CARLISLE WALKABILITY ASSESSMENT
Final Report
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SUST 301 Building Sustainable Communities, Dickinson College

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Photo credit: Brenda Landis

Table of Contents

I. Acknowledgements

We would like to thank Professor Neil Leary who taught our course, Building Sustainable Communities, and supervised this community-based research project. We would also like to express our gratitude to our community partner, Carlisle Borough Council member Brenda Landis, for providing valuable feedback and guidance throughout the project. Next, we would like to acknowledge all of the local Carlisle organizations who helped to make this research possible by distributing our survey to their members, including Project Share, Partnership for Better Health, Safe Harbor, Soso Carlisle Facebook page, Carlisle East Side Neighbors, CARS Carlisle, The Sentinel, and Hope Station. Finally, we would like to thank all respondents to the survey for taking the time to contribute their experiences, opinions, and ideas.

II. Introduction

This study was done by a team of five Dickinson College students for the class "Building Sustainable Communities" taught by Professor Neil Leary in the Fall of 2018. In this course we explored different visions for and characteristics of sustainable and resilient communities and examined approaches to sustainable community development. We sought to examine how walkability and bikeability relate to grocery store access in Carlisle, PA. We wanted to better understand the barriers residents with transportation issues face (such as lack of a car) when trying to walk or bike to the grocery store. Brenda Landis, a member of the Carlisle Borough, an employee of Dickinson College, and a Carlisle resident, was the community partner for this study; she helped us understand the walkability and bikeability issues faced by residents and provided support throughout the research process. Our study attempts to answer the following questions: Do Carlisle residents face issues regarding food access and walkability? What are they and who tends to face them? Are grocery stores in Carlisle accessible via walking and biking? What could be done to encourage walking and biking to grocery stores? to assess if Carlisle residents face issues surrounding food access, walkability, and bikeability. Using an original audit and survey, we found that most Carlisle residents drive and would not consider walking to get groceries. Distance, having too many bags to carry, and poor walkability and bikeability infrastructure were the biggest obstacles to walking and biking to the grocery stores. We propose short-term and long-term physical, policy, and social recommendations to help improve walkability and bikeability in Carlisle.

III. **Setting**

Demographics

Carlisle is a borough in and is the county seat for Cumberland County, PA with a population estimate of 19,259 in 2017 (United States Census 2018). 17.1% of the population lives in poverty, 27.2% of the population is under 18, and 15.2% of the population is 65 and older, and 8.9% of the population has a disability (United States Census 2018). These statistics are noteworthy because low income people, people with disabilities, and younger people have greater transportation needs (Zhao and Gustafson 2013). Regarding food security, 9.9% of Cumberland County residents are considered "food insecure," which means that they, "lack access, at times, to enough food for an active, healthy life for all household members and limited or uncertain availability of nutritionally adequate foods" (Feeding America 2018). Figure 1 (below) shows a map of the borough by census tract income levels. The northwest census tract in dark purple has the greatest number of low-income residents (the median income for this census tract is about $25,000/year) (Justice Map 2018). The locations of the three largest grocery stores are indicated by green diamonds. This reveals that the grocery stores are located further from low-income residents that may face greater transportation issues.

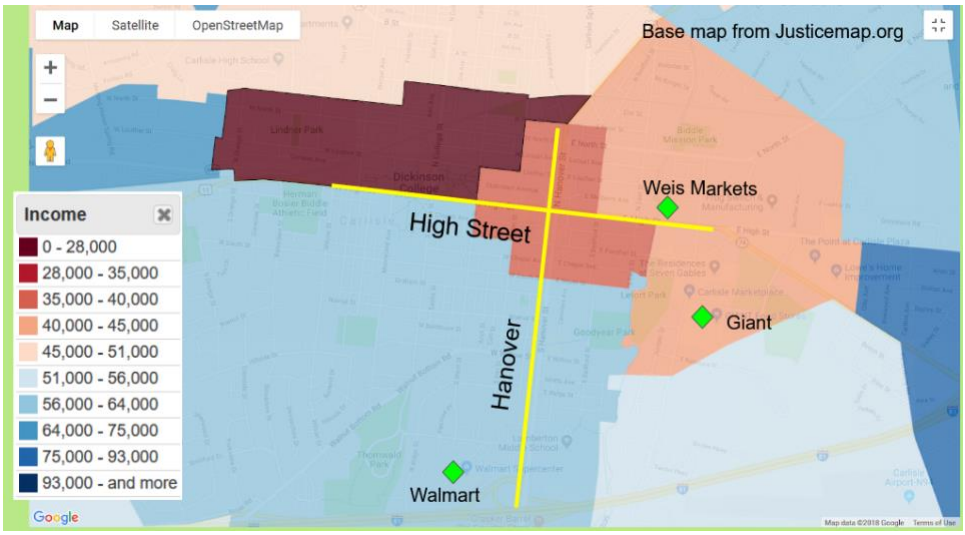


Figure 1.

Transportation and Infrastructure

Carlisle does not have a public transportation system after the Carlisle Circulator pilot project was terminated in 2017 due to low ridership (CAT 2017). However, despite lacking a public transportation system, the Carlisle Parks and Recreation Department has completed a 13.8-mile network of trails for pedestrians and bicyclists which "includes on-road and off-road trails, connects all Borough parks, schools and downtown Carlisle" (Carlisle Parks and Recreation 2018). Carlisle also underwent a "road diet" in 2011, which reduced the number of lanes from four to two on High Street and Hanover Street, in addition to creating bike lanes, extending curbs, and adding new stoplight technologies. Of the Borough's three main grocery stores, only Weis Markets is located near a "on-street bicycle lane," while Giant and Walmart are located near "bike routes." A bike lane creates a designated section for cyclists only on the road while a bike route indicates a recommended road for a cyclist to travel on, which may be a path, lane, or a regular road known to be safer for cyclists. Figure 2 (below) was created from the Borough's Bicycle and Trail Network Map, and shows the locations of Weis Markets, Giant, and

Walmart indicated with yellow stars. On the map, the blue roads indicate that there is a “on-street bicycle lane, "and green indicates that there is a “bike route” (Carlisle Parks and Recreation 2018). Although these grocery stores appear to be pedestrian and bike friendly due to their placement along bike lanes or bike routes, our research goal is to assess whether Carlisle’s walking and biking infrastructure is extended sufficiently to these grocery stores

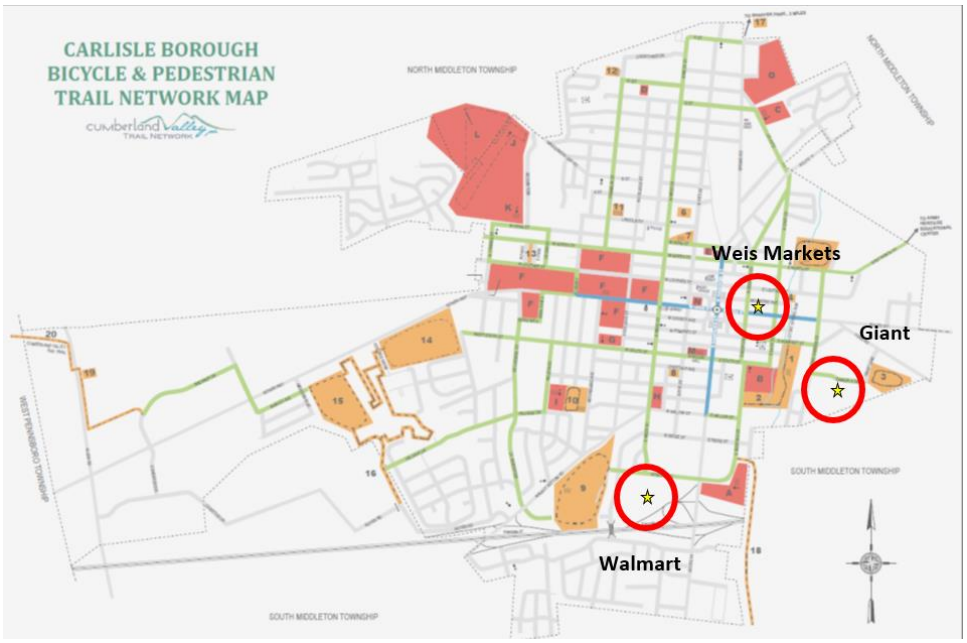


Figure 2.

Although Carlisle has made great strides in improving walkability and bikeability, data from Walkscore.com indicates that Carlisle has room to improve its walking infrastructure. Using a methodology that awards points based on distance to amenities and measures pedestrian friendliness based on population density and road metric analysis, Walkscore.com gives Carlisle a score of 60/100. This means that Carlisle is "somewhat walkable" and that "some errands can be accomplished on foot" (Walkscore.com 2018). Figure 3 (below) shows the walkability score for Carlise, where green indicated greater walkability and red indicates less walkability. The three main grocery stores are indicated by green diamonds, revealing that only Weis Markets is in the most walkable zone of the downtown intersection of High Street and Hanover Street. The data from both Figure 2 and 3 indicate the grocery stores are located further away from the most bikeable and walkable area of Carlisle, which is the downtown intersection of High Street and Hanover Street.

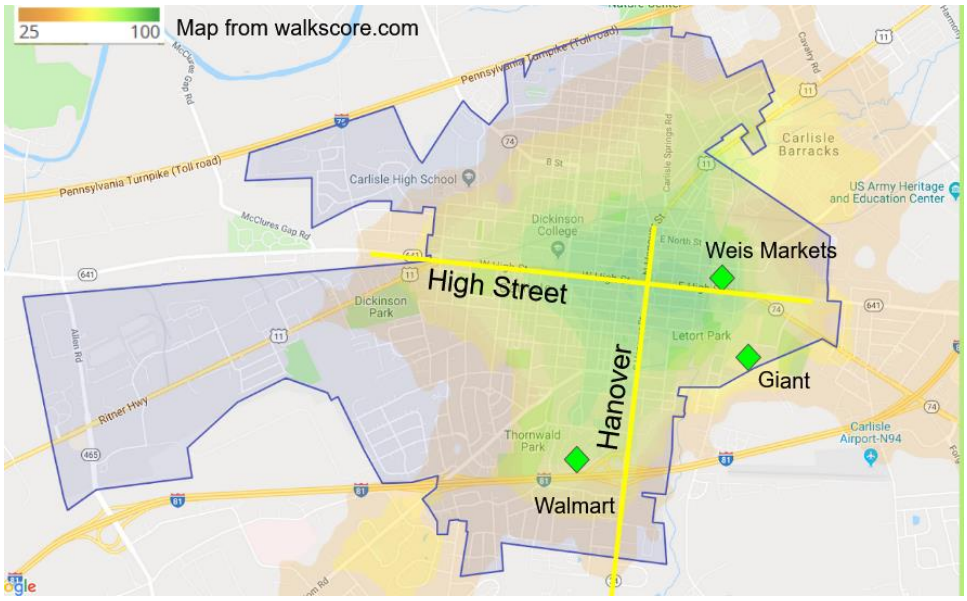


Figure 3.

IV. **Literature Review**

First, why is walking and biking good for cities? Biking is good for the economy because people who ride bikes are more likely to "make repeat trips to their local stores," and they have lower travel costs and therefore spend more money on local businesses (Flusche 2012). A 2009 study of Bloor Street in Ontario found that people who biked more spent more money in the area per month than customers who drove (Flusche 2012). Safe Routes to School National Partnership (2016) suggested similar findings, saying that "improving pedestrian and bicycle infrastructure in commercial areas, such as walkways, bikeways, and bike racks, can increase sales and economic activity at local stores." Creating biking infrastructure can also be good for local governments because bike parking is cheaper and more space-efficient than car-parking infrastructure, and "bicycling and walking projects create more jobs per dollar than road projects" (Flusche 2012). In a study done in Louisville, Kentucky, it was also found that with an increase in walkability and bikeability not only was there a rise in housing values, but the rates of foreclosures decreased (Florida 2014). Walkability and bikeability in communities also encourage small businesses and help with the growth of a healthy downtown environment (Walljasper 2017).

Walking and biking accessibility is particularly important for low-income communities, where residents are more likely to live in food-insecure areas and are less likely to have a car. Safe Routes to School National Partnership (2016) notes that "lack of access to healthy foods, public transit, and safe places to walk or bike is bad for people's health, and disproportionately effects low-income communities, rural communities, and communities of color." Aside from helping residents who do not have cars access the grocery store, walking and biking infrastructure also puts "more eyes on the street" which can influence perceptions of safety.

Additionally, high walkability, low crime, and high social cohesion were associated with greater access to fruits and vegetables (Carlisle et al. 2018).

How are cities doing this? Moscow, Idaho created a program where children who rode their bikes to the market received a $1 token to purchase fresh produce from the farmers market (Safe Routes to School National Partnership 2016). This program, called the "High Five Passport Program" was implemented to incentivize walking or biking to the market and thus "empowering kids to begin making their own healthy eating choices by allowing them to purchase fresh produce from vendors" (Moscow Farmer's Market 2015). In Portland, Oregon, a convenience store chain offered bike-care stations with pumps, tire repair kits, and lots of bike parking. Siler City, North Carolina took food access into account in their Pedestrian Master Plan and developed recommendations to prioritize "sidewalk, multi-use greenway, and multi-use side paths" that create connections between stores that sell healthy foods and residential neighborhoods (Safe Routes to School National Partnership 2016). In general, local governments need to think about health food access and transportation infrastructure as interconnected in a network of "linking people to places they want and need to go" such as grocery stores, restaurants, work, parks, and schools (Safe Routes to School National Partnership 2016).

For our research we focused on walkability and bikeability in relation to food access, so it was important for us to understand what difficulties the community faces regarding accessing food stores. The term "Food Desert" is often used to describe a community that the residents do not have easy access to fresh and healthy food. What officially qualifies an area to be a food desert is not always consistent. However, it usually means that residents are located too far from food stores to be considered easily and safely accessible, one mile for urban communities and ten miles for rural ones (Sumo 2018). There are some issues with the concept of food deserts that

can leave certain members of a community out of the equation. Defining food deserts may work for assisting areas of highly concentrated poverty, but in some cases, poverty is a more widespread issue in larger urban communities (Berg 2012). The concept of the food desert is highly reliant on context and the community environment; it relies on the idea that rural residents all have cars and urban residents don't (Berg 2012).

The concept of food security takes into many more features of a community and the physical and financial accessibility of healthy food to its residents (FAO 2003). When looking into food security it is determined by individual's ability to safely, easily, and affordably access the necessary amount of food (FAO 2003). This considers the number of other obstacles members of a community might be experiencing other than just the physical distance of a food store from their place of residence. Food security, unlike the determining of a food desert, can be determined in percentages and it is a more comprehensive way of evaluating accessibility to food.

V. **Methodology**

To answer our three research questions, we decided to conduct a survey and an audit. We created the survey to answer the questions based on the opinions and views of local Carlisle residents. We used the survey to gauge the residents' attitudes regarding biking and walking in relation to food access. The survey also helped us see what the most common issues are regarding food access in Carlisle and which members of the community are experiencing the largest obstacles. The audit was used to understand where exactly the most problematic areas are when trying to bike or walk to the most popular food stores. The audit provided us with information such as: sidewalk quality, intersection safety, bike lane conditions, and auto centric zones.

Survey

To understand Carlisle residents' food challenges and specifically food accessibility challenges, we conducted a survey (see Appendix 1). The survey was submitted to Dickinson's International Review Board (IRB) and approved to be exempt from any further review. The survey used both quantitative and qualitative questions to best understand residents' views. The survey was written by the research team and then reviewed and edited by our community partner, Brenda Landis, and our professor, Neil Leary. After the survey had been edited, we distributed it using Google Forms. It had 15 quantitative questions asking about demographics, grocery shopping habits, transportation methods, food concerns, and accessibility to grocery store concerns. The survey also had 4 qualitative questions asking about what would have to change for the respondent to walk or bike to the grocery store, biggest food concerns, biggest obstacle faced when accessing the grocery store, and a section to elaborate or indicate other comments.

The research team then, with input from Brenda Landis, asked key community members and organizations, via email, if they would be willing to distribute the online link to the survey amongst the community. Many organizations agreed to help us with the distribution of the survey, such as Project Share, Partnership for Better Health, Safe Harbor, Soso Carlisle Facebook page, Carlisle East Side Neighbors, and CARS Carlisle. The local newspaper, The Sentinel, also published the survey link in an online article (https://tinyurl.com/yay2fow7). The community members and organizations were chosen to reach the most amount of community members. Paper versions of the survey were also distributed to Hope Station, a local nonprofit serving the low-income community, in order to reach more residents. Unfortunately, we did not receive any responses to the paper surveys. The answers to the three qualitative questions

(excluding the question asking if they had any other concerns) were categorized based on common themes. No statistical analysis was done for the rest of the responses.

Audit

In order to assess grocery access in Carlisle for pedestrians and bikers, we needed to assess the physical and environmental obstacles this population faces. An "audit" is a tool that can be used to systematically evaluate the walkability or bikeability of a given space. In the context of our project, an audit can be defined as a means to measure infrastructure, environment, and safety in regard to walkability and bikeability in a specific location (Pedestrian and Bicycle Information Center). Completing an audit requires an individual to fill out a questionnaire regarding walkability and bikeability; the specific format of the audit –what questions are asked and how detailed the audit is – can vary. There are a handful of widely used and popular audits that can be downloaded and used to assess walkability and bikeability. However, in order to gather relevant data in a timely manner, it was in our best interest to draft an original audit that focused specifically on measuring walkability and bikeability to and from grocery stores.

Pre-existing audits served as inspiration and helped us design the structure of our audit. We looked at Walkscore (State of Place, 5), State of Place (State of Place, 8), Walc Institutes Walking Audit Tool (State of Place, 12), and Walkanomics (State of Place, 15). We designed our Grocery Accessibility Audit to document the infrastructure, environment and safety along specific walking and biking routes to and from the three major grocery stores currently in Carlisle: Walmart, Giant, and Weis Markets (see Appendix 2). All three stores are located on the outskirts of Carlisle; therefore, auditors were requested to start their audit from near the city center and travel along a direct route to a specific grocery store. Each store is located off one of

Carlisle's main roads down which the auditors were requested to travel as opposed to auditing less direct side streets.

The Grocery Accessibility Audit assesses walkability to and from a particular grocery store by asking the auditor to document sidewalk quality, crosswalk quality, and pedestrian safety (perceptions of safety from crime and traffic). The audit assesses bikeability by requesting documentation on bike safety, bike routes, and bike racks. In addition, there are questions regarding the aesthetics and surroundings that the auditor documents and reflects on as well as ways in which the auditor can voice any additional comments or concerns. The five completed audits provide important data that helped us form a picture of what the conditions of walkability and bikeability are in Carlisle and how the physical landscape of Carlisle may impede or benefit grocery store accessibility.

Unlike our survey, which provides biased insight about resident experiences and quantitative data about the conditions of walkability, bikeablity, and food accessibility in Carlisle, the audit provides relatively unbiased results and collecting an immense number of audits is not necessary or effective (and is also very time consuming given the semester-length timeline of our project).We completed five audits – one team member completed three, another team member completed one, and a peer at Dickinson College completed the fifth. Each auditor was aware of how to correctly fill in the double-sided audit and was prompted or selected one of the three grocery stores. We were able to collect useful data about walkability and bikeability from two audits that documented conditions on a route to Weis, two that related to Walmart, and one that related to Giant.

VI. **Analysis of Survey and Audit Data**

Demographics

With the help of eight local organizations, a total of 148 people participated in an online survey assessing food access in Carlisle as it relates to walkability and bikeability. The majority of participants identified as female (*Figure 4*) and additionally, almost half the respondents were between the age range of 46 to 65 years old (*Figure 5*). 91% of the participants identified as white/Caucasian, compared to the actual demographics of the borough, where 81.6% of residents identified as white/Caucasian (United States Census 2018). As the results of our survey does not reflect the real population in Carlisle, and we acknowledge that having the time and opportunity to complete this online survey is a privilege that gives a greater voice to the opinions of the more financially wealthy people, which is reflected in our results (only 11 people reported that they do not have access to a car or bike).

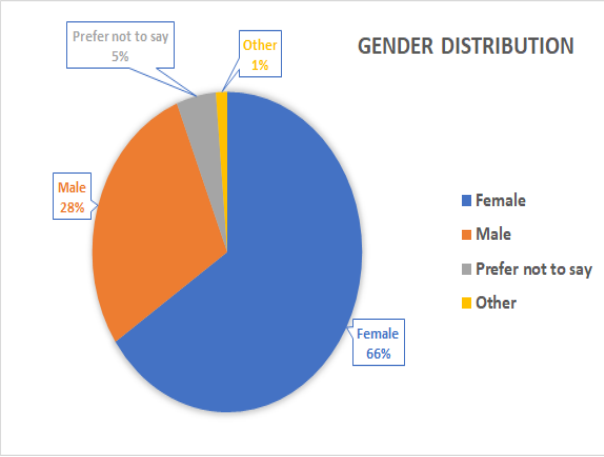


Figure 4.

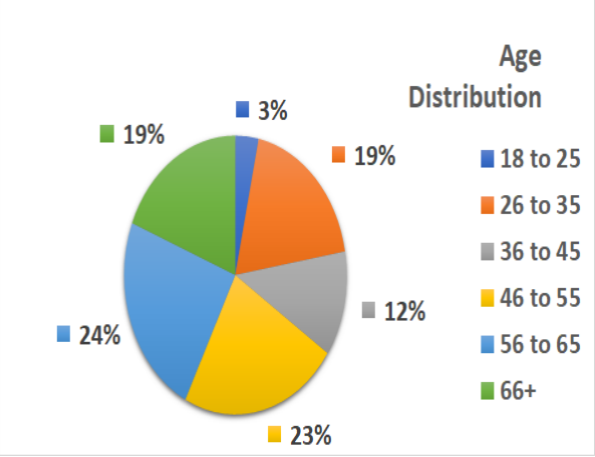


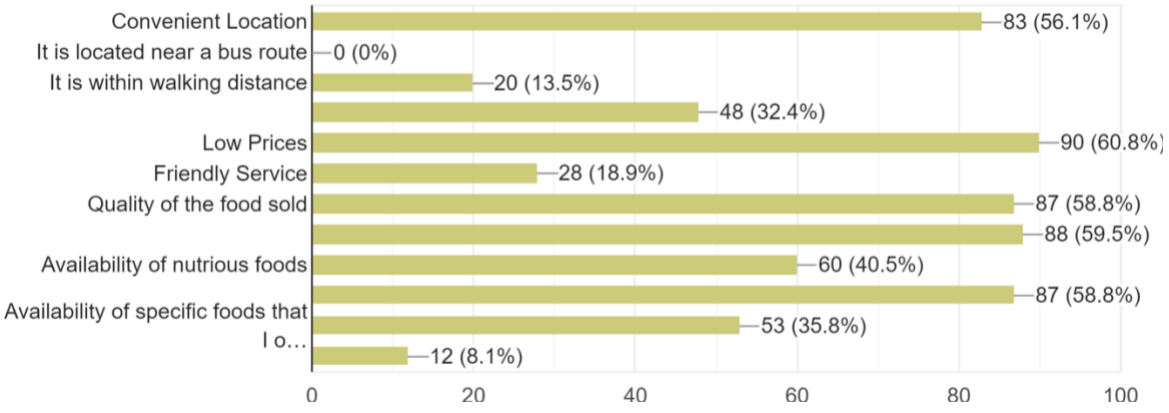
Figure 5.

Almost 90% of respondents reported that they either were the main grocery shopper for their household or shared the grocery shopping responsibility, the stereotype of women being the ones that shop for food can be insinuated in this context. Most of the respondents said they were shopping for 2-3 people (56%). Giant, Walmart, Weis, Aldi, and Karns were the most frequented

grocery stores in Carlisle although Mersida's Market, Carlisle Barracks Commissary, and small convenience stores were reported as well. The most frequently reported reasons (above 50%) for choosing to purchase from these stores included location, low prices, quality of food, large selection and availability of fresh produce (Figure 6).

Carlisle does not have any public transit options and that can be seen in the results. Most people therefore own a car. Those who do not own a car are very limited by the amount of groceries they can buy from the store and from which store they can buy from. If you can afford to use a car, you are more likely able to buy food without having to worry about the price but about instead about other hustles like nutrition, variety of options and freshness. People who cannot afford to drive to the store, usually go there very frequently and care first about the price then if they have the ability to, can also check for the other categories. This conclusion can be reached as only 60.8% of respondents cared about low prices. "Low prices" is the leading reason for grocery store preference but it is only on top by just a few selections, it was expected that more people would worry about it than any other category.

Reasons for Grocery Store Preference



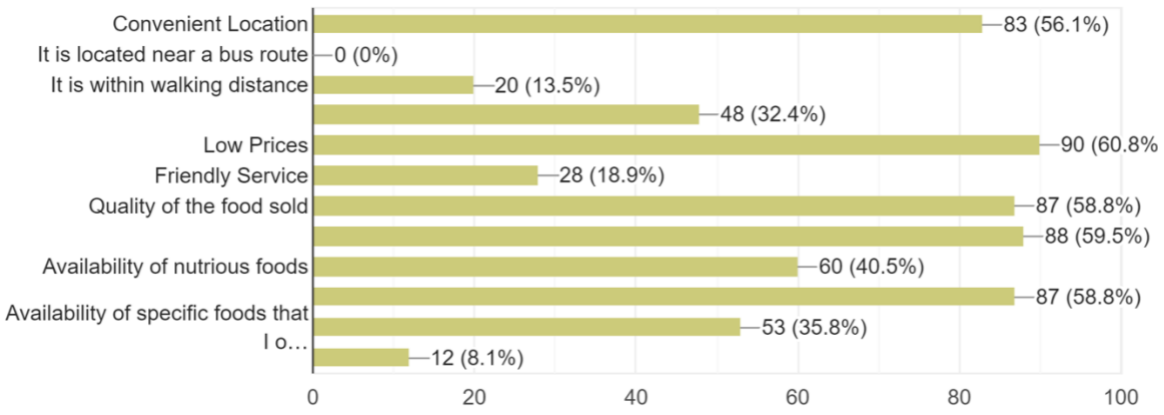


Figure 6.

As stated earlier, only 11 people reported that they do not have access to a car or bike. Over 90% of respondents also said that they have access to a car and 40% reported that they have access to a bike. This is surprising considering a 2015 People for Bikes survey (conducted by Breakaway Research Group) found that only 34% of Americans rode a bike in the past year, and therefore Carlisle residents have more access to bikes than the national average. However, although 40% of people said that they have access to a bike, only 1.4% of respondents said they usually bike to the grocery store, while over 90% said that they usually drove. Even with the availability of bikes, people still do not use them to go to food stores. Accessing food sources through roads on a bike is a dangerous and not safe because of the density of car traffic and the conditions of roads and sidewalks. Additionally, Walmart, Giant and Weis, have huge parking lots in front of the entrance of the store, which can be dangerous spaces to navigate on bike or on foot. Cars have priority in parking lots even though pedestrians and bikers should be the one having major priority in any sustainable transportation system.

Most respondents stated that they did not use any type of food aid services available in Carlisle (Figure 7). Less than 15% reported using SNAP, which is a service associated with helping low-income individuals.

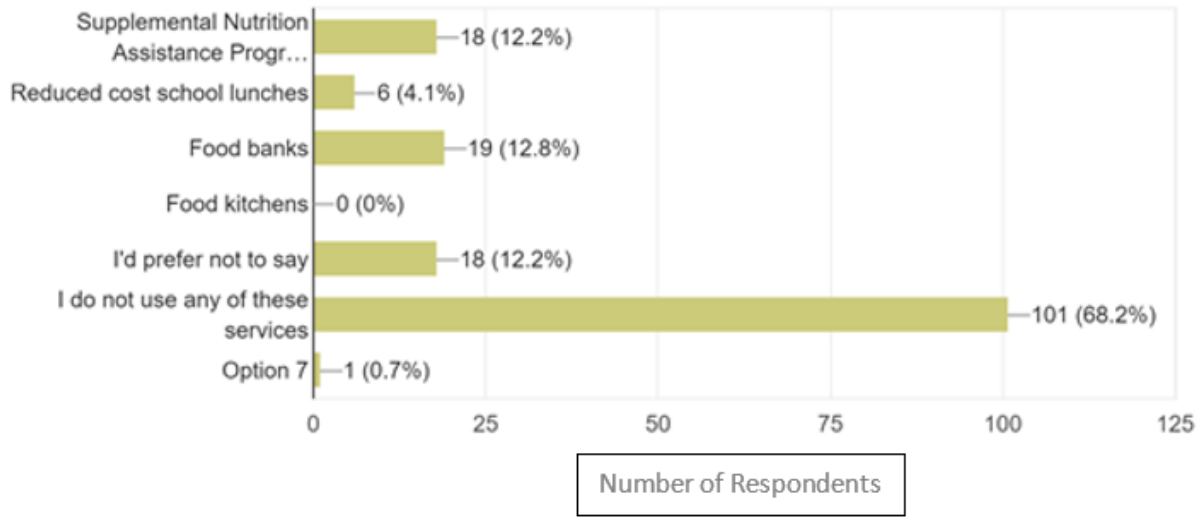


Figure 7.

Answering the Research Questions

In order to answer our research questions, "Do Carlisle residents face issues regarding walkability and food access? What are they? Who tends to face them?" and "Are grocery stores accessible via walking or biking?", we analyzed the data collected from both the audit and the survey. Below are the primary themes or concerns that became evident in regards to each of the above research questions:

Do Carlisle residents face issues regarding walkability and food access? What are they?

- *The grocery stores are too far away from residential areas.* The single most prominent concern around walking and biking to grocery stores in Carlisle was that the stores are too far away to easily access via foot or bike. When asked what would have to change in order for residents to consider biking or walking to the grocery store, 36% voiced concerns that the distance would need to be shorter. See Figure 8.

- *People have too many bags to carry.* The majority of respondents to the survey reported that they would not consider walking or biking to grocery store due to the amount of groceries bags they would need to carry and the inconvenience, especially when many own a car. Even those who do report having a bike (40% of respondents) they do not use it to access to the grocery store. See Figure 9.
- *Carlisle is too auto-centric to walk or bike to grocery stores.* Information from the audits revealed that the areas around the major grocery stores tend to be auto-centric, as auditors generally reported feeling unsafe because they needed to walk/bike down roads with heavy traffic and busy intersections. Moreover, the grocery store parking lots were challenging to navigate by bike or foot as there were also busy with traffic and lacked a clear path from the street to the store entrance. The auto-centric nature of Carlisle is supported by our survey data which indicated that the major way of accessing groceries stores in Carlisle is via cars, with 90% of respondents reporting that they usually drive to the grocery store. In fact, although around 40% of respondents owned a bike, very few reported using it to access the grocery store. See Figure 8.

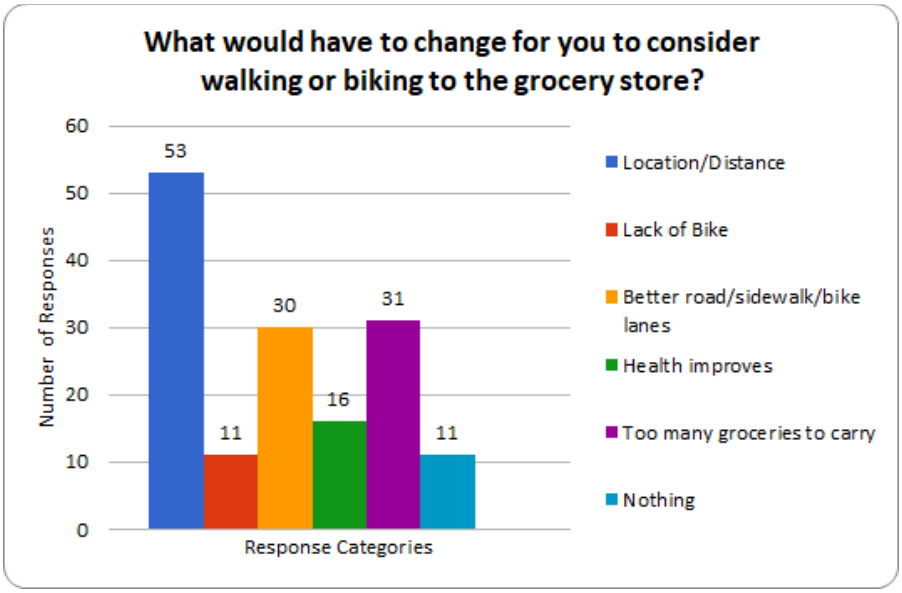


Figure 8.

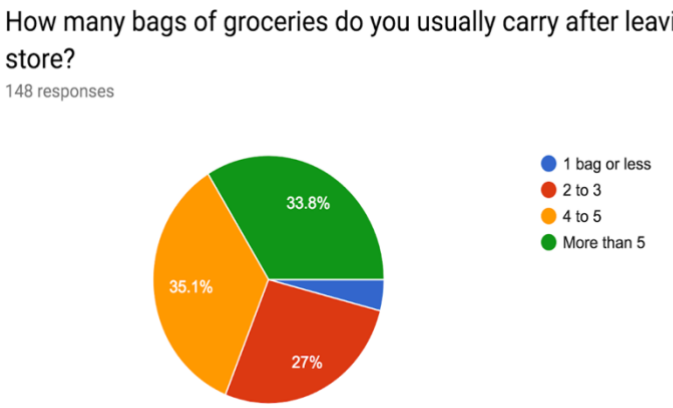


Figure 9.

- *Cost and nutrition.* Cost of food was the biggest food concern to Carlisle residents according to both the write-in question and the multiple-choice question. However, nutrition and freshness of food was detected as another significant concern, as well as finding the time to go to the grocery store. In terms of the types of food assistance that the respondents use, a vast majority agreed that they do not use any of the services that were listed, although around 12% did. Furthermore, roughly 12% of participants reported being recipients of SNAP, 12% reported using food banks, 6.4% reported using reduced cost school lunch programs, while 68% did not use any of these services. 91% of participants reported having access to a car while only 38% reported owning a bike, and about 7% did not have access to either. See Figure 10.

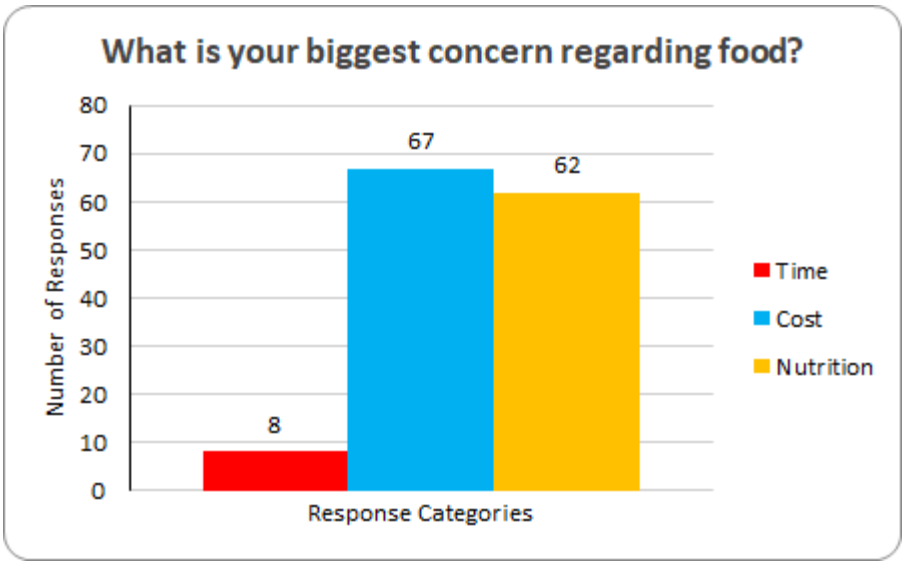


Figure 10.

Who tends to face these issues?

- *Older/elderly people.* The survey responses suggested that older people (age categories of 56-65 and 66+) may face additional barriers when it comes to food access and walkability. In fact, 19% of those 56 and older reported having some type of disability or health problem that would hinder them from walking or biking to the grocery. However, they were also the age demographic with the highest probability for lacking access to transportation such as a car or a bike, with 8% of the demographic lacking a car or bike. Thus, older residents of Carlisle may be at greater risk for facing difficulties when it comes to food access and walkability due to health and transportation concerns.
- *Residents on government food assistance programs.* While it may be no surprise that those who utilize government food assistance programs tend to experience additional barriers when it comes to accessing food, our research suggests that they also may face heightened challenges regarding walkability and bikeability as well. 40.7% of respondents who utilize food assistance programs reported having to travel 10-30 minutes

in order to get to access food (Figure 11), whereas the average respondent not on government assistance traveled 5-10 minutes. One reason for this additional barrier is that those on government assistance programs may utilize food banks in Cumberland County which tend to be farther away from residential areas of town. Secondly, Carlisle grocery stores may be farther away from low-income residential areas than higher-income areas.

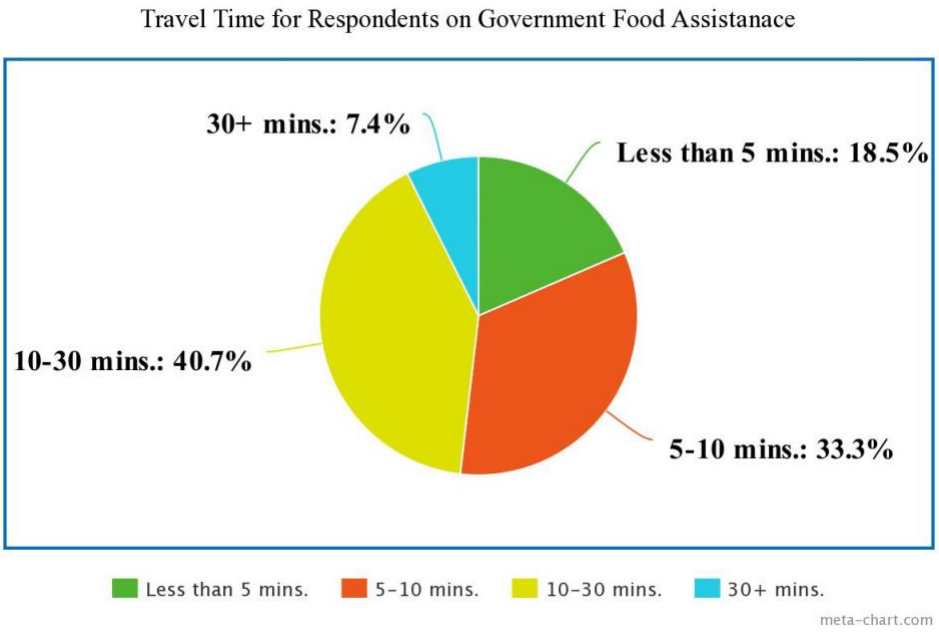


Figure 11.

- *Residents who lack access to transportation.* About 8% of respondents reported not having access to a car or a bike. While they account for a relatively small portion of the participants, they face many additional barriers when trying to get to grocery stores in Carlisle which are not close to residential areas. In fact, among those who lacked transportation, many reported utilizing nearby convenience stores instead of grocery stores which tend to be more expensive and lack healthy food options. Furthermore, about 53% of these respondents disclosed that they may pay for an Uber, Lyft, or taxi in

order to access this grocery store. First, this indicates that many are willing to pay for a car service instead of walking or biking to the grocery store, suggesting that distance and/or low walkability are a serious impediment to accessing grocery on foot or by bike. Furthermore, it implies that there is no good public transportation option in Carlisle which significantly impacts those without cars or bikes.

*It is important to note that many respondents fall into more than one demographic category and thus may be at an increased risk for being affected by these issues.

Are grocery stores accessible via walking and biking? Why or why not?

- *Walmart, Weis, and Giant do not have sufficient bike facilities.* Through the audits, we discovered Walmart and Weis do not have bike racks and that there is a bike rack near Giant, but it is more closely located to the liquor store Fine Wine & Good Spirits.
- *The Walmart Parking lot impedes walkability and bikeabilty. It is largely auto-centric and difficult to maneuver on foot and presumably on bike.* Data from the two audits completed on separate routes to Walmart both support this conclusion. A pedestrian or a cyclist travelling down Hanover Street or West Street toward Walmart eventually passes Noble Street and before them lies an expanse of parking lots that belong to Walmart and the neighboring stores. It is not clear – coming from either Hanover or West – how to effectively arrive at the entrance of Walmart; there is a lack of signage and there are no pedestrian walkways that lead directly to the store's entrance.
- *Grocery stores are located outside of walkable and bikeable Carlisle.* There is a disconnect and discontinuation of walkable and bikeable infrastructure that is visible on Carlisle's Walkscore map (see figure 3) and in the data collected from audits. An exmaple of this discontinuation was identified by an auditor who noted that there were

bike lanes stretching down High Street for the duration of their audit route from High Street and College Street towards Weis. However, they also noted that Weis does not have a bike rack. Another example of low levels of walkability and bikeability is the discontinuation of the bike lane along Hanover Street which leads to Walmart. The bike lane suddenly ends after Willow street and what was one lane, a bike lane, and parked cars, becomes two lanes for motor vehicles. The implications of the ending of this bike lane before Walmart is that cyclists may be less safe.

- *Uneven sidewalks are plentiful and could impede grocery access.* Audit responses suggested that sidewalks were generally not level which could prevent elderly people, disabled people, and mothers with strollers from commuting on foot.
- *Grocery stores are on the outskirts of town.* Because our project is based on food access in Carlisle, it became evident in the beginning stages of our research that the main grocery stores are located on the outskirts of the city.

VII. Limitations and Future Research

Although our study was successful in gathering valuable insight from a variety of Carlisle residents, our results reflect the opinions of a limited number of participants who were recruited from 8 local organizations and had the spare time, access to a computer with internet access, as well as the interest/motivation to contribute to our project. As such, we recognize that our results may not be representative of all Carlisle residents and that there are voices that may not have been heard in this study.

Additional research on this topic should attempt to gauge more diverse and representative opinions, especially those of residents who may be low-income, face physical disabilities, lack transportation, or live particularly far away from access to food. For example, participants who

reported receiving government assistance were more likely to face challenges when it came to accessing affordable, healthy foods as well as finding the time and transportation to visit the grocery store. As such, future research should seek out additional opinions of those who appear to be most affected by the issues of food access.

VIII. Recommendations

In order to answer our final research question, "What can be done to encourage walking and biking to grocery stores?", we outlined a three-tiered recommendation plan with suggestions developed from our current research as well as successful examples implemented in other towns and cities. This plan was inspired by Kania, Kramer, and Senge's "The Water of Systems Change" which provides a model for how problems can be dealt with at multiple levels (Kania, Kramer, and Senge). Below are our suggestions for producing short-term, long-term, and social/cultural change that we believe is necessary to increase walkability and bikeability while improving food accessibility in Carlisle:

1. **Short-term Solutions:** These solutions can be understood as quick-fix or "band-aid" solutions that may help in solving some aspects of the problem short-term but do not address the underlying infrastructural or social contributors to the issue. This includes:

A) *Addition of bike racks and bike lanes in grocery store parking lots*: We found that lack of bike racks and designated bike lanes in grocery store parking lots were a significant deterrent to biking to grocery stores in Carlisle. As such, we recommend that each grocery store in Carlisle have at least one bike rack as well as a clearly-defined bike path or route that outlines how one can safely travel from the parking lot entrance to the store entrance. Studies show that bikeable communities with biking infrastructure (bike lanes and bike racks) have increased commercial activity for local stores (Safe Routes to School National Partnership 2016). Because Carlisle

lacks bike racks at Walmart and Weis, and the bike rack in the vicinity of Giant is old and possibly insecure, adding adequate bike infrastructure could encourage people to bike to and spend more money at Carlisle grocery stores. See Figure 12 for example.

Figure 12.

B) *Addition of shopping cart corrals in low-walkability or distant neighborhoods:* Having too many groceries to carry in hand or on a bike was a frequent concern voiced by the participants of the survey as walking or biking home with 4-5 bags or more was not considered feasible. To address this issue, we propose that shopping corrals could be built and dispersed throughout Carlisle neighborhoods, especially those with populations that lack transportation. A resident could take a cart from the corral, shop for groceries, easily walk their groceries back with their cart, and return the cart to the corral in their neighborhood for others to use. While we haven't been able to find other towns that have implemented residential shopping cart corrals, we believe it would be a worthwhile idea to attempt in Carlisle.

2. **Infrastructure/Policy Long-Term Solutions:** These solutions refer to actions that address the fundamental infrastructure or policies that hold Carlisle walkability, bikeability, and food access problems in place. Assistance and authority from the local government is often required for these solutions to take place. This solution includes:

A) *Establishment of a downtown grocery store*: Participants frequently reported location/distance as a primary factor that might make them reconsider walking or biking to the grocery store, and many even independently offered the idea of a downtown grocery store being established in Carlisle. Because downtown Carlisle is the most walkable and bikeable part of town and closer in distance to many residential areas, we recommend that a supermarket be built downtown or asked to inhabit one of the empty shops on Hanover St. Not only would a downtown grocery store allow residents to avoid facing the more dangerous walking/biking areas, decrease time needed to spend on grocery shopping, and eliminate the challenge of carrying groceries too far, but it could be a potentially thriving Carlisle business that would receive heavy foot and bike traffic.

B) *Extending bike lanes and walkable sidewalks from downtown:* We recommend that the Carlisle Borough Council investigate extending and emphasizing the bike lanes created by the Road Diet in 2011, particularly further down High St., Hanover St., and West St., which connect Carlisle residents from residential areas of town to shopping areas where they can fulfill basic needs such as going to the grocery store or stopping at the pharmacy. Research conducted by the National Association of City Transportation Officials as well as the U.S. Department of Transportation suggests that when comfortable, protected walkways and bike lanes are built in a given town, rates of walking and biking can significantly increase. Moreover, extended walkways and bike lanes would provide a safe travel option for residents who do not have access to transportation.

C) *Addition of a short route, shuttle transportation system:* While a public transportation system may not necessarily encourage walking or biking to grocery stores, it would still decrease overall greenhouse gas emissions and provide a travel option for those who lack personal transportation

to access their basic needs. Thus, we propose that Carlisle establish a local public transportation system such as a shuttle bus that makes stops to popular Carlisle destinations, including grocery stores, shopping areas, and downtown. In Flint Michigan, for example, the Flint Mass Transit Authority implemented a successful Rides to Groceries bus line which stopped directly at major grocery stores as well as high-density residential areas (Safe Routes to School National Partnership). Not only would this be more cost-effective (because the Borough isn't paying for large buses such and more employees to run longer routes, such as with CAT), but it would potentially be more time-efficient because patrons wouldn't have to endure a long, roundabout loop or wait extended periods of time for a shuttle.

3. **Social or Cultural Change Solutions:** These are solutions which re-wire the community or culture to understand the problems regarding walkability, bikeability, and food access in a different light, and change their attitudes and behaviors accordingly.

A) Implement social media campaign: Social media campaigns have been shown to increase motivation for walking and biking. One study performed by researchers at Pennsylvania State University examined how a social media campaign influenced college students to walk or bike short distances to get to and from their university campus (Wilson, Bopp, Colgan, Sims, Matthews, Rovniak, & Poole, 2016). Results suggested that Facebook and Twitter posts promoting the movement were successful in motivating more students to walk or bike (Wilson et al., 2016). However, the study also indicates that while social media may be an effective marketing tool for influencing young people, it may be more difficult to reach middle or older aged constituents via these platforms (Wilson et al., 2018). As such, although a pro-biking and walking social media campaign may help to motivate some sectors of the community, more must be done to reach out to older populations.

B) Ask respected community members to model walking/biking: We also recommend the idea of requesting a respected member of the community, such as a local business-owner or a member of the Carlisle Borough Council, to model walking or biking in order to motivate other members of the community to do so as well. For example, bosses or managers biking to work has been shown to encourage their employees to bike to work as well (Porter-Rockwell, 2010). Thus, whether it's a local celebrity or an influential member of a Carlisle business, club, or group, having a respected person in the community model walking and biking behaviors may increase overall biking.

IX. Conclusion

Walkability (and bikeability) is a key component of a sustainable community. First, a walkable community requires less transportation and fossil fuels and is therefore better for the environment. A walkable community also helps residents stay active and live healthy lives. It also helps residents cut down on transportation costs, allowing them to spend more money on other basic needs or help boost the local economy by spending more and by increasing property values. A walkable community also can lead to more resident interaction and a sense of community as more people spend time outside, together with their neighbors. Above all, walkability and bikeability help people access their basic needs in an environmentally friendly way and are therefore a key element to a sustainable community. Our research project seeks to help Carlisle become a more sustainable community by initiating the walkability conversation as it relates to grocery store access. We recognize that Carlisle has made great strides in improving walking and biking infrastructure with the road diet and the pedestrian and bike trail network. However, more can be done to ensure that those with transportation issues can access all of their basic needs. Walkability is vitally intertwined not only with health, fitness, and the environment,

but with the general concept of transportation equity. As Carlisle works towards creating a more sustainable community, this transportation equity needs to be taken into consideration to ensure that all Carlisle residents can live safe, healthy, happy, and productive lives.

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Appendix 1

Walkability and Bikeability to Grocery Stores Survey

You are invited to participate in a survey about your experiences and concerns about purchasing food in the Carlisle area, including challenges you may face in getting to and from food stores. The information that you provide will be used to help members of the Carlisle community to understand challenges that residents may face regarding access to food and to consider possible remedies. The survey will take approximately 10 minutes.

Participation is voluntary, and your responses will be confidential. You must be at least 18 years old to participate.

The research is being conducted by a team of student researchers from Dickinson College. If you have any questions, concerns or comments about the research, you may contact Dr. Neil Leary, who is supervising this research, at learyn@dickinson.edu , or Professor James Ellison, chair of Dickinson College's Institutional Review Board, at ellisonj@dickinson.edu."

1. Who usually does most of the shopping for your household?

❑ Me

❑ My partner/spouse

❑ My roommate(s)

❑ It is a shared responsibility

❑ Other _____

2. How many people, including yourself, are you buying food for?

❑ 1

❑ 2-3

❑ 4-5

❑ 6-7

❑ 8+

3. Where do you usually buy groceries when you are buying a lot of groceries? Check all that apply.

❑ GIANT

❑ Mersida’s Market

❑ Weis Markets

❑ Karns Foods

❑ Kera’s Honey Bees

❑ Carlisle Barracks Commissary

❑ Walmart

❑ Aldi

❑ A convenience store or mini mart (Examples: Minute Stop, Sheetz, etc.)

❑ Other(s)_____

4. Where do you buy groceries when you are buying just a few food items? Check all that apply.

❑ GIANT

❑ Mersida’s Market

❑ Weis Markets

❑ Karns Foods

❑ Kera’s Honey Bees

❑ Carlisle Barracks Commissary

❑ Walmart

❑ Aldi

❑ A convenience store (Examples: Minute Stop, Sheetz, etc.)

❑ Other(s)_____

5. What are the reasons you choose to buy groceries at stores selected in the questions above? Check all that apply.

❑ Convenient location

❑ It is located near a bus route

❑ It is within walking distance

❑ It is open early in the morning or late at night

❑ Low prices

❑ Friendly service

❑ Quality of the food sold

❑ Large selection of many different kinds of food

❑ Availability of nutritious foods

❑ Availability of fresh vegetables and fruits

❑ Availability of specific foods that I or my family like

❑ Other: _____

6. Do you own or have regular access to a

❑ Car

❑ Bike

❑ None of the above

7. How do you usually get to the grocery store?

❑ Driving

❑ Walking

❑ Biking

❑ Public Transportation

❑ Other:

_____

8. How long does it take you to get to the grocery store from where you live?

❑ Less than 5 minutes

❑ 5 to 10 minutes

❑ 10 to 30 minutes

❑ More than 30 minutes

9. If you answer to the previous question was that you usually drive to the grocery store, what are the reasons for not walking or biking? Choose all that apply

❑ The distance is too far

❑ It would take too long

❑ It is not safe to walk or bike to the grocery store

❑ The sidewalks or roads are in poor condition

❑ There is too much traffic

❑ It would be difficult to carry my groceries

❑ I do not own a bike

❑ I find it physically difficult to walk or ride a bike

❑ I am not comfortable riding a bike

❑ I don’t like to walk or ride a bike

❑ Other:
_____

10. What would have to change for you to consider walking or riding a bike to buy groceries?

_____
_____
_____
_____
_____

11. How many bags of groceries do you usually have after leaving the grocery store?

❑ 1 bag or less

❑ 2 to 3

❑ 4 to 5

❑ More than 5

12. What are some of your concerns about buying food for yourself and your family? Check all that apply.

❑ Prices are high for all foods

❑ Prices are high for foods that are more nutritious

❑ Prices are high for fresh fruits and vegetables

❑ The stores that are close to me don't have many nutritious foods

❑ The stores that are close to me don't have good selections of fresh fruits and vegetables

❑ The stores that are close to me don't have good selections of the types of food that I and my family like

❑ It is hard to get to a grocery store because it is too far away

❑ It is hard to get to the grocery store because I don't have a car

❑ It is hard to get to a grocery store because I don't have enough time

❑ I don't have time to cook family meals

❑ I don't have enough space to store groceries

❑ I don't have enough money to buy all the food that my family needs

❑ Sometimes our family skips meals because of the cost

❑ Other:
_____

13. What is your biggest concern regarding food?
_____
_____
_____
_____
_____

14. What is your biggest obstacle you face when trying to access the grocery store?
_____
_____
_____

_____

_____

15. Do you and your family use any of the following services:

❑ Supplemental Nutrition Assistance Program (SNAP)

❑ Reduced cost school lunches

❑ Food banks

❑ Food kitchens

❑ I'd prefer not to say

❑ I do not use any of these services

❑ Other:

_____

16. What is your age range?

❑ 18 to 25

❑ 26 to 35

❑ 36 to 45

❑ 46 to 55

❑ 56 to 65

❑ 66+

17. What is your gender?

❑ Female

❑ Male

❑ Prefer not to say

❑ Other_____

18. What is your Racial/Ethnic background? Check all that apply.

❑ White/Caucasian

❑ Hispanic/Latino

❑ Black or African American

❑ Native American or American Indian

❑ Asian or Pacific Islander

❑ Other _____

Appendix 2

Grocery Accessibility Audit

• Your Name _____Date_____

• Weather Conditions _____Time_____

Before Beginning the Audit

• Contact Claudia at 224-247-9167 if you have any questions

• You will need something hard to write on

• Browse the content of this audit

• Which grocery store are you traveling to? _____

• What street are you going down and what is the intersection at which you are beginning the audit?_____

Walkability

Sidewalk Quality

- What is the condition of the sidewalk? Well made? Level? Smooth? _____

_____

- Would you say the sidewalk's width is narrow or standard with plenty of room for two people to walk side-by-side?_____

- Give the quality of the sidewalk a rating considering your observations ☆☆☆☆☆

Crosswalk Quality

- Are there stop signs or traffic lights?_____

- Are you having to cross major intersections with many lanes of traffic?_____

_____

- Are there any crosswalks that make you feel unsafe and vulnerable to moving vehicles?

Cross street_____

Cross street_____

Cross street_____

- Give the quality of the crosswalks a rating considering your observations ☆☆☆☆☆

Route Aesthetics and Surroundings

- What kinds of natural landscaping are along this street?_____

_____

_____

- Is there a strip of grass, plantings, or barriers between the sidewalk and the street?_____

_____

- What kinds of buildings, institutions or amenities are along this street?_____

_____

- Do the surroundings– trees, buildings or other objects– create shade along the route? If it is not a sunny day, take an educated guess._____

_____

• Give the route aesthetics and surroundings a rating considering your observations
☆☆☆☆☆

Overall Pedestrian Safety, Relating to Traffic Safety and Safety From Crime

• Do you feel anxious walking to this grocery store? Why or why not?_____

_____

_____

• Are there street lights?_____

• Rate pedestrian safety considering your feelings and the anticipated emotions of others
☆☆☆☆☆

Bikeability

Bike Routes, Lanes, and Sharrows

• Are there bike routes (signaled by signs) down this street at any point? _____

_____

• Are there bike lanes? If so, are they consistent?_____

_____

• Are there Sharrows (a visual marker on the road indicating that motor vehicles and bicycles share the road)_____

Bike Racks

• Are there bike racks at the grocery store?_____

• If so, is is easy to get from the street to the bike rack_____
_____

Bike Safety

• Is the road level, well paved, and generally without obstacles_____

_____

• Do you believe this route is safe overall for bikers? If not, what is potentially dangerous
_____
_____

- Give bike safety a rating considering your observations ☆☆☆☆☆

Wrapping up

- Would you say this street is popular among pedestrians and bikers
_____
_____

- Have you seen pedestrians or bikers carrying groceries? If so, how are they carrying them?_____
_____

- Is there anything else you have observed that could potentially decrease walkability or bikeability to and from this grocery store
_____
_____
_____