign at the intersection of the ring road with Fairfield Commons Drive. Stopping here would also shorten the distance workers heading to or from the offices on the west side of Commons Boulevard would have to walk.

From either location, the bus should continue along the mall's ring road until it arrives at the intersection of Mall Ring Road and Fairfield Commons Drive. A stop here gives riders access to a different side of the mall as well as the hotels across the road from the shopping mall. However, if mall officials do not want an additional bus stop on mall property, the bus could exit the property at Fairfield Commons Drive, turning north to get back on to Commons Boulevard. The proposed fourth stop could then be located just before the intersection of Commons Boulevard with Pentagon Boulevard. A large grassed area on the eastern side of Commons Boulevard provides the potential for a bus lane. Use of a bus lane would prevent traffic from backing up behind a stopped bus. The final proposed stop would be present after the bus turns left onto Pentagon Boulevard. Where the road intersects Grange Hall Road a bus stop should be added. Additionally a crosswalk will need to be added crossing Pentagon Boulevard for pedestrians to access the condominiums and houses on the south side of Pentagon Boulevard. From this intersection the bus could turn right onto Grange Hall Road to return to its original route on Colonel Glenn Highway.

In order to maximize the effectiveness of the proposed bus stops, a reconstruction, or at a minimum, a renovation, of the Mall at Fairfield Commons will be needed. The first situation analyzed will be a complete rebuild of the mall. If this shopping center was to be rebuilt, the most important change would be to shift the mall northeast, closer to the intersection of Pentagon and Commons Boulevard. A drawing of the proposed

reconstruction is located in Appendix H of this document. With the renovation of the Mall at Fairfield Commons, the focus will be on two out of the many entrances. The first entrance will be that nearest to the proposed third bus stop described above. This entrance and surrounding area can be viewed in Figure 14. This area will be considered the main pedestrian entrance for the mall. The bus stop, ideally, will be located adjacent to the sidewalk that surrounds the mall so that bus passengers have very little distance to walk between disembarking the bus and entering the mall. A very small parking area will also be located across the driveway from the doors with an emphasis on handicapped parking. Placing the handicapped parking in this area minimizes the distance the disabled will have to walk to get to the mall.

Large pedestrian crossing areas are prominent in this area. Similar to the crosswalks used in the Dayton Mall design, these crosswalks are paved with a different material than asphalt or concrete. Use of a different material visually highlights pedestrian-heavy areas for drivers as well as forces them to slow down in these areas. Pedestrian crossing signs in the area also make drivers aware of pedestrians that may potentially cross their path.

On the right side of the driveway that branches off from the ring road and leads up to the mall is a sidewalk connecting the ring road with the mall entrance. A pedestrian crossing has been added crossing the ring road to the additional parking on the opposite side of the road. This parking area is already in existence, but fits in well with the new design because it places the emphasis on the pedestrian rather than the motorist. Only a small amount of parking spaces are placed between the pedestrian walkway and the mall entrance and additional automobile parking is available across the road. By providing the pedestrians with the preferred, closer areas, the designer is encouraging shoppers to arrive by walking or taking the bus.

While the parking is minimized near the entrance, a large number of parking spaces will still be required to comply with zoning code regulations. A greater amount of parking is available on the right side of the driveway that cuts through the entrance area.

Figure 14: Proposed Main Pedestrian Entrance at the Mall at Fairfield Commons

However, this area is not only for automobile parking, but bicycle parking as well. A bike rack has been placed in the elevated island that runs between the drive and the parking lot, preventing the bikes from being hit by a car while also placing them very close to the mall. This placement increases the ease with which bicycle users can enter and exit the mall and will encourage others to use a bike to get to and from the mall because of this ease. This area also has a small seating area just outside of the mall for shoppers to rest or chat with friends. A small fountain, benches, and vegetation helps to prevent the area from becoming a vast area of asphalt and concrete. It also encourages shoppers to stay at the shopping center for longer periods of time, as they can take a break in a park-like setting.

While the main pedestrian entrance is best served by construction of a bus stop adjacent to the mall entrance, if a traffic study reveals that too much congestion will develop in this area as a result of the stop, or officials do not want a bus stop on mall property, the stop can be moved to the intersection of Fairfield Commons Drive and Commons Boulevard. Only modest upgrades to the area would be needed, including a waiting platform and an extension of the sidewalk to the bus stop from the existing sidewalk along the ring road. Because people working in the offices on the west side of Commons Boulevard may use the bus service to this location, crosswalks should be added crossing Fairfield Commons Drive and across Commons Boulevard to connect the existing sidewalks along Fairfield Commons Drive and the west side of Commons Boulevard.

Whatever the design is, one of the most important concepts to remember is to make every area walkable for pedestrians. Sidewalks, crosswalks, and warning signs are all elements that can increase the walkability of the area and ensure that pedestrians remain safe, even in automobile-heavy areas. Currently, the sidewalks surrounding the Mall at Fairfield Commons are unconnected and end abruptly in spots (see Figure 15).

Figure 15: Unconnected Sidewalk along Ring Road at the Mall at Fairfield Commons

The sidewalks are limited in their effectiveness, because they cannot safely transport pedestrians from one place to another if they are unconnected. In a redesign of this shopping center, an uninterrupted sidewalk should be constructed along the side of the mall's ring road. Doing so ensures pedestrians can travel safely from the shopping mall to the surrounding restaurants and movie theatre.

In keeping the pedestrian, who often is also a transit user, in mind, one must consider the space surrounding the bus stop. Many times the bus stop is simply a small platform or even just a sign indicating the presence of a bus stop. However, one of the goals of compact design is to create not just a stop, but a destination. People should see a visit to the shopping center as an experience, rather than just a place to shop. The secondary bus-focused entrance at Fairfield seeks to create an experience for not just transit users, but anyone visiting the mall. Visible in Figure 16, the bus stop is situated close to the mall to minimize the walking distance. Again, crosswalks connect the bus stop to the hotels on the north side of the ring road to help facilitate travel between the two areas. Hotel users can easily access the bus stop with the addition of a sidewalk extension in order to travel to other areas of Dayton without having to use a car.

Figure 16: Proposed Secondary Pedestrian and Transit Mall Entrance

The unique part of this bus stop is that it is not located on a strip of grass or sidewalk on the side of the road but part of a larger green space. The green space separates the bus stop from the small parking lot adjacent to it and enables bus passengers and pedestrians to access the mall without having to ever set foot in the parking lot. Furthermore, the green space provides a relaxing area for bus passengers to wait for their bus. Benches should be interspersed throughout the area for passengers and shoppers to rest or wait. A further proposed amenity is the small kiosk located in this area. This kiosk could be a coffee stand or other small refreshment vendor. The kiosk is located on a cobblestoned area which is directly connected to the bus stop platform by a path for easy access. Small, café-like tables could also be added to this green space to further encourage patrons to take advantage of this area. Trees are added along the length of the road to help seclude the area from cars, noise, and vehicular fumes.

Creating a small oasis in the sea of concrete and asphalt that often accompanies large shopping malls is important for compact design. A green space contributes to the mixed use aspect of the design that may help encourage patrons to remain longer because they are able to accomplish more activities in one area rather than having to drive to multiple places. Additionally, green areas encourage pedestrian traffic on the property. These spaces provide a place to rest after a walk, wait for a bus, or meet with a friend or colleague. Finally, green spaces are important for mall investors because they reduce the impervious areas on the property. This, in turn, decreases the amount of rainwater runoff that must be controlled and detained. Less detention means lower construction and maintenance costs for the investors.

If renovation, rather than reconstruction, is preferred for shopping centers like the Mall at Fairfield Commons, mixed use elements can still be incorporated. The mall is surrounded by many different restaurants. However, for shoppers that may want an area to eat outside when the weather is nice, take a break from their errands, or wait for their bus or other ride to arrive, small green spaces can be added to the property. For the Fairfield property, the restaurants are concentrated to the north and south of the main mall building. Hence, secluded areas to relax should be concentrated in these areas. When designing these areas several things should be kept in mind. These areas should help connect the various elements of the property, rather than further divide them. These areas

should also be pedestrian-friendly, with wide sidewalks around them, trees, and other amenities. Finally, transit may be integrated into these areas, but only where it will not be detrimental to traffic flow or pedestrian safety (Dittmar and Ohland, 2004).

Figure 17 depicts three potential areas for green spaces on the Fairfield Mall property, two on the north side and one to the south. Each space should be separated from vehicular traffic by a curb, at a minimum, and accessible by pedestrians via sidewalks and crosswalks as necessary. An additional area already exists on the property and could be modified slightly to improve its appeal to pedestrians. This area is indicated by an arrow in the figure below.

Figure 17: Proposed Green Spaces

The spaces do not have to be large areas, simply large enough to accommodate a few benches, trashcans, and trees. The existing area is approximately 7100 square feet, but green spaces may be even smaller than this. Each space will be unique depending on the size, layout, and location, but all should be safe and comfortable for visitors and be easily accessible by sidewalks so that pedestrians do not have to cut through parking lots. If the addition of the green spaces lowers parking spaces below minimum allowable numbers, a small parking garage could be added in order to meet parking minimums without requiring additional land.

In fact, designers might consider a parking garage whether it is needed to meet the parking space minimum requirement or not. Some shopping centers use 2.5 – 3.5 times more space for parking than for retail structures (Porter et al., 2002). The area needed for parking can be reduced first by reducing parking spaces to only the minimum number of spaces required by the local zoning code. It can further be reduced by building upward, rather than outward. Parking garages, while more costly than traditional parking lots, allow a large portion of the space saved by building the parking lot vertically to be used for green space or additional retail or office space. The construction of new structures for office areas, restaurants, or entertainment venues adds to the mix of uses in the area and reduces the amount of driving trips needed for people to visit all of their desired destinations. Mixed use areas contribute to the “being there” concept, or idea that patrons begin to see a mixed use area as an experience, rather than just another destination. They are willing to spend more time in a single area rather than spread out over several destinations dispersed throughout the city (Porter et al. 2002). If property owners are concerned about the cost of a parking garage, a small fee could be charged to park in the garage. This fee, while helping to cover construction and maintenance costs, would simultaneously promote transit use and pedestrian activity, as expensive parking helps to increase transit use. If shoppers are forced to pay to park, they will consider other options that may be less expensive (Porter et al., 2002).

Whether the mall is rebuilt or renovated, many of the preceding recommendations made are applicable. The pedestrian crosswalks should be highlighted in a contrasting material and automobile drivers should be made aware of heavy pedestrian areas with warning signs. Again, one of the most important aspects of the remodel is the sidewalks.

The sidewalk that often runs along the side of the ring road should be made continuous, and sidewalks leading from the ring road up to the mall, such as the one shown in Figure 18, should be added.

Figure 18: Connecting Sidewalk

Additionally, the bus stops should be placed as previously suggested for ease of pedestrian access to the shopping center. Designers must ensure that the bus stops follow any local zoning or building codes. For example, Beavercreek, Ohio, the location of the Mall at Fairfield Commons, has a set of design criteria for public transit stops. Criteria include placing the stops adjacent to a sidewalk or bike path, providing for continued efficient passage of vehicular traffic and pedestrian access to the surrounding areas, and the inclusion of a shelter, boarding pad, bench, sign, trash receptacle, schedule holder, and transit pad among other stipulations (City of Beavercreek, 2012). Designers must ensure that all criteria are met in order to gain the support and approval of the city and property owners if attempting to place the stops on private property. However, many of the stipulations included in Beavercreek's design criteria encourage transit-oriented development and should be considered regardless of whether they are a requirement or

not. The amenities, such as benches and schedule holders, make the stops more comfortable for users. More people will be willing to take the bus if they know a comfortable place to wait exists. Furthermore, if the bus stop is connected to the final destination by a path, bus riders will have a more convenient and safe route to travel to their final destination than if they must cross roads or parking lots without marked pedestrian walkways.

The Greene Town Center

While the Dayton Mall and the Mall at Fairfield Commons are traditional shopping malls surrounded by a plethora of parking lots, the Greene Town Center is an example of a mixed use, compact design. The design, modeling the downtown streets of early twentieth century cities, consists of roads lined with shops, restaurants, and entertainment venues. Sidewalks line all roads with the buildings opening up onto the sidewalks for ease of pedestrian access. Parking is available on the streets in addition to several parking lots to the north and south of the property and a parking garage located in the southwest corner of the property. The area is laid out in a grid pattern with a green space located in the center of the shopping area.

The New Transit Town describes the ABCs of transit-oriented development as active, walkable streets, building intensity and scale, and careful transit integration (Dittmar and Ohland, 2004). As far as active and walkable streets are concerned the Greene is an excellent example. The sidewalks are wide and available on both sides of the roads. Furthermore, the buildings are adjacent to the sidewalks so that pedestrians can quickly and easily access them. Large windows invite passerby to window shop and make the buildings appear more inviting. Furthermore, only on-street parking separates the buildings from the street. Pedestrians do not have to cross parking lots to reach the shopping area like they may have to at a traditional shopping mall. Additionally, the sidewalks are well lit and trees and shrubbery improve the aesthetics of the area.

Crosswalks marked with painted lines and pedestrian crossing signs improve the safety of pedestrians crossing the street by highlighting the areas for automobile drivers. As one may be able to see in Figure 19, the street is also not overly wide. Street lanes are generally ten to twelve feet in width; by minimizing the width of the lane designers force drivers to slow down. A decrease in speed equals an increase to pedestrians' safety. To

further increase pedestrians' safety, designers could decrease the curb radii near pedestrian crosswalks (ULI, 2006). A reduction in the radius of the curve means drivers must take turns slowly, giving both pedestrians and drivers more time to become aware of each other and avoid a collision.

Figure 19: Street View of the Greene Town Center

Compact design draws on historic designs and patterns. Historically, one characteristic of a city's downtown are the short blocks. Short blocks favor pedestrians because a higher level of connectivity is created than when blocks are long and without windows (Dittmar and Ohland, 2004). Long, blank blocks appear formidable and disjointed while short blocks appear easily walked and connected. Short blocks are further enhanced by the addition of windows and interesting facades that draw the eye up and around, creating a more wholesome experience. The Greene makes use of this concept with short blocks that are easily walked and buildings with many windows and a variety of colors and designs.

At the Greene Town Center a green space exists in the center of the property that is inaccessible by vehicles (Figure 20). A fountain is located in the center as well as benches, trash receptacles, and maps of the area. The space provides an area for events to

be held, shoppers to rest, and children to play. The area helps to break up the space to prevent it from being overrun by cars and gives priority to pedestrians, as the area can only be accessed by foot. Furthermore, the green space is an important design element, because it gives the shopping center a focal point for users to orient themselves around, and this focal point is not vehicular in nature, in contrast to the focal point of a traditional shopping mall, which may be the main entrance or large parking area. Finally, the green space prevents the shopping center from becoming an endless expanse of pavement and adds another use to the mix of uses already in existence.

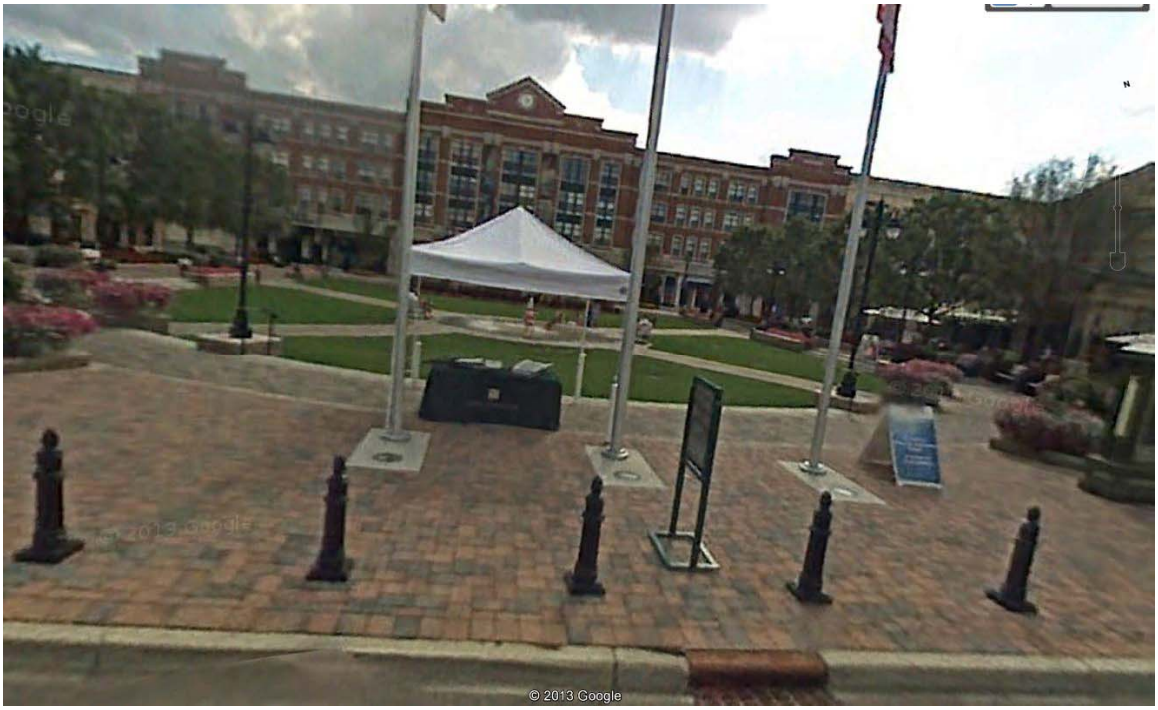

Figure 20: Central Green Space

The scale of the buildings is not overwhelming, with buildings generally being only two or three stories high. The multiple stories, however, serve several purposes. The first is that they contribute to the city feel. Compact design draws on the layouts of historic downtown areas with their multistory buildings, interesting facades, mix of uses in buildings, and heavy foot traffic. The second purpose of the multistory buildings, related to the first, is the mix of uses available with more than one level. Shops and restaurants, uses that are more frequently visited and can make use of large windows, fill the first floors of the buildings. Offices and apartments, which are less visited and more

private, can be located on the second or third stories of the buildings. People who live and work in these buildings can access shops, restaurants, bars, a movie theatre, and gym without having to get in their car to drive to each destination. By simply providing a variety of tenants at the Greene, the number of vehicular trips users generate will be decreased. Furthermore, mixed uses may help decrease the number of parking spaces required for the area if the various uses experience peak traffic at different times. For example, offices will require parking spaces for their employees during the workday Monday through Friday, while residences will need the most parking in the evening and weekend hours. Because these uses require available parking at different times of day, the same parking space may be counted for both uses, rather than constructing two spaces to meet the parking needs (Porter et al., 2002).

The Greene Town Center is highly walkable while not forsaking automobile users. Vehicle parking is still available in parking lots, on-street parking, and a parking garage. The difference between parking at the Greene and other, more traditional shopping centers is that the parking is organized in such a way that pedestrians can access the area as easily as automobile drivers can. The parking does not completely surround the shopping area, but is limited to areas near the vehicle entrances or interspersed in the shopping area. The majority of the vehicles will enter off of Dorothy Lane and can park in one of two main parking lots. Additionally, vehicles may enter the property off of East Stroop Road and park in the parking garage, or drive further into the Greene and park in the parking lots to the southeast side of the property. Minimizing the area taken up by parking not only allows more property to be used for retail area, but it also creates a more welcoming destination for pedestrians.

While the Greene is extremely pedestrian-friendly, one of the most important aspects of transit-oriented development, public transportation itself, could be better integrated into the shopping center. Two bus stops are close to the Greene, each with excellent walking paths between the stops and the shopping center. Sidewalks and pedestrian crosswalks provide a safe path for transit users to walk to and from the Greene to the two bus stops. However, a concern about the path between the shopping center and the stops is the crossing distance of Stroop Road. At the intersection of Stroop and Dorothy pedestrians must cross six lanes of traffic.

Figure 21: Crossing across Stroop Road as Viewed from Dorothy Lane

The intersection at Stroop and Glengarry is six lanes as well. Based on the author's observations at the Stroop and Glengarry intersection, the time allotted for pedestrians to cross the road to get to the Greene does not appear to be sufficient at first glance. Pedestrians can walk, on average, 4.63 feet per second for females and 4.93 feet per second for males (Garber and Hoel 2009). Therefore, a design speed at intersections of 4 feet per second is generally used. While the time to cross may seem insufficient at this intersection, a misinterpretation of the signal, rather than the signal length, may be the problem. The walk signal at this intersection is the image of a person walking, while an orange hand indicates that pedestrians should not cross the street at that time (see Figure 22 (a)). A flashing orange hand is similar to a yellow light on a traffic signal, indicating that pedestrians can still cross the road safely, but should clear the intersection. The flashing hand can be confusing to many pedestrians, as it appears to signal pedestrians to stop crossing the street. This confusion may cause congestion on the sidewalks, as pedestrians do not want to cross unsafely. To reduce congestion and ensure pedestrian

safety, crossing signals such as the one shown in Figure 22 (b) should be installed. These signals provide a countdown for pedestrians to see how long they have to safely cross the

(a) (b)

Figure 22: Existing and Proposed Pedestrian Crossing Signals

street before the traffic light changes. The timer eliminates possible misunderstandings and confusion associated with the current signal, allowing pedestrians to cross the street safely and more efficiently.

Several improvements could be made to the bus routes in this area to improve the integration of public transit in this area, should the officials of the Greene Town Center allow them. The first change would be for the 12 south bus, which normally stops at the corner of Dorothy Lane and Stroop before turning right and continuing down Stroop, to continue east on Dorothy Lane before turning into the shopping center via Green Boulevard. At the intersection of Green and Walnut Street the bus could make a stop before turning right onto Walnut, left onto Chestnut Street, and exiting via Glengarry Drive. The problem with this route is the number of turns required. The bus may have a difficult time with the tight turn radii in the streets of the Greene. An alternative to this route would be to have the bus exit the Greene via Walnut Street; however, currently vehicles can only make a right turn onto Stroop in the northern direction from Walnut. Route 12 travels south along Stroop. Therefore, to continue onto the original path, a light would need to be added at this intersection to allow the bus to make a left turn out of the

Greene.

Figure 23: Proposed Improvements to Route 12

An additional improvement to the bus routes in the area can be made to the 11 south route. Currently the bus travels north along East Stroop Road before turning left and stopping at Glengarry Drive. Many Dayton RTA door-to-door para-transit service buses were observed stopping at the movie theatre located just off of Stroop at the Greene. These buses are used for those with physical disabilities that may prevent them from walking from the bus stop to their final destination or vice versa. The amount of buses that would need to make the trip to the Greene's movie theatre could be reduced by placing a bus stop at this location, therefore reducing operation costs for the Dayton RTA. Hence, the 11 south buses should turn right onto Beech Street off of Stroop; make a left on Chestnut Street, and another left on Glengarry Drive to stop in front of the movie theatre. From there the bus can continue straight on Glengarry to its next scheduled stop

at the intersection of Glengarry Drive and Stroop Road near Gracemore Avenue

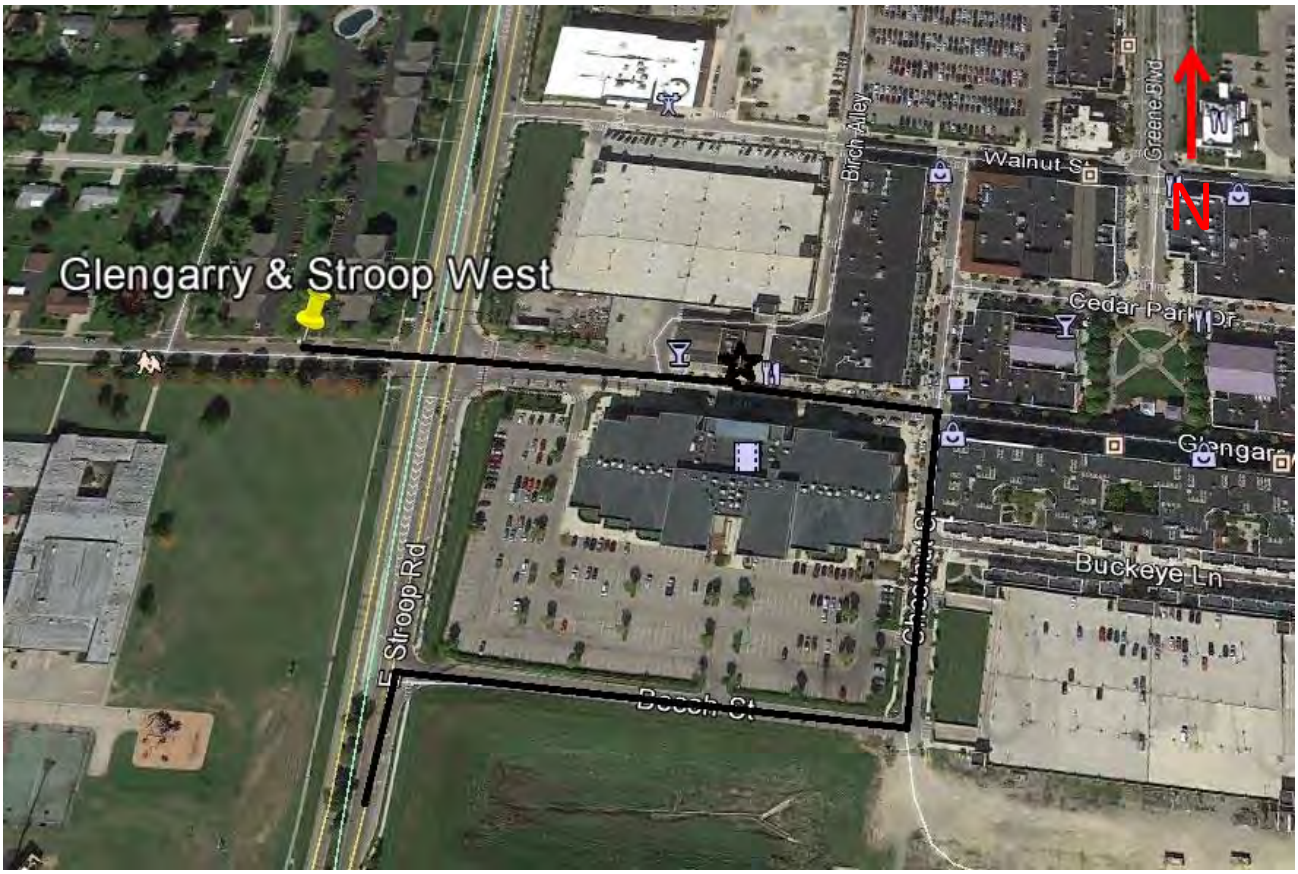

Figure 24: Proposed Improvements to Route 11 South

While this improvement works for route 11 in the southern direction, due to the island running down the center of East Stroop Road south of Glengarry Drive, the same improvement would not work for route 11 in the northern direction because the bus would not be able to turn left off of Beech Street to maintain the original route.

One other small improvement that can be made is to add several amenities to the bus stops in this area. The three stops that are at the two locations around the Greene Town Center do not have benches or trash receptacles for bus users. People waiting for the bus are forced to stand or sit on the ground. This is inconvenient for the elderly or physically disabled bus riders. Additionally, a lack of trash receptacles encourages people to litter, which negatively impacts the neighborhoods, businesses, and streets that surround the bus stops. Neighbors and business owners will have a more positive response to clean bus stops than those that dirty their yards and parking lots.

Additionally, these simple amenities will make public transit more appealing to potential users.

Conclusion

This study looked at three different shopping centers in Dayton, Ohio and the Dayton RTA bus stops near them in order to make design recommendations that would increase bus ridership to the three locations. The three shopping malls included the Dayton Mall in Miamisburg Township, the Mall at Fairfield Commons in Beavercreek, and the Greene Town Center in Beavercreek. The design recommendations are drawn from transit-oriented development and compact design, two design methods that are increasing in popularity as urban sprawl and automobile congestion become increasing problems in today's society. The recommendations were made not only for the shopping centers, but the transit routes that surround them as well.

While every situation is going to be unique and have its own design limitations, challenges, and benefits, several design principles can be applied to every situation. By looking at three very different situations in this case study, future designers should be able to find elements applicable to their project within at least one, if not all three, of the properties. The Dayton Mall is located near an interstate highway and is surrounded by other shopping areas and restaurants. Additionally, many bus stops surround the Dayton Mall, although only one is present on the property. The Mall at Fairfield Commons, in contrast, has no bus stops near it. The closest one is over one mile away. The Mall is located near an interstate as well but is also near restaurants, a university, a large office complex, and a neighborhood. Both malls, however, are traditional shopping centers with one main building surrounded by large expanses of parking lots. In contrast to the two traditional malls, the Greene Town Center is a more contemporary, mixed-use design that makes use of compact design. The shopping center is laid out as a downtown area might be with streets broken into small blocks and lined with shops and restaurants. Office space and apartments make use of the upper levels of the buildings and a central green space area provides a focal point for the area. The Greene offers a sharp contrast to the Dayton and Fairfield Malls due to its contemporary design. While some improvements

can be made to improve transit usage in the area, the Greene provides an example of what future shopping centers will look like and provides inspiration for future remodels of the other two shopping malls.

Arguably the most important design aspect derived from this study is the importance of the pedestrian. Even transit users are pedestrians, as some walking distance between the bus stops and final destinations and vice versa must almost always be traversed. The key is to minimize the distance the bus riders must walk to arrive at their final destination. Studies have shown that this distance should be limited to one quarter mile; any distance farther than this discourages bus usage, particularly for the elderly or physically disabled who may have trouble walking long distances. In keeping the pedestrian in mind, mall properties and the area surrounding the property should contain walkable and appealing streets. Design elements that make an area walkable include sidewalks, safe crosswalks, street lamps, short blocks, and a lack of parking lots between sidewalks and buildings.

To further enhance the experience of the pedestrian, aesthetics and functionality should not be forgotten in the design. Some of the simplest improvements include the addition of benches and trash receptacles. Other design improvements include interesting building facades, kiosks or coffee stands for waiting transit users or resting pedestrians, and large, multiple windows, particularly on the first floors of buildings, which appeal to pedestrians and make the buildings more inviting.

Another important design element is the idea of mixed-use areas. Traditionally shopping centers are limited to one or two uses, shopping and perhaps eating. This means that people drive to a shopping mall, shop, and then drive to another destination. Mixed use designs like the Greene Town Center apply an increased number of land uses to the area to minimize the number of automobile trips patrons will have to make. Other uses include office space, movie theatres, bars and clubs, fitness centers, and living spaces. People that live or work at mixed use shopping centers no longer have to drive to lunch, the gym, or to run errands. Additionally, mixed uses may help to reduce the amount of parking required if they experience peak traffic flows at different times of day. An example of this would offices, which require the most parking spaces during daytime

hours on weekdays, and residences, which require more parking in the evenings and on weekends.

A third concept to always consider in transit-oriented development at shopping centers is how public transportation will be connected to the area. The transit facilities should not interfere with automobile or pedestrian traffic (which includes bicycle users), but should work in conjunction with them. Even with an increase in transit usage, automobile traffic will still exist. One must be careful not to negatively impact automobile traffic in the area, or overall patronage may decrease. However, by making changes such as placing the automobile parking farther from the mall entrance than the bus stop, designers can place the emphasis on non-automobile traffic without forsaking drivers altogether. Public buses will operate alongside the cars, and designers must keep this in mind during the design phase. Driveways must be wide enough to accommodate buses and cars, as well as bus stop areas if applicable. Additionally, small curve radii that are used as a slowing mechanism for vehicles should be large enough to accommodate the larger turn radius of a passenger bus. Bus stops that may increase congestion in the area should be avoided or designed in such a way that congestion is minimized. This may include the use of bus lanes or pull-offs to provide a place for buses to stop while traffic continues to flow as normal.

Finally, the placement and design of automobile parking is important for designers to consider. The number of parking spaces should be reduced to the minimum allowable by local zoning codes. Additionally, parking lots should never inhibit pedestrian access to the mall. This can be prevented by placing parking to the sides and rear of the mall and, when possible, constructing the mall close to the roads from where pedestrians are most likely to enter. A “pedestrian entrance” may be designated in design as one that places the emphasis on pedestrians and bus users rather than automobile drivers. “Automobile entrances,” or mall entrances closer to the parking lots, can also be designated separately from pedestrian areas. Designers may also consider parking garages as a way to decrease the area needed for parking and limit parking to one area of the property.

Finally, public transit organizations such as the Dayton RTA should evaluate their routes and how they relate to large areas of public interest such as shopping centers.

Transit authorities should attempt to work with mall officials to move bus stops as close to the mall building(s) as possible, emphasizing the importance of a minimal walking distance for mall patrons that are also potential bus riders. Additionally, passenger data collected from buses should be analyzed on a regular basis to help determine the most popular routes and stops. Knowing this information can help transit authorities eliminate unused stops or increase the frequency of popular routes.

Transit-oriented development will help to encourage transit usage shopping trips if these design elements are kept in mind when constructing, rebuilding, or renovating shopping areas. An increase in transit use can help to reduce congestion and compact, mixed-use designs can help to slow urban sprawl. Additionally, transit-oriented development will increase the ease with which the elderly, young, disabled, or others without access to a car can travel to and from the mall. Transit-oriented development thus becomes not just a design choice, but an element for equal access. This development comes in many forms, with no formula for how a shopping center should be laid out, but using case studies such as this one as a guide, designers can draw from common ideas as well as site-specific examples to create an area that is transit and pedestrian-friendly.

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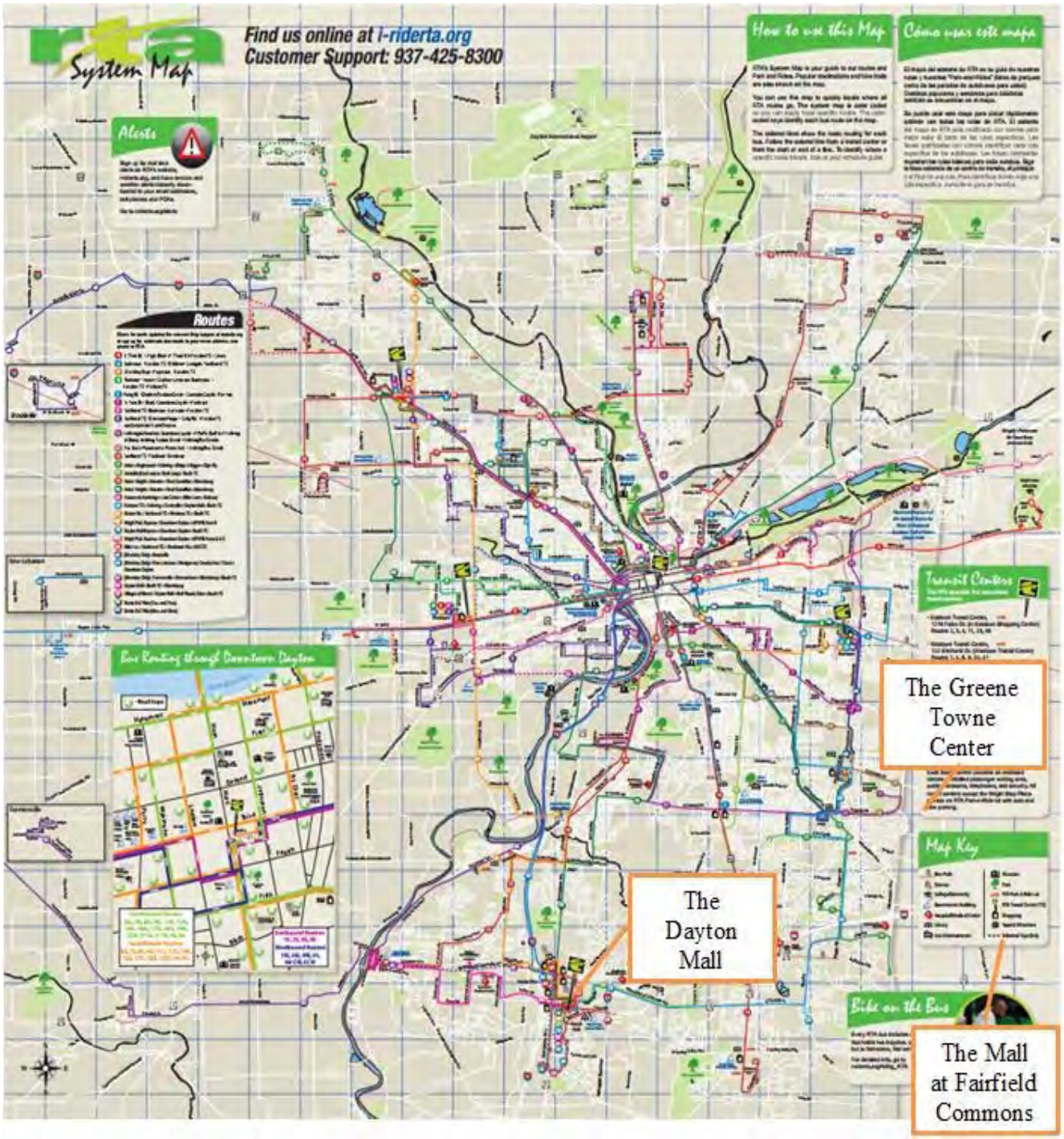
Appendix A: RTA Routes



Appendix B: Data Sheets

TRAFFIC COUNT DATA RECORD

Date:_____ Road: _____

Location: _____

Volunteer(s) Who Made Count	Volunteer's Address	Phone Number

Direction:			Direction:		
15-Minute Increments		COUNT (Use hatch marks to record vehicles)	15-Minute Increments		COUNT (Use hatch marks to record vehicles)
Start	End		Start	End	

Appendix C: Sample Letter Sent to Mall Officials

Sara Hardman
[redacted]
Dayton, OH 45409

July 13, 2013

To Whom It May Concern:

My name is Sara Hardman and I am a senior civil engineering student at the University of Dayton working on my honors thesis. My thesis is entitled Transit as an Alternative Mode of Transportation: A Case Study of its Usage, Availability, Patterns, and Value for Non-Commuter Trips. I am examining several local shopping centers and the bus stops for the Dayton RTA closest to the shopping centers to determine the frequency with which the bus system is used for shopping and running errands, and how this frequency can be increased through shopping center design.

I am contacting you with a request for your assistance on this project. Enclosed you will find a survey with questions

Appendix D: IRB Letter Accompanying Surveys

Dear Participant,

This letter is a request for you to take part in a thesis project examining the RTA bus system and its relationship to three Dayton area malls with the hopes of providing design recommendations for both the shopping center areas and RTA bus routes. Furthermore, with the results of this study the researcher hopes to increase bus ridership and ease of access to the mall for patrons arriving by bus. This project is being conducted by Sara Hardman, an undergraduate civil engineering student at the University of Dayton. Your participation in this project is greatly appreciated and will take approximately 15-20 minutes to fill out the attached questionnaire, which can be returned in the self-addressed envelope included.

Your involvement in this project will be kept as confidential as legally possible. Any specific references made in the thesis report to your comments will be kept anonymous. You must be 18 years of age or older to participate. Your participation is completely voluntary. You may skip any question you do not wish to answer and may discontinue the survey at any time. No effects exist for choosing not to participate in this survey. The University of Dayton's Institutional Review Board acknowledgement of this project is on file.

I hope that you will participate in this research project, as it could be beneficial in increasing the safety and comfort of those customers who arrive at the mall by bus, as well as increase the number of visitors arriving by bus to the mall. Should you have any questions about this letter or the thesis project, please feel free to contact me at (330) 714-5513 or by e-mail at hardmans1@udayton.edu. You may also contact my advisor, Deogratias Eustace, at (937) 229-2984 or by e-mail at deustace1@udayton.edu.

Thank you for your time and assistance with this project.

Sincerely,

Sara Hardman

Appendix E: Distance Measurements from Stop to Mall

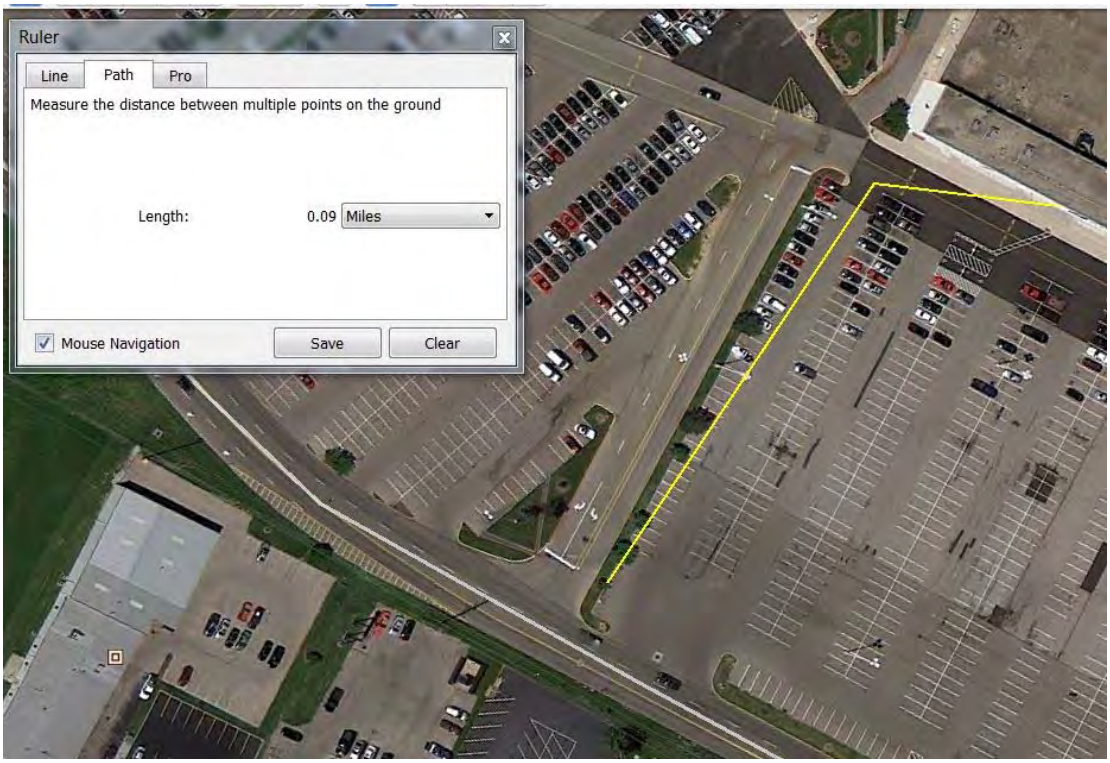


Figure 1: Mall Park Drive and Lyons Bus Stop

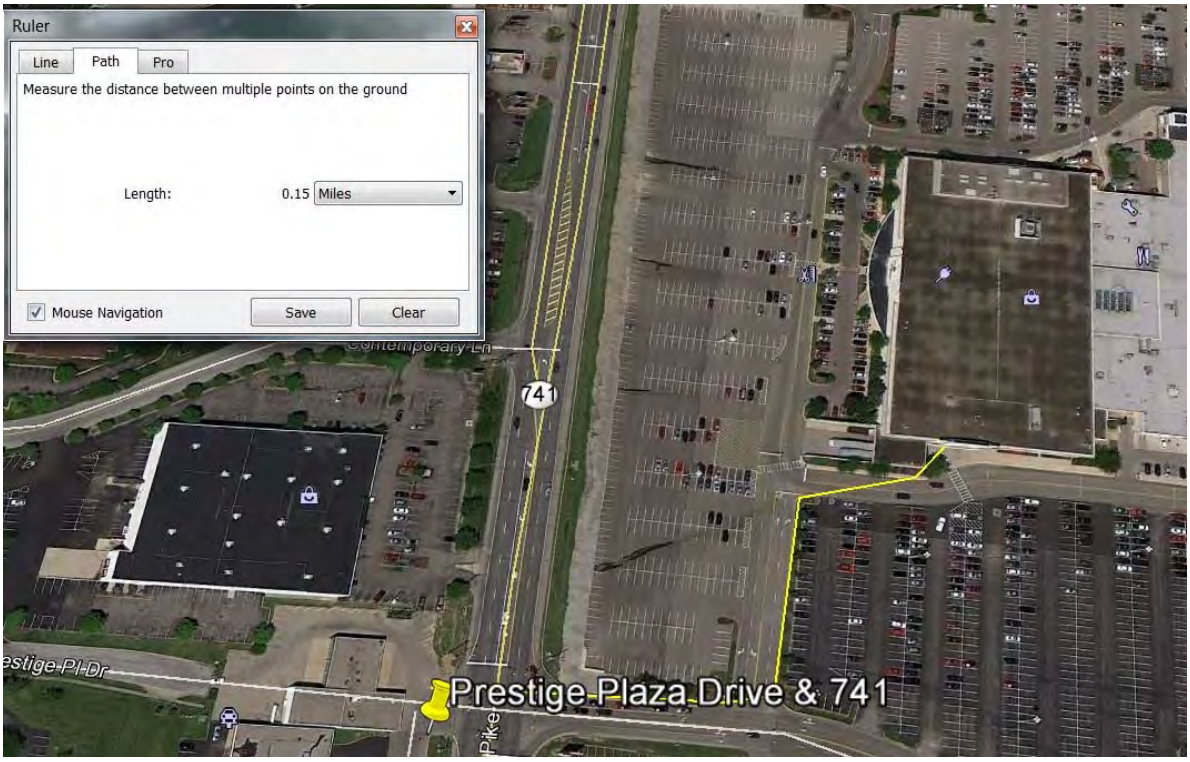


Figure 2: Prestige Plaza Drive and State Route 741

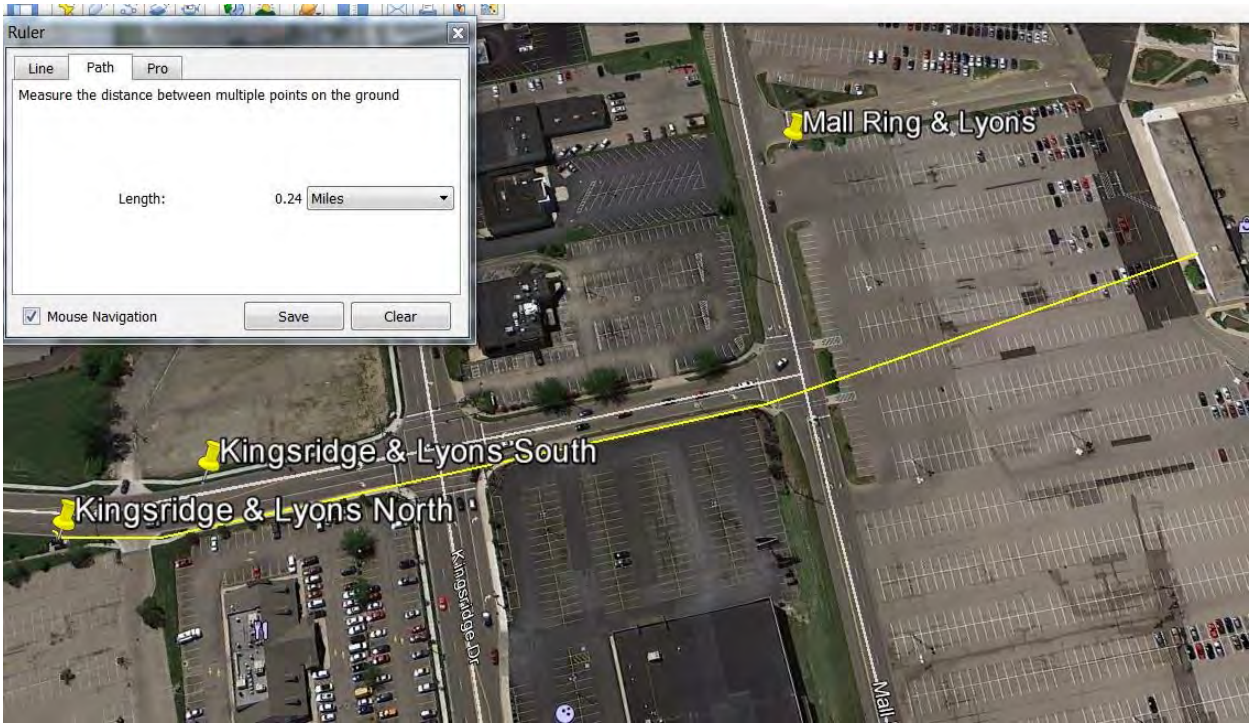


Figure 3: Kingsridge Road and Lyons Road

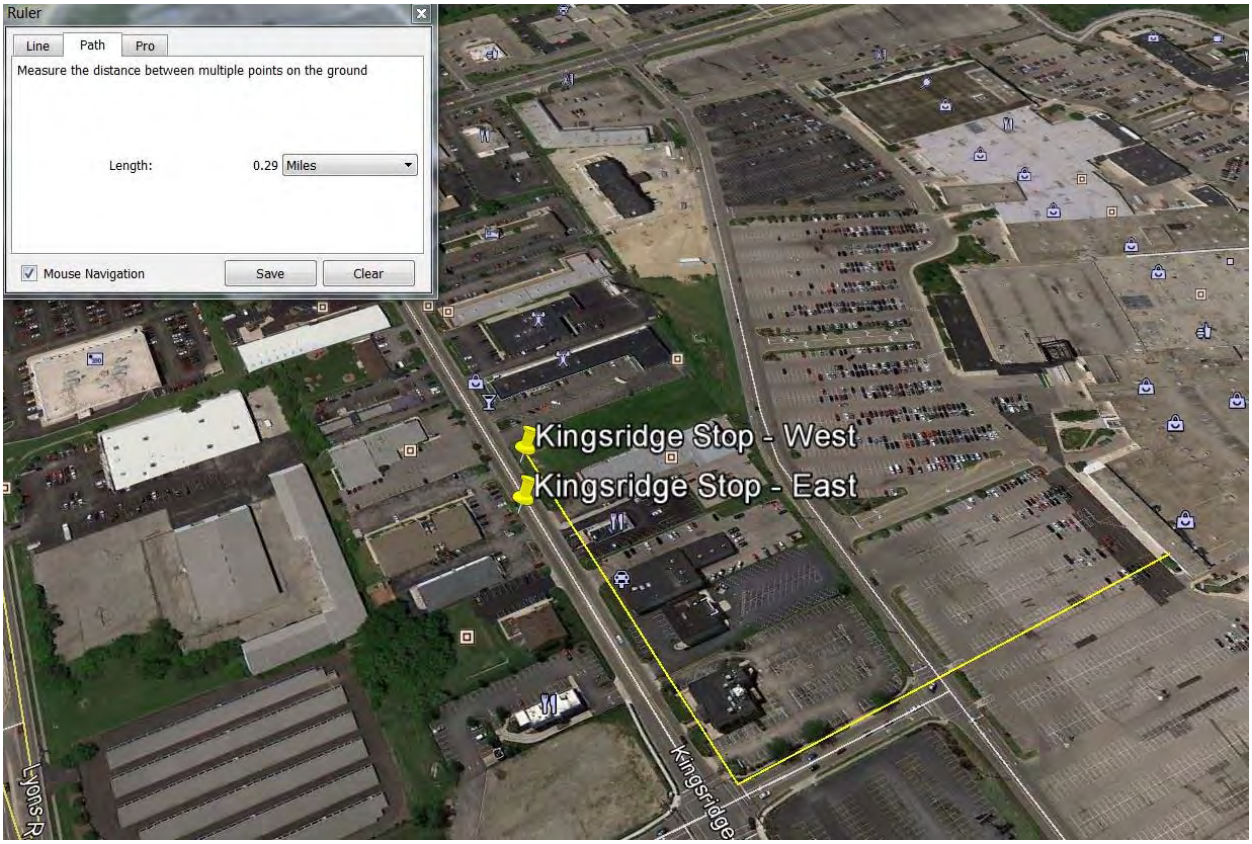


Figure 4: Kingsridge Road

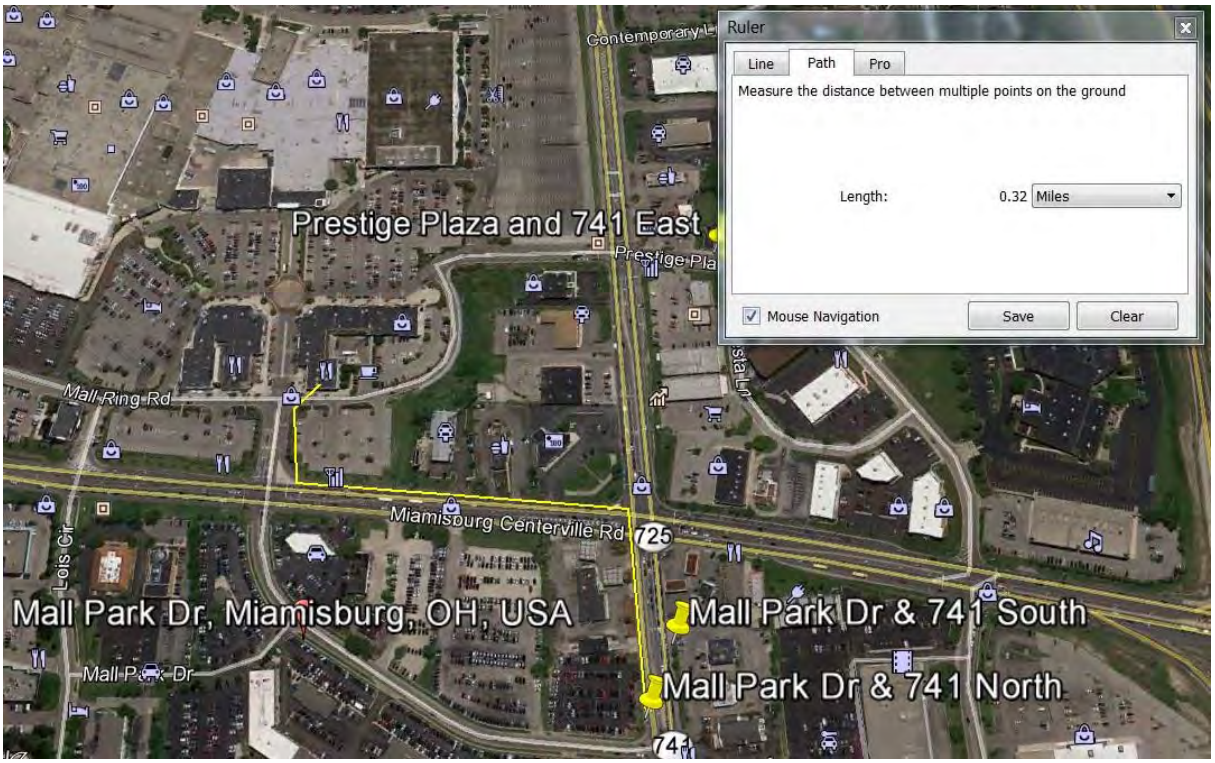


Figure 5: Mall Park Drive and State Route 741

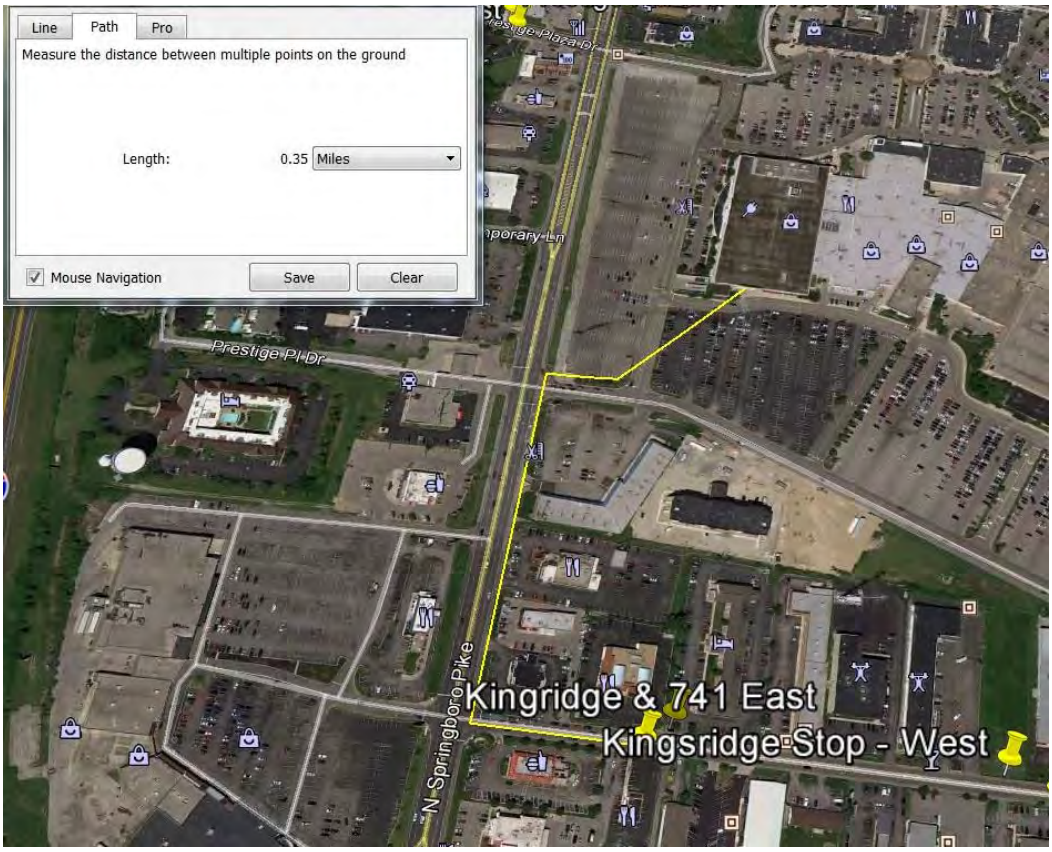


Figure 6: Kingsridge Road and State Route 741

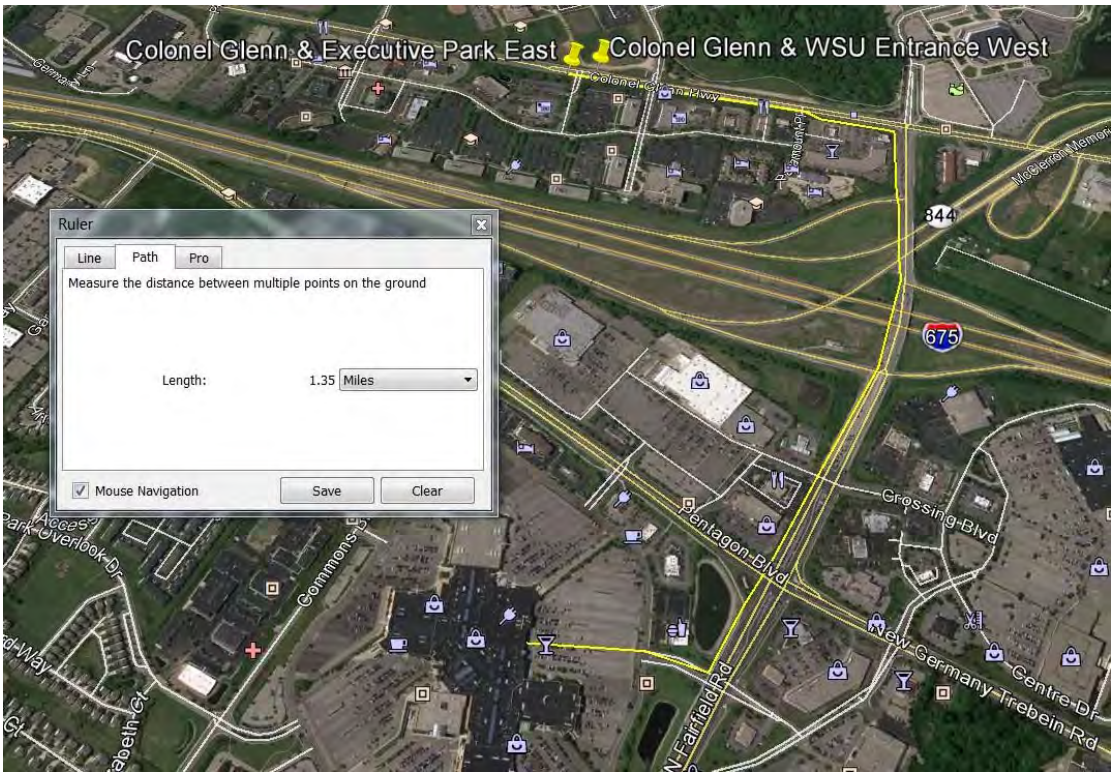


Figure 7: Colonel Glenn Highway and Executive Park

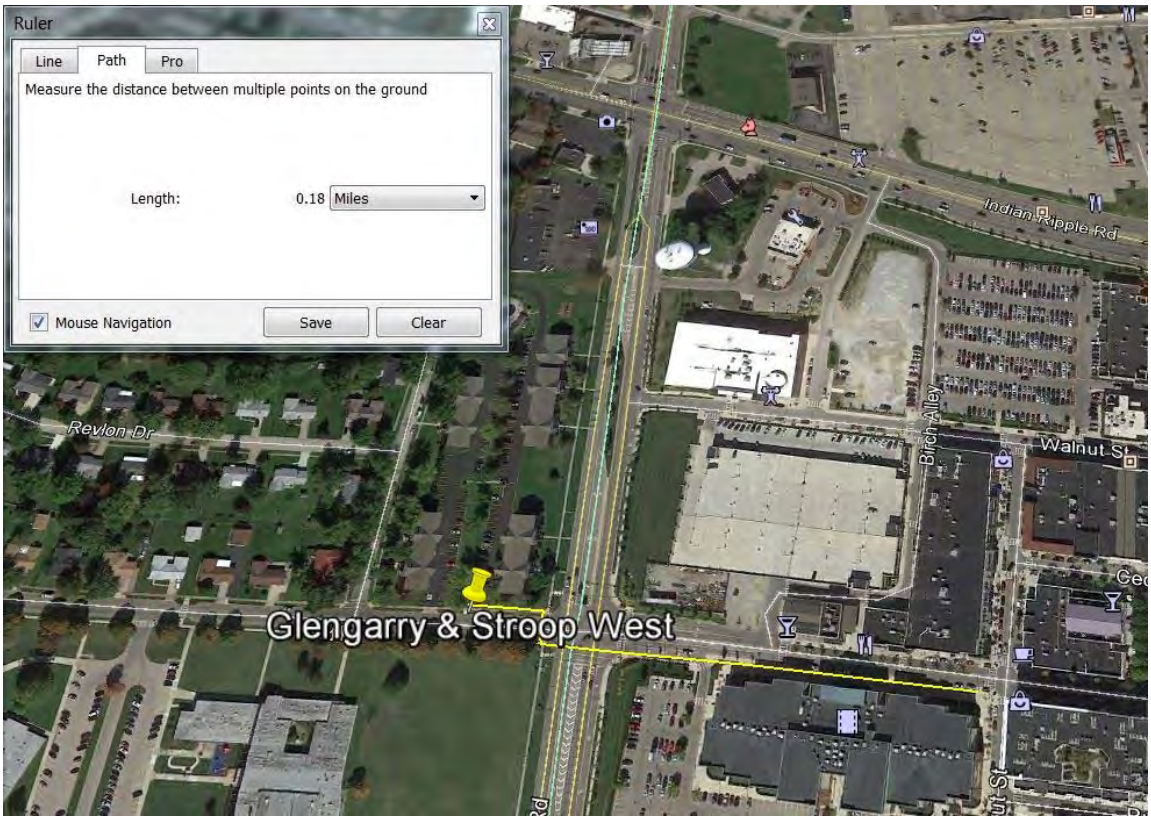


Figure 8: Glengarry Drive and East Stroop Road

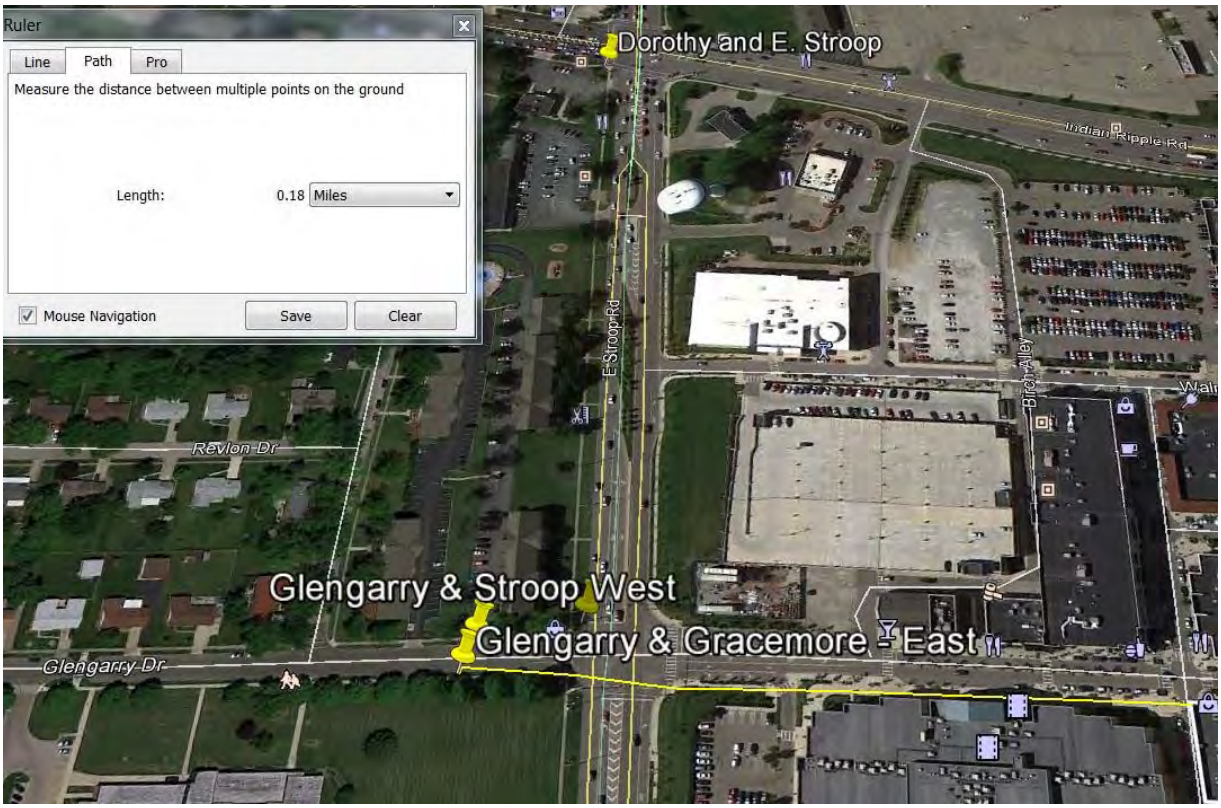


Figure 9: Glengarry Drive and Gracemore Avenue

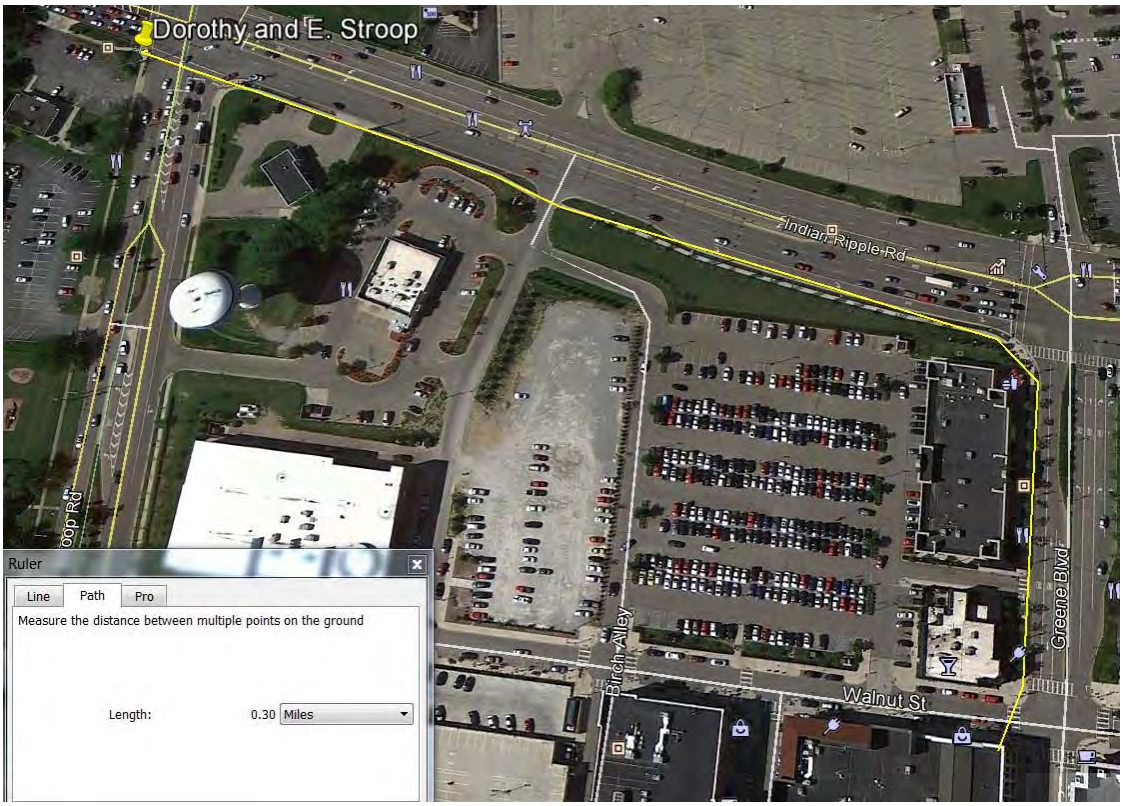


Figure 10: Dorothy Lane and East Stroop Road

Appendix F: Passenger Count Data

Data Recorded: Saturday, August 10th

23 South - Mall Loop at Lyons

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
11:37	never	0	0	N/A
12:37	12:40	1	0	03:00
4:35	4:36	2	3	01:00

Total Counts:	3	3
Daily Avg. this time last yr:	1	3
Daily Avg. 2013:	13	1

23 North - Mall Loop at Lyons

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
11:30	11:33	0	0	03:00
12:37	12:37	1	1	00:00
4:39	4:45	3	0	06:00

Total Counts:	4	1
Daily Avg. this time last yr:	9	1
Daily Avg. 2013:	7	23

60 E - Mall Loop at Lyons

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
11:20	11:24	0	1	04:00
12:30	12:35	3	0	05:00
4:30	4:33	0	1	03:00

Total Counts:	3	2
Daily Avg. this time last yr:	7	5
Daily Avg. 2013:	5	7

61 N - Mall Loop at Lyons

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
11:01	11:06	0	2	05:00
12:08	12:11	0	0	03:00
4:05	4:12	1	1	07:00

Total Counts:	1	3
Daily Avg. this time last yr:	1	2
Daily Avg. 2013:	2	2

Data Recorded: Saturday, October 5th

17 South - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:52	4:03	0	3	11:00
5:32	5:41	0	0	09:00

Total Counts:	0	3
Daily Avg. this time last yr:	1	15
Daily Avg. 2013:	2	22

17 North - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
4:05	4:06	0	0	01:00
5:49	5:50	0	0	01:00

Total Counts:	0	0
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	0	0

19 South - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
4:04	4:04	0	1	0:00
5:50	5:40	0	0	-10:00

Total Counts:	0	1
Daily Avg. this time last yr:	1	14
Daily Avg. 2013:	2	15

19 North - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
4:05	4:08	2	0	03:00
5:33	5:52	4	0	19:00

Total Counts:	6	0
Daily Avg. this time last yr:	unknown	unknown
Daily Avg. 2013:	unknown	unknown

23 South - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:37	3:38	0	1	01:00
4:35	5:19	0	0	44:00

Total Counts:	0	1
Daily Avg. this time last yr:	0	3
Daily Avg. 2013:	1	1

23 North - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:36	3:43	2	0	07:00
4:38	4:40	0	0	02:00
5:38	5:40	0	0	02:00

Total Counts:	2	0
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	1	6

24 South - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:23	3:26	0	2	03:00
4:42	4:42	0	2	00:00

Total Counts:	0	2
Daily Avg. this time last yr:	3	11
Daily Avg. 2013:	2	20

24 North - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:33	3:34	1	0	01:00
4:52	4:53	0	0	01:00

Total Counts:	1	0
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	0	0

X5 South - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
2:53	3:00	1	1	07:00
3:23	3:34	0	7	11:00
3:53	3:53	0	1	00:00
4:23	4:27	1	1	04:00
4:53	4:56	0	5	03:00
5:23	5:23	0	0	00:00
5:53	5:52	0	4	-01:00

Total Counts:	2	19
Daily Avg. this time last yr:	3	26
Daily Avg. 2013:	9	29

X5 North - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:05	3:07	5	2	02:00
3:35	3:38	5	0	03:00
4:05	4:07	0	0	02:00
4:35	4:38	4	0	03:00
5:05	5:06	2	0	01:00
5:35	5:57	9	0	22:00

Total Counts:	25	2
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	1	1

60 East - Lyons Ridge and Kingsridge (South)

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:30	3:33	0	0	03:00
4:30	4:31	0	0	01:00
5:30	5:34	0	0	04:00

Total Counts:	0	0
Daily Avg. this time last yr:	0	4
Daily Avg. 2013:	4	6

60 East - Lyons Ridge and Kingsridge (North)

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:29	3:35	0	0	06:00
4:29	4:35	0	0	06:00
5:29	5:38	1	0	09:00

Total Counts:	1	0
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	1	1

61 South - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:19	3:24	0	0	05:00
4:19	4:28	0	0	09:00
5:19	5:42	0	0	23:00

Total Counts:	0	0
Daily Avg. this time last yr:	-	-
Daily Avg. 2013:	-	-

61 North - Lyons Ridge and Kingsridge

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:07	3:08	0	0	01:00
4:07	4:08	0	0	01:00
5:07	5:06	0	0	-01:00

Total Counts:	0	0
Daily Avg. this time last yr:	0	4
Daily Avg. 2013:	-	-

Data Recorded: Saturday, October 12th

X5 North - Kingsridge Rd.

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:06	3:07	0	0	01:00
3:36	3:40	0	0	04:00
4:06	4:11	0	0	05:00
4:36	4:40	2	0	04:00
5:06	5:10	2	0	04:00
5:36	6:00	0	0	24:00

Total Counts:	4	0
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	0	0

X5 South - Kingsridge Rd.

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:22	3:24	0	1	02:00
3:52	3:53	0	0	01:00
4:22	4:26	0	1	04:00
4:52	4:53	0	0	01:00
5:22	5:25	0	0	03:00
5:52	5:53	0	0	01:00

Total Counts:	0	2
Daily Avg. this time last yr:	13	27
Daily Avg. 2013:	12	24

19 North - Kingsridge Rd.

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
4:05	4:07	0	0	02:00
5:51	5:52	0	0	01:00

Total Counts:	0	0
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	0	0

19 South - Kingsridge Rd.

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:53	3:59	0	0	06:00
5:33	5:41	0	0	08:00

Total Counts:	0	0
Daily Avg. this time last yr:	1	8
Daily Avg. 2013:	4	11

24 North - Kingsridge Rd.

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:35	3:38	0	0	03:00
4:54	4:56	1	0	02:00

Total Counts:	1	0
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	0	0

24 South - Kingsridge Rd.

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:22	3:24	0	0	02:00
4:41	4:43	0	3	02:00

Total Counts:	0	3
Daily Avg. this time last yr:	3	7
Daily Avg. 2013:	3	10

Data Recorded: Saturday, October 19th

X5 North - Kingsridge & State Route 741

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:06	3:08	5	0	02:00
3:36	3:40	1	0	04:00
4:06	4:12	8	0	06:00
4:36	4:45	6	0	09:00
5:06	5:14	9	0	08:00
5:56	6:02			06:00

*17 people waiting at 6p.m.

Total Counts:	29	0
Daily Avg. this time last yr:	0	1
Daily Avg. 2013:	0	1

X5 South - Kingsridge & State Route 741

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:22	3:27	0	2	05:00
3:52	3:51	0	2	-01:00
4:22	4:22	1	2	00:00
4:52	4:52	1	2	00:00
5:22	5:30	0	0	08:00
5:52	5:54	0	2	02:00

Total Counts:	2	10
Daily Avg. this time last yr:	1	31
Daily Avg. 2013:	4	39

24 North - Kingsridge & State Route 741

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:35	3:39	3	0	04:00
4:54	4:53	5	0	-01:00

Total Counts:	8	0
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	1	0

24 South - Kingsridge & State Route 741

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:22	3:25	0	7	03:00
4:40	4:39	0	2	-01:00
5:58	5:59	0	0	01:00

Total Counts:	0	9
Daily Avg. this time last yr:	2	16
Daily Avg. 2013:	2	30

19 North - Kingsridge & State Route 741

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
4:05	4:11	2	0	06:00
5:51	5:53	1	0	02:00

Total Counts:	3	0
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	0	0

19 South - Kingsridge & State Route 741

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:52	3:51	0	2	-01:00
5:32	5:36	0	2	04:00

Total Counts:	0	4
Daily Avg. this time last yr:	1	31
Daily Avg. 2013:	3	33

61 North - Kingsridge & State Route 741

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:18	3:25	0	0	07:00
4:18	4:23	0	0	05:00
5:18	5:18	0	0	00:00

Total Counts:	0	0
Daily Avg. this time last yr:	1	1
Daily Avg. 2013:	-	-

Data Recorded: Saturday, October 26th

X5 South - Prestige Plaza (Contemporary Lane) @ State Hwy 741

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:21	3:18	0	2	-03:00
3:51	3:49	0	17	-02:00
4:21	4:21	0	4	00:00
4:51	4:51	0	4	00:00
5:21	5:21	0	0	00:00
5:51	5:49	0	8	-02:00

Total Counts:	0	35
Daily Avg. this time last yr:	12	57
Daily Avg. 2013:	12	61

24 South - Prestige Plaza (Contemporary Lane) @ State Hwy 741

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:20	3:21	0	8	01:00
4:38	4:36	0	1	-02:00
5:56	5:57	0	0	01:00

Total Counts:	0	9
Daily Avg. this time last yr:	4	20
Daily Avg. 2013:	4	27

61 North - Prestige Plaza (Contemporary Lane) @ State Hwy 741

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:17	3:24	0	0	07:00
4:17	4:16	0	0	-01:00
5:17	5:23	0	0	06:00

Total Counts:	0	0
Daily Avg. this time last yr:	0	0
Daily Avg. 2013:	0	0

Data Recorded: Saturday, November 2nd

19 North - State Hwy. 741 & Mall Park Dr.

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
4:08	4:11	3	0	03:00
5:53	5:58	1	0	05:00

Total Counts:	4	0
Daily Avg. this time last yr:	14	2
Daily Avg. 2013:	19	3

19 South - State Hwy. 741 & Mall Park Dr.

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:50	3:51	0	2	01:00
5:30	5:32	0	1	02:00

Total Counts:	0	3
Daily Avg. this time last yr:	3	13
Daily Avg. 2013:	4	20

24 North - State Hwy. 741 & Mall Park Dr.

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:39	3:41	0	0	02:00
4:58	4:58	1	0	00:00

Total Counts:	1	0
Daily Avg. this time last yr:	4	1
Daily Avg. 2013:	10	2

Data Recorded: Saturday, November 2nd

23 South - Mall Loop at Lyons

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:37	3:36	1	1	-01:00
4:35	4:37	0	6	02:00
5:36	5:39	0	2	03:00

*bus labeled as 61 S

Total Counts:	1	9
Daily Avg. this time last yr:	2	13
Daily Avg. 2013:	13	1

23 North - Mall Loop at Lyons

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:37	3:42	2	0	05:00
4:39	4:47	0	0	08:00
5:39	5:40	2	0	01:00

Total Counts:	4	0
Daily Avg. this time last yr:	9	1
Daily Avg. 2013:	7	23

60 E - Mall Loop at Lyons

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
3:30	3:38	1	1	08:00
4:30	4:31	5	0	01:00
5:30	5:34	0	0	04:00

Total Counts:	6	1
Daily Avg. this time last yr:	7	5
Daily Avg. 2013:	5	7

Date of Record: Saturday, August 24th

1 East - Colonel Glenn Highway at Executive Park

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
10:56	10:59	0	1	03:00
11:36	11:38	0	1	02:00
12:18	12:19	0	2	01:00
12:56	past 1	0	?	+10:00
4:16	4:18	0	0	02:00
4:56	5:05	0	1	09:00

Total Counts:	0	5
Daily Avg. this time last yr:	3	41
Daily Avg. 2013:	4	41

1 West - Colonel Glenn Highway at Center Road

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
11:02	11:03	0	0	01:00
11:42	11:44	2	0	02:00
12:24	12:23	3	0	-01:00
1:02	past 1:05	0	?	+10:00
4:22	4:24	2	4	02:00
5:02	5:10	2	0	08:00

Total Counts:	9	4
Daily Avg. this time last yr:	2	1
Daily Avg. 2013:	46	13

Date of Record: Saturday, September 14th

11 South - Stroop and Glengarry

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
10:45	10:48	0	4	03:00
12:25	12:32	1	2	07:00
3:45	3:51	0	2	06:00

Total Counts:	1	8
Daily Avg. this time last yr:	2	8
Daily Avg. 2013:	6	21

11 North - Glengarry and Gracemore

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
11:11	11:11	0	0	00:00
12:51	12:55	2	0	04:00
4:11	4:11	3	0	00:00

Total Counts:	5	0
Daily Avg. this time last yr:	15	0
Daily Avg. 2013:	19	3

12 South - Stroop & Dorothy

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
10:58	10:59	0	0	01:00
11:43	11:51	0	0	08:00
12:28	12:32	0	0	04:00
4:13	4:14	0	0	01:00
4:53	4:55	0	4	02:00

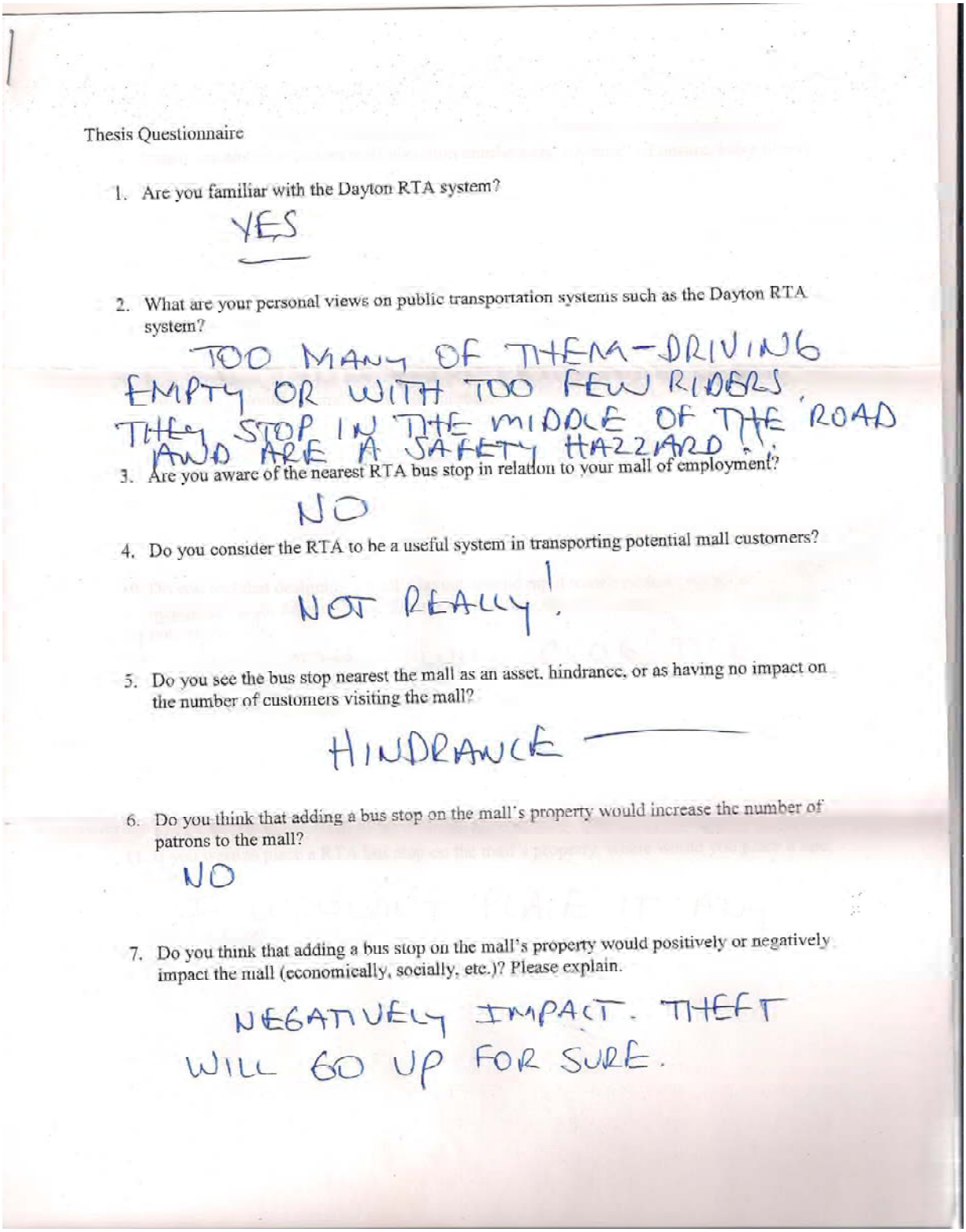
Total Counts:	0	4
Daily Avg. this time last yr:	7	21
Daily Avg. 2013:	13	25

12 South - Stroop & Glengarry

Scheduled Arrival Time	Actual Arrival Time	On	Off	Time Delay (min)
10:59	10:59	0	1	00:00
11:44	11:51	0	2	07:00
12:29	12:32	0	5	03:00
4:14	4:15	1	0	01:00
4:54	4:56	1	5	02:00

Total Counts:	2	13
Daily Avg. this time last yr:	19	24
Daily Avg. 2013:	23	29

Appendix G: Returned Survey by a Greene Town Center Official



Thesis Questionnaire

1. Are you familiar with the Dayton RTA system?

   YES

2. What are your personal views on public transportation systems such as the Dayton RTA system?

   TOO MANY OF THEM - DRIVING EMPTY OR WITH TOO FEW RIDERS. THEY STOP IN THE MIDDLE OF THE ROAD AND ARE A SAFETY HAZZARD.

3. Are you aware of the nearest RTA bus stop in relation to your mall of employment?

   NO

4. Do you consider the RTA to be a useful system in transporting potential mall customers?

   NOT REALLY!

5. Do you see the bus stop nearest the mall as an asset, hindrance, or as having no impact on the number of customers visiting the mall?

   HINDRANCE

6. Do you think that adding a bus stop on the mall's property would increase the number of patrons to the mall?

   NO

7. Do you think that adding a bus stop on the mall's property would positively or negatively impact the mall (economically, socially, etc.)? Please explain.

   NEGATIVELY IMPACT. THEFT WILL GO UP FOR SURE.

8. How would you describe overall opinion at your mall of employment regarding rapid transit use and its effect on mall visitation numbers and revenue? (if unsure, leave blank)

9. In your opinion, if a RTA bus stop was constructed in close proximity to the mall's entrance(s), would the mall's revenue increase?

NO.

10. Do you feel that designing a mall's layout around rapid transit systems would be beneficial? If so, whom do you think would benefit, the RTA users, the mall, or both? If not, why?

WILL NOT BENEFIT!

NO. THEY WILL CLOG THE RINGROADS

11. If you were to place a RTA bus stop on the mall's property, where would you place it and why?

I WOULDN'T PLACE IT ANY WHERE!

For The Greene Town Center officials only:

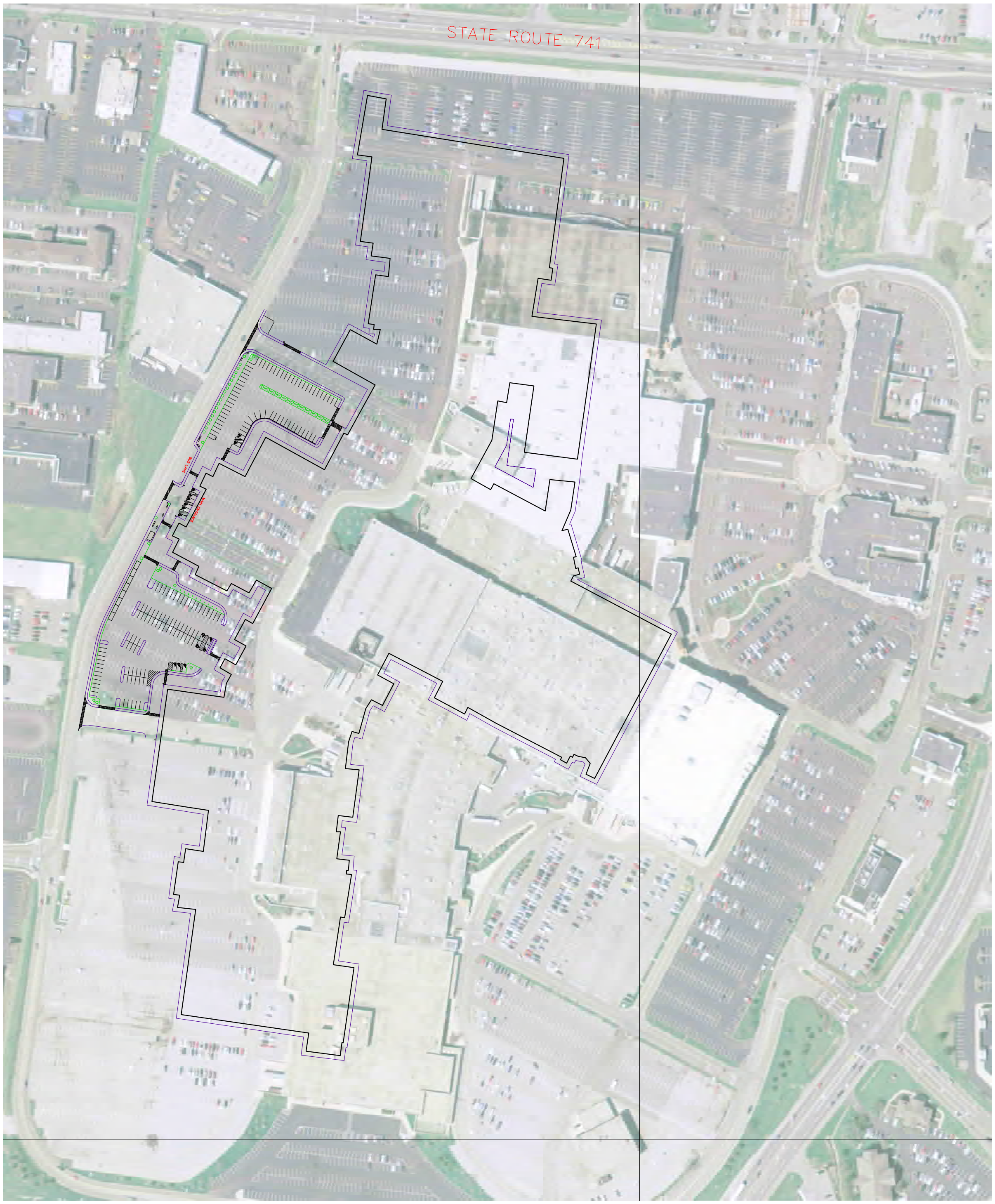
1. Since the placement of a RTA bus stop in close proximity to the Greene, have you noticed an increase of customers? An increase in revenue?

2. Do you feel that the inclusion of a new bus stop close to the Greene shopping center is valuable to the shopping center? Why or why not?

3. Dou you have any suggestion(s) in terms of improving RTA services serving passengers destined to your shopping center?

I MANAGED MALLS. IN HOUSTON THEY FORCED BUSES ON PERIMETER ROADWAYS. THEFT SOARED. MOST PEOPLE WHO RIDE BUSES CAN'T AFFORD TO SHOP THERE - SO THEY STEAL!

Appendix H: Proposed Mall Layout Drawings



GRAPHIC SCALE (IN FEET)
100 0 100 200

N

PROPOSED
PROPOSED PAVEMENT
PROPOSED VEGETATION
PROPOSED BUILDING
PROPOSED CROSSWALK
BENCH
STOP SIGN
PEDESTRIAN WARNING SIGN
SMALL BUSH
LARGE BUSH
TREE

ISSUE:
DATE: 12/19/13
JOB NO.:
DESIGN: S. HARDMAN
DRAWN: S. HARDMAN
CHECKED:
SHEET NO. 1

DAYTON MALL

THESIS

DAYTON OHIO

REVISIONS

NO.	DATE	DESCRIPTION

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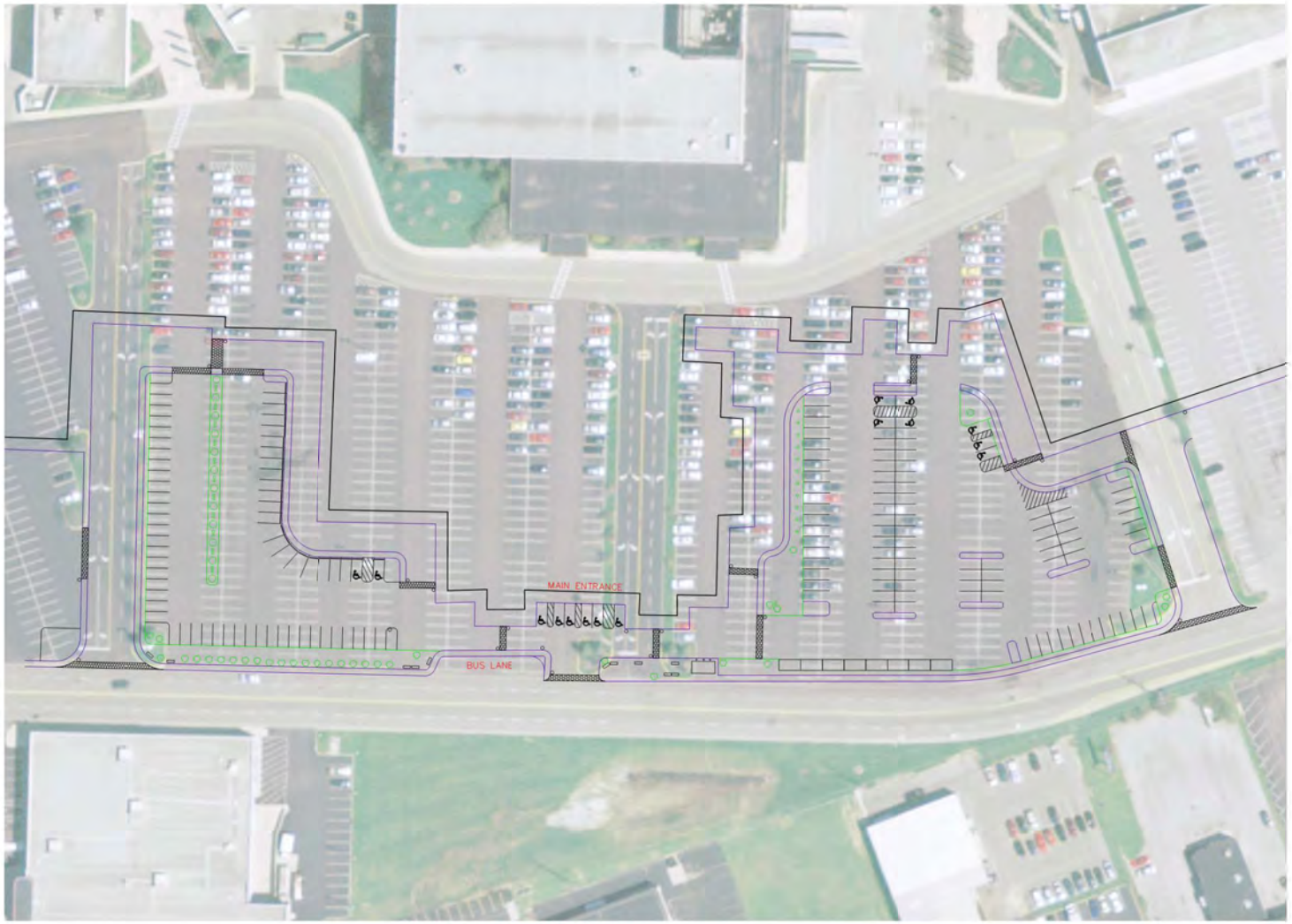

PROPOSED MAIN ENTRANCE

PROPOSED

N

GRAPHIC SCALE (IN FEET)

REVISIONS NO.	DATE	DESCRIPTION

DAYTON MALL

THESIS

DAYTON OHIO

ISSUE:	
DATE:	12/19/13
JOB NO.:	
DESIGN:	S. HARDMAN
DRAWN:	S. HARDMAN
CHECKED:	
SHEET NO.	2

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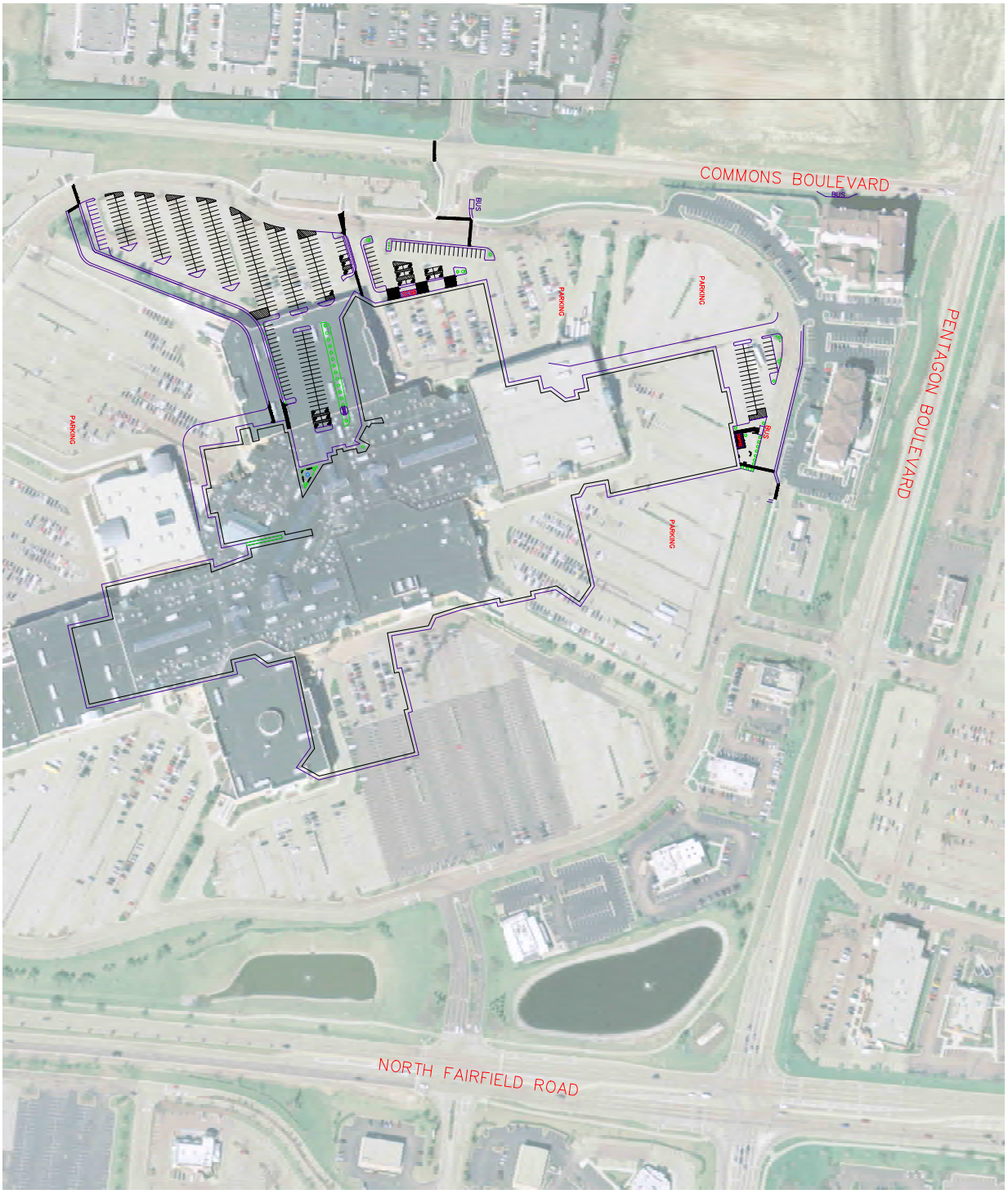

PROPOSED

TREE
LARGE BUSH
SHRUB, ROW
PEDESTRIAN PAVEMENT PATTERN
STOP SIGN
BENCH
PROPOSED CROSSWALK
PROPOSED BUILDING
PROPOSED VEGETATION
PROPOSED PAVEMENT

GRAPHIC SCALE (IN FEET)

N

ISSUE	
DATE	12/20/13
JOB NO.	
DESIGN:	S. HARDMAN
DRAWN:	S. HARDMAN
CHECKED:	
SHEET NO.	3

THE MALL AT FAIRFIELD COMMONS

THESIS

DAYTON OHIO

REVISIONS

NO.	DATE	DESCRIPTION

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PROPOSED BUS STOP AND ACCOMPANYING MALL ENTRANCE

PROPOSED

- PROPOSED PAVEMENT
- PROPOSED VEGETATION
- PROPOSED BUILDING
- PROPOSED CROSSWALK
- BENCH
- STOP SIGN
- PEDESTRIAN WARNING SIGN
- SMALL SHRUB
- LARGE SHRUB
- TREE

GRAPHIC SCALE (IN FEET)

REVISIONS NO.	DATE	DESCRIPTION

THE MALL AT FAIRFIELD COMMONS

THESIS

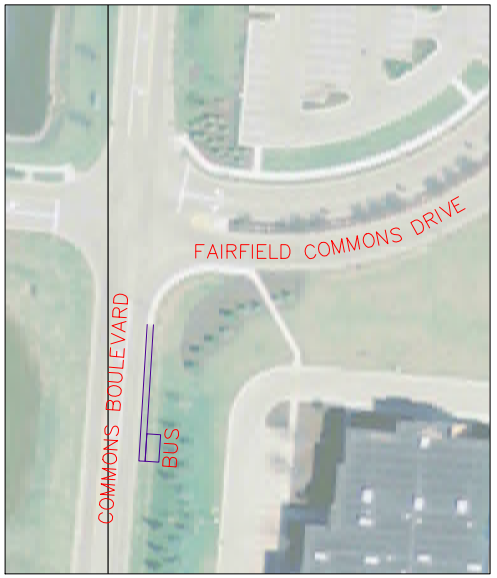
DAYTON OHIO

ISSUE:
DATE: 12/28/13
JOB NO.:
DESIGN: S. HARDMAN
DRAWN: S. HARDMAN
CHECKED:
SHEET NO. 4

PROPOSED BUS STOP AND ACCOMPANYING MALL ENTRANCE

PROPOSED

PROPOSED PAVEMENT
PROPOSED VEGETATION
PROPOSED BUILDING
PROPOSED CROSSWALK
BENCH
STOP SIGN
PEDESTRIAN WARNING SIGN
SMALL BUSH
LARGE BUSH
TREE



PROPOSED BUS STOP AT INTERSECTION OF COMMONS BOULEVARD AND FAIRFIELD COMMONS DRIVE

N

40 0 40 80
GRAPHIC SCALE (IN FEET)

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REVISIONS
NO. DATE DESCRIPTION

THE MALL AT FAIRFIELD COMMONS
THESIS
DAYTON OHIO

ISSUE:
DATE: 12/26/13
JOB NO.:
DESIGN: S. HARDMAN
DRAWN: S. HARDMAN
CHECKED:
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