BICYCLE CONFLICT MODELING ON NON-MOTORIZED PATHS ON SUBURBAN COLLEGE CAMPUSES

by

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ABSTRACT

Bicycling is an important way for college students and employees to get around campuses. Colleges are trying to reduce the number of cars on campus to alleviate traffic problems, help protect the environment, and save money on vehicle and parking infrastructure. Because of this, bicycling is a growing mode of commuting on college campuses as well as across the entire country. With a rise in bicycling on campuses comes a rise in bicycle collisions with pedestrians walking to and from classes and work. This thesis studies those interactions between bicyclists and pedestrians on non-motorized paths on the University of Delaware campus in Newark, DE. These interactions can be harmless, but also can result in serious injuries to the pedestrian or the bicyclist.

Bicyclist on these paths exhibit different behavior based on the number of pedestrians using the same path. The pedestrian volumes on a college campus drastically fluctuate when classes change and students are leaving academic buildings at the same time. However, during classes, these non-motorized paths can be virtually empty. The difficulty of infrastructure planners on college campuses is to accommodate for these high fluctuations of pedestrians and bicycles. Yet they still need to consider the safety of the users of the paths. This thesis aims to predict the likelihood of a serious bicycle crash on a non-motorized path based on the characteristics of the path.

Chapter 1

INTRODUCTION

1.1 Background

With the increase in population across the United States, there has been an increased demand on the transportation network. The additional vehicles on the roads have created heavy congestion and delays for drivers. This congestion has brought a rise in alternative modes of transportation. Bicycling is becoming more and more used as a way of commuting in a person's average day. Unfortunately, this has created a rise in bicycle collisions with vehicles, pedestrians, and other bicycles. This is especially critical on college campuses where the proportion of people biking and walking is higher than the average town.

1.2 Problem Statement

Conflicts can occur on both roads with vehicles, pedestrians and bicycles, and on paths that only have non-motorized transportation. Both instances can be very serious, as seen at the University of Delaware, where a pedestrian was hit and killed by a bicyclist on a non-motorized path (Horn, 2016). Reducing bicycle collisions on college campuses is important to all schools to ensure the safety of its students and staff. There is a lack of literature to assist college campuses in identifying dangerous locations on existing non-motorized paths. This knowledge would be useful for planning and designing new non-motorized paths as well as updating existing infrastructure.

1.3 Purpose

College campuses contain extensive networks of roads and paths to move students and employees around the campus. These roads and paths can become heavily crowded with people walking and biking. Collisions between bikers and pedestrians do occur, unfortunately. There needs to be a way for colleges to evaluate their physical infrastructure network to ensure the safety of the students and the community. Then they can appropriately plan new roads and paths, as well as improving existing infrastructure.

1.4 Research Objectives

This thesis aims to develop a model to identify locations on roads and paths (hotspots) on college campuses that are likely to have a bicycle collision. There are several objectives that the research will accomplish:

Objective 1: Collect data on selected non-motorized paths on the University of Delaware Newark campus

Objective 2: Design a model based on geometric variables of the non-motorized path as well as non-physical variables such as speed and density of users

Objective 3: Create an output value and scale that will determine the safety of locations on non-motorized paths

The final results of the model will give an output value for each location. A rating scale will be developed for the output value that will show how likely or unlikely it is for there to be a bicycle collision at that location. This will show the user of the model what locations are possible hotspots for collisions.

The model results that can be used by planners and engineers will help make college campuses safer. It will show what attributes of a road or non-motorized path contribute most to bicycle collisions. Knowing what attributes contribute most to collisions will assist planners and engineers in avoiding those attributes as best as possible. They can design while keeping bicycle and pedestrian safety at the forefront of consideration.

This thesis also offers areas to expand on the model. The focus for this study will be on suburban college campuses, but it could be expanded to include towns and communities. The study will also focus on non-motorized paths, but the model can be expanded to include path intersections as well.

1.5 Organization of the Thesis

In the next chapter, the methodology of the data collection and analysis will be discussed. The data collection process is an innovative process that was used to collect the data for this project. This chapter also discusses how the raw data was processed and analyzed. The analysis chapter shows the final data collected and the various graphs that are developed from the data. It is from these graphs that several linear and non-linear models are developed, as shown in the results chapter. The models are applied in GIS to create visual representations of the rating scale developed. From the analysis, recommendations are given of how to enhance the safety of non-motorized paths from the results of the modeling.

Chapter 2

LITERATURE REVIEW

A literature review was conducted to identify previous research in multiple fields including, but not limited to, bicycle growth and safety, crash statistics, pedestrian and bicycle interactions, and non-motorized paths. The majority of the research done on bicyclists has dealt with bicyclists on roads interacting with motor vehicles. While the scope of this thesis does not cover roads, some aspects of that research can be applied to non-motorized paths research.

2.1 Bicycling in the United States

Bicycling is becoming an increasingly popular mode of transportation in the United States. Users of bicycles can be divided into three categories: recreational, sport/exercise, and commuters. The category that this thesis focuses on is commuters, where people on college campuses are commuting to class or work. A report from the United States Census Bureau provides information on bicycling and walking to work based on the American Community Surveys from 2008-2012, as well as previous census data. This report studies "workers" in the United States which the report defines as "Workers are civilians and members of the Armed Forces, 16 years and older, who were at work the previous week. Persons on vacation or not at work the prior week are not include" (McKenzie, 2014). While this report does not specifically target students at universities, it studies the trend of bicycling across the country. From 2000 to 2008-2012, bicycling had the largest percentage increase for any commuter mode of transportation increasing from about 488,000 commuting workers to 786,000 (McKenzie, 2014).

This growth of bicycling affects college campuses as well, but it also varies by the type and size of the community. Cities have the highest rate of commuters bicycling to work at 1.0%, followed by suburban at 0.4%, and those outside metropolitan areas also at 0.4% (McKenzie, 2014). College campuses exist in all three of these communities, therefore are affected by the growth of bicycling.

2.2 Bicycling on College Campuses

Bicycling is a very popular way for college students and faculty to get around on their campus. The University of Wisconsin-Madison is one of the leaders in bicycling on college campuses. A 2012 study of the campus showed that 22% of students bicycle to campus in good weather (Schmitt, 2014). This is a very large percentage of their student population that is bicycling around campus. While this does mean more potential for bicycle collisions, colleges try to promote bicycling and walking on their campuses. Colleges want to encourage bicycling for many reasons including environmental conservation, simplicity for students, and to save the college money on vehicle parking. Saving money on vehicle parking is a huge financial incentive for colleges. In the same Schmitt article from 2014, the author states the Stanford University estimates it has saved $100 million on construction and maintenance of parking facilities by promoting ways to reduce solo car commuting. Bicycling is notably one of the ways to reduce solo car commuting.

2.3 University of Delaware and Newark, Delaware

This thesis conducted a case study of bicycling on the University of Delaware Newark campus. The University of Delaware campus in Newark, Delaware is categorized as a suburban campus. The city of Newark where the University resides has a population of 31,454 according to the 2010 Census. The University is located in the center of Newark with the highly commercialized Main Street running through the campus. Because of this, the campus is not totally contained and has non-university workers and residents moving through and around the campus.

Bicycling and walking are common ways for students and faculty to get around the campus. However, the University has encountered problems with students bicycling on campus. On October 23rd, 2015, a student was hit by a bicyclist outside of the Trabant University Center. The student was standing outside of the Trabant Center attending an event and was struck by a passing bicyclist. The student suffered severe head trauma, required multiple surgeries, and sadly passed away after five months of hospitalization. (Horn, 2016)

The student's parents have since filed a lawsuit against the University claiming the University was negligent in protecting students attending the outdoor event (Horn, 2016). This lawsuit is still pending at the time of this thesis. This shows that bicycle and pedestrian collisions do happen on college campuses and they can be very serious. The location that this incident occurred has since become a "Walk your wheels" zone on campus. This means bicyclists and other wheeled users (skateboarders, scooter users, etc.) must walk in this area. In this case study for this thesis, that location was studied.

Figure 2.1: “Walk Your Wheels” sign outside of Trabant Student Center

2.4 Modeling Methods Review

There has been extensive research studying bicycle and pedestrian crashes. However, most of this research involves crashes with vehicles which are more common. One study by the University of California Transportation Center compiled crash data from three university campus areas; University of California – Berkley, University of California – Los Angeles, and California State University – Sacramento. The study combined crash data from the California Highway Patrol, the three campus’ police units, and an online survey administered to each campus (Grembeck, 2014). The study does include bicycle and pedestrian crashes that occurred on multi-use paths and separated bike path, but does not single these crashes out. The focus of the report involves crashes with vehicles, yet its methods could be applied to pedestrian and bicycle conflicts on non-motorized paths.

Another study out of Clemson University by Dobbs studies pedestrian and bicycle crashes and conflicts on the Clemson University campus. The study again focuses on crashes and conflicts with vehicles. The study developed a Campus Conflict Prediction model to assess 69 crosswalks on the campus (Dobbs, 2009). This model used conflict, speed, pedestrian volume, vehicle volume, and facility characteristic data (Dobbs, 2009). These are all data factors that can be applied to non-motorized paths with vehicle volume becoming bicycle volume. The model was developed to predict the number of conflicts at each crosswalk and rank the cross walks to prioritize safety improvements (Dobbs, 2009).

A 2000 report from Japan studied shared pavements that were used by bicyclists and pedestrians. These pavements were on the sides of roads, free of motor vehicles. The study compiled bicycle speed and pedestrian density data for the shared pavement. It found that as the number of pedestrians increased, the speeds of the bicycles decreased (Kiyota, 2000).

The study only collected this data on one shared pavement area in Kyusyu, Fukuoka. For this thesis, we will study paths of different widths and geometric characteristics to determine how pedestrians and bicyclists behave. The behavior of college students going to and from classes and work will also be different from the average person on a city sidewalk.

2.5 Data Collection Review

The paper by Kiyota from 2000 collects data on shared pavement using video recording and marking the pavement with masking tape. The masking tape was spaced out at 5 meter and 50cm intervals to measure the spacing between pedestrians (Kiyota, 2000). This technique worked well for this project because it also studied the spacing of the pedestrians and the risk perception of the users based on the spacing. This data collection method was useful for the small amount of data collected in that project.

2.6 Literature Review Summary

There are many important lessons learned from the literature review conducted. Most importantly, the literature showed how bicycling is becoming an increasingly popular mode of transportation. This affects all types and sizes of communities which includes university campuses. The University of Delaware campus in Newark is accustom to bicycle users, but has also experienced a serious crash in recent years. This shows that it is important to study non-motorized paths and evaluate them for their safety. The literature review showed many papers the involve bicycle conflict modeling but on roads with motor vehicles. While some aspects of this research can be applied to non-motorized paths, there is a lack of research strictly focusing on only bicycles and pedestrians. There has been an important paper from Japan that studies pedestrians and bicycles on a sidewalk next to a road. The behavior between the pedestrian volume and the bicycle speeds could be similar to what is observed on the University of Delaware campus. The paper from Japan also shows a way to collect pedestrian and bicycle data, however this methodology would not be useful for the scale and scope of this project. The literature review yielded important ways to assist this project, but more importantly showed the lack of literature for bicycle conflicts on non-motorized paths.

Chapter 3

METHODOLOGY

The University of Delaware campus was used to study and develop the model to identify bicycle conflict hotspots. The first step in the process was determining what variables were to be collected for analysis. This was done by determining key geometric features as well as user characteristics. Once the variables were identified, the locations for data collection and analysis were selected. These were selected to include paths that are near both academic areas and residential areas on campus. Within the two categories, the locations were selected to have varying characteristics. Once the locations were identified, the data was collected. Geometric data was collected first, and then the characteristic data was collected both in the summer and again in the fall when school was in full session. The different variables from the data collected were plotted on various graphs. Best fit lines were graphed to model the data. These equations were used as models to predict conflicts on the non-motorized paths.

3.1 Variables

The variables used in the model are categorized as either geometric variables or characteristic variables. The geometric variables are physical features of the paths. The characteristic variables describe the users of the paths and their actions.

Geometric Variables

- Width: The width of the path, measured in feet.

- Grade: The grade is measured along the direction of the path as a percent. It was taken at three points on each segment, the beginning, middle, and end.
- Cross Slope: The cross slope was measured at the same three points on each segment as the grade. It measures the slope perpendicular to the direction of the path.
- Horizontal Curvature: The horizontal curvature is categorized as either "curved" or "angled". The degree of curvature was not measured because some paths were not uniform or had multiple curves in the study segment. "Angled" means the paths bends at an angle, not as a curve. Not all locations had horizontal curvature.

Characteristic Variables

- Pedestrian Volume: The number of people walking or running on the path, divided into both directions. The volume is given as volume per fifteen-minute segment. Skateboarders were not counted in this data collection because they do not have the characteristics of pedestrians or bicycles. They were chosen to be omitted for this reason and because they are a rare occurrence.
- Bicycle Volume: The number of people riding bicycles on the path, divided into both directions. A person walking a bicycle is counted as a pedestrian, not a bicycle. The volume is given as volume per fifteen-minute segment.
- Crossing Pedestrian: The number of pedestrians who crossed the path perpendicular to the normal flow of users. The crossing pedestrians is given as number per fifteen-minute segment.

- Crossing Bicycle: The number of bicycles who crossed the path perpendicular to the normal flow of users. The crossing bicycles is given as number per fifteen-minute segment.
- Conflict: The number of times a bicyclist nearly collides with a pedestrian or another bicyclist at any point on the study segment. This is defined as when a bicyclist or pedestrian must abruptly change speed and/or direction to avoid a collision. Examples are quickly breaking, dangerously turning out of the way, or the pedestrian has to stop or quickly sidestep. A bicyclist weaving through pedestrians or adjusting speed safely is not a conflict. If a collision occurred, this was tallied as a conflict but also a description of the collision was recorded.
- Pedestrian Speed: The speed in feet per second of the pedestrians, divided into the two normal directions of the path.
- Bicycle Speed: The speed in feet per second of the bicyclists, divided into the two normal directions of the path.

3.2 Locations

The locations for the data collection were chosen to encompass different geometric features on the University of Delaware campus. The horizontal curvatures, widths, and grades vary at the different locations. The paths chosen are critical paths on the campus that are between residential buildings and academic buildings or between two academic buildings. Many students and faculty walking to and from classes throughout the day use these paths. A total of twelve locations were chosen around campus. This number is a large enough sample to include different geometric features and user characteristics. For each path, a segment was chosen to collect the data. The segment chosen had uniform width and did not contain a major intersection with another path. However, there are building entrances, side door entrances, benches, and bike racks within the segments chosen. The segment lengths range from 45 feet to 176 feet long.

After the locations were chosen, the University changed one of the paths to a "Walk your Wheels" path during the summer before data collection began. This means bicyclists are required to dismount their bike and walk it on that path. This would make data collection at this location useless, however upon preliminary observation, users continued to ride their bikes at this location. So, it was decided to continue the data collection at this location as planned. Users continuing to ride their bicycles at this location may be a combination of users not knowing this is a "Walk your Wheels" path because they do not see the small signs, or users see the signs but choose not to follow the new rule.

The twelve locations for the data collection are shown on the map below (Figure 3.1) and the locations are listed in Table 3.1.

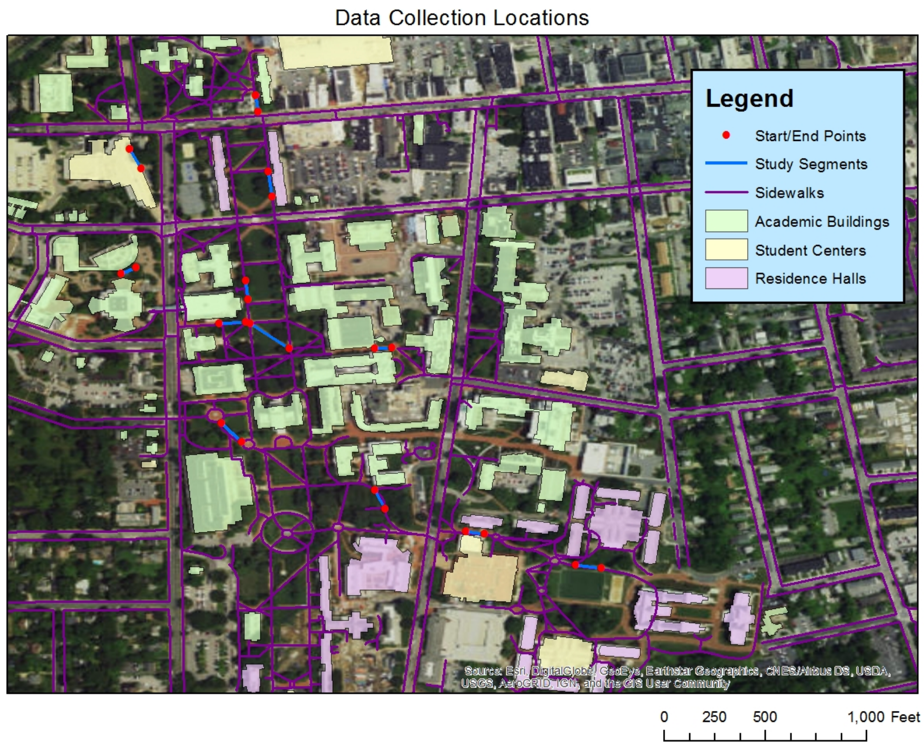

Figure 3.1: Data Collection Locations Map

Table 3.1: Data Collection Locations

Location Name	Location Map	Width (ft.)	Length (ft.)
Harrington Turf Path	https://goo.gl/maps/H6KhyCbFFV52	12	96
Elliot Hall Path	https://goo.gl/maps/3YPZsWyqeSm	7.5	81
Trabant Path	https://goo.gl/maps/cE3xghVJsJS2	18.5	95
North Green, Sharp Hall Path	https://goo.gl/maps/Yp7aHTX9ck12	15	118
Kirkbride Path	https://goo.gl/maps/Yp7aHTX9ck12	11	55
North Green, Gore Hall Path	https://goo.gl/maps/RaZKCv3JoEw	15	72
Mitchell Hall Path	https://goo.gl/maps/4eofeJYWne82	12	92
North Green, Crossing Path	https://goo.gl/maps/EDQxnfCCvgG2	10	176
Evans Hall Path	https://goo.gl/maps/HQbbhCWbJm32	10	45
Mentor's Circle Path	https://goo.gl/maps/RVnBSRq7SUo	15	127
Allison Hall Path	https://goo.gl/maps/4E2WSkjUSiF2	11	90.5
Perkins Path	https://goo.gl/maps/y462xnpaRE92	16	73

3.2.1 Location Photos

Photos of each location are shown on the following pages. Each location has two photos showing both directions of the study segment.

Figure 3.2: Location 1 – Harrington Turf Path WB

Figure 3.3: Location 1 – Harrington Turf Path EB

Figure 3.4: Location 2 – Elliot Hall Path SB

Figure 3.5: Location 2 – Elliot Hall Path NB

Figure 3.6: Location 3 – Trabant Path SB

Figure 3.7: Location 3 – Trabant Path NB

Figure 3.8: Location 4 – North Green, Sharp Hall Path SB

Figure 3.9: Location 4 – North Green, Sharp Hall Path NB

Figure 3.10: Location 5 – Kirkbride Path WB

Figure 3.11: Location 5 – Kirkbride Path EB


Figure 3.12: Location 6 – North Green, Gore Hall Path SB


Figure 3.13: Location 6 – North Green, Gore Hall Path NB

Figure 3.14: Location 7 – Mitchell Hall Path EB

Figure 3.15: Location 7 – Mitchell Hall Path WB


Figure 3.16: Location 8 – North Green, Crossing Path EB


Figure 3.17: Location 8 – North Green, Crossing Path WB

Figure 3.18: Location 9 – Evans Hall Path EB

Figure 3.19: Location 9 – Evans Hall Path WB

Figure 3.20: Location 10 – Mentor's Circle Path NB

Figure 3.21: Location 10 – Mentor's Circle Path SB


Figure 3.22: Location 11 – Allison Hall Path SB


Figure 3.23: Location 11 – Allison Hall Path NB

Figure 3.24: Location 12 – Perkins Path EB

Figure 3.25: Location 12 – Allison Hall Path WB

3.3 Data Collection

The data collection was done in two seasons, the summer and the fall. The summer data was collected first to have samples with smaller volumes when there are fewer people on campus. Data was collected again in the fall at all locations when all students and faculty were back on campus. This collection showed higher volumes as expected. The summer was also used to tweak the new data collection process to ensure it would be affective in the fall.

The data was collected for two-hour periods at each location during midday on weekdays. The summer collections were done from 11:30AM - 1:30PM and were done once at eight of the twelve locations. The remaining four locations had little to no volume during the summer because they were located near residence halls that were unoccupied. In the fall, two data collections were done at each location.

The procedure of the data collection was developed specifically for this project. It consisted of 2-3 persons sitting at the location next to the path to ensure they had an unobstructed view of the entire segment. One or two people collected the volume data, depending on the usage volume of the path. The collectors used counting sheets (Appendix A) that were divided into 15-minute intervals over the two-hour collection. These collectors counted the number of pedestrians and bicycles in each direction, and recorded them in the appropriate 15-minute interval. These collectors also counted any crossing pedestrians or bicycles, also recording them in the appropriate 15-minute interval. Finally, these collectors counted any conflicts they saw and noted any collisions. The final person was the speed data collector. This person used several stopwatches to record the time it took randomly selected pedestrians and bicyclists to travel through the segment. As noted before, each segment had a different length that was denoted by some type of physical feature.

Some examples of these were cross paths, trees, benches, or signs. So, the speed collector picked a pedestrian or bicyclist at random and recorded the time it took them to go through the segment. This time was then recorded on the speed collection sheet in the corresponding 15-minute interval. This was done in both directions for both pedestrians and bicyclists for each 15-minute period. The target sample size for the collector was ten data points for each of the four categories in each 15-minute period. If a pedestrian or bicyclist stopped at any time during the segment, turned around, or turned off the segment, that time was thrown out and not recorded. After that data was collected, the times (in seconds) were input into a spreadsheet and then converted to speed in feet per second based on the length of the segment.

3.4 Data Processing

The data from the data collection sheets was input into Excel in separate files for the volume data and speed data. The volume data was input just as the collectors recorded on the collection sheets. As stated before, the speed data was input as times (in seconds) and the spreadsheet converted these times to speeds in feet per second. In the same Excel file, the low, mean, and high speeds were calculated for each fifteen-minute period in each direction. These speed values were copied into a final Excel sheet where they were matched with the corresponding volume values. The geometric data for the paths were added as well as time and location of the collection data. So, each line in this final spreadsheet is one fifteen-minute period of data collection, and contains the identification information, geometric characteristic, volume value, and calculated speed values.

From this data, separate spreadsheets were made to create the appropriate graphs needed for data analysis. Separate spreadsheets were copied from the final data sheet. This was done so the data could be manipulated or unneeded data deleted, depending on what was needed for that particular graph. This was done repeatedly for various graphs and the same process was used in Excel for modeling linear and non-linear equations to the data.

After the models were developed, a scale was developed to rate the non-motorized paths. Using Geographic Information Systems software, the rating scale was used to create a visual representation of the ratings of the non-motorized paths on the University of Delaware campus.

3.5 Methodology Summary

The methodology used to collect the data for this project was developed based on the needs of the project. The volume collection was the same procedure used to count cars. The speed collection procedure had to be able to observe the speeds of both pedestrians and bicycles. A radar gun would not have been realistic for these speed observations because the pedestrians and some bicycles move too slowly to be detected. The procedure used in this project was developed so even pedestrians moving at slow speeds could be recorded. The data collection methods used were very reliable for the project, and was successful in collected a large amount of data to analyze.

Chapter 4

ANALYSIS

4.1 Data

The data from the volume and speed collections was entered into Excel format. The speeds were calculated from the times collected in the field. The low speed, mean speed, and max speed for pedestrians and bicycles in both directions were calculated. A sample of the data is shown in the following table that includes location and time identification, geometric features, volumes, and calculated speeds. The full data for the summer and fall is shown in Appendix B.

Table 4.1: Data Sample – Fall

Location Name	Number	Width (ft)	Avg Grade (%)	Avg Cross Slope (%)	H Curve	Segment ID	Date	Weather	Time	Direction #1	Ped Volume #1	Low Speed #1	Mean Speed #1	Max Speed #1	Bike Volume #1	Low Speed #1	Mean Speed #1	Max Speed #1
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	65	10/24/16	Sunny	2:15:00 PM	EB (To Clbrn)	110	4.29	4.84	5.77	7	7.50	12.38	15.52
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	66	10/24/16	Sunny	2:30:00 PM	EB (To Clbrn)	23	3.88	4.78	5.42	0	0.00	0.00	0.00
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	67	10/24/16	Sunny	2:45:00 PM	EB (To Clbrn)	31	4.05	4.67	5.84	2	8.18	10.71	13.24
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	68	10/24/16	Sunny	3:00:00 PM	EB (To Clbrn)	33	4.05	4.86	5.92	2	14.52	14.52	14.52
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	69	10/24/16	Sunny	3:15:00 PM	EB (To Clbrn)	98	3.81	4.62	5.36	2	7.50	7.50	7.50
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	70	10/24/16	Sunny	3:30:00 PM	EB (To Clbrn)	25	3.98	4.90	7.03	1	15.00	15.00	15.00
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	71	10/24/16	Sunny	3:45:00 PM	EB (To Clbrn)	20	4.13	4.87	5.77	0	0.00	0.00	0.00
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	72	10/24/16	Sunny	4:00:00 PM	EB (To Clbrn)	14	4.17	4.79	5.36	3	9.38	12.22	13.64
										Direction #2	Ped Volume #2	Low Speed #2	Mean Speed #2	Max Speed #2	Bike Volume #2	Low Speed #2	Mean Speed #2	Max Speed #2
										WB (To Grn)	91	4.21	4.80	5.63	2	10.00	10.00	10.00
										WB (To Grn)	28	3.31	4.61	5.36	1	12.86	12.86	12.86
										WB (To Grn)	12	4.21	4.78	5.42	0	0.00	0.00	0.00
										WB (To Grn)	33	3.44	4.69	5.11	2	9.78	11.71	13.64
										WB (To Grn)	100	3.72	4.99	6.34	4	6.82	9.66	13.64
										WB (To Grn)	37	3.95	4.87	5.36	2	11.25	11.25	11.25
										WB (To Grn)	11	4.69	4.95	5.36	2	11.54	13.80	16.07
										WB (To Grn)	31	4.29	4.74	5.70	3	10.23	11.15	12.50

Each line represents a 15-minute data collection period. For formatting purposes for this sample, the Direction #2 data lines were moved under Direction #1. In the Appendix, they are shown all in one line. The data for each location includes the location name and number, the width, the average grade, the average cross slope, any horizontal curvature, a given segment ID number, the weather, and the time and date. Following that information are the pedestrian and bicycle volumes for each direction as well as the minimum, mean, and maximum speeds for pedestrians and bicycles.

There are 16 hours of summer data collected, which breaks down into 64 fifteen-minute periods. For the fall data, there are 50 hours of data for 200 fifteen-minute periods. As states before, all twelve locations were counted twice in the fall. However, location 3 (Trabant Path), was counted a third time because of weather. That is why there are an additional two hours of data for the fall. Over the summer and fall, this totals 66 hours of data collected which breaks down into 264 fifteen-minute periods.

4.1.1 Possible Problems with the Data

There are several possible problems that could have occurred when collecting the data. The first is the speed collection. The speed collectors were instructed to get ten pedestrians speeds in each direction for each fifteen-minute period and as many bicycle speeds as possible. The problem with collecting the bicycle speeds was it was sometimes difficult to see them coming and prepare to start the stopwatch when they crossed into the study segment. For example, if the bicycle was behind a group of people, the path curved out of sight, or the bicycle was moving very fast, the speed collector could have missed collecting their speed. This is why in some cases in the volume data shows there was a bicyclist that passed through the study segment, but there is no corresponding speed. Conversely, there are some instances where there is a speed data point for a bicycle, but no corresponding volume data point. In this case, the volume collector missed the passing bicycle.

Another problem that arose was the lack of crossing pedestrians and bicycles, and the lack of conflicts observed. Addressing the lack of crossing pedestrians and bicycles first, there are two possible reasons for this. The first is that the study segments were selected to not include any major intersections with other non-motorized paths. Because of this, people crossing the path would not be very common. The second is that the data collectors were not able to clearly recognize them on the study segments. During peak volume periods, the collectors were focusing on counting the large volumes of pedestrians, and any crossing movements were covered up by the large crowds. This is also a reason for why there were not any conflicts observed. In such a large crowd of people, people moving out of the way of bicycles could have been blocked from the collectors' perspective. Also, it is hard for a collector to judge what is a conflict based on just watching. Someone stepping out of the way of a bicycle may feel uncomfortable at the time, worried about getting hit, but to an observer it may appear as though they are simply moving out of the way. There is some subjective nature to identifying a conflict.

4.2 Graphing the Data: Volume

After the data was processed and put into an Excel format, the different variables were graphed against each other and the results are shown below. The independent variable in this section, shown on the x-axis, is the volume of pedestrians on the path. The pedestrian volume is used rather than the bicycle volume because the pedestrian volume is much larger and governs the density of the path. The dependent variable that we want to focus on is the speed of the bicycles. This is because if bicycles are moving faster compared to the pedestrians, it is more likely that a collision will be serious and that a bicyclist is less able to move out of the way. Therefore, the models that will be developed will be generating bicycle speeds as an output.

The first graph (Figure 4.1) that is shown is from the fall data, and it is showing the pedestrian volume on the x-axis and the mean speed of the bicycles of the corresponding segment on the y-axis. The pedestrian volume shown is the volume in the same direction as the corresponding bicycle speed shown on the y-axis. The opposite direction is not taken into account yet.

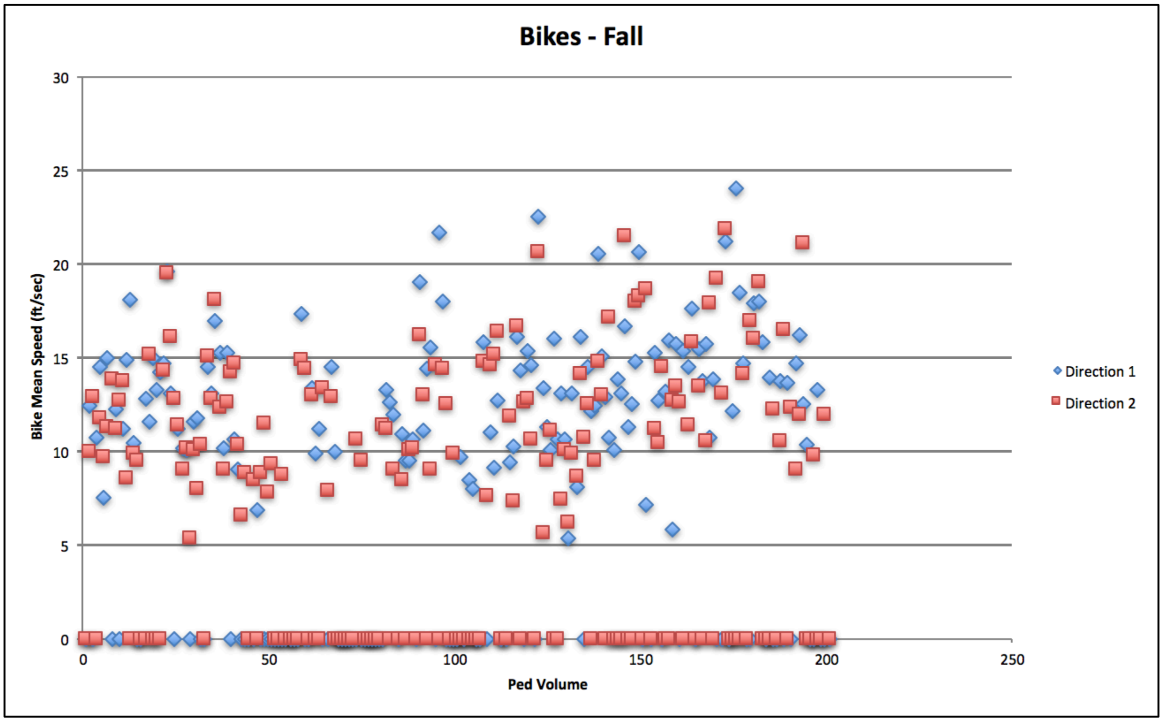

Figure 4.1: Ped Volume vs Bike Mean Speed – Fall

This graph reveals that bicycles can travel at varying speeds across all of the varying pedestrian volumes. However, this does not take into effect the width of the path. A volume of 100 pedestrians in a fifteen-minute period has a much higher density if it is on an 8-foot-wide path versus a 16-foot-wide path. To account for this, a new variable was developed “Pedestrian Volume per Ft of Width”.

$$Ped\ Vol\ per\ Ft\ of\ Width = \frac{Ped\ Volume}{Path\ Width}$$

This new variable can be thought of as a density term and it standardizes all the paths studied. This variable was then graphed on the x-axis with the same corresponding mean bicycle speeds on the y-axis, as shown in Figure 4.2.

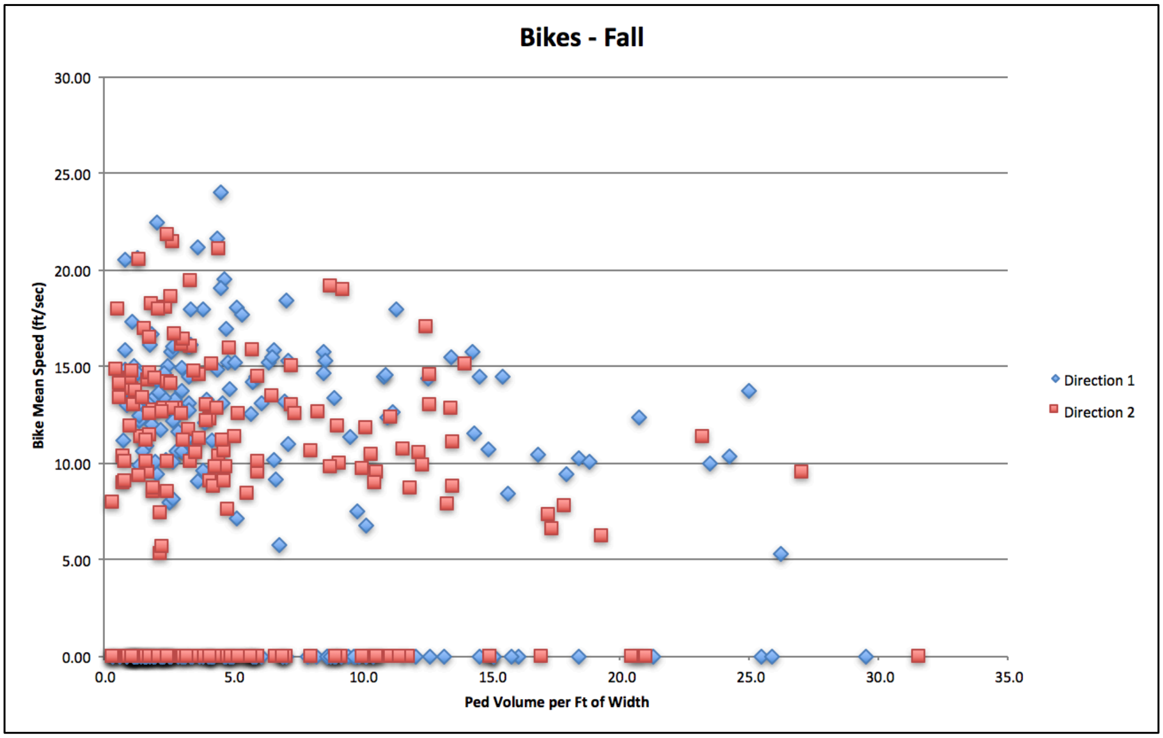

Figure 4.2: Ped Volume per Ft of Width vs Bike Mean Speed – Fall

In this figure, we can see that as the Pedestrian Volume per Ft of Width term increases, the speed of the bicycle decreases. In Chapter 5, this trend will be fit with a trend line to model the characteristics. We see this trend again in when the Bicycle Maximum Speed is graphed again the Pedestrian Volume per Ft of Width, as shown in Figure 4.3. The trend again shows a decline in the Bicycle Maximum Speed as the Pedestrian Volume per Ft of Width term increases. Figure 4.3 is very important because it shows the maximum speed a bicyclist achieved during each fifteen-minute period.

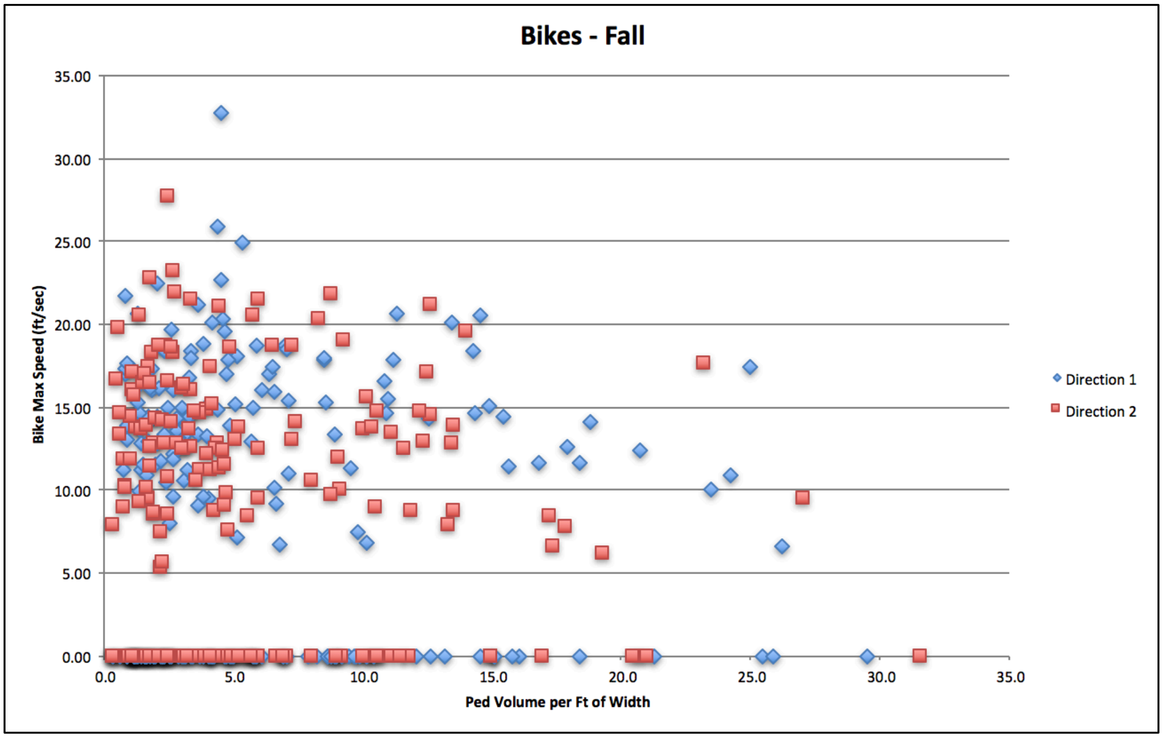

Figure 4.3: Ped Volume per Ft of Width vs Bike Max Speed - Fall

4.3 Graphing the Data: Total Volume

The previous section only graphed the mean speeds and maximum speeds of bicycles versus the pedestrian volume in the same direction of travel. This does not take into account the pedestrians going in the opposite direction, which increases the overall density of the path. The next step is to graph the mean speeds and maximum speeds versus the total pedestrian volumes. For this, the pedestrian volumes for both directions for each fifteen-minute period were added together to make a total volume term. The total pedestrian volume gives a better representation of the overall density of the non-motorized path at the time. The next graph (Figure 4.4) shows the Mean Bicycle Speed versus the Total Pedestrian Volume.

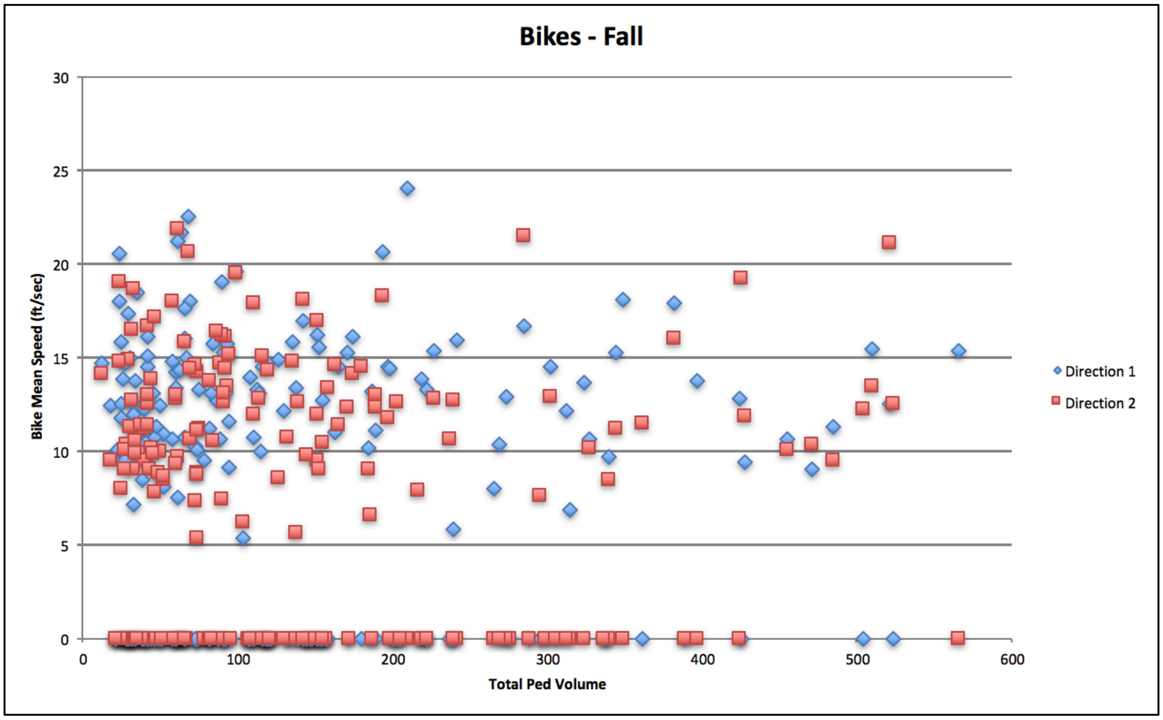

Figure 4.4: Total Ped Volume vs Bike Mean Speed - Fall

This figure differs from Figure 4.1 because of the higher total volumes. The figure shows that most of data points have less than 200 total pedestrians in a fifteen-minute period. Only several of the data points are greater than 500 total pedestrians in a fifteen-minute period.

Just as in section 4.2, the next step is to use the density term to standardize the volumes of the different paths. Figure 4.5 graphs the Total Pedestrian Volume per Ft of Width versus the Bicycle Mean Speed. Using the same process as before, the total pedestrian volume is divided by the width of the path in feet.

$$Total\ Ped\ Vol\ per\ Ft\ of\ Width = \frac{Total\ Ped\ Volume}{Path\ Width}$$

This term is graphed on the x-axis and shows the same trend observed in Figure 4.2.

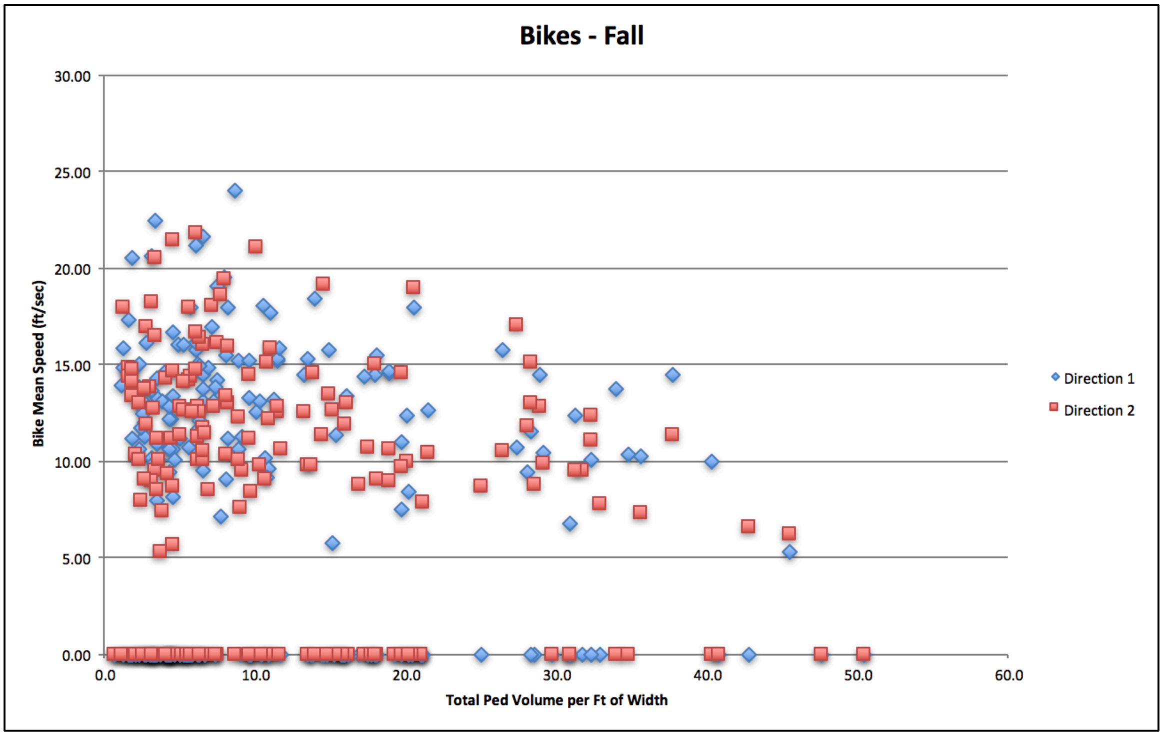

Figure 4.5: Total Ped Volume per Ft of Width vs Bike Mean Speed – Fall

The Bicycle Mean Speed again declines as the Total Pedestrian Volume per Ft of Width increases. Finally, we will graph this term versus the Bicycle Maximum Speed to see the maximum speed a bicyclist attained based on the total pedestrian volume. This graph shows the same trend of decline as the total pedestrian volume increases.

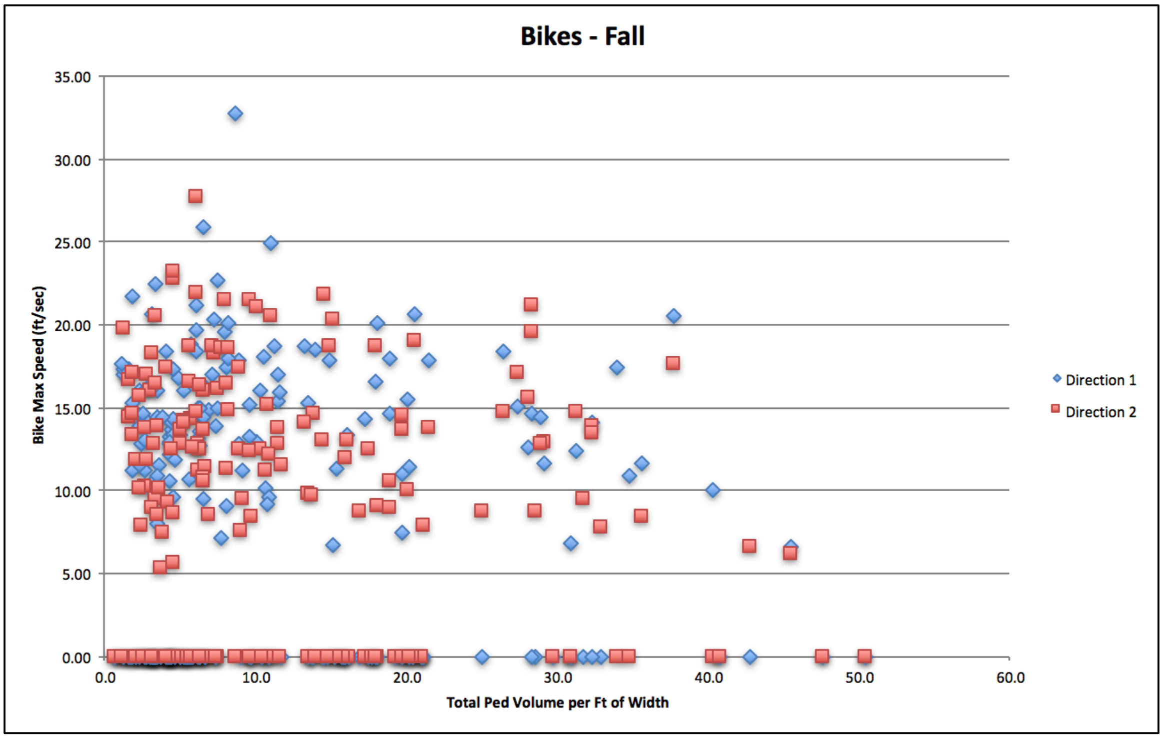

Figure 4.6: Total Ped Volume per Ft of Width vs Bike Max Speed – Fall

4.3.1 Assumptions

There are several assumptions that need to be made at this point based on the data shown. It should be assumed that this maximum speed (As shown in Figure 4.3 and Figure 4.6) is the greatest speed the bicyclist was able to achieve based on the density of the path at the time. This should be assumed so the maximum speed attainable on different paths can be modeled based on the density. The maximum speed attainable can be used as a measure of the safeness of the non-motorized path. We will assume that the faster a bicycle is moving, the more likely it is to be involved in a conflict or crash with a pedestrian or another bicycle. This is also important because it can be assumed that the faster a bicycle speed is, the more serious an injury will be if a collision occurs.

4.4 Graphing the Data: Geometric Characteristics

The previous sections focused only on graphing the bicycle speeds as they were dependent on the volume of pedestrians on the paths. This section will now graph the bicycle speeds as dependent on the geometric characteristics of the non-motorized paths. The geometric variables that will be focused on are width, grade, and curvature.

The first to be shown is width as the independent variable on the x-axis. The mean bicycle speed is graphed as the dependent variable on the y-axis.

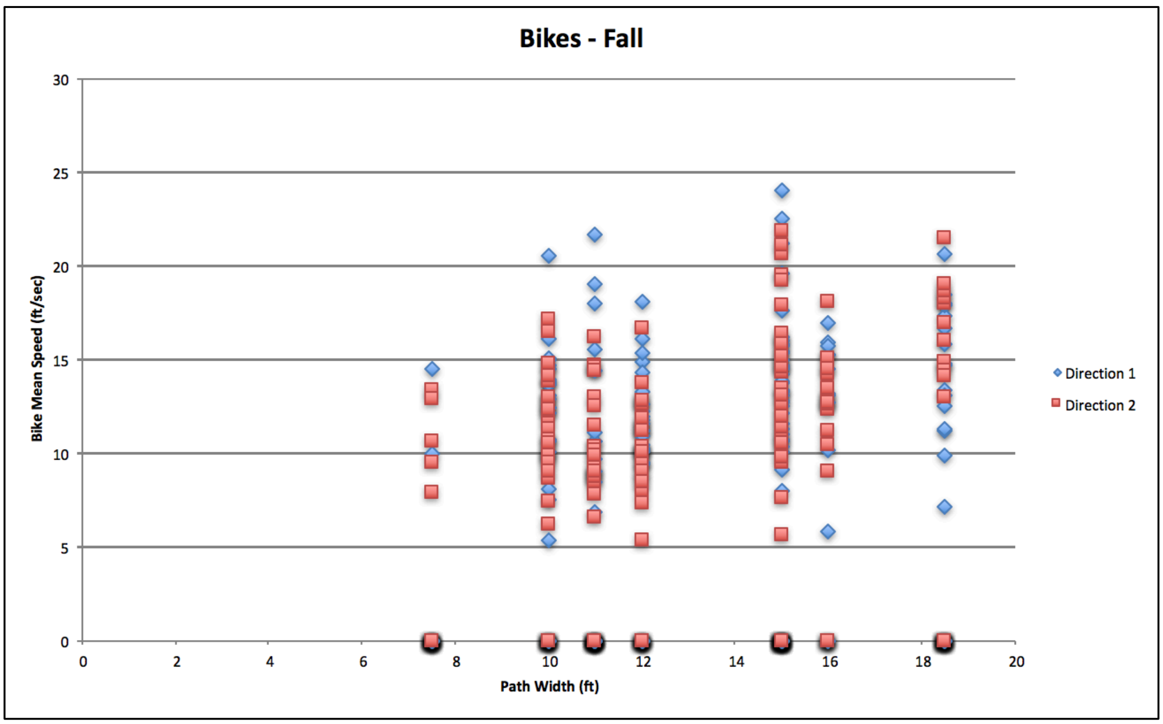

Figure 4.7: Path Width vs Bike Mean Speed – Fall

This graph is much different than the previous graphs that have been looked at in this section. The data is spaced out based on the different path widths that range from 7.5 feet wide to 18.5 feet wide. It is possible that there is a trend showing a rise in mean bicycle speed as the Path Width term increases. This will be analyzed in the following chapter. The next step is to graph the maximum bicycle speed as the dependent variable.

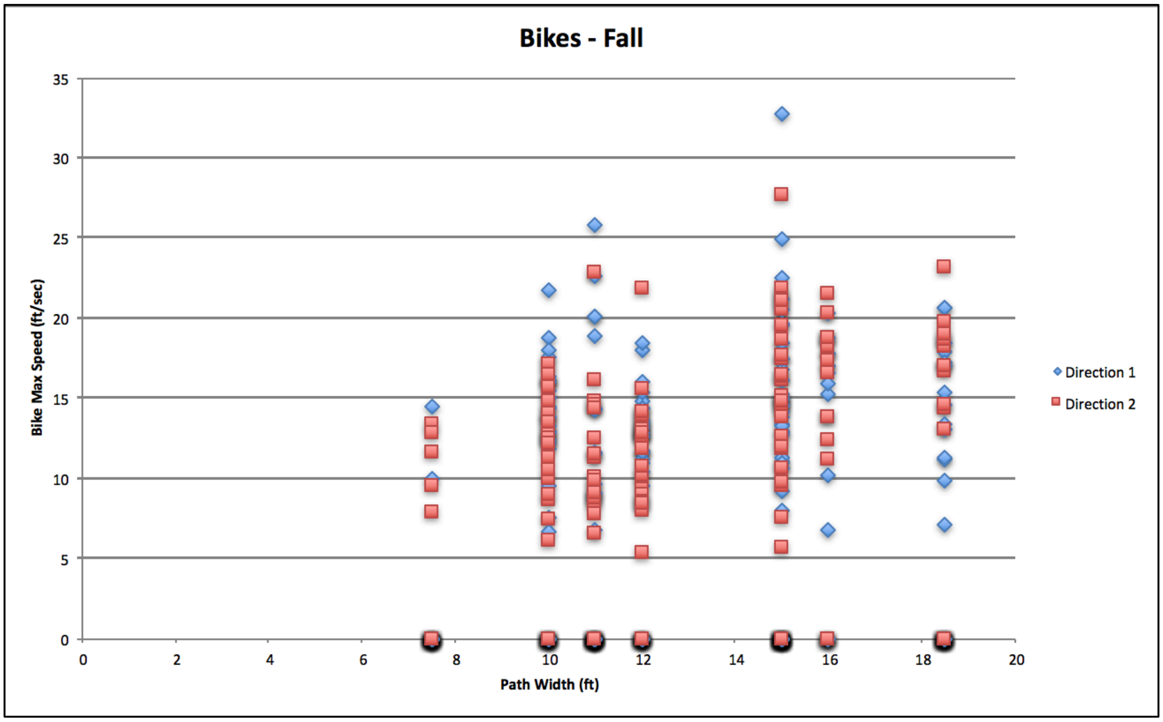

Figure 4.8: Path Width vs Bike Max Speed – Fall

Similarly to Figure 4.7, the graph possibly shows an upward trend as the Path Width increases. The maximum speed is more important to the evaluation of the safety of the path because it shows how fast a bicyclist can travel.

One problem with using the Path Width as the independent variable is this does not show the pedestrian volume. The assumption would be the University designs the paths to be wider in areas that are more heavily traveled and would have a higher pedestrian volume. To see if this is true, the relationship between pedestrian volume and the path width is shown in Section 4.5 where the Path Width is graphed as the independent variable and the Pedestrian Volume is the dependent variable.

The next geometric variable to be graphed is the grade of the path. The data is divided into two sections: directions with positive slope and directions with negative slope. The directions of the study locations are split into the appropriate section to graph the data.

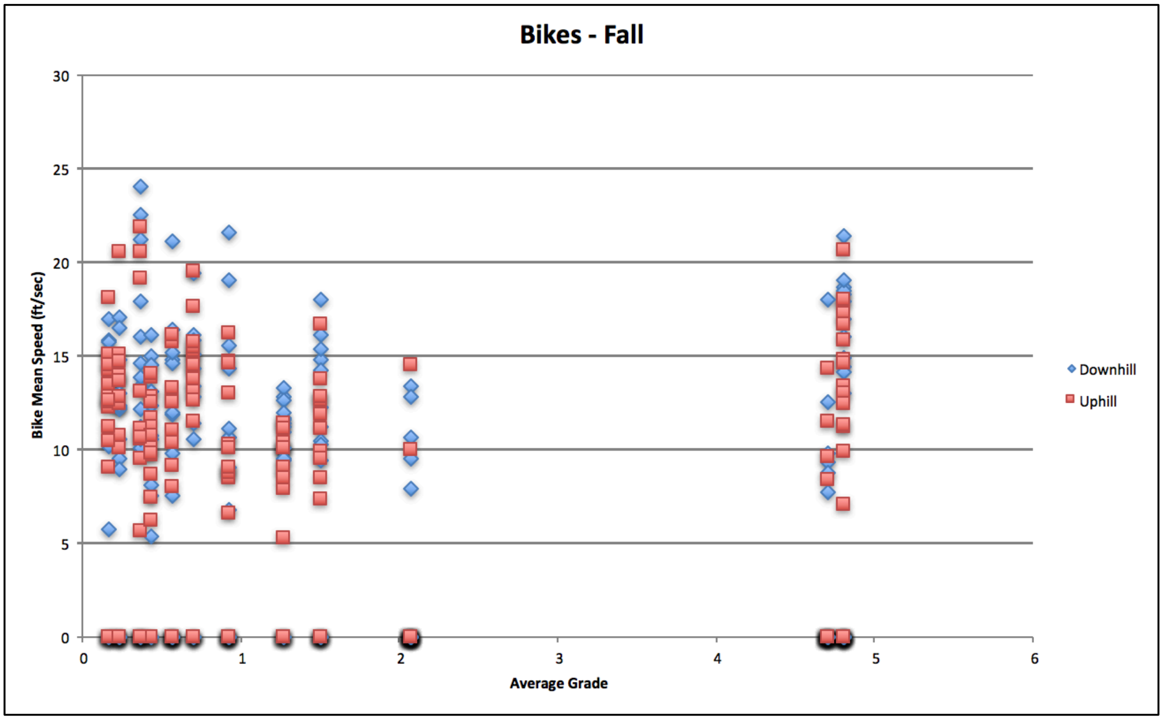

Figure 4.9: Average Grade vs Bike Mean Speed – Fall

The average grade appears to have little effect on the speed of the bicycles. The red squares denote the uphill direction of the path and the blue diamonds denote the downhill direction of the path. For grade to be a major contributor factor to influencing the speed of the bicycles, the assumption would be the downhill speeds are faster than the uphill speeds. Also, the mean speed would have an upward trend for the downhill directions, since bicyclist should be able to pick up speed on the negative grade. So, a bicycle should pick up more speed the steeper the negative grade. Vice versa, the mean speed would have a downward trend for the uphill directions. Next, the maximum speed of the bicycles will be graphed as the dependent variable to see if the grade has any effect.

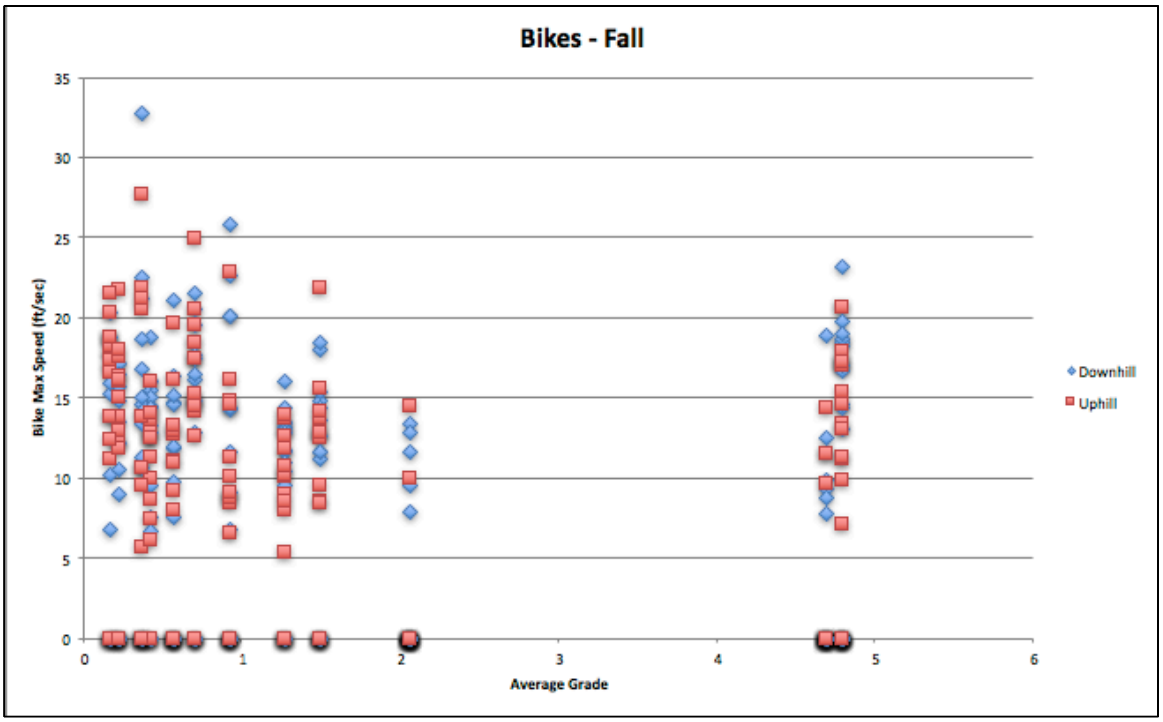

Figure 4.10: Average Grade vs Bike Max Speed – Fall

The graph of the maximum bicycle speed looks like the graph of the mean bicycle speed. There appears to be no indication that grade significantly influences the speed of the bicycles. The data will be fit with best fit lines in Chapter 5 to conclude if there are any significant trends.

The final geometric characteristic to be graphed is the horizontal curvature of the study segment. The locations are categorized as curved, angled, and no curvature.

Angled means the path is straight but has an angled bend in the middle, rather than a smooth curve. Three of the locations are curved, one location is angled, and eight have no horizontal curvature, so they are straight. Figure 4.11 shows the Mean Bicycle Speed split into the three categories of horizontal curvature.

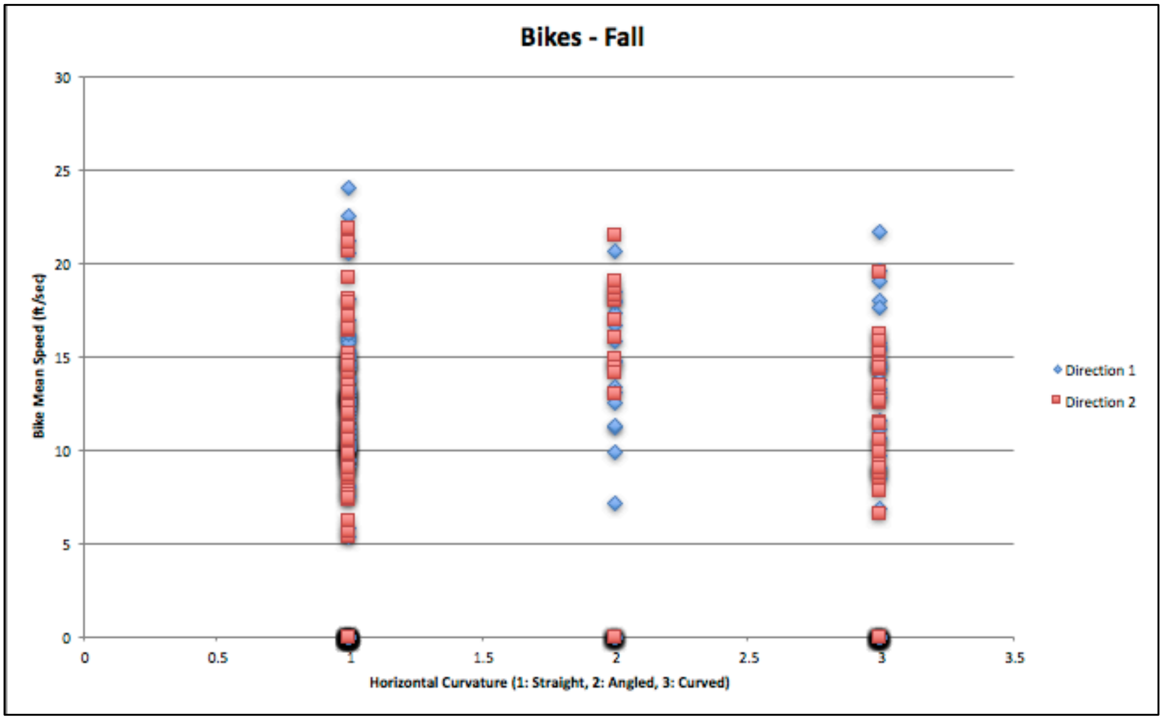

Figure 4.11: Horizontal Curvature vs Bike Mean Speed – Fall

The straight paths are identified with a "1", the angled paths are identified with a "2", and the curved paths are identified with a "3". The highest Bicycle Mean Speed is in on a straight path, however the speeds for the angled and curved paths are similar to each other and close to the straight paths speeds. The Bicycle Maximum Speed is shown in Figure 4.12 to see how it compares to the mean speeds.

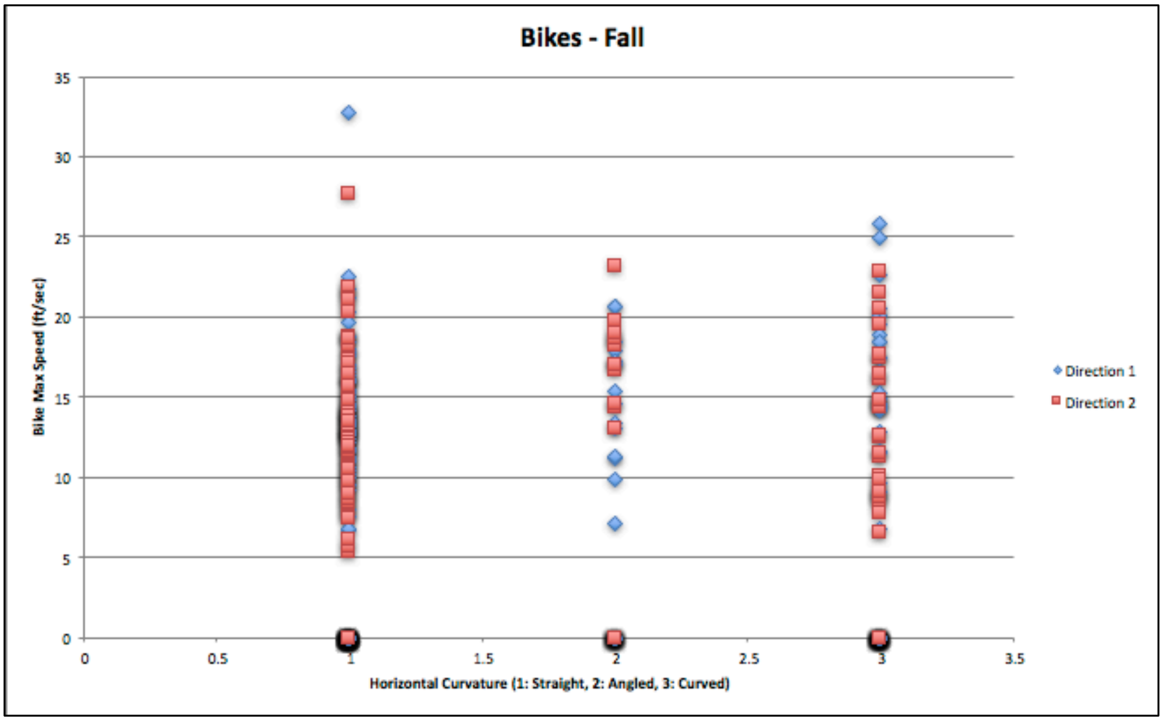

Figure 4.12: Horizontal Curvature vs Bike Max Speed – Fall

Just as in Figure 4.11, the highest bicycle speed is on a straight path. The angled path has the lowest Maximum Speed, and the curved paths are in between. It is possible that the path's horizontal curvature has a significant effect on the bicycle speeds, however a conclusion cannot be made with the data collected. A more detailed study with measured curvature would be needed to yield a conclusion.

4.5 Graphing the Data: Pedestrians

It is also important to look at the behavior of the pedestrians to understand the full behavior of the users of the non-motorized paths. While the speeds of the pedestrians do not vary as much as the bicycle speeds, the pedestrian volumes do fluctuate. The volumes of pedestrians differ based on both the location and the time of day. The volume differs based on location because the study locations are spread out throughout the campus. Some locations are in more traveled areas like in the center of campus on The Green. Other locations are on other parts of campus that are less traveled. The pedestrian volume fluctuates based on time of day because the data collection captured the change of classes. Students are leaving class all at once, which increases the number of pedestrians on the non-motorized path network. Then when the students are in their next class, or have left the main part of campus, there are much less users on the network.

In Section 4.4, the possible assumption was brought up that the wider the path is, the higher the pedestrian volume on that path. It was assumed that the paths on the center of campus are designed to be wider because they will be more highly traveled. To see if this is true, the Path Width is graphed against the Pedestrian Volume.

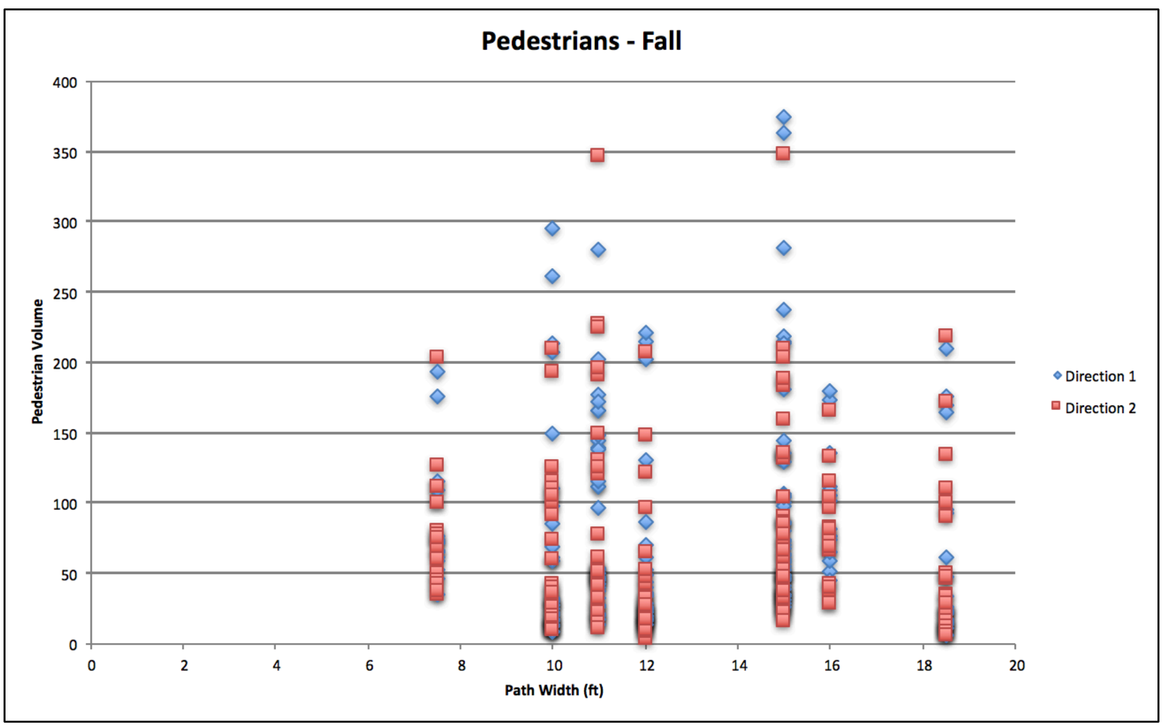

Figure 4.13: Path Width vs Pedestrian Volume – Fall

The data shows that this assumption is false. If the assumption were true, the Pedestrian Volume would increase as the Path Width increases, but this is not the case. The Pedestrian Volume is highest at a Path Width of 15 feet, followed by a Path Width of 11 feet. While these high values may be extreme cases, the widest paths at 16 feet and 18.5 feet do not show any high pedestrian volumes relative to the other paths. Next, the pedestrian density is looked at to see how it differs based on the width of the path. Figure 4.14 shows the Pedestrian Volumes per Ft of Width graphed on the y-axis to look at the comparison based on the Path Width.

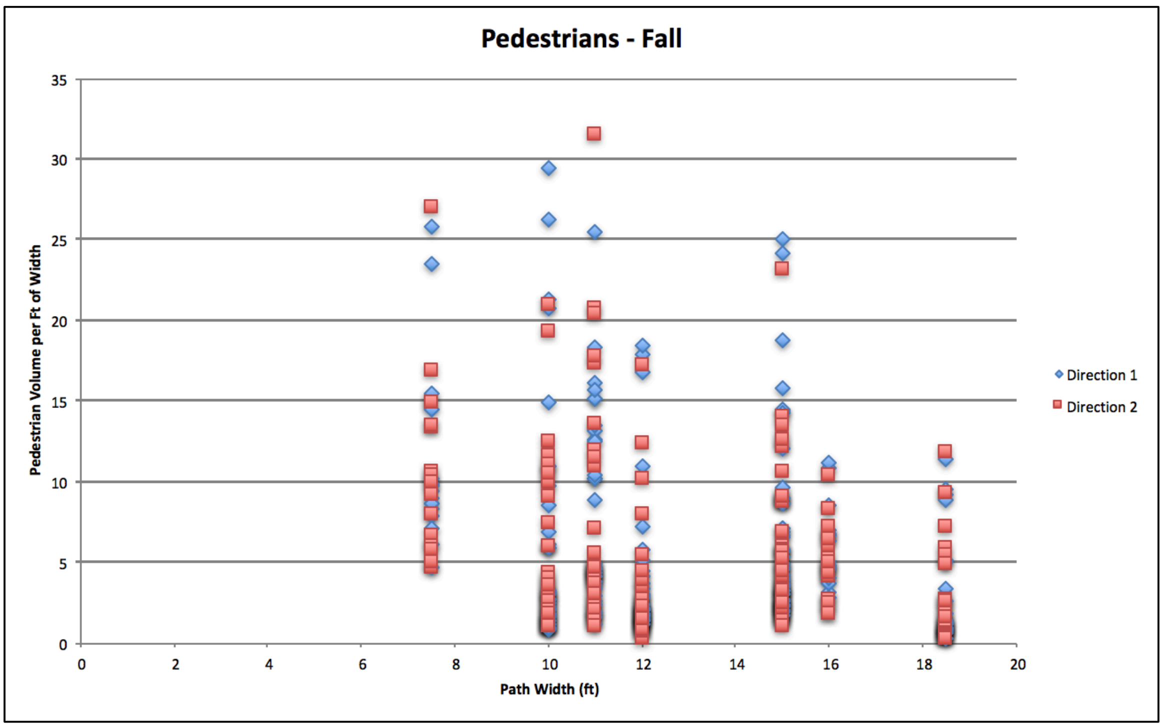

Figure 4.14: Path Width vs Pedestrian Volume per Ft of Width – Fall

The density term appears to decrease as the Path Width increases. This makes sense because of the lower pedestrian volumes on the wider paths. Because of that, the density on those paths will be lower than that on a narrower path. Both Figure

4.13 and Figure 4.14 show how the pedestrian volume and density differ based on the path widths. This is important because it was shown in Section 4.2 how the pedestrian volume and density affects the speed of the bicycles.

4.6 Analysis Summary

The data collection process yielded large amounts of data and many characteristics of the non-motorized paths. The many characteristics collected were graphed against each other to see how they affect each other. The data analysis revealed many trends in the data that will be modeled in Chapter 5.

There were several important trends that were observed. The first was the relationship between the pedestrian density and the bicycle speeds as shown in Figures 4.2, 4.3, 4.5. and 4.6. When the pedestrian volume was first graphed against the bicycle speed, there did not appear to be a trend because paths of different widths experienced very different volumes. Once the volume was converted to the density term, volume per foot of width of the path, the data points were standardized and showed a downward trend in bicycle speed as the pedestrian density increased. This is a logical trend because when there are more pedestrians on a non-motorized path, a bicycle is not able to reach a high speed.

The second important trend that was observed was the relationship between path width and bicycle speed. When the path width was graphed as the independent variable and the bicycle speed as the dependent variable, the graph appeared to show an upward trend in the bicycle speed as the path width increased. This is shown in both Figures 4.7 and 4.8. This is also a logical trend because it would mean the wider paths have lower pedestrian densities than the narrower paths and bicycles are able to travel at a faster speed. This is an important trend because it would allow paths to be evaluated without having to collect pedestrian volume data.

Both trends mentioned will be modeled with both linear and non-linear equations in Chapter 5 to confirm the assumptions. These will be the basis for a rating scale to evaluate the non-motorized paths.

Chapter 5

RESULTS

5.1 Modeling

The second objective of this thesis is to develop a model using non-physical characteristics such as volume and density as well as geometric characteristics of the paths. The graphs shown in Chapter 4 display the data collected in the fall of 2016 on the University of Delaware campus in Newark, Delaware. This data will be used to create empirical models that will evaluate the safety of the non-motorized paths on campus.

5.2 Non-Physical Characteristics Modeling

In this section, the non-physical characteristics such as pedestrian volume and density will be used create a model to predict the maximum possible speed of a bicycle. To reiterate, the volume data was collected by students on selected paths in fifteen-minute periods. The density term that will be used, Pedestrian Volume per Ft of Width, was developed by dividing the volume of each fifteen-minute period by the width of the path. This was done to be able to compare paths of different widths to each other.

For the non-physical characteristics modeling, a best fit equation was developed but not using all of the data points. Instead, data points were selected that represented the highest speed a bicycle achieved at each pedestrian density. This was done because the goal is to model the maximum speed a bicycle could achieve at a given density, rather than what the average speed would be. Fitting the entire data set would not give an accurate model for the maximum achievable speed. Both the mean speed and maximum speed will be used to create the models.

The first graph that will be used to model the bicycle speed is the Figure 4.3. This is the Pedestrian Volume per Ft of Width versus the Bicycle Maximum Speed. The maximum speed values are the maximum speed that the data collectors observed in each fifteen-minute segment. On this graph, data points were selected that represented the highest values that were achieved. A linear equation was fit to these selected points as shown in Figure 5.1 below.

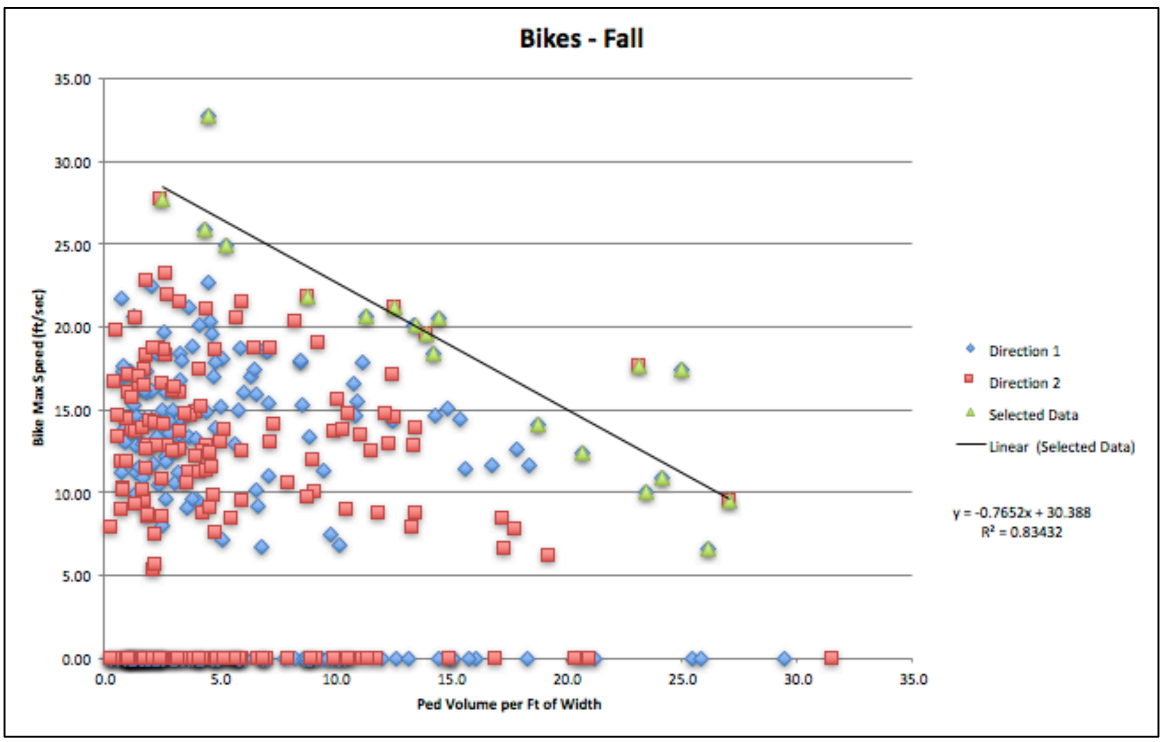

Figure 5.1: Model 1

The model for this data shows a linear equation with a slope of -0.7652 and a y-intercept of 30.388. The regression coefficient is 0.83432. The negative slope means the bicycle speed decreases as the density term increases, as we expected when we observed the data in Chapter 4. The y-intercept indicates a bicycle could travel 30.388 ft/s when the pedestrian density of the path is zero, i.e. there are no pedestrians on the path. This is a realistic value because the highest bicycle speed observed was 32.75 ft/sec which equates to 22.3 miles per hour.

The next graphed used to create a model is Figure 4.6 which shows the Total Pedestrian Volume per Ft of Width verses the Bicycle Maximum Speed. This data accounts for pedestrians moving in both directions of the path. This gives a more accurate representation of the overall density of the path. Just as in Model 1, data was selected to represent the highest speed a bicycle could achieve. The model is shown below in Figure 5.2.

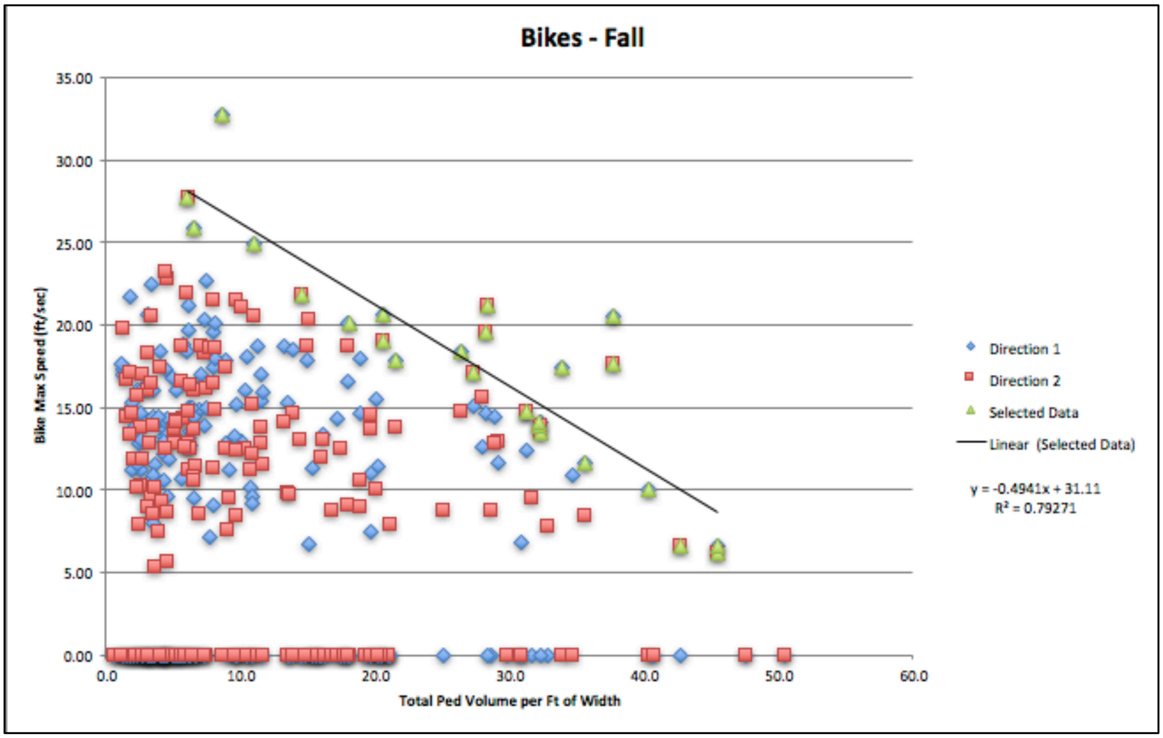

Figure 5.2: Model 2

This model is similar to Model 1 as it is a linear equation with a negative slope. The slope of the equation is -0.4941 and the y-intercept is 31.11. The regression coefficient of this equation is 0.79271. This regression factor is less than the regression factor for Model 1, which is 0.83432. This indicates that Model 1 is a better fit to the respective selected data than Model 2. However, both models can be used to predict the maximum speed of a bicycle based on pedestrian volume and path width. Model 1 and Model 2 are shown below with the input variables shown.

5.2.1 Model 1

$$Maximum\ Bicycle\ Speed = (-0.7652 * \frac{Pedestrian\ Volume}{Path\ Width}) + 30.388$$

Maximum Bicycle Speed is given in feet per second.

Pedestrian Volume is given as the volume in one direction in a fifteen-minute period.

Path Width is given in feet.

5.2.2 Model 2

$$Maximum\ Bicycle\ Speed = \left(-0.4941 * \frac{Total\ Pedestrian\ Volume}{Path\ Width}\right) + 31.11$$

Maximum Bicycle Speed is given in feet per second.

Total Pedestrian Volume is given as the volume in both directions in a fifteen-minute period.

Path Width is given in feet.

5.3 Geometric Characteristic Modeling

The non-physical modeling relies on having pedestrian volume data to input into the model. This is a drawback to using this model if the user does not have pedestrian data available. The user would need to collect pedestrian data at the study locations to be able to use the model. If this is not possible, the second option would be to use a model that only uses geometric variables as inputs. This section will create models based on the grade and width of the path without using pedestrian volumes.

The first model that will be developed will use the grade of the path. As shown in Figure 4.10, there appeared to be no trend difference in the negative grade versus the positive grade. To determine if that is true, the data was fit with best fit lines as shown in Figures 5.3 and 5.4.

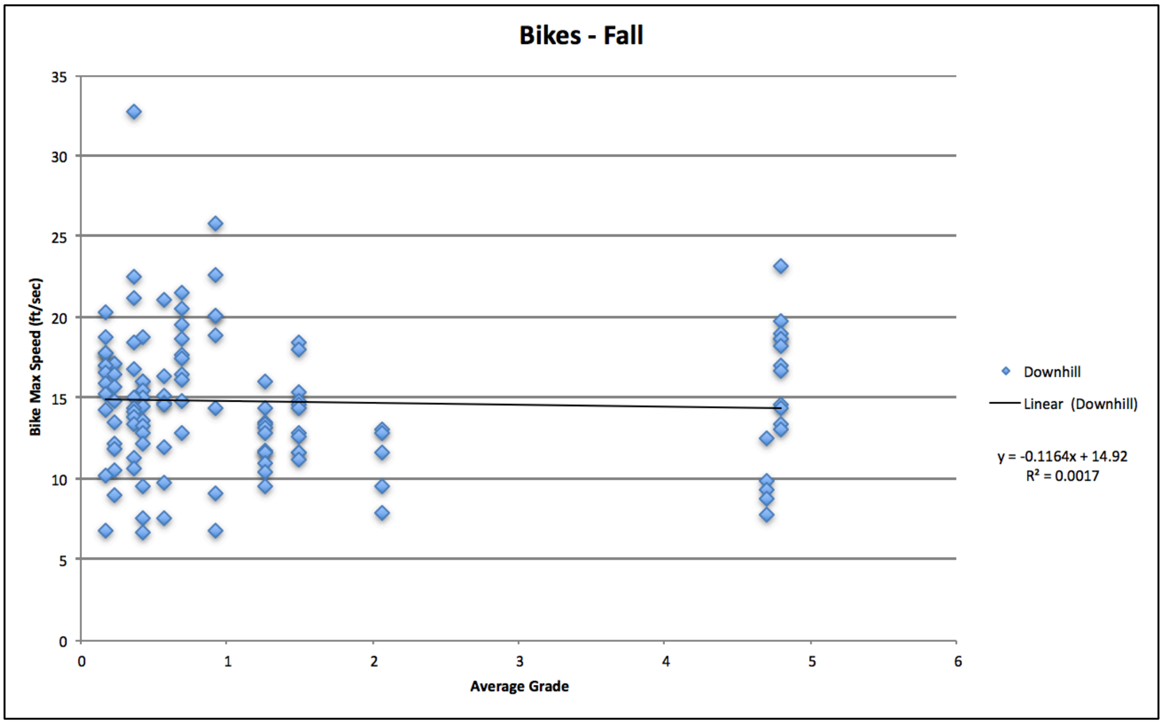

Figure 5.3: Downhill Grade – Best Fit Line

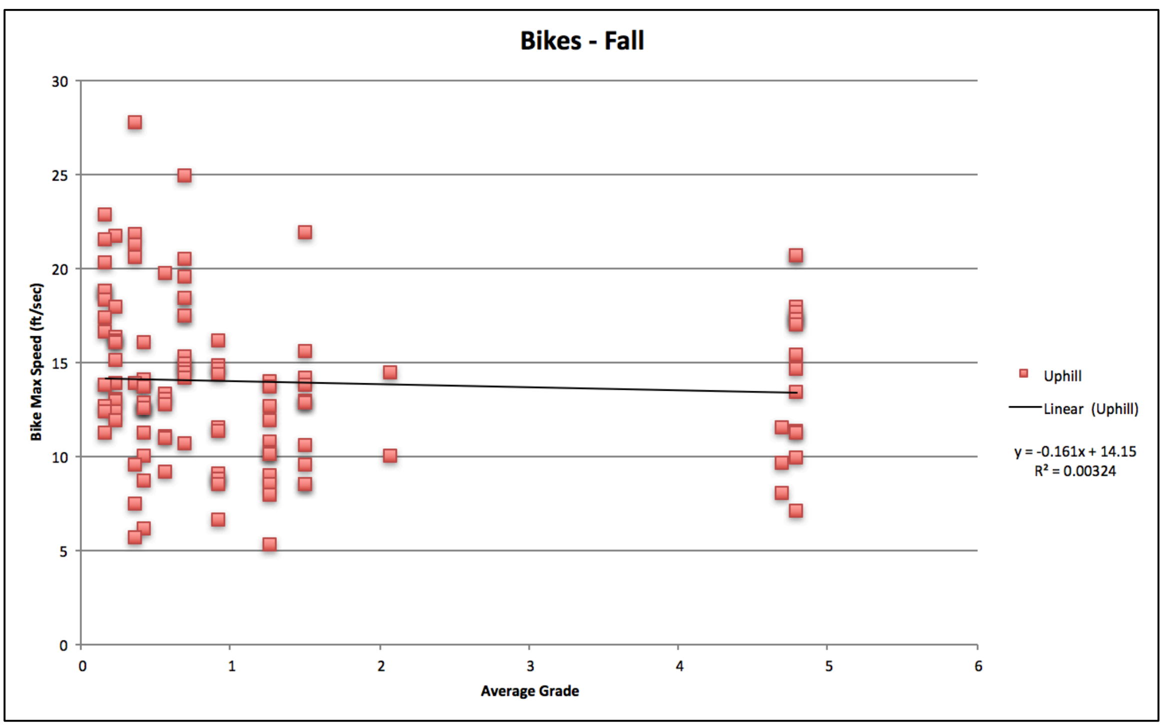

Figure 5.4: Uphill Grade – Best Fit Line

Both the downhill and uphill graphs show negative sloping trends in the data. This means that the grade of the path has the same affect for both negative and positive grades. This is contrary to the assumption made in Section 4.4 stating that downhill paths are faster than uphill paths. The bicycle speeds would increase as the value of the grade increased for downhill grades, and speeds would decrease as the value of the grade increased for uphill grades. This is not what the data shows, as both equations show the Bicycle Maximum Speeds decrease as the values of the grade increases. This makes sense for the uphill paths, but is opposite to the assumption for downhill paths. One possible reason for this is that bicycle users intentionally brake and slow down when traveling on downhill paths. The users know they are going to pick up speed, so they apply the brakes to control their speed. There could be other reasons, but in terms of this data, there is no difference between negative and positive grades. Because of this, the grade will not be used in a path evaluation model.

The path width has already been used as a variable in Models 1 and 2 in conjunction with the pedestrian volume. The path width will now be the sole variable used to model the maximum bicycle speeds. First, a best fit line was graphed based on the entire data set. This is to determine whether the upward trend assumed in Section 4.4 is plausible. The resulting trend line is shown in Figure 5.5.

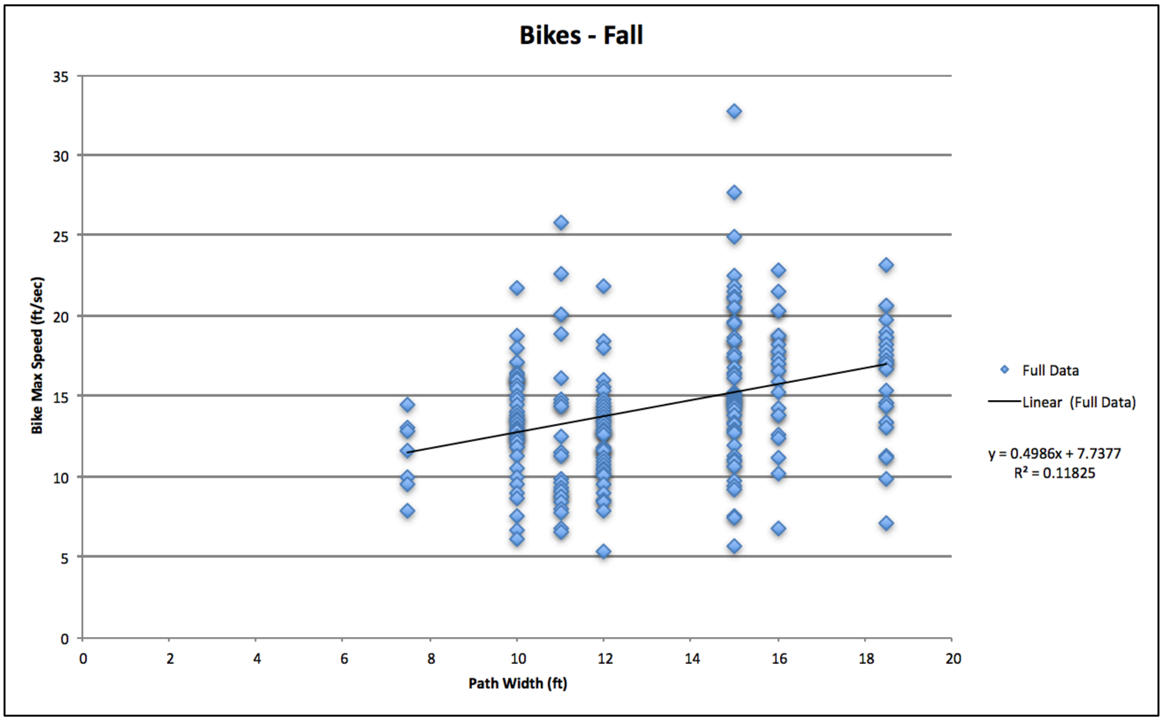

Figure 5.5: Path Width – Best Fit Line

The analysis shows that there is indeed an increasing trend in the Bicycle Maximum Speed as the Path Width increases. The slope of the best fit line is positive (0.4986). The regression coefficient is relatively small (0.11825), but this is expected because the entire data set was fit with a linear equation. This data can now be used to create a model to analyze the non-motorized paths based on the width. To do this, Figure 4.8 was fit using the same method used to develop Models 1 and 2. The highest three values at each path width were selected and then that data was fit with a best fit line. This was done because the model needs to show the maximum possible speed a bicycle can travel at the given width. The results of this analysis are shown below in Figure 5.6.

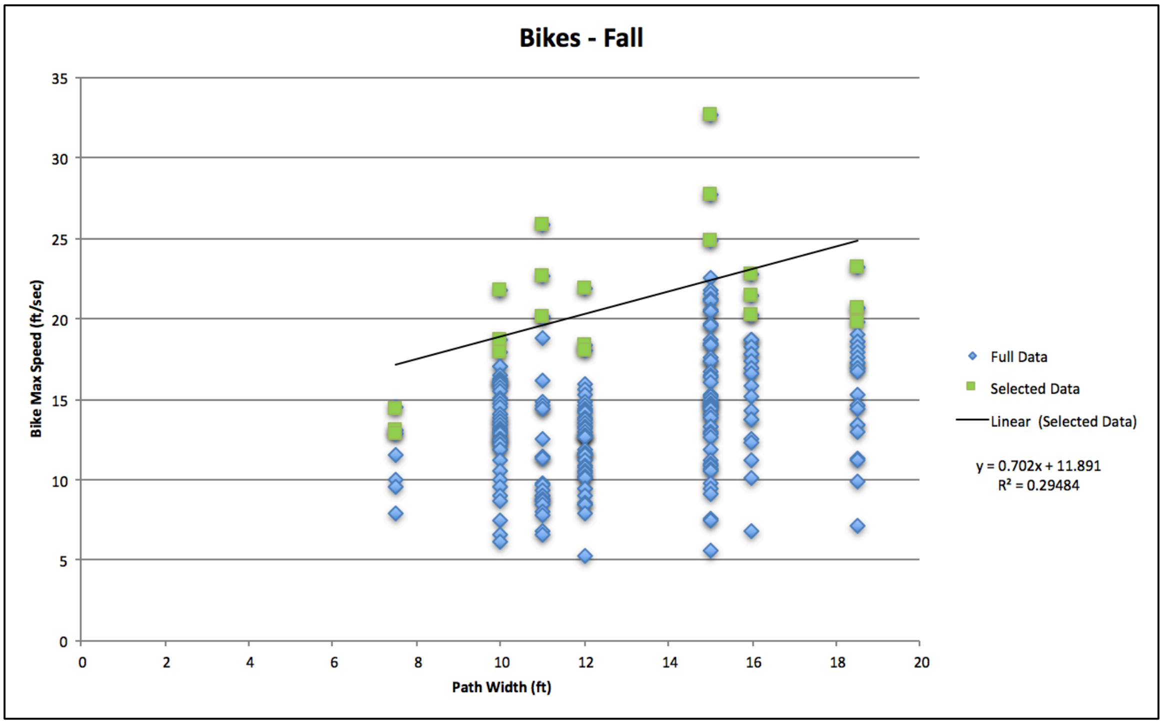

Figure 5.6: Path Width – Top Three Points Best Fit

The selected data was fit with a linear trend line to develop a usable model. This model has an increasing slope of 0.702 and a y-intercept of 11.891. This indicates that the maximum speed a bicycle can achieve increases as the width of the path increases. However, the regression coefficient of 0.29484 is much smaller than for Model 1 and Model 2, which were 0.83432 and 0.79271, respectively. This could be because there were high values at the 15-foot path width. The lower values are closer to the model developed. To see if a better fit can be created, the highest five values at each path width will be selected rather than the highest three. The results of that analysis are shown below in Figure 5.7.

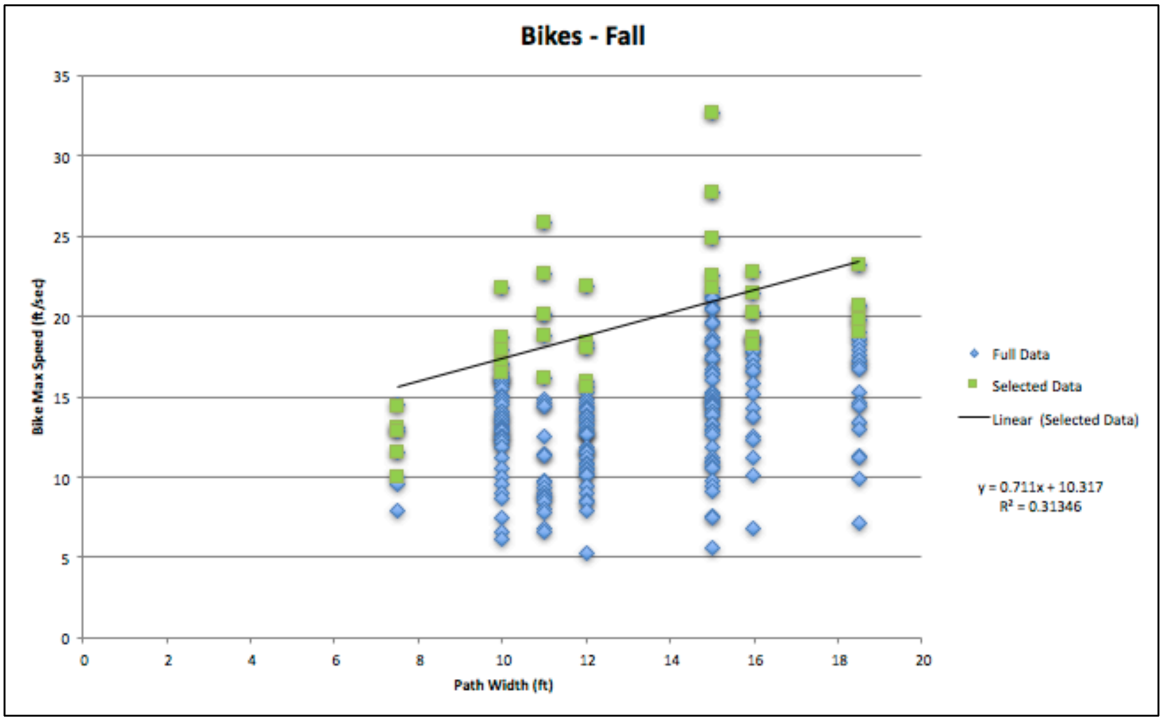

Figure 5.7: Path Width – Top Five Points Best Fit

The top five points linear fit has a slightly better regression coefficient of 0.31346 compared to the previous fit of 0.29484. However, this linear fit yields slower bicycle speeds compared to the three points linear fit. While the regression coefficient is smaller, the three points fit is a more useful model because it gives higher values for the bicycle speeds. This fit will be used as Model 3 to evaluate the non-motorized paths. Model 3 has an advantage over Model 1 and Model 2 because it does not need pedestrian volume data to input into the model. The final model and variables are shown below.

5.3.1 Model 3

$$Maximum\ Bicycle\ Speed = (0.702 * Path\ Width) + \ 11.891$$

Maximum Bicycle Speed is given in feet per second.

Path Width is given in feet.

5.4 Comparing the Models

The results of the three models will now be compared against each other. However, each model requires different inputs. All three models require path width as an input value. Models 1 and 2 require pedestrian volumes as inputs values as well. Model 1 uses the pedestrian volume in one direction of travel, while Model 2 uses the total pedestrian volume in both directions.

A table in Excel was set up to compare the three models to each other using pre-determined input values. The path widths start at 4 ft. and increase in 2 ft. increments up to 20 ft. At each of the path widths, the single direction pedestrian volumes start at 30 users per fifteen-minutes. The number of users increases by 30 and goes up to 300 users per fifteen-minutes. For the total volume, the single direction volume was doubled. So, the total volume starts at 60 users per fifteen-minutes and increases to 600 users per fifteen-minutes. These values are realistic because the path widths on the University of Delaware campus range from 7.5 ft. to 18.5 ft. The highest pedestrian volumes observed were 201 users per fifteen-minutes in one direction and 566 users per fifteen-minutes combined both directions.

Table 5.1: Model Comparison – 4 ft. to 8 ft. Widths

Ped Volume Single Direction (Per 15 mins)	Total Ped Volume Both Directions (Per 15 mins)	Path Width (In Feet)	Model 1	Model 2	Model 3
30	60	4	24.65	23.70	14.70
60	120	4	18.91	16.29	14.70
90	180	4	13.17	8.88	14.70
120	240	4	7.43	1.46	14.70
150	300	4	1.69	-5.95	14.70
180	360	4	-4.05	-13.36	14.70
210	420	4	-9.79	-20.77	14.70
240	480	4	-15.52	-28.18	14.70
270	540	4	-21.26	-35.59	14.70
300	600	4	-27.00	-43.01	14.70
30	60	6	26.56	26.17	16.10
60	120	6	22.74	21.23	16.10
90	180	6	18.91	16.29	16.10
120	240	6	15.08	11.35	16.10
150	300	6	11.26	6.41	16.10
180	360	6	7.43	1.46	16.10
210	420	6	3.61	-3.48	16.10
240	480	6	-0.22	-8.42	16.10
270	540	6	-4.05	-13.36	16.10
300	600	6	-7.87	-18.30	16.10
30	60	8	27.52	27.40	17.51
60	120	8	24.65	23.70	17.51
90	180	8	21.78	19.99	17.51
120	240	8	18.91	16.29	17.51
150	300	8	16.04	12.58	17.51
180	360	8	13.17	8.88	17.51
210	420	8	10.30	5.17	17.51
240	480	8	7.43	1.46	17.51
270	540	8	4.56	-2.24	17.51
300	600	8	1.69	-5.95	17.51

Table 5.2: Model Comparison – 10 ft. to 14 ft. Widths

Ped Volume Single Direction (Per 15 mins)	Total Ped Volume Both Directions (Per 15 mins)	Path Width (In Feet)	Model 1	Model 2	Model 3
30	60	10	28.09	28.15	18.91
60	120	10	25.80	25.18	18.91
90	180	10	23.50	22.22	18.91
120	240	10	21.21	19.25	18.91
150	300	10	18.91	16.29	18.91
180	360	10	16.61	13.32	18.91
210	420	10	14.32	10.36	18.91
240	480	10	12.02	7.39	18.91
270	540	10	9.73	4.43	18.91
300	600	10	7.43	1.46	18.91
30	60	12	28.48	28.64	20.32
60	120	12	26.56	26.17	20.32
90	180	12	24.65	23.70	20.32
120	240	12	22.74	21.23	20.32
150	300	12	20.82	18.76	20.32
180	360	12	18.91	16.29	20.32
210	420	12	17.00	13.82	20.32
240	480	12	15.08	11.35	20.32
270	540	12	13.17	8.88	20.32
300	600	12	11.26	6.41	20.32
30	60	14	28.75	28.99	21.72
60	120	14	27.11	26.87	21.72
90	180	14	25.47	24.76	21.72
120	240	14	23.83	22.64	21.72
150	300	14	22.19	20.52	21.72
180	360	14	20.55	18.40	21.72
210	420	14	18.91	16.29	21.72
240	480	14	17.27	14.17	21.72
270	540	14	15.63	12.05	21.72
300	600	14	13.99	9.93	21.72

Table 5.3: Model Comparison – 16 ft. to 20 ft. Widths

Ped Volume Single Direction (Per 15 mins)	Total Ped Volume Both Directions (Per 15 mins)	Path Width (In Feet)	Model 1	Model 2	Model 3
30	60	16	28.95	29.26	23.12
60	120	16	27.52	27.40	23.12
90	180	16	26.08	25.55	23.12
120	240	16	24.65	23.70	23.12
150	300	16	23.21	21.85	23.12
180	360	16	21.78	19.99	23.12
210	420	16	20.34	18.14	23.12
240	480	16	18.91	16.29	23.12
270	540	16	17.48	14.43	23.12
300	600	16	16.04	12.58	23.12
30	60	18	29.11	29.46	24.53
60	120	18	27.84	27.82	24.53
90	180	18	26.56	26.17	24.53
120	240	18	25.29	24.52	24.53
150	300	18	24.01	22.88	24.53
180	360	18	22.74	21.23	24.53
210	420	18	21.46	19.58	24.53
240	480	18	20.19	17.93	24.53
270	540	18	18.91	16.29	24.53
300	600	18	17.63	14.64	24.53
30	60	20	29.24	29.63	25.93
60	120	20	28.09	28.15	25.93
90	180	20	26.94	26.66	25.93
120	240	20	25.80	25.18	25.93
150	300	20	24.65	23.70	25.93
180	360	20	23.50	22.22	25.93
210	420	20	22.35	20.73	25.93
240	480	20	21.21	19.25	25.93
270	540	20	20.06	17.77	25.93
300	600	20	18.91	16.29	25.93

There are a few observations that should be noted about the comparison tables. The first is that the resulting values in the Model 1, Model 2, and Model 3 columns are bicycle speeds given in feet per second. These speeds are the what that model givens as the maximum possible bicycle speed for the inputs given. The second observation that should be noted is that some of these values are less than the maximum speeds observed in the data collection. This is because the model was fit to selected data points where some values are lower than the linear fit and some are higher than the linear fit. The final observation is that some values the model gives are negative. This occurs when the pedestrian volume is extremely high for the size of the path, and this only happens at the 4-ft. 6-ft, and 8-ft widths. The negative values occur because the models are linear and decrease as the pedestrian density of the path increases. The high volumes on narrow paths create pedestrian densities that may be at jam density or are unrealistic. For these reasons, the Models 1 and 2 result in some negative bicycle speeds at high densities.

5.5 Output Scale

The three models that have been developed all output maximum bicycle speeds for the given path with and pedestrian volumes. These models can be used to evaluate the safety of the non-motorized paths on the University of Delaware campus. To use these models to evaluate the paths, an output scale must be created. The numerical results of the models will fall into safety levels that show how safe or unsafe the non-motorized path is.

The scales will be developed by dividing the simulated outputs into four proportional level of safety. The four levels are given names to represent their safety level. These four levels are Safe, Moderately Safe, Moderately Unsafe, Unsafe. It should be noted that there is always the possibility of a bicycle collision on a non-motorized path. These models are estimating the maximum speed of a bicycle based on the inputs. In Section 4.2, the assumption was made that bicycles traveling at a faster speed have a higher probability of a collision with a pedestrian or other bicycle. It was also assumed that it is more likely the collision is serious the faster the bicycle is traveling. So, the levels created are based on the maximum speed of a bicycle and represent the possibility of a bicycle collision and how serious a bicycle collision would be. The Unsafe level represents a higher likelihood that a bicycle collision will occur compared to the Moderately Unsafe level. The Safe level represents the least likelihood of a bicycle collision. The output values and levels for the models are shown below.

Table 5.4: Levels of Safety

Output Bicycle Speed	Level of Safety
Less than 15.00 ft/s	Safe
15.00 – 19.99 ft/s	Moderately Safe
20.00 – 24.99 ft/s	Moderately Unsafe
25.00 ft/s or greater	Unsafe

The bicycle speeds for the levels of safety were determined by dividing the range of simulated outputs shown in Tables 5.1, 5.2 and 5.3. The majority of the outputs were in the range of 10 to 30 ft/s. There were no simulated outputs that were greater than 30 ft/s. That range was divided into four equal sections, and any outputs less than 10 ft/s were grouped with the Safe level. The levels of safety can be applied to the simulated model outputs in a color-coded representation (Table 5.5). This is shown in Sections 5.5.1, 5.5.2 and 5.5.3.

Table 5.5: Levels of Safety Color Code

Safe
Moderately Safe
Moderately Unsafe
Unsafe

5.5.1 Model 1 Output Values

Table 5.6: Model 1 Output Values

Single Direction	4 ft Path	6 ft Path	8 ft Path	10 ft Path	12 ft Path	14 ft Path	16 ft Path	18 ft Path	20 ft Path
30 Peds	24.65	26.56	27.52	28.09	28.48	28.75	28.95	29.11	29.24
60 Peds	18.91	22.74	24.65	25.80	26.56	27.11	27.52	27.84	28.09
90 Peds	13.17	18.91	21.78	23.50	24.65	25.47	26.08	26.56	26.94
120 Peds	7.43	15.08	18.91	21.21	22.74	23.83	24.65	25.29	25.80
150 Peds	1.69	11.26	16.04	18.91	20.82	22.19	23.21	24.01	24.65
180 Peds	-4.05	7.43	13.17	16.61	18.91	20.55	21.78	22.74	23.50
210 Peds	-9.79	3.61	10.30	14.32	17.00	18.91	20.34	21.46	22.35
240 Peds	-15.52	-0.22	7.43	12.02	15.08	17.27	18.91	20.19	21.21
270 Peds	-21.26	-4.05	4.56	9.73	13.17	15.63	17.48	18.91	20.06
300 Peds	-27.00	-7.87	1.69	7.43	11.26	13.99	16.04	17.63	18.91

5.5.2 Model 2 Output Values

Table 5.7: Model 2 Output Values

Both Directions	4 ft Path	6 ft Path	8 ft Path	10 ft Path	12 ft Path	14 ft Path	16 ft Path	18 ft Path	20 ft Path
60 Peds	23.70	26.17	27.40	28.15	28.64	28.99	29.26	29.46	29.63
120 Peds	16.29	21.23	23.70	25.18	26.17	26.87	27.40	27.82	28.15
180 Peds	8.88	16.29	19.99	22.22	23.70	24.76	25.55	26.17	26.66
240 Peds	1.46	11.35	16.29	19.25	21.23	22.64	23.70	24.52	25.18
300 Peds	-5.95	6.41	12.58	16.29	18.76	20.52	21.85	22.88	23.70
360 Peds	-13.36	1.46	8.88	13.32	16.29	18.40	19.99	21.23	22.22
420 Peds	-20.77	-3.48	5.17	10.36	13.82	16.29	18.14	19.58	20.73
480 Peds	-28.18	-8.42	1.46	7.39	11.35	14.17	16.29	17.93	19.25
540 Peds	-35.59	-13.36	-2.24	4.43	8.88	12.05	14.43	16.29	17.77
600 Peds	-43.01	-18.30	-5.95	1.46	6.41	9.93	12.58	14.64	16.29

5.5.3 Model 3 Output Values

Table 5.8: Model 3 Output Values

	4 ft Path	6 ft Path	8 ft Path	10 ft Path	12 ft Path	14 ft Path	16 ft Path	18 ft Path	20 ft Path
All Ped Volumes	14.70	16.10	17.51	18.91	20.32	21.72	23.12	24.53	25.93

5.6 Results Summary

The models developed provide three important tools in evaluating the safety of non-motorized paths on college campuses. It was established in this thesis that the safety of these paths is determined by the speed of bicycles on the path. There are two assumptions that were made that support this statement. The first is that bicycles traveling at faster speeds are more likely to collide with a pedestrian or another bicycle. The second is that the faster a bicycle is moving, the more serious a collision will be. Because bicycle speeds are used to determine the safety of the path, the models output bicycle speeds in feet per second.

The models were created by fitting selected data from graphs developed in Chapter 4. The data selected were the highest bicycle speeds as the independent variable increased in the graph. This was done because the model should represent how fast a bicycle could travel on the path in the given conditions. Fitting the entire data set would model the average bicycle speed. In some cases, there were observed bicycle speeds that were greater than the model prediction. This is because the data was fit linearly, so some data points are higher than the model and some are lower. The data points that are higher are extreme cases.

Each model requires different path characteristics to input. All three of the models use the Path Width as an input variable, which is a geometric feature of the path. Model 1 also uses Pedestrian Volume in a single direction of travel that is given in number of users in a fifteen-minute period. Model 2 uses the Total Pedestrian Volume which is the number of users in both directions of travel in a fifteen-minute period. These models require pedestrian data to be obtained or collected in order to run the models, which could be a disadvantage. However, an advantage of these models is they can be more accurate because inputting the pedestrian volumes yields a more accurate representation of the path. Model 3 only uses the Path Width as an input variable. The advantage of Model 3 is that only the width of the path needs to be measured to run the model.

The models were compared by simulating pedestrian and path width variables. Each model was run with the simulated data and the output values were shown. A rating scale was developed to rate the non-motorized paths on their safety. The rating scale is dependent on the output bicycle speed. The rating scale consists of four levels of safety that convert the output value to a certain safety level, giving a verbal representation of the safety of the path. The four levels of safety are Safe, Moderately Safe, Moderately Unsafe, and Unsafe. These levels represent the likelihood of a bicycle collision on a non-motorized path under the given conditions.

Chapter 6

GIS APPLICATIONS

6.1 Display Applications

Geographic Information Systems are able to display the model results on a visually appealing map that is easy for viewers to understand. This allows for simple displays when evaluating the safety of non-motorized paths around the campus. It gives a color-coded representation using the color scheme shown in Chapter 5. The maps created can be displayed for planners and designs who can work to improve the safety of non-motorized paths. The maps identify key areas that are more dangerous than others on campus.

6.1.1 Study Segment Results

Using only the path width, the study segments can be input into Model 3 to determine the levels of safety. The other two models can be used as well, however a pedestrian volume must be chosen and input into the model along with the path width. The results of Model 3 using the 12 study segments are shown in the following table.

Table 6.1: Model 3 – Study Segment Outputs

	Width (ft)	Model 3 Output (ft/s)
Harrington Turf Path	12	20.31
Elliot Hall Path	7.5	17.15
Trabant Path	18.5	24.87
North Green, Sharp Hall Path	15	22.42
Kirkbride Path	11	19.61
North Green, Gore Hall Path	15	22.42
Mitchell Hall Path	12	20.31
North Green, Crossing Path	10	18.91
Evans Hall Path	10	18.91
Mentor's Circle Path	15	22.42
Allison Hall Path	11	19.61
Perkins Path	16	23.12

Five of the study segments fall into the Moderately Safe level of safety, while the remaining seven fall into the Moderately Unsafe level of safety. None of the paths studied are determined to be Safe or Unsafe. However, this is only using the outputs from Model 3. If pedestrian data is used, then Model 1 or Model 2 are also able to be used.

These results from Model 3 can then be displayed on a map using the ArcMap program. The color-coded study segments are created as a layer and are overlaid on top of satellite imagery of the campus. A sidewalks layer obtained from the State of Delaware First Map website is also overlaid onto the satellite imagery to show all of the paths on campus. The sidewalks layer includes both sidewalks next to roads and walking paths around campus that are defined as non-motorized paths. This map is show in the following figure.

Results: Model 3

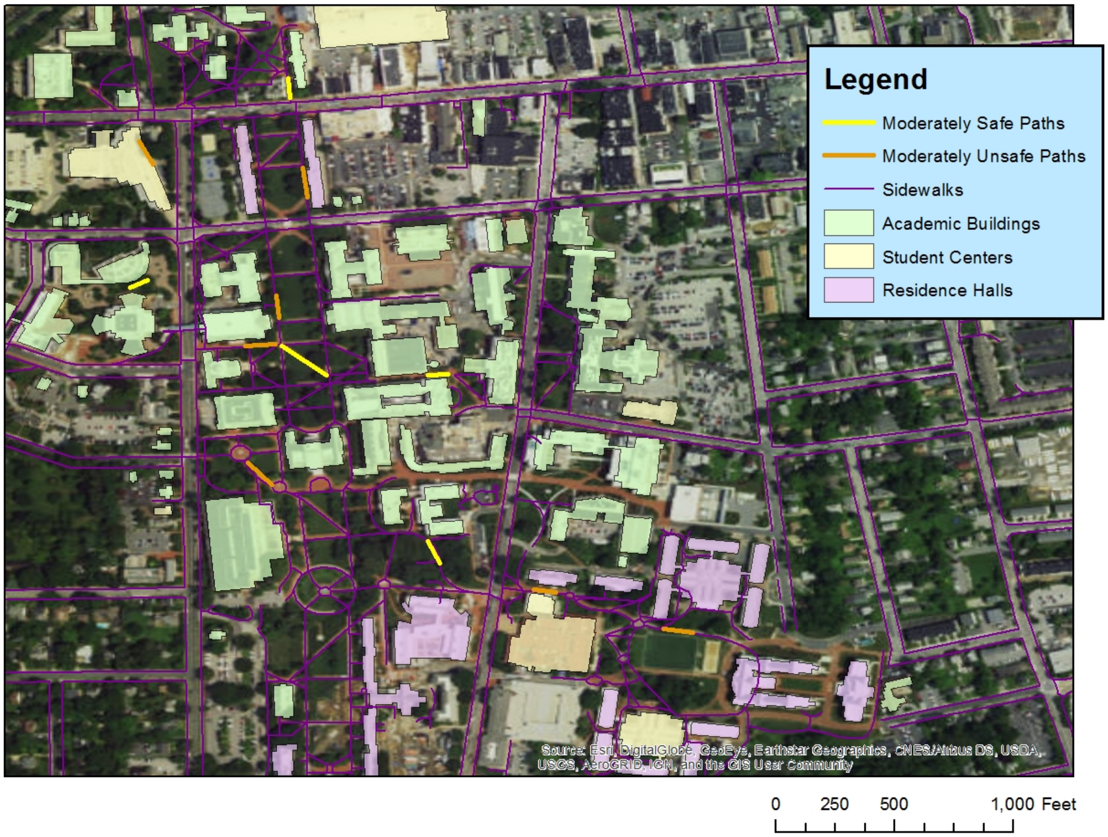

Figure 6.1: Model 3 – Study Segment Map

The GIS map is an easy visual representation of the results from Model 3. The viewer can determine what non-motorized paths fall into each level of safety using the color scheme.

6.2 Additional Data Applications

The sidewalk shapefile from the State of Delaware First Map website does not contain width data for the non-motorized paths on the University of Delaware campus. However, if a shapefile were created or obtained with the path width data, creating a level of safety map for the entire campus would be possible. This would help the University planners and designers create a safer non-motorized path network.

6.3 GIS Applications Summary

The Geographic Information Systems provide a way to create visual representations of the model outputs. The maps created are visual appearing and help identify critical areas on campus that the model determines are unsafe. Identifying critical areas is very important for the improvement of the non-motorized path network.

Chapter 7

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

7.1 Study Summary

Non-motorized paths have not been studied in much detail, therefore the behavior pedestrians and bicycles exhibit is relatively unknown. It is even more unknown for non-motorized paths located on college campuses. However, the motivation for studying these paths on college campuses is apparent, following a fatal collision between a pedestrian and a bicycle on the University of Delaware campus in the fall of 2015. Understanding how pedestrians and bicycles behave on non-motorized paths is the key to identifying dangerous locations and improving the safety of the network.

Collecting pedestrian and bicycle data was the first step in this study because there was no data available for the University of Delaware campus. The extensive data collection process during the summer and fall of 2016 collected 66 hours of data on 12 study segments around campus. The collection process yielded volume and speed data for pedestrians and bicycles on the study segments from Monday to Friday. These collections were done during the middle of the day for two-hour periods to capture the change of classes. Once the data was collected, it was input into Excel for further analysis.

The analysis of the data was done in Excel by comparing different variables to each other. The bicycle was the most important variable because it determined how safe or unsafe the path was. This is because the assumption was made that the faster a bicyclist is traveling, the more likely they are to collide with a pedestrian or another bicycle. Also, it was assumed that the faster a bicycle a traveling, the more serious a collision would be. Because of these assumptions, the conclusion was made the bicycle speed determines the safety of the non-motorized path.

With this conclusion, models were developed by selecting data from the analysis to fit with best-fit lines. Three models were developed that used pedestrian volumes and path widths as input data, and output maximum bicycle speeds. The output was assumed to be the maximum speed a bicycle could travel on that path under the input conditions. A rating scale was then developed for the outputs that determined the level of safety of the path. The scale had four categories: Safe, Moderately Safe, Moderately Unsafe, and Unsafe.

These models were applied to the study non-motorized paths on the University of Delaware campus with the appropriate input data. The results of the models were displayed on a GIS map that is visually appealing to a viewer. The paths were color coded based on their level of safety, so it is easy to observe problematic areas of the network. This technique can be applied to the entire campus network of non-motorized paths to study the whole system. This can then be used by planners and designers to identify areas that need upgrading and improve the overall safety of the non-motorized path system.

7.2 Conclusions

There are several conclusions that can be made from this non-motorized path analysis. These conclusions are based on the data collected and analyzed from the University of Delaware campus.

- Pedestrian density of a path is a major factor in the maximum speed bicyclists can achieve.
- The wider the path, the higher the maximum speed is that a bicyclist can obtain. This is because a wider path width decreases the pedestrian density.
- The grade of the path has little effect on bicycle speeds.

At the beginning of this thesis, there were three objectives that were laid out with the goal of providing tools to improve the safety of non-motorized paths on college campuses. The three objectives were as follows:

7.2.1 Objective 1: Collect data on selected non-motorized paths on the University of Delaware Newark campus

This objective was clearly met with an extensive data collection process taking place. The data collection process collected 66 hours of pedestrians and bicycle speed and volume data. This database of information can be used for additional studies relating to non-motorized path research.

7.2.2 Objective 2: Design a model based on geometric variables of the non-motorized path as well as non-physical variables such as speed and density of users

This objective was also met as three models were developed to evaluate non-motorized paths. Both geometric and non-physical variables were used in the development and as input values.

7.2.2.1 Model 1

Model 1 uses the width of the path and the volume of pedestrians in one direction as input variables.

$$Maximum\ Bicycle\ Speed = (-0.7652 * \frac{Pedestrian\ Volume}{Path\ Width}) + 30.388$$

Maximum Bicycle Speed is given in feet per second.

Pedestrian Volume is given as the volume in one direction in a fifteen-minute period.

Path Width is given in feet.

7.2.2.2 Model 2

Model 2 uses the width of the path and the total volume of pedestrians in both directions as input variables.

$$Maximum\ Bicycle\ Speed = \left(-0.4941 * \frac{Total\ Pedestrian\ Volume}{Path\ Width}\right) + \ 31.11$$

Maximum Bicycle Speed is given in feet per second.

Total Pedestrian Volume is given as the volume in both directions in a fifteen-minute period.

Path Width is given in feet.

7.2.2.3 Model 3

Model 3 uses only the width of the path as an input variable.

$$Maximum\ Bicycle\ Speed = (0.702 * Path\ Width) + 11.891$$

Maximum Bicycle Speed is given in feet per second.

Path Width is given in feet.

7.2.3 Objective 3: Create an output value and scale that will determine the safety of locations on non-motorized paths

This objective was also met with the level of safety output scale. This scale rated the outputs of the models and determined the level of safety the output fell into. The scale is divide into four categories that show the safety of the non-motorized path in question.

7.3 Outside User Applications

An advantage of this analysis is that it can be used by other universities and planners to study non-motorized path networks. Other universities can apply this analysis in two ways. The first way would be to collect data on their own campus and run the models using the data collected. This process is more time consuming and requires extensive data collection. The minimum data needed would be path width data, but to do a full analysis using all three of the models, pedestrian volume data would need to be collected. This collection process can be very resource and time consuming. However, the method would be very useful for university planners to analyze the safety of the non-motorized path network.

The second way other universities can apply this analysis is by simply applying the findings directly to their planning. This analysis has shown that path width and pedestrian density are the major factors in bicycle speeds. Wider paths offer more space for bicycles to build up speed and can make the path unsafe. Narrower paths with higher pedestrian densities can keep bicycles at lower speeds and increase the level of safety. Planners can use these findings and apply them directly to improving their non-motorized path network.

7.4 Recommendations

The data collection, analysis, and models developed are useful tools to study the non-motorized paths on the University of Delaware campus. These tools can also be applied to other suburban universities that have similar campus traits, as discussed in the previous section. However, with three models developed, it is difficult to say which is the "best" at evaluating the safety of non-motorized paths. All three of the models have their advantages and disadvantages as explained in section 5.6. Model 3 is easier to use since it only uses path width as an input. However, Model 1 and Model 2 are more accurate because they use pedestrian volume data as well as path width. Model 2 uses pedestrian data for both directions on the path, which is an advantage over Model 1 because both directions gives a more accurate pedestrian density. So, if pedestrian data is available, Model 2 is the most accurate and useful model.

However, one disadvantage of Model 2 is how to determine what pedestrian volume to input into the model. Since the pedestrian volume of the path fluctuates throughout the day so drastically, it is difficult to determine what volume to input to evaluate the path. There are several options that could be done. The first is that a mean or median of the pedestrian volumes could be calculated and then input. This gives an average level of safety of the path. Another option would be to use peak or off-peak flow volumes, just as vehicles on roads are studied for level of service. For the non-motorized paths, level of safety can be calculated during peak flow periods and off-peak flow periods. Model 2 allows for the flexibility to calculate the level of safety at different times of the day based on the different pedestrian volumes.

After the paths are evaluated for their level of safety, planners and designers can work to improve the safety in key areas. The results of this analysis show that maximum bicycle speed is determined by a number of factors and is a key component in the overall safety of a non-motorized path. Therefore, planners and designers should focus on ways to reduce bicycle speeds on campus.

7.4.1 Bicycle Speed Control Devices

There are several speed control devices that could be used to help reduce bicycle speeds on college campuses. These have the same general purpose as traffic calming devices that are used on roadways to slow down motor vehicles. Some of these devices have been implemented in practice in some areas around the world, but some are possible ideas that could be used.

7.4.1.1 Signs

Signs are a very common use of traffic control devices that are used on both roadways and non-motorized paths. Speed limit signs are obviously used on roadways to control motor vehicle speeds. However, speed limit signs may not work on non-motorized paths because most bicyclists don't know how fast they are going. Another option would be to install "Slow Biking" signs. These signs could make bicycle users think about their speed and consciously slow down. A benefit to using signs as a speed control device is they do not get in the way of the flow of pedestrians or bicycles. They would be placed outside the traveled way where they can be seen by bicycles.

7.4.1.2 Speed Bumps

Speed bumps and speed humps are common on roadways to slow down vehicles. They have also been used for bicycles on a smaller scale. In Portland Oregon, speed bumps were installed on a bike lane on the side of the road (Maus, 2013). The bumps, that look more like rumble strips, are placed next to a roadway where the bike lane transitions to a shared use path with pedestrians. The goal is to alert the bicyclists that they are entering an area with pedestrians and need to slow down. The bumps had mixed reviews from bicycle users when first implemented. Some people were not happy about having to ride over bumps in the bike lane. This device could be affective, but also be unpopular with the public. Speed bumps could also be unpopular because they would be placed in the same traveled way as pedestrians unless a separate bicycle lane is created. Speed bumps installed on the same path where pedestrians walk could be more dangerous for pedestrians or simply uncomfortable. They would also affect people in wheelchairs. Speed bumps would need to be placed in bicycle only lanes.

7.4.1.3 Path Width

The width of the path is shown to affect bicycle speeds because of the pedestrian density. As the pedestrian density increases, the speed of bicycle decreases. Therefore, narrower paths are safer than wider paths. This can also have the same effect as lane narrowing that is used on roadways. The road narrows so drivers slow down because it is uncomfortable to drive through a narrow section at a fast speed. The same effect could happen with bicycles.

7.5 Moving Forward

The bicycle speed control devices that were previously mentioned all have the potential to reduce bicycle speeds and improve the safety of non-motorized paths. These devices can be studied in the field to see if they indeed reduce bicycle speeds, and if so, by how much. To be studied, they can be temporarily installed in a location on campus, and data can be collected using the same method that was used to collect the data for this thesis. The speeds of bicycles with the certain devices can be compared to the speeds in the same location at the same time of day. The studies would need to be done on the same day of the week to minimize other variables. If any of the devices prove successful, they can be implemented around campus permanently. The devices implemented could help improve the overall safety of the non-motorized path network.

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Appendix A

DATA COLLECTION SHEETS

Volume Data Collection Sheet **Non-Motorized Path**

Location Name: ______________________________ Location Number:________ Collection Time: ______________

Date: ______________ Weather: Sunny Cloudy Rainy Foggy Sun/Cloud Mix

Collector Name(s):____

	Direction: _______________		Direction: _______________				
Time (15 Minute Period)	Pedestrian Volume	Bicycle Volume	Pedestrian Volume	Bicycle Volume	Crossing Pedestrian	Crossing Bicycle	Conflict

Speed Data Collection Sheet **Non-Motorized Path**

Location Name: ______________________________ Location Number:________ Collection Time: ______________

Date: ______________ Weather: Sunny Cloudy Rainy Foggy Sun/Cloud Mix

Collector Name(s):____

Collection Segment Description: ____

	Direction: ______________		Direction: ______________	
Time (15 Minute Period)	Pedestrian Times (seconds)	Bicycle Times (seconds)	Pedestrian Times (seconds)	Bicycle Times (seconds)

Appendix B

FULL DATA SHEETS

Location Name	#	Width (ft)	Avg Grade (%)	Avg Cross Slope (%)	Horiz. Curve	Seg. ID	Date	Weather	Time	Direction #1	Ped Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Bike Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Direction #2	Ped Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Bike Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Crossing Ped	Crossing Bike	Conflict
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	1	7/25/16	Sunny	11:30:00 AM	EB (To Clbrn)	8	4.09	4.95	6.43	2	6.72	8.98	11.25	WB (To Grn)	14	3.33	4.39	5.42	0	0.00	0.00	0.00	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	2	7/25/16	Sunny	11:45:00 AM	EB (To Clbrn)	11	4.25	4.71	5.06	1	12.50	12.50	12.50	WB (To Grn)	11	2.33	3.82	4.41	4	10.47	10.47	10.47	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	3	7/25/16	Sunny	12:00:00 PM	EB (To Clbrn)	19	3.49	4.47	5.77	0	0.00	0.00	0.00	WB (To Grn)	13	2.16	3.83	4.55	1	13.24	13.24	13.24	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	4	7/25/16	Sunny	12:15:00 PM	EB (To Clbrn)	9	3.63	4.46	5.29	2	12.16	12.51	12.86	WB (To Grn)	7	3.88	4.13	4.29	0	0.00	0.00	0.00	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	5	7/25/16	Sunny	12:30:00 PM	EB (To Clbrn)	15	3.31	4.23	4.74	0	0.00	0.00	0.00	WB (To Grn)	9	3.85	4.26	4.64	0	0.00	0.00	0.00	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	6	7/25/16	Sunny	12:45:00 PM	EB (To Clbrn)	11	3.57	4.36	6.08	0	16.07	16.07	16.07	WB (To Grn)	8	3.66	3.92	4.13	1	0.00	0.00	0.00	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	7	7/25/16	Sunny	1:00:00 PM	EB (To Clbrn)	13	3.95	4.32	5.06	1	9.78	9.78	9.78	WB (To Grn)	22	4.02	4.51	4.95	1	14.06	14.06	14.06	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	8	7/25/16	Sunny	1:15:00 PM	EB (To Clbrn)	15	3.63	4.46	4.84	1	18.75	18.75	18.75	WB (To Grn)	16	4.17	5.40	10.71	2	15.00	15.00	15.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	9	7/26/16	Sunny	11:30:00 AM	NB (To Main St)	36	3.73	4.42	4.94	0	0.00	0.00	0.00	SB (To Del Av)	10	3.70	4.48	4.92	0	0.00	0.00	0.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	10	7/26/16	Sunny	11:45:00 AM	NB (To Main St)	24	3.73	4.33	5.44	2	11.68	14.52	17.35	SB (To Del Av)	18	4.23	7.44	14.75	2	13.11	16.56	20.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	11	7/26/16	Sunny	12:00:00 PM	NB (To Main St)	109	3.66	6.37	19.34	0	0.00	0.00	0.00	SB (To Del Av)	11	3.49	4.66	5.54	1	0.00	0.00	0.00	1	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	12	7/26/16	Sunny	12:15:00 PM	NB (To Main St)	50	3.89	4.59	5.44	2	8.94	8.94	8.94	SB (To Del Av)	21	3.93	4.59	5.44	0	0.00	0.00	0.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	13	7/26/16	Sunny	12:30:00 PM	NB (To Main St)	29	3.69	4.31	5.22	0	0.00	0.00	0.00	SB (To Del Av)	28	3.51	4.54	4.98	0	0.00	0.00	0.00	1	1	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	14	7/26/16	Sunny	12:45:00 PM	NB (To Main St)	29	3.66	4.56	5.54	1	31.05	31.05	31.05	SB (To Del Av)	31	3.27	4.94	5.81	0	0.00	0.00	0.00	1	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	15	7/26/16	Sunny	1:00:00 PM	NB (To Main St)	40	2.91	4.01	4.78	0	0.00	0.00	0.00	SB (To Del Av)	87	3.31	5.42	9.59	1	11.13	11.13	11.13	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	16	7/26/16	Sunny	1:15:00 PM	NB (To Main St)	27	3.65	4.37	5.54	0	0.00	0.00	0.00	SB (To Del Av)	57	3.63	5.23	9.59	0	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	17	7/27/16	Sunny	11:30:00 AM	NB (To Del Av)	10	4.50	4.72	4.90	0	0.00	0.00	0.00	SB (To Mem)	28	3.56	4.08	4.59	1	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	18	7/27/16	Sunny	11:45:00 AM	NB (To Del Av)	35	3.51	4.32	5.18	1	12.86	12.86	12.86	SB (To Mem)	13	3.81	4.32	5.03	1	16.36	16.36	16.36	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	19	7/27/16	Sunny	12:00:00 PM	NB (To Del Av)	18	3.75	4.10	4.59	0	0.00	0.00	0.00	SB (To Mem)	10	3.41	4.52	5.33	0	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	20	7/27/16	Sunny	12:15:00 PM	NB (To Del Av)	19	3.81	4.46	5.26	0	0.00	0.00	0.00	SB (To Mem)	16	3.58	4.46	5.29	1	14.40	14.40	14.40	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	21	7/27/16	Sunny	12:30:00 PM	NB (To Del Av)	10	3.85	4.30	5.11	1	18.00	18.00	18.00	SB (To Mem)	33	3.75	4.27	5.14	2	13.85	19.34	24.83	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	22	7/27/16	Sunny	12:45:00 PM	NB (To Del Av)	25	4.24	4.58	5.22	1	11.43	11.43	11.43	SB (To Mem)	22	3.83	4.59	5.45	0	0.00	0.00	0.00	2	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	23	7/27/16	Sunny	1:00:00 PM	NB (To Del Av)	14	3.10	4.56	9.00	1	0.00	0.00	0.00	SB (To Mem)	35	3.29	4.96	10.00	0	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	24	7/27/16	Sunny	1:15:00 PM	NB (To Del Av)	11	4.26	6.14	9.47	0	0.00	0.00	0.00	SB (To Mem)	36	3.24	3.97	4.71	0	0.00	0.00	0.00	0	0	0
Mitchell Hall Path	7	12	1.50 EB To Grn	1.50 SB	-	25	8/1/16	Cloudy	11:30:00 AM	EB (To Green)	7	3.54	4.01	4.49	1	11.95	11.95	11.95	WB (To S Coll)	5	4.07	4.28	4.62	0	0.00	0.00	0.00	0	0	0
Mitchell Hall Path	7	12	1.50 EB To Grn	1.50 SB	-	26	8/1/16	Cloudy	11:45:00 AM	EB (To Green)	8	3.22	4.83	7.93	0	0.00	0.00	0.00	WB (To S Coll)	4	4.82	4.94	5.05	1	17.04	17.04	17.04	0	0	0
Mitchell Hall Path	7	12	1.50 EB To Grn	1.50 SB	-	27	8/1/16	Cloudy	12:00:00 PM	EB (To Green)	3	4.30	4.38	4.47	0	0.00	0.00	0.00	WB (To S Coll)	15	2.53	4.10	5.38	0	0.00	0.00	0.00	0	0	0
Mitchell Hall Path	7	12	1.50 EB To Grn	1.50 SB	-	28	8/1/16	Cloudy	12:15:00 PM	EB (To Green)	7	3.98	4.65	5.08	2	13.33	19.10	24.86	WB (To S Coll)	1	0.00	0.00	0.00	2	9.48	12.04	14.60	0	0	0
Mitchell Hall Path	7	12	1.50 EB To Grn	1.50 SB	-	29	8/1/16	Cloudy	12:30:00 PM	EB (To Green)	9	4.13	4.83	6.01	3	8.07	11.94	14.60	WB (To S Coll)	3	3.30	3.87	4.44	1	12.96	12.96	12.96	0	0	0
Mitchell Hall Path	7	12	1.50 EB To Grn	1.50 SB	-	30	8/1/16	Cloudy	12:45:00 PM	EB (To Green)	1	4.42	4.42	4.42	0	0.00	0.00	0.00	WB (To S Coll)	6	3.18	3.87	4.42	0	0.00	0.00	0.00	0	0	0
Mitchell Hall Path	7	12	1.50 EB To Grn	1.50 SB	-	31	8/1/16	Cloudy	1:00:00 PM	EB (To Green)	10	1.35	4.54	8.60	0	0.00	0.00	0.00	WB (To S Coll)	6	3.65	3.86	4.07	1	12.11	12.11	12.11	0	0	0
Mitchell Hall Path	7	12	1.50 EB To Grn	1.50 SB	-	32	8/1/16	Cloudy	1:15:00 PM	EB (To Green)	14	3.45	4.07	4.87	0	0.00	0.00	0.00	WB (To S Coll)	9	3.52	4.03	5.11	0	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	33	8/2/16	Cloudy	11:30:00 AM	WB (To Gore)	8	3.63	3.79	3.99	4	8.00	10.63	14.67	EB (To Brown)	2	5.52	5.52	5.52	2	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	34	8/2/16	Cloudy	11:45:00 AM	WB (To Gore)	5	3.87	4.28	4.50	6	6.54	6.85	7.15	EB (To Brown)	7	4.12	4.41	4.82	1	16.76	16.76	16.76	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	35	8/2/16	Cloudy	12:00:00 PM	WB (To Gore)	3	3.74	4.49	5.04	1	15.30	15.30	15.30	EB (To Brown)	0	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	36	8/2/16	Cloudy	12:15:00 PM	WB (To Gore)	3	3.69	4.47	5.25	1	17.96	17.96	17.96	EB (To Brown)	6	3.67	4.14	4.48	0	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	37	8/2/16	Cloudy	12:30:00 PM	WB (To Gore)	3	4.32	4.61	4.81	0	0.00	0.00	0.00	EB (To Brown)	1	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	38	8/2/16	Cloudy	12:45:00 PM	WB (To Gore)	6	2.51	3.99	4.84	2	14.08	23.04	32.00	EB (To Brown)	2	4.27	4.31	4.36	1	16.15	16.15	16.15	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	39	8/2/16	Cloudy	1:00:00 PM	WB (To Gore)	4	2.44	3.76	4.72	2	9.21	11.94	14.67	EB (To Brown)	1	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	40	8/2/16	Cloudy	1:15:00 PM	WB (To Gore)	0	0.00	0.00	0.00	1	13.33	13.33	13.33	EB (To Brown)	5	3.34	4.60	5.59	0	0.00	0.00	0.00	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	41	8/3/16	Sunny	11:30:00 AM	NB (To Ment)	4	3.64	4.24	4.74	1	0.00	0.00	0.00	SB (To Lib)	9	3.64	3.64	3.64	0	12.21	12.21	12.21	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	42	8/3/16	Sunny	11:45:00 AM	NB (To Ment)	17	3.42	3.42	3.42	1	0.00	0.00	0.00	SB (To Lib)	8	3.84	4.58	5.02	0	11.65	11.65	11.65	0	1	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	43	8/3/16	Sunny	12:00:00 PM	NB (To Ment)	44	3.62	4.34	5.10	0	12.96	12.96	12.96	SB (To Lib)	12	3.75	3.77	3.79	2	0.00	0.00	0.00	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	44	8/3/16	Sunny	12:15:00 PM	NB (To Ment)	66	3.92	4.40	4.98	0	11.24	11.24	11.24	SB (To Lib)	16	2.85	3.48	4.11	1	0.00	0.00	0.00	0	0	0

Location Name	#	Width (ft)	Avg Grade (%)	Avg Cross Slope (%)	Horiz. Curve	Seg. ID	Date	Weather	Time	Direction #1	Ped Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Bike Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Direction #2	Ped Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Bike Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Crossing Ped	Crossing Bike	Conflict
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	45	8/3/16	Sunny	12:30:00 PM	NB (To Ment)	6	3.22	4.19	4.74	1	0.00	0.00	0.00	SB (To Lib)	8	3.88	3.88	3.88	0	12.45	12.45	12.45	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	46	8/3/16	Sunny	12:45:00 PM	NB (To Ment)	30	2.22	3.74	5.67	0	20.82	20.82	20.82	SB (To Lib)	27	3.58	4.12	4.57	1	0.00	0.00	0.00	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	47	8/3/16	Sunny	1:00:00 PM	NB (To Ment)	12	3.51	4.24	4.74	1	0.00	0.00	0.00	SB (To Lib)	6	4.25	4.62	4.87	0	18.41	18.41	18.41	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	48	8/3/16	Sunny	1:15:00 PM	NB (To Ment)	10	3.26	4.28	5.29	3	0.00	0.00	0.00	SB (To Lib)	9	2.74	3.83	4.92	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	49	8/9/16	Sunny	11:30:00 AM	NB (To Main St)	1	5.00	5.00	5.00	0	0.00	0.00	0.00	SB (To Del Av)	1	4.13	4.13	4.13	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	50	8/9/16	Sunny	11:45:00 AM	NB (To Main St)	1	3.65	3.65	3.65	0	0.00	0.00	0.00	SB (To Del Av)	3	3.96	4.35	4.75	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	51	8/9/16	Sunny	12:00:00 PM	NB (To Main St)	3	4.32	4.69	5.00	1	23.75	23.75	23.75	SB (To Del Av)	2	4.52	4.64	4.75	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	52	8/9/16	Sunny	12:15:00 PM	NB (To Main St)	7	3.80	4.73	5.59	0	0.00	0.00	0.00	SB (To Del Av)	1	4.32	4.32	4.32	4	11.88	15.86	19.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	53	8/9/16	Sunny	12:30:00 PM	NB (To Main St)	4	3.65	4.23	5.00	1	31.67	31.67	31.67	SB (To Del Av)	1	4.52	4.52	4.52	1	19.00	19.00	19.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	54	8/9/16	Sunny	12:45:00 PM	NB (To Main St)	9	4.52	5.46	7.92	1	15.83	15.83	15.83	SB (To Del Av)	1	4.75	4.88	5.00	2	15.83	17.42	19.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	55	8/9/16	Sunny	1:00:00 PM	NB (To Main St)	4	3.65	4.56	5.28	0	0.00	0.00	0.00	SB (To Del Av)	11	3.96	5.08	6.33	1	19.00	19.00	19.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	56	8/9/16	Sunny	1:15:00 PM	NB (To Main St)	2	3.96	4.24	4.52	0	0.00	0.00	0.00	SB (To Del Av)	1	4.52	4.52	4.52	1	15.83	15.83	15.83	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	57	8/11/16	Sunny	11:30:00 AM	NB (To CSB)	15	5.09	6.07	6.43	1	11.74	11.74	11.74	SB (To Main St)	13	5.06	5.21	5.33	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	58	8/11/16	Sunny	11:45:00 AM	NB (To CSB)	20	4.20	5.35	6.59	0	0.00	0.00	0.00	SB (To Main St)	16	4.71	5.52	6.04	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	59	8/11/16	Sunny	12:00:00 PM	NB (To CSB)	27	5.06	5.77	6.64	0	0.00	0.00	0.00	SB (To Main St)	20	4.07	4.87	5.36	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	60	8/11/16	Sunny	12:15:00 PM	NB (To CSB)	19	4.68	5.05	5.70	1	18.00	18.00	18.00	SB (To Main St)	17	4.45	5.25	6.48	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	61	8/11/16	Sunny	12:30:00 PM	NB (To CSB)	20	4.85	5.11	5.91	0	0.00	0.00	0.00	SB (To Main St)	17	5.33	5.60	6.00	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	62	8/11/16	Sunny	12:45:00 PM	NB (To CSB)	17	4.31	4.81	5.40	0	0.00	0.00	0.00	SB (To Main St)	41	3.95	4.60	5.63	0	0.00	0.00	0.00	1	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	63	8/11/16	Sunny	1:00:00 PM	NB (To CSB)	28	3.65	4.88	5.51	0	0.00	0.00	0.00	SB (To Main St)	26	3.99	4.57	5.36	1	13.28	13.28	13.28	1	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	64	8/11/16	Sunny	1:15:00 PM	NB (To CSB)	24	4.38	5.30	6.38	0	0.00	0.00	0.00	SB (To Main St)	20	4.43	4.72	5.19	1	15.28	15.28	15.28	0	0	0

Location Name	#	Width (ft)	Avg Grade (%)	Avg Cross Slope (%)	Horiz. Curve	Seg. ID	Date	Weather	Time	Direction #1	Ped Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Bike Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Direction #2	Ped Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Bike Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Crossing Ped	Crossing Bike	Conflict
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	65	10/24/16	Sunny	2:15:00 PM	EB (To Clbrn)	110	4.29	4.84	5.77	7	7.50	12.38	15.52	WB (To Grn)	91	4.21	4.80	5.63	2	10.00	10.00	10.00	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	66	10/24/16	Sunny	2:30:00 PM	EB (To Clbrn)	23	3.88	4.78	5.42	0	0.00	0.00	0.00	WB (To Grn)	28	3.31	4.61	5.36	1	12.86	12.86	12.86	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	67	10/24/16	Sunny	2:45:00 PM	EB (To Clbrn)	31	4.05	4.67	5.84	2	8.18	10.71	13.24	WB (To Grn)	12	4.21	4.78	5.42	0	0.00	0.00	0.00	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	68	10/24/16	Sunny	3:00:00 PM	EB (To Clbrn)	33	4.05	4.86	5.92	2	14.52	14.52	14.52	WB (To Grn)	33	3.44	4.69	5.11	2	9.78	11.71	13.64	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	69	10/24/16	Sunny	3:15:00 PM	EB (To Clbrn)	98	3.81	4.62	5.36	2	7.50	7.50	7.50	WB (To Grn)	100	3.72	4.99	6.34	4	6.82	9.66	13.64	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	70	10/24/16	Sunny	3:30:00 PM	EB (To Clbrn)	25	3.98	4.90	7.03	1	15.00	15.00	15.00	WB (To Grn)	37	3.95	4.87	5.36	2	11.25	11.25	11.25	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	71	10/24/16	Sunny	3:45:00 PM	EB (To Clbrn)	20	4.13	4.87	5.77	0	0.00	0.00	0.00	WB (To Grn)	11	4.69	4.95	5.36	2	11.54	13.80	16.07	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	72	10/24/16	Sunny	4:00:00 PM	EB (To Clbrn)	14	4.17	4.79	5.36	3	9.38	12.22	13.64	WB (To Grn)	31	4.29	4.74	5.70	3	10.23	11.15	12.50	0	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	73	10/25/16	Sun/Cloud	2:15:00 PM	EB (To Grn)	17	3.93	4.30	4.95	1	0.00	0.00	0.00	WB (To S Coll)	23	4.04	4.79	5.71	2	12.60	12.69	12.78	0	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	74	10/25/16	Sun/Cloud	2:30:00 PM	EB (To Grn)	17	4.09	4.48	4.89	1	11.22	11.22	11.22	WB (To S Coll)	15	4.14	4.73	5.41	1	13.73	13.73	13.73	0	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	75	10/25/16	Sun/Cloud	2:45:00 PM	EB (To Grn)	53	3.05	4.52	7.36	1	14.84	14.84	14.84	WB (To S Coll)	30	3.37	4.41	4.87	1	8.52	8.52	8.52	0	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	76	10/25/16	Sun/Cloud	3:00:00 PM	EB (To Grn)	62	3.62	4.34	4.84	1	18.04	18.04	18.04	WB (To S Coll)	65	3.83	4.49	4.79	3	0.00	0.00	0.00	0	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	77	10/25/16	Sun/Cloud	3:15:00 PM	EB (To Grn)	202	3.17	4.34	5.51	3	9.29	10.47	11.65	WB (To S Coll)	148	4.00	4.84	5.68	6	5.64	9.87	12.96	2	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	78	10/25/16	Sun/Cloud	3:30:00 PM	EB (To Grn)	20	4.02	4.51	5.29	0	0.00	0.00	0.00	WB (To S Coll)	21	3.80	5.02	5.86	2	9.48	9.48	9.48	0	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	79	10/25/16	Sun/Cloud	3:45:00 PM	EB (To Grn)	26	3.14	4.56	5.32	0	0.00	0.00	0.00	WB (To S Coll)	14	3.64	4.57	5.51	0	0.00	0.00	0.00	0	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	80	10/25/16	Sun/Cloud	4:00:00 PM	EB (To Grn)	17	3.50	4.34	5.32	1	12.78	12.78	12.78	WB (To S Coll)	13	4.42	4.85	5.61	0	0.00	0.00	0.00	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	81	10/28/16	Sunny	2:15:00 PM	NB (To Ment)	215	4.87	5.33	6.05	12	8.58	11.53	14.60	SB (To Lib)	210	4.31	4.83	5.50	6	10.67	15.11	19.54	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	82	10/28/16	Sunny	2:30:00 PM	NB (To Ment)	45	4.65	5.18	6.41	3	14.94	14.94	14.94	SB (To Lib)	50	4.14	4.57	5.10	2	0.00	0.00	0.00	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	83	10/28/16	Sunny	2:45:00 PM	NB (To Ment)	41	4.58	5.28	5.75	2	12.10	13.29	14.11	SB (To Lib)	27	4.58	4.72	4.83	1	0.00	0.00	0.00	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	84	10/28/16	Sunny	3:00:00 PM	NB (To Ment)	87	4.15	5.03	6.20	2	13.51	14.23	14.94	SB (To Lib)	26	3.57	4.63	5.59	0	0.00	0.00	0.00	0	1	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	85	10/28/16	Sunny	3:15:00 PM	NB (To Ment)	35	3.80	4.70	5.57	10	10.85	14.68	18.41	SB (To Lib)	26	4.14	4.99	6.05	7	12.57	14.31	17.40	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	86	10/28/16	Sunny	3:30:00 PM	NB (To Ment)	70	3.53	4.75	5.62	1	19.54	19.54	19.54	SB (To Lib)	50	3.34	4.94	6.35	3	17.40	19.46	21.53	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	87	10/28/16	Sunny	3:45:00 PM	NB (To Ment)	49	4.25	5.38	6.90	5	12.45	13.11	14.43	SB (To Lib)	50	3.58	4.95	6.08	1	16.08	16.08	16.08	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	88	10/28/16	Sunny	4:00:00 PM	NB (To Ment)	58	3.98	5.06	5.91	1	0.00	0.00	0.00	SB (To Lib)	35	3.68	4.73	6.79	11	12.83	12.83	12.83	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	89	10/31/16	Sunny	2:15:00 PM	EB (To Red)	44	2.88	3.27	3.60	11	5.93	11.20	13.33	WB (To Perk)	17	2.94	3.37	3.95	7	7.56	11.38	13.71	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	90	10/31/16	Sunny	2:30:00 PM	EB (To Red)	29	2.81	3.32	4.16	2	9.80	10.12	10.43	WB (To Perk)	9	3.22	3.50	3.86	1	8.97	8.97	8.97	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	91	10/31/16	Sunny	2:45:00 PM	EB (To Red)	24	2.47	3.10	3.39	5	8.35	10.04	11.57	WB (To Perk)	20	2.86	3.26	4.07	1	10.11	10.11	10.11	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	92	10/31/16	Sunny	3:00:00 PM	EB (To Red)	19	2.80	3.34	3.62	0	0.00	0.00	0.00	WB (To Perk)	26	2.73	3.19	3.53	1	5.30	5.30	5.30	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	93	10/31/16	Sunny	3:15:00 PM	EB (To Red)	35	2.65	3.16	3.69	7	10.79	11.61	13.15	WB (To Perk)	40	3.01	3.40	3.72	6	7.50	10.07	12.63	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	94	10/31/16	Sunny	3:30:00 PM	EB (To Red)	26	3.00	3.52	4.00	2	11.71	11.71	11.71	WB (To Perk)	4	3.09	3.26	3.40	1	7.93	7.93	7.93	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	95	10/31/16	Sunny	3:45:00 PM	EB (To Red)	16	2.99	3.39	3.69	0	0.00	0.00	0.00	WB (To Perk)	9	3.23	3.35	3.45	2	8.81	10.33	11.85	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	96	10/31/16	Sunny	4:00:00 PM	EB (To Red)	14	3.20	3.31	3.40	0	0.00	0.00	0.00	WB (To Perk)	15	2.67	3.18	3.87	0	0.00	0.00	0.00	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	97	11/4/16	Sunny	2:15:00 PM	EB (To Turf)	173	3.65	4.73	5.75	3	12.37	14.48	16.59	WB (To Acad)	116	3.88	5.02	6.29	5	12.17	15.07	18.72	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	98	11/4/16	Sunny	2:30:00 PM	EB (To Turf)	74	4.27	4.62	5.49	7	8.49	13.06	20.28	WB (To Acad)	43	4.53	5.42	8.59	6	5.93	12.79	18.25	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	99	11/4/16	Sunny	2:45:00 PM	EB (To Turf)	76	3.40	4.52	5.53	3	16.98	16.98	16.98	WB (To Acad)	38	4.08	4.89	5.53	1	17.38	18.05	18.72	1	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	100	11/4/16	Sunny	3:00:00 PM	EB (To Turf)	77	3.95	4.29	4.87	3	12.59	15.20	17.80	WB (To Acad)	66	4.37	4.72	5.79	4	9.48	12.29	17.38	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	101	11/4/16	Sunny	3:15:00 PM	EB (To Turf)	106	3.90	4.58	5.29	2	10.14	10.14	10.14	WB (To Acad)	66	4.12	4.88	5.49	7	5.29	9.02	11.23	1	1	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	102	11/4/16	Sunny	3:30:00 PM	EB (To Turf)	102	3.44	4.53	5.57	5	13.52	15.25	16.98	WB (To Acad)	83	3.99	5.06	5.89	3	10.43	12.57	13.77	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	103	11/4/16	Sunny	3:45:00 PM	EB (To Turf)	51	3.92	4.46	5.29	3	0.00	0.00	0.00	WB (To Acad)	40	3.99	4.61	5.37	2	11.77	14.18	16.59	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	104	11/4/16	Sunny	4:00:00 PM	EB (To Turf)	45	4.03	4.42	4.87	4	7.53	10.64	14.31	WB (To Acad)	29	4.06	4.84	6.03	4	10.14	14.67	22.81	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	105	11/9/16	Rain	11:45:00 AM	SB (To CR)	40	2.83	3.45	3.92	2	9.05	9.05	9.05	NB (To Allis)	49	2.58	3.36	4.10	3	9.53	10.30	11.31	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	106	11/9/16	Rain	12:00:00 PM	SB (To CR)	280	2.79	3.41	4.00	0	0.00	0.00	0.00	NB (To Allis)	191	2.81	3.30	3.88	2	6.61	6.61	6.61	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	107	11/9/16	Rain	12:15:00 PM	SB (To CR)	139	2.78	3.17	3.49	1	0.00	0.00	0.00	NB (To Allis)	47	2.40	3.31	4.50	2	8.79	8.79	8.79	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	108	11/9/16	Rain	12:30:00 PM	SB (To CR)	26	2.90	3.36	3.93	0	0.00	0.00	0.00	NB (To Allis)	23	2.89	3.49	3.99	0	0.00	0.00	0.00	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	109	11/9/16	Rain	12:45:00 PM	SB (To CR)	46	2.85	3.33	4.35	1	0.00	0.00	0.00	NB (To Allis)	61	2.54	3.45	3.97	1	8.46	8.46	8.46	0	0	0

Location Name	#	Width (ft)	Avg Grade (%)	Avg Cross Slope (%)	Horiz. Curve	Seg. ID	Date	Weather	Time	Direction #1	Ped Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Bike Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Direction #2	Ped Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Bike Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Crossing Ped	Crossing Bike	Conflict
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	110	11/9/16	Rain	1:00:00 PM	SB (To CR)	112	2.87	3.16	3.44	2	6.80	6.80	6.80	NB (To Allis)	228	2.77	3.11	3.56	1	0.00	0.00	0.00	1	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	111	11/9/16	Rain	1:15:00 PM	SB (To CR)	166	2.79	3.39	3.87	1	0.00	0.00	0.00	NB (To Allis)	149	2.91	3.10	3.28	1	8.79	8.79	8.79	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	112	11/9/16	Rain	1:30:00 PM	SB (To CR)	54	2.51	3.16	3.55	1	0.00	0.00	0.00	NB (To Allis)	20	2.85	3.09	3.28	1	11.46	11.46	11.46	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	113	11/9/16	Rain	2:15:00 PM	WB (To Prn)	166	2.72	3.17	3.59	1	0.00	0.00	0.00	EB (To S Coll)	196	2.31	2.65	3.33	2	7.75	7.75	7.75	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	114	11/9/16	Rain	2:30:00 PM	WB (To Prn)	32	2.86	3.35	3.87	0	0.00	0.00	0.00	EB (To S Coll)	15	3.24	3.29	3.37	1	9.32	9.32	9.32	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	115	11/9/16	Rain	2:45:00 PM	WB (To Prn)	18	1.99	3.03	4.51	0	0.00	0.00	0.00	EB (To S Coll)	43	2.17	3.03	4.58	0	0.00	0.00	0.00	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	116	11/9/16	Rain	3:00:00 PM	WB (To Prn)	52	2.82	3.61	4.58	1	0.00	0.00	0.00	EB (To S Coll)	121	2.40	2.88	3.20	0	0.00	0.00	0.00	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	117	11/9/16	Rain	3:15:00 PM	WB (To Prn)	145	2.93	3.29	3.74	0	0.00	0.00	0.00	EB (To S Coll)	131	2.56	3.04	3.40	1	8.73	8.73	8.73	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	118	11/9/16	Rain	3:30:00 PM	WB (To Prn)	45	3.07	3.44	4.01	0	0.00	0.00	0.00	EB (To S Coll)	29	2.33	3.08	3.72	1	0.00	0.00	0.00	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	119	11/9/16	Rain	3:45:00 PM	WB (To Prn)	21	2.42	3.27	3.69	0	0.00	0.00	0.00	EB (To S Coll)	18	2.61	3.10	4.44	0	0.00	0.00	0.00	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	120	11/9/16	Rain	4:00:00 PM	WB (To Prn)	13	2.67	3.41	3.82	0	0.00	0.00	0.00	EB (To S Coll)	46	2.42	3.19	4.04	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	121	11/9/16	Rain	2:15:00 PM	NB (To Main)	170	4.42	5.21	6.42	1	0.00	0.00	0.00	SB (To Del Av)	219	4.40	5.27	6.51	1	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	122	11/9/16	Rain	2:30:00 PM	NB (To Main)	21	4.77	5.05	5.69	1	17.27	17.27	17.27	SB (To Del Av)	9	4.04	5.19	5.86	1	13.01	14.84	16.67	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	123	11/9/16	Rain	2:45:00 PM	NB (To Main)	11	3.28	4.26	5.14	0	0.00	0.00	0.00	SB (To Del Av)	19	3.09	4.45	5.49	1	14.39	14.39	14.39	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	124	11/9/16	Rain	3:00:00 PM	NB (To Main)	47	4.61	4.99	5.79	1	0.00	0.00	0.00	SB (To Del Av)	46	4.04	4.80	5.56	1	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	125	11/9/16	Rain	3:15:00 PM	NB (To Main)	165	4.01	4.90	6.01	0	13.38	13.38	13.38	SB (To Del Av)	134	4.42	5.20	6.13	0	13.01	13.01	13.01	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	126	11/9/16	Rain	3:30:00 PM	NB (To Main)	26	4.40	5.17	6.09	1	9.90	9.90	9.90	SB (To Del Av)	35	4.85	5.33	6.33	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	127	11/9/16	Rain	3:45:00 PM	NB (To Main)	14	4.38	5.03	6.29	1	11.18	11.18	11.18	SB (To Del Av)	22	4.44	5.03	5.40	1	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	128	11/9/16	Rain	4:00:00 PM	NB (To Main)	22	4.42	4.89	5.65	0	0.00	0.00	0.00	SB (To Del Av)	12	4.24	5.15	5.97	1	13.38	13.38	13.38	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	129	11/10/16	Sunny	11:45:00 AM	NB (To Lil B)	59	3.25	4.58	5.66	1	0.00	0.00	0.00	SB (To Main)	100	4.50	4.99	5.44	1	7.86	7.86	7.86	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	130	11/10/16	Sunny	12:00:00 PM	NB (To Lil B)	116	3.89	5.24	6.23	3	14.46	14.46	14.46	SB (To Main)	101	5.06	5.52	6.09	1	12.86	12.86	12.86	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	131	11/10/16	Sunny	12:15:00 PM	NB (To Lil B)	176	4.35	4.98	5.33	0	10.00	10.00	10.00	SB (To Main)	127	4.63	5.00	5.83	1	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	132	11/10/16	Sunny	12:30:00 PM	NB (To Lil B)	65	4.97	5.33	5.87	0	0.00	0.00	0.00	SB (To Main)	50	4.05	5.28	5.91	1	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	133	11/10/16	Sunny	12:45:00 PM	NB (To Lil B)	62	3.91	5.32	5.79	0	0.00	0.00	0.00	SB (To Main)	60	4.50	5.55	7.04	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	134	11/10/16	Sunny	1:00:00 PM	NB (To Lil B)	46	3.72	4.80	5.83	0	0.00	0.00	0.00	SB (To Main)	112	3.49	5.00	6.23	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	135	11/10/16	Sunny	1:15:00 PM	NB (To Lil B)	67	4.66	5.15	6.43	0	0.00	0.00	0.00	SB (To Main)	69	3.93	5.14	5.70	1	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	136	11/10/16	Sunny	1:30:00 PM	NB (To Lil B)	65	3.91	5.41	6.69	0	0.00	0.00	0.00	SB (To Main)	80	4.74	5.04	5.70	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	137	11/10/16	Sunny	2:15:00 PM	NB (To Lil B)	53	4.11	5.18	5.79	0	0.00	0.00	0.00	SB (To Main)	35	4.48	5.51	6.38	2	9.64	10.61	11.57	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	138	11/10/16	Sunny	2:30:00 PM	NB (To Lil B)	35	4.45	5.22	5.70	0	0.00	0.00	0.00	SB (To Main)	203	4.24	4.81	5.74	1	9.53	9.53	9.53	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	139	11/10/16	Sunny	2:45:00 PM	NB (To Lil B)	74	4.22	5.24	5.83	2	0.00	0.00	0.00	SB (To Main)	78	4.05	4.69	5.36	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	140	11/10/16	Sunny	3:00:00 PM	NB (To Lil B)	73	4.60	5.07	5.59	1	0.00	0.00	0.00	SB (To Main)	75	4.05	4.64	5.47	0	0.00	0.00	0.00	1	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	141	11/10/16	Sunny	3:15:00 PM	NB (To Lil B)	194	4.07	4.62	5.23	1	0.00	0.00	0.00	SB (To Main)	112	4.26	4.90	5.36	1	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	142	11/10/16	Sunny	3:30:00 PM	NB (To Lil B)	109	3.91	4.77	5.47	0	0.00	0.00	0.00	SB (To Main)	45	4.18	4.57	5.09	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	143	11/10/16	Sunny	3:45:00 PM	NB (To Lil B)	76	4.18	4.68	5.36	0	0.00	0.00	0.00	SB (To Main)	43	4.43	4.93	5.96	0	0.00	0.00	0.00	0	0	0
Elliot Hall Path	2	7.5	2.07 SB To Main	0.5 EB	-	144	11/10/16	Sunny	4:00:00 PM	NB (To Lil B)	71	4.18	4.59	5.33	1	0.00	0.00	0.00	SB (To Main)	38	4.05	4.80	6.28	2	9.64	11.35	13.06	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	145	11/11/16	Sunny	11:45:00 AM	EB (To Red)	22	2.61	3.34	3.84	6	10.43	13.26	16.00	WB (To Perk)	20	3.00	3.36	3.62	3	8.50	11.15	13.91	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	146	11/11/16	Sunny	12:00:00 PM	EB (To Red)	34	2.87	3.41	4.09	4	11.71	12.61	13.52	WB (To Perk)	42	3.27	3.51	3.74	2	0.00	0.00	0.00	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	147	11/11/16	Sunny	12:15:00 PM	EB (To Red)	22	2.94	3.31	3.82	2	10.00	11.96	14.33	WB (To Perk)	10	3.09	3.42	4.34	3	8.35	9.04	10.21	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	148	11/11/16	Sunny	12:30:00 PM	EB (To Red)	20	2.91	3.25	3.82	0	0.00	0.00	0.00	WB (To Perk)	13	2.94	3.25	3.71	0	0.00	0.00	0.00	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	149	11/11/16	Sunny	12:45:00 PM	EB (To Red)	20	2.94	3.25	3.78	2	10.91	10.91	10.91	WB (To Perk)	23	2.74	3.19	3.50	3	8.50	8.50	8.50	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	150	11/11/16	Sunny	1:00:00 PM	EB (To Red)	25	2.63	3.05	3.42	7	6.53	9.44	12.80	WB (To Perk)	28	2.57	3.13	3.47	0	0.00	0.00	0.00	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	151	11/11/16	Sunny	1:15:00 PM	EB (To Red)	49	2.90	3.22	3.52	1	9.50	9.50	9.50	WB (To Perk)	30	2.82	3.17	3.69	6	8.42	10.07	10.79	0	0	0
Harrington Turf Path	1	12	1.27 EB To Red	0.7 SB	-	152	11/11/16	Sunny	1:30:00 PM	EB (To Red)	18	2.74	3.17	3.66	5	9.70	10.63	11.57	WB (To Perk)	10	3.11	3.36	3.56	3	10.11	10.11	10.11	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	153	11/11/16	Sun/Cloud	2:15:00 PM	SB (To CR)	202	4.25	5.12	5.52	3	0.00	0.00	0.00	NB (To Allis)	126	4.13	5.08	5.84	0	0.00	0.00	0.00	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	154	11/11/16	Sun/Cloud	2:30:00 PM	SB (To CR)	50	4.39	5.01	5.84	3	15.60	19.03	22.63	NB (To Allis)	33	4.69	5.28	6.03	1	16.16	16.16	16.16	0	0	0

Location Name	#	Width (ft)	Avg Grade (%)	Avg Cross Slope (%)	Horiz. Curve	Seg. ID	Date	Weather	Time	Direction #1	Ped Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Bike Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Direction #2	Ped Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Bike Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Crossing Ped	Crossing Bike	Conflict
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	155	11/11/16	Sun/Cloud	2:45:00 PM	SB (To CR)	46	4.02	4.75	5.48	2	4.84	11.13	20.11	NB (To Allis)	44	4.23	5.11	6.03	3	11.17	13.00	14.84	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	156	11/11/16	Sun/Cloud	3:00:00 PM	SB (To CR)	138	4.69	5.06	5.42	1	14.37	14.37	14.37	NB (To Allis)	52	3.68	4.59	5.08	1	0.00	0.00	0.00	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	157	11/11/16	Sun/Cloud	3:15:00 PM	SB (To CR)	148	4.15	4.81	5.76	6	13.51	15.51	20.11	NB (To Allis)	51	4.10	4.67	5.06	2	9.05	9.05	9.05	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	158	11/11/16	Sun/Cloud	3:30:00 PM	SB (To CR)	112	4.17	4.83	5.55	0	0.00	0.00	0.00	NB (To Allis)	41	3.63	4.90	5.76	0	14.60	14.60	14.60	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	159	11/11/16	Sun/Cloud	3:45:00 PM	SB (To CR)	48	4.06	4.78	5.20	3	17.40	21.63	25.86	NB (To Allis)	25	3.95	4.94	5.55	0	0.00	0.00	0.00	0	0	0
Allison Hall Path	11	11	0.93 SB To CR	0.43 EB	Curve	160	11/11/16	Sun/Cloud	4:00:00 PM	SB (To CR)	42	3.77	4.82	5.55	2	17.08	17.96	18.85	NB (To Allis)	22	4.21	5.06	5.42	2	14.37	14.37	14.37	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	161	11/14/16	Sunny	11:45:00 AM	WB (To Prn)	37	1.69	3.04	3.79	0	0.00	0.00	0.00	EB (To S Coll)	33	2.43	3.21	4.23	1	12.50	12.50	12.50	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	162	11/14/16	Sunny	12:00:00 PM	WB (To Prn)	177	2.63	3.14	4.10	2	0.00	0.00	0.00	EB (To S Coll)	347	2.44	2.91	3.62	1	0.00	0.00	0.00	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	163	11/14/16	Sunny	12:15:00 PM	WB (To Prn)	97	2.47	3.21	3.82	0	0.00	0.00	0.00	EB (To S Coll)	52	2.55	3.08	3.72	1	9.82	9.82	9.82	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	164	11/14/16	Sunny	12:30:00 PM	WB (To Prn)	20	2.67	3.36	3.79	0	0.00	0.00	0.00	EB (To S Coll)	15	2.29	3.01	3.77	0	0.00	0.00	0.00	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	165	11/14/16	Sunny	12:45:00 PM	WB (To Prn)	42	2.66	3.30	4.04	1	9.65	9.65	9.65	EB (To S Coll)	78	2.31	2.97	3.50	0	0.00	0.00	0.00	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	166	11/14/16	Sunny	1:00:00 PM	WB (To Prn)	115	2.72	3.15	3.77	0	0.00	0.00	0.00	EB (To S Coll)	225	2.24	3.07	3.72	0	0.00	0.00	0.00	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	167	11/14/16	Sunny	1:15:00 PM	WB (To Prn)	172	2.18	3.22	3.64	4	5.34	8.42	11.46	EB (To S Coll)	51	2.59	3.16	4.07	0	0.00	0.00	0.00	0	0	0
Kirkbride Hall Path	5	11	4.70 EB To S Coll	0.13 SB	Curve	168	11/14/16	Sunny	1:30:00 PM	WB (To Prn)	28	2.57	3.26	3.96	1	7.97	7.97	7.97	EB (To S Coll)	11	2.66	3.15	4.30	0	0.00	0.00	0.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	169	11/14/16	Cloudy	2:15:00 PM	NB (To Main)	181	4.31	5.10	5.81	0	0.00	0.00	0.00	SB (To Del Av)	85	3.46	4.76	5.39	2	0.00	0.00	0.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	170	11/14/16	Cloudy	2:30:00 PM	NB (To Main)	39	3.62	4.49	5.27	0	0.00	0.00	0.00	SB (To Del Av)	44	4.35	5.00	5.78	0	0.00	0.00	0.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	171	11/14/16	Cloudy	2:45:00 PM	NB (To Main)	39	4.03	4.51	5.11	2	13.11	15.78	19.67	SB (To Del Av)	53	3.71	4.73	5.41	0	14.75	14.75	14.75	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	172	11/14/16	Cloudy	3:00:00 PM	NB (To Main)	64	3.28	4.67	5.57	0	0.00	0.00	0.00	SB (To Del Av)	72	4.14	4.51	4.92	1	7.56	7.56	7.56	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	173	11/14/16	Cloudy	3:15:00 PM	NB (To Main)	107	3.47	4.61	5.57	0	11.03	11.03	11.03	SB (To Del Av)	189	3.27	4.58	6.63	1	14.57	14.57	14.57	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	174	11/14/16	Cloudy	3:30:00 PM	NB (To Main)	100	3.88	4.76	5.93	1	9.15	9.15	9.15	SB (To Del Av)	63	3.72	5.04	6.08	1	15.13	15.13	15.13	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	175	11/14/16	Cloudy	3:45:00 PM	NB (To Main)	49	4.24	4.98	5.78	1	12.69	12.69	12.69	SB (To Del Av)	46	3.89	4.97	5.67	2	16.39	16.39	16.39	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	176	11/14/16	Cloudy	4:00:00 PM	NB (To Main)	52	3.73	4.93	5.76	0	0.00	0.00	0.00	SB (To Del Av)	35	4.31	4.93	5.36	0	0.00	0.00	0.00	0	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	177	11/15/16	Sun/Cloud	11:45:00 AM	EB (To Grn)	70	3.98	4.47	5.44	0	0.00	0.00	0.00	WB (To S Coll)	47	3.68	4.93	6.30	1	0.00	0.00	0.00	3	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	178	11/15/16	Sun/Cloud	12:00:00 PM	EB (To Grn)	215	3.59	4.47	5.38	2	6.22	9.41	12.60	WB (To S Coll)	122	3.79	4.60	5.35	3	8.07	11.83	15.59	2	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	179	11/15/16	Sun/Cloud	12:15:00 PM	EB (To Grn)	221	4.09	4.80	5.38	8	9.39	10.24	11.65	WB (To S Coll)	207	3.69	4.50	5.44	9	6.39	7.30	8.44	30	3	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	180	11/15/16	Sun/Cloud	12:30:00 PM	EB (To Grn)	40	3.76	4.41	4.95	4	12.96	16.13	18.40	WB (To S Coll)	33	3.57	4.86	6.26	4	12.96	16.70	21.90	2	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	181	11/15/16	Sun/Cloud	12:45:00 PM	EB (To Grn)	25	4.04	4.67	5.20	2	14.15	14.26	14.38	WB (To S Coll)	18	4.05	4.44	5.90	0	0.00	0.00	0.00	0	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	182	11/15/16	Sun/Cloud	1:00:00 PM	EB (To Grn)	36	3.24	4.52	5.32	0	0.00	0.00	0.00	WB (To S Coll)	27	3.71	4.67	5.44	2	11.08	12.62	14.15	0	0	1
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	183	11/15/16	Sun/Cloud	1:15:00 PM	EB (To Grn)	86	4.02	4.63	5.58	3	15.33	15.33	15.33	WB (To S Coll)	53	4.00	4.40	4.89	1	12.78	12.78	12.78	0	0	0
Mitchell Hall	7	12	1.50 EB To Grn	1.50 SB	-	184	11/15/16	Sun/Cloud	1:30:00 PM	EB (To Grn)	131	3.16	4.52	5.29	2	14.60	14.60	14.60	WB (To S Coll)	96	4.09	4.80	5.48	2	10.57	10.57	10.57	1	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	185	11/15/16	Sun/Cloud	2:15:00 PM	SB (To Mem)	29	4.14	4.43	5.37	0	0.00	0.00	0.00	NB (To Del Av)	41	3.20	4.28	5.58	2	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	186	11/15/16	Sun/Cloud	2:30:00 PM	SB (To Mem)	31	4.16	4.82	5.41	1	22.50	22.50	22.50	NB (To Del Av)	21	2.81	3.89	4.50	1	20.57	20.57	20.57	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	187	11/15/16	Sun/Cloud	2:45:00 PM	SB (To Mem)	35	4.04	4.48	5.07	1	13.33	13.33	13.33	NB (To Del Av)	34	3.33	3.99	5.26	1	5.63	5.63	5.63	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	188	11/15/16	Sun/Cloud	3:00:00 PM	SB (To Mem)	48	3.77	4.42	4.97	1	11.25	11.25	11.25	NB (To Del Av)	90	3.50	4.05	4.68	1	9.47	9.47	9.47	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	189	11/15/16	Sun/Cloud	3:15:00 PM	SB (To Mem)	282	3.81	4.60	5.41	3	4.74	10.09	14.12	NB (To Del Av)	203	3.89	4.24	4.71	7	8.78	11.07	13.85	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	190	11/15/16	Sun/Cloud	3:30:00 PM	SB (To Mem)	49	4.24	4.58	4.93	3	15.32	16.03	16.74	NB (To Del Av)	26	3.64	4.10	4.65	1	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	191	11/15/16	Sun/Cloud	3:45:00 PM	SB (To Mem)	46	4.19	4.82	5.37	2	10.59	10.59	10.59	NB (To Del Av)	20	3.32	4.01	4.83	0	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	192	11/15/16	Sun/Cloud	4:00:00 PM	SB (To Mem)	26	3.69	4.27	5.58	2	11.80	13.10	14.40	NB (To Del Av)	33	3.29	4.07	5.50	1	7.42	7.42	7.42	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	193	11/16/16	Cloudy	11:45:00 AM	EB (To Clbrn)	30	3.17	4.53	5.29	3	7.89	10.58	12.86	WB (To Grn)	60	3.69	4.78	5.56	5	6.25	10.04	12.50	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	194	11/16/16	Cloudy	12:00:00 PM	EB (To Clbrn)	262	3.44	4.88	5.36	4	4.46	5.32	6.62	WB (To Grn)	193	4.17	5.12	6.25	2	6.16	6.16	6.16	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	195	11/16/16	Cloudy	12:15:00 PM	EB (To Clbrn)	61	4.64	5.16	5.77	4	11.25	13.05	16.07	WB (To Grn)	43	4.17	4.87	5.92	4	6.00	9.83	12.50	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	196	11/16/16	Cloudy	12:30:00 PM	EB (To Clbrn)	27	3.41	4.63	5.23	1	6.62	8.10	9.57	WB (To Grn)	19	4.46	4.94	5.77	1	8.65	8.65	8.65	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	197	11/16/16	Cloudy	12:45:00 PM	EB (To Clbrn)	27	4.29	5.33	6.08	2	16.07	16.07	16.07	WB (To Grn)	26	4.84	5.35	6.00	1	14.06	14.06	14.06	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	198	11/16/16	Cloudy	1:00:00 PM	EB (To Clbrn)	59	4.13	5.12	6.08	0	0.00	0.00	0.00	WB (To Grn)	116	3.63	5.06	6.16	5	7.76	10.70	12.50	0	0	0
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	199	11/16/16	Cloudy	1:15:00 PM	EB (To Clbrn)	59	3.66	5.08	6.00	4	12.16	14.47	18.75	WB (To Grn)	74	4.17	4.87	5.23	3	10.98	12.52	14.06	0	0	0

Location Name	#	Width (ft)	Avg Grade (%)	Avg Cross Slope (%)	Horiz. Curve	Seg. ID	Date	Weather	Time	Direction #1	Ped Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Bike Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Direction #2	Ped Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Bike Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Crossing Ped	Crossing Bike	Conflict
Evans Hall Path	9	10	0.43 EB To Clbrn	0.77 SB	-	200	11/16/16	Cloudy	1:30:00 PM	EB (To Clbrn)	27	4.37	5.13	6.00	0	12.16	12.16	12.16	WB (To Grn)	16	4.41	5.14	5.92	0	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	201	11/16/16	Sun/Cloud	2:15:00 PM	EB (To Brwn)	207	3.67	4.70	5.55	1	12.39	12.39	12.39	WB (To Gore)	106	3.93	4.60	5.16	5	6.09	9.52	14.79	1	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	202	11/16/16	Sun/Cloud	2:30:00 PM	EB (To Brwn)	8	3.86	4.28	4.68	1	19.34	20.53	21.73	WB (To Gore)	11	3.71	4.22	4.76	3	12.48	14.78	17.09	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	203	11/16/16	Sun/Cloud	2:45:00 PM	EB (To Brwn)	12	4.16	4.69	5.83	3	14.08	15.04	16.00	WB (To Gore)	12	3.04	4.32	5.73	2	10.23	12.97	15.71	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	204	11/16/16	Sun/Cloud	3:00:00 PM	EB (To Brwn)	17	4.06	4.62	5.27	1	12.75	12.85	12.94	WB (To Gore)	26	3.73	4.57	5.15	2	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	205	11/16/16	Sun/Cloud	3:15:00 PM	EB (To Brwn)	149	4.55	5.14	6.07	4	6.01	10.73	15.04	WB (To Gore)	125	4.00	4.52	5.15	1	17.09	17.09	17.09	2	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	206	11/16/16	Sun/Cloud	3:30:00 PM	EB (To Brwn)	27	4.52	4.99	5.40	5	8.71	10.08	11.89	WB (To Gore)	20	4.47	4.82	5.68	2	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	207	11/16/16	Sun/Cloud	3:45:00 PM	EB (To Brwn)	9	3.61	4.14	4.72	1	13.86	13.86	13.86	WB (To Gore)	14	4.00	4.54	4.97	0	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	208	11/16/16	Sun/Cloud	4:00:00 PM	EB (To Brwn)	9	3.87	4.39	5.52	1	13.04	13.04	13.04	WB (To Gore)	18	3.52	4.62	5.40	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	209	11/18/16	Sunny	11:45:00 AM	NB (To Main)	34	4.20	4.93	5.79	2	16.10	16.69	17.27	SB (To Del Av)	50	4.01	5.49	7.04	4	19.00	21.42	23.17	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	210	11/18/16	Sunny	12:00:00 PM	NB (To Main)	176	4.36	5.02	5.72	4	11.31	11.31	11.31	SB (To Del Av)	110	4.24	5.47	6.74	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	211	11/18/16	Sunny	12:15:00 PM	NB (To Main)	26	5.08	5.56	6.33	3	10.33	12.47	14.62	SB (To Del Av)	22	4.52	5.50	6.46	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	212	11/18/16	Sunny	12:30:00 PM	NB (To Main)	15	5.03	5.33	5.72	2	12.67	14.82	16.96	SB (To Del Av)	10	4.68	5.23	5.90	2	16.10	17.95	19.79	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	213	11/18/16	Sunny	12:45:00 PM	NB (To Main)	24	4.06	5.53	6.99	1	20.65	20.65	20.65	SB (To Del Av)	34	3.70	4.99	6.29	1	18.27	18.27	18.27	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	214	11/18/16	Sunny	1:00:00 PM	NB (To Main)	93	4.22	4.90	5.69	0	0.00	0.00	0.00	SB (To Del Av)	101	4.42	4.99	5.72	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	215	11/18/16	Sunny	1:15:00 PM	NB (To Main)	95	4.68	5.09	5.72	1	7.09	7.09	7.09	SB (To Del Av)	48	4.90	5.50	6.17	1	18.63	18.63	18.63	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	216	11/18/16	Sunny	1:30:00 PM	NB (To Main)	17	3.67	4.94	6.13	0	0.00	0.00	0.00	SB (To Del Av)	16	4.34	5.01	5.69	0	0.00	0.00	0.00	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	217	11/18/16	Sunny	11:45:00 AM	EB (To Turf)	81	3.76	4.41	5.89	1	15.21	15.21	15.21	WB (To Acad)	74	3.78	4.76	5.53	2	10.00	11.19	12.37	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	218	11/18/16	Sunny	12:00:00 PM	EB (To Turf)	179	4.22	4.89	5.84	9	5.70	12.65	17.80	WB (To Acad)	166	4.53	4.93	5.84	6	6.24	10.47	13.77	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	219	11/18/16	Sunny	12:15:00 PM	EB (To Turf)	59	3.48	4.60	5.79	3	0.00	0.00	0.00	WB (To Acad)	96	3.80	4.80	5.57	7	10.74	14.47	21.47	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	220	11/18/16	Sunny	12:30:00 PM	EB (To Turf)	112	3.65	4.62	5.45	7	7.60	13.20	18.72	WB (To Acad)	69	3.71	4.48	5.21	3	0.00	0.00	0.00	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	221	11/18/16	Sunny	12:45:00 PM	EB (To Turf)	106	3.71	4.40	5.07	2	15.87	15.87	15.87	WB (To Acad)	81	4.17	4.94	5.75	0	0.00	0.00	0.00	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	222	11/18/16	Sunny	1:00:00 PM	EB (To Turf)	109	3.97	4.60	5.93	3	4.80	5.78	6.76	WB (To Acad)	133	4.68	5.06	5.70	5	7.45	12.65	20.28	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	223	11/18/16	Sunny	1:15:00 PM	EB (To Turf)	136	3.78	4.71	5.89	4	12.37	15.72	17.80	WB (To Acad)	104	3.74	4.85	6.46	8	11.59	13.45	18.72	0	0	0
Perkins Path	12	16	0.17 EB To Turf	0.53 NB	-	224	11/18/16	Sunny	1:30:00 PM	EB (To Turf)	65	3.82	4.46	5.57	2	0.00	0.00	0.00	WB (To Acad)	29	3.61	4.59	5.07	1	12.59	12.59	12.59	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	225	11/28/16	Sunny	11:45:00 AM	NB (To Ment)	129	3.87	5.12	6.79	2	15.30	15.30	15.30	SB (To Lib)	74	5.10	5.40	5.67	0	0.00	0.00	0.00	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	226	11/28/16	Sunny	12:00:00 PM	NB (To Ment)	218	4.50	5.12	5.67	8	9.01	14.51	20.48	SB (To Lib)	348	3.91	4.57	5.08	7	6.23	11.37	17.64	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	227	11/28/16	Sunny	12:15:00 PM	NB (To Ment)	80	4.41	5.27	6.58	4	12.45	17.64	24.90	SB (To Lib)	86	4.64	5.86	8.36	2	11.14	15.81	20.48	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	228	11/28/16	Sunny	12:30:00 PM	NB (To Ment)	34	4.76	5.14	5.67	4	0.00	0.00	0.00	SB (To Lib)	32	3.99	4.70	5.64	0	0.00	0.00	0.00	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	229	11/28/16	Sunny	12:45:00 PM	NB (To Ment)	98	4.60	5.22	6.20	4	13.51	15.45	17.40	SB (To Lib)	23	4.43	4.87	5.34	3	10.24	13.42	16.49	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	230	11/28/16	Sunny	1:00:00 PM	NB (To Ment)	375	4.23	4.97	5.55	10	12.21	13.72	17.40	SB (To Lib)	135	4.28	4.92	5.62	2	0.00	0.00	0.00	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	231	11/28/16	Sunny	1:15:00 PM	NB (To Ment)	214	4.58	5.13	6.05	9	13.23	15.75	18.41	SB (To Lib)	183	4.03	4.85	5.67	6	5.20	10.56	14.77	0	0	0
Mentors Circle Path	10	15	0.70 SB To Lib	0.43 EB	Curve	232	11/28/16	Sunny	1:30:00 PM	NB (To Ment)	53	4.32	4.69	5.16	4	10.67	10.67	10.67	SB (To Lib)	32	4.36	4.88	5.70	2	17.16	17.92	18.68	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	233	12/1/16	Sunny	11:45:00 AM	SB (To Mem)	73	4.44	6.00	7.35	2	13.85	13.85	13.85	NB (To Del Av)	38	5.14	5.80	7.35	0	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	234	12/1/16	Sunny	12:00:00 PM	SB (To Mem)	87	5.07	5.98	6.79	1	0.00	0.00	0.00	NB (To Del Av)	132	4.71	5.90	9.47	4	13.85	19.16	21.82	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	235	12/1/16	Sunny	12:15:00 PM	SB (To Mem)	237	5.07	5.87	6.79	1	0.00	0.00	0.00	NB (To Del Av)	189	4.59	5.88	7.42	8	6.86	13.05	21.18	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	236	12/1/16	Sunny	12:30:00 PM	SB (To Mem)	55	3.43	5.60	7.50	2	21.18	21.18	21.18	NB (To Del Av)	37	4.36	6.04	7.06	1	16.00	21.85	27.69	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	237	12/1/16	Sunny	12:45:00 PM	SB (To Mem)	46	5.22	5.75	6.67	0	0.00	0.00	0.00	NB (To Del Av)	16	4.68	5.68	6.73	0	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	238	12/1/16	Sunny	1:00:00 PM	SB (To Mem)	59	3.58	5.52	7.35	2	9.23	12.12	15.00	NB (To Del Av)	37	4.62	5.32	6.05	0	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	239	12/1/16	Sunny	1:15:00 PM	SB (To Mem)	68	4.83	5.65	6.92	3	15.32	24.02	32.73	NB (To Del Av)	62	4.65	5.85	8.00	1	0.00	0.00	0.00	0	0	0
Gore Hall Path	6	15	0.37 SB To Mem	0.63 EB	-	240	12/1/16	Sunny	1:30:00 PM	SB (To Mem)	106	5.14	5.85	6.43	1	18.46	18.46	18.46	NB (To Del Av)	104	5.22	5.82	6.79	1	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	241	12/1/16	Cloudy	2:15:00 PM	NB (To Main)	24	4.34	5.27	6.17	3	13.97	14.65	15.32	SB (To Del Av)	12	5.11	5.47	5.86	2	13.57	14.09	14.62	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	242	12/1/16	Cloudy	2:30:00 PM	NB (To Main)	6	4.28	5.13	5.90	0	0.00	0.00	0.00	SB (To Del Av)	7	4.42	4.88	5.43	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	243	12/1/16	Cloudy	2:45:00 PM	NB (To Main)	23	4.68	5.10	5.76	0	0.00	0.00	0.00	SB (To Del Av)	29	4.55	5.14	6.25	1	16.96	16.96	16.96	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	244	12/1/16	Cloudy	3:00:00 PM	NB (To Main)	62	4.48	5.08	5.76	1	17.92	17.92	17.92	SB (To Del Av)	90	4.38	5.50	6.17	2	13.97	15.97	18.63	0	0	0

Location Name	#	Width (ft)	Avg Grade (%)	Avg Cross Slope (%)	Horiz. Curve	Seg. ID	Date	Weather	Time	Direction #1	Ped Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Bike Vol #1	Low Spd #1	Mean Spd #1	Max Spd #1	Direction #2	Ped Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Bike Vol #2	Low Spd #2	Mean Spd #2	Max Spd #2	Crossing Ped	Crossing Bike	Conflict
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	245	12/1/16	Cloudy	3:15:00 PM	NB (To Main)	210	4.15	4.90	5.56	2	15.32	17.99	20.65	SB (To Del Av)	172	4.68	5.36	6.33	1	19.00	19.00	19.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	246	12/1/16	Cloudy	3:30:00 PM	NB (To Main)	15	4.04	4.79	5.46	2	14.39	15.83	17.27	SB (To Del Av)	9	3.96	5.31	6.42	1	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	247	12/1/16	Cloudy	3:45:00 PM	NB (To Main)	17	3.73	5.32	6.74	0	0.00	0.00	0.00	SB (To Del Av)	8	3.93	4.90	5.76	0	0.00	0.00	0.00	0	0	0
Trabant Path	3	18.5	4.80 SB To Del Ave	0.8 EB	Angled	248	12/1/16	Cloudy	4:00:00 PM	NB (To Main)	16	4.19	5.21	6.25	2	10.22	13.90	17.59	SB (To Del Av)	6	4.90	5.31	6.38	0	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	249	12/2/16	Sun/Cloud	11:45:00 AM	EB (To Brwn)	69	4.25	4.67	5.13	1	0.00	0.00	0.00	WB (To Gore)	40	4.08	4.48	5.01	1	12.22	12.22	12.22	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	250	12/2/16	Sun/Cloud	12:00:00 PM	EB (To Brwn)	295	3.71	4.51	5.40	3	0.00	0.00	0.00	WB (To Gore)	210	4.16	4.75	5.27	1	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	251	12/2/16	Sun/Cloud	12:15:00 PM	EB (To Brwn)	30	3.81	4.52	5.64	2	12.31	13.70	16.30	WB (To Gore)	36	4.13	4.71	5.77	2	10.54	10.54	10.54	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	252	12/2/16	Sun/Cloud	12:30:00 PM	EB (To Brwn)	16	3.69	4.20	4.88	0	0.00	0.00	0.00	WB (To Gore)	18	3.64	4.23	4.96	1	16.45	16.45	16.45	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	253	12/2/16	Sun/Cloud	12:45:00 PM	EB (To Brwn)	21	3.89	4.39	5.04	2	11.21	13.68	16.15	WB (To Gore)	11	4.20	4.77	5.59	2	0.00	0.00	0.00	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	254	12/2/16	Sun/Cloud	1:00:00 PM	EB (To Brwn)	213	3.99	4.33	4.88	1	0.00	0.00	0.00	WB (To Gore)	111	3.89	4.53	5.00	1	11.50	12.36	13.44	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	255	12/2/16	Sun/Cloud	1:15:00 PM	EB (To Brwn)	85	4.09	4.85	5.50	3	11.35	14.66	17.96	WB (To Gore)	105	3.77	4.72	5.55	1	8.98	8.98	8.98	0	0	0
Crossing Path	8	10	0.23 WB To Gore	0.27 NB	-	256	12/2/16	Sun/Cloud	1:30:00 PM	EB (To Brwn)	18	3.90	4.50	5.53	2	16.15	16.15	16.15	WB (To Gore)	10	3.81	4.72	5.61	1	11.89	11.89	11.89	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	257	12/2/16	Sun/Cloud	11:45:00 AM	NB (To Main)	85	3.54	4.93	6.05	4	12.04	12.50	12.97	SB (To Del Av)	67	4.07	4.84	5.78	2	21.07	21.07	21.07	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	258	12/2/16	Sun/Cloud	12:00:00 PM	NB (To Main)	363	3.89	4.69	5.99	4	9.75	10.34	10.93	SB (To Del Av)	159	4.45	4.98	5.81	0	0.00	0.00	0.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	259	12/2/16	Sun/Cloud	12:15:00 PM	NB (To Main)	135	3.42	4.75	5.39	2	0.00	0.00	0.00	SB (To Del Av)	135	3.66	4.96	6.74	2	0.00	0.00	0.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	260	12/2/16	Sun/Cloud	12:30:00 PM	NB (To Main)	74	3.88	4.54	5.49	0	0.00	0.00	0.00	SB (To Del Av)	132	2.99	4.48	5.02	0	9.75	9.75	9.75	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	261	12/2/16	Sun/Cloud	12:45:00 PM	NB (To Main)	60	3.95	5.08	6.86	1	13.26	13.26	13.26	SB (To Del Av)	85	3.84	4.89	7.07	0	0.00	0.00	0.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	262	12/2/16	Sun/Cloud	1:00:00 PM	NB (To Main)	145	3.66	4.79	5.65	1	0.00	0.00	0.00	SB (To Del Av)	78	3.48	4.73	6.08	1	0.00	0.00	0.00	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	263	12/2/16	Sun/Cloud	1:15:00 PM	NB (To Main)	104	4.10	4.85	5.96	0	0.00	0.00	0.00	SB (To Del Av)	136	3.45	4.59	5.59	4	11.92	11.92	11.92	0	0	0
Sharp Hall Path	4	15	0.57 SB To Del Ave	0	-	264	12/2/16	Sun/Cloud	1:30:00 PM	NB (To Main)	63	3.76	4.46	5.11	0	0.00	0.00	0.00	SB (To Del Av)	48	4.01	4.76	5.32	1	0.00	0.00	0.00	0	0	0