University of Maryland

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Neighborhood Locations and Amenities

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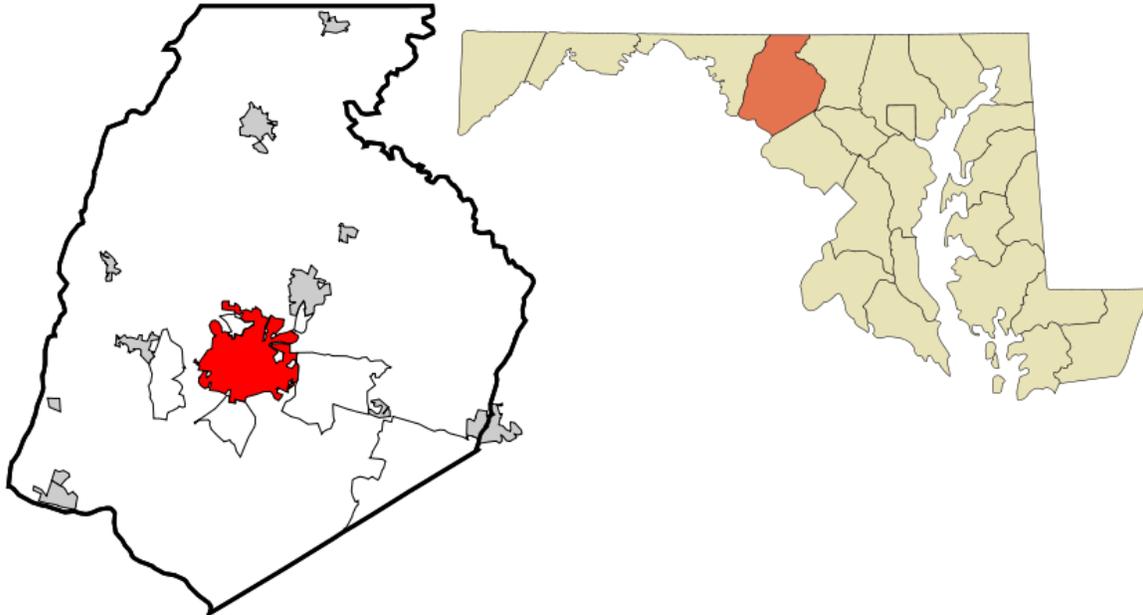
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Executive Summary

This report presents exploratory research that examines the relationship between neighborhood boundaries and amenity location/accessibility in The City of Frederick. A series of maps were produced that depict neighborhoods based on distance to amenities. Surveys were conducted to better understand which amenities draw locally and which draw regionally. Research shows that accessibility is higher the closer to downtown you live. Additionally, residents prefer to use grocery stores close to their local neighborhood, but travel to Baker Park regardless of where they live. This research provides a framework for addressing the amenity accessibility of neighborhoods and discusses potential further research using this framework and how it could benefit the City of Frederick.

Background

The City of Frederick is the county seat of Frederick County. The City has its own Municipal Airport, which primarily accommodates general aviation traffic. The county's largest employer is the U.S. Army's Fort Detrick bioscience/communications research installation. The City's population was 65,239 people at the 2010 United States Census, making it the second-largest incorporated city in Maryland, behind only Baltimore.

The goal of this GIS project was to define neighborhoods based on certain criteria and on the feedback received from Frederick residents, which could be later used by the Neighborhood Advisory Council (NAC), a forum to involve residents to identify and recommend positive changes to improve their neighborhoods. (Neighborhood Advisory Council, 2014).

Location

Location in Maryland

Coordinates: 39°24′50″N 77°24′40″W

http://en.wikipedia.org/wiki/Frederick,_Maryland

Research Question: What is a Neighborhood?

In the past, a lot of effort has been made to define neighborhoods by planners and planning critiques. Neighborhoods are defined in various degrees but tend to revolve around the concepts of walkability, density, diversity of uses and interconnectivity. This project's objective was to question the definition of "neighborhood" and redefine them in the City of Frederick. In order to identify neighborhoods for the City, more questions emerged including: Are neighborhoods meant to be the places were people mostly shop? Or where they go for recreation such as parks? Or based on the primary health care facilities? Or based on the school districts? Answering all these questions led to the conclusion that neighborhoods can be an aggregate of these individual aspects.

Objective

The objective of this project is to define the City's neighborhoods based on the minimum distances of the residents from the daily amenities, which include commercial centers, parks, elementary schools and health care providers.

Four maps show the minimum distance of residential parcels to each of these four amenities. More data comes from a survey of residents' views of their neighborhoods based on similar criteria. The map and survey information were superimposed to analyze neighborhoods based on the proximity to the daily amenities provided.

Data/Approach

The maps were made using geospatial data, information from on-site observations and the on-site surveys of Frederick area residents. A series of analyses were performed using tools on the spatial data software, ArcMap 10.2. These analyses determined the distance, along the road network, from residential parcels to basic amenities defined above (commercial centers, medical centers, parks and elementary schools). To accurately describe the map-making process, we must first understand the input data.
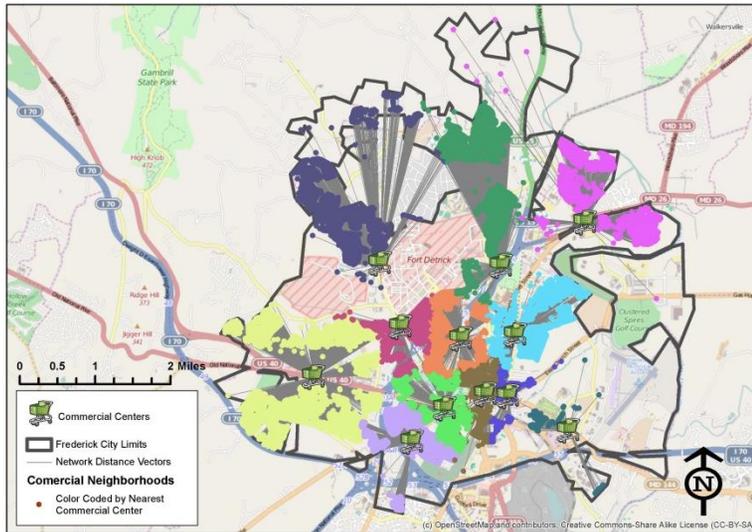
Several datasets of geospatial information were used in this analysis. First was point-based data representing the locations of five different land uses: predominately residential parcels, predominately commercial parcels, predominately medical or healthcare parcels, parks and elementary schools. These data subsets were downloaded from the Maryland IMAP website. Other data used in the analysis included the road network and census block boundaries for the City of Frederick, which were downloaded from the US Census Bureau TIGER/Line® database as well as the NAC boundaries provided by the City of Frederick. All of the data is in the shapefile (.shp) file format.

Our analysis focused on commercial and medical centers in a broad sense and not individual parcels. In other words, if there was a medical office park with multiple medical parcels, the cluster was counted as one location. Therefore, commercial and medical parcel clusters had to be condensed into single points. Ground based information acquired during two site visits and from Google Maps Street View allowed the research team to make collective

decisions about which point clusters constituted commercial and medical centers. Parks and elementary schools were marked as individual locations.
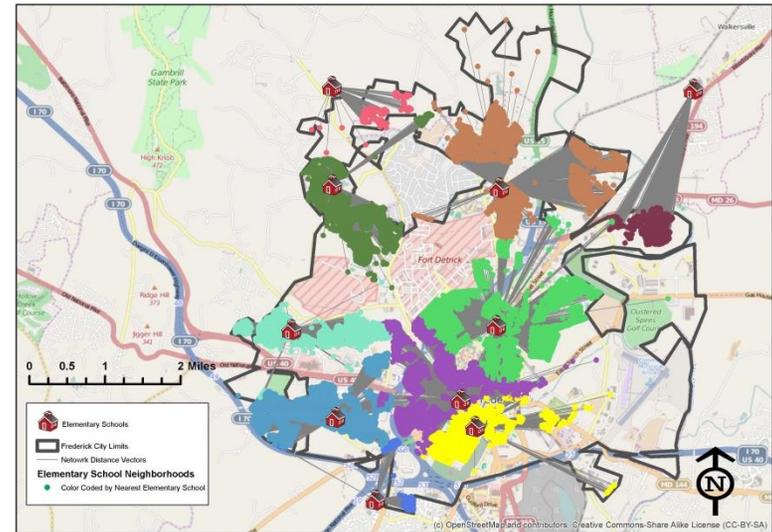
The process in ArcMap 10.2 involved the Network Analyst extension and the Origin-Destination Cost Matrix tool. The first step was to build the road network from the road line file. Our road network was fairly basic, and did not account for travel impediments such as speed limits, congestion, stoplights, one-way streets or travel mode (for example, a person may be more likely to walk to a park that is farther away rather than one closer if there is a barrier, such as a highway, between their home and the closer park). We used the Origin Destination Cost Matrix tool to calculate the distances from each residential parcel to each amenity along the road network. These distances are displayed on the map by direct line vectors, as opposed to travel paths. We selected only the shortest paths from each residential parcel to each amenity. We then color-coded the map so that residential parcels with common nearest amenities shared the same color. A different map was produced using each set of amenities (see Figures 1-4).

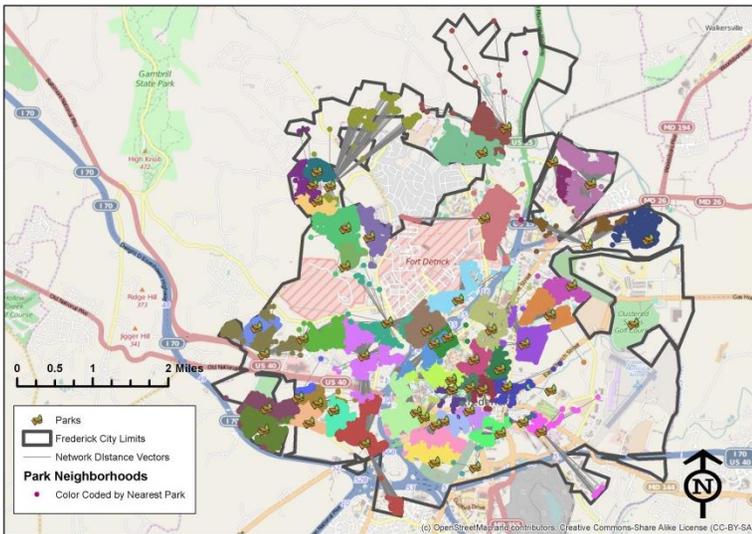## Figure 1: Neighborhoods by Commercial Center Distance

Data Sources: Maryland IMAP, City of Frederick, US Census Bureau

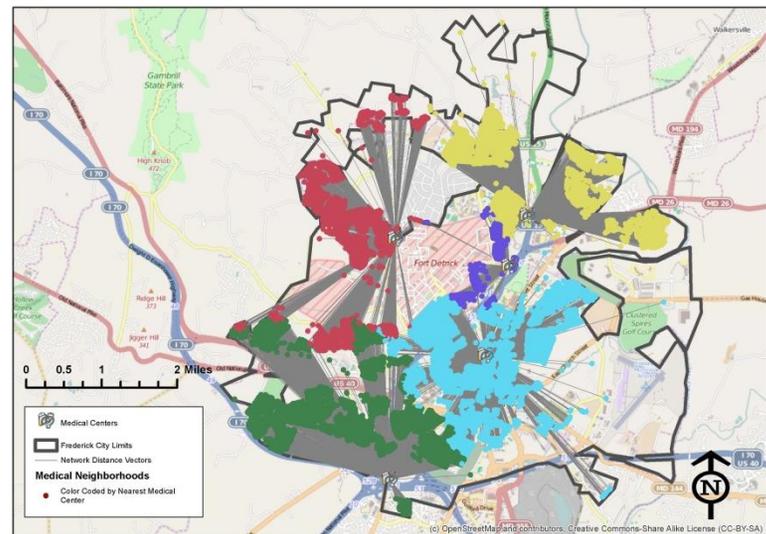## Figure 2: Neighborhoods by Elementary School Distance

Data Sources: Maryland IMAP, City of Frederick, US Census Bureau

Figure 3: Neighborhoods by Park Distance

Data Sources: Maryland IMAP, City of Frederick, US Census Bureau

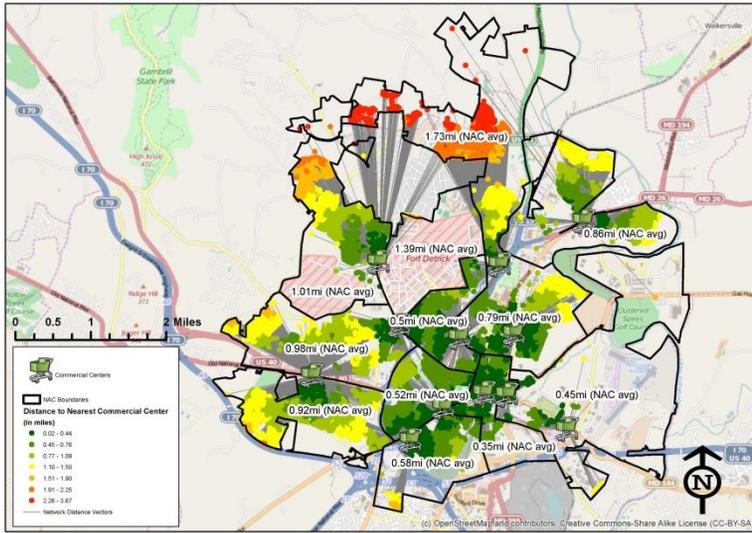## Figure 4: Neighborhoods by Medical Center Distance

Data Sources: Maryland IMAP, City of Frederick, US Census Bureau

We next color-coded the residential parcels to show those closest to amenities. Figures 5-8 show accessibility for each amenity category while Figure 9 shows the cumulative distance to all amenity categories. We overlaid the NAC boundaries and the census block boundaries to calculate averages for each geographic unit. This will allow the City of Frederick to examine which NACs or census blocks need improved accessibility to amenities (see Figures 5-8).
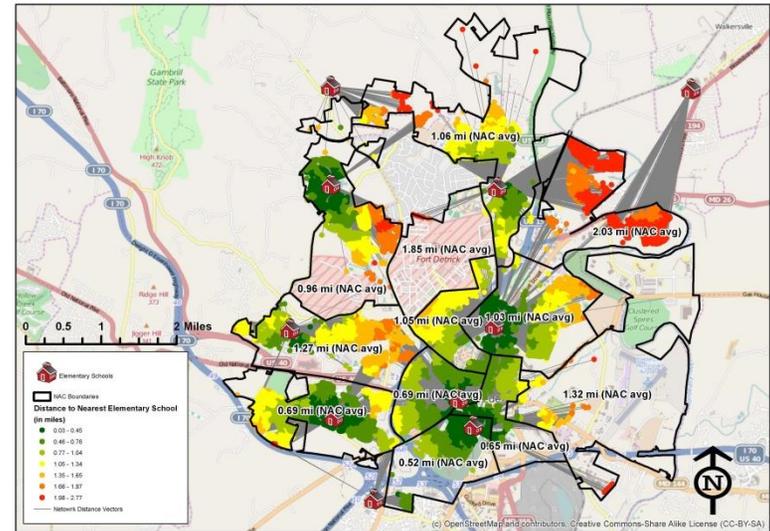
To better understand which amenities drew local users and which were drew regional users, we conducted surveys along Market Street in downtown Frederick on a Sunday morning from 10:30am to 12:00pm. Respondents were asked to circle on a map the locations of their home, the grocery store they most frequently visited, and the park they most frequently visited. The survey was used to determine whether residents visited the closest commercial centers and parks or whether they traveled to other neighborhoods for these amenities (see Appendix for individual maps).

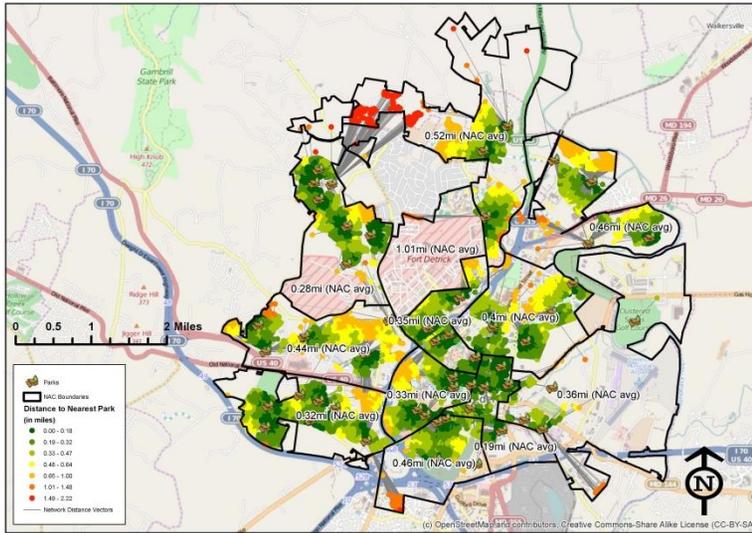Figure 5: Commercial Center Accessibility

Data Sources: Maryland IMAP, City of Frederick, US Census Bureau
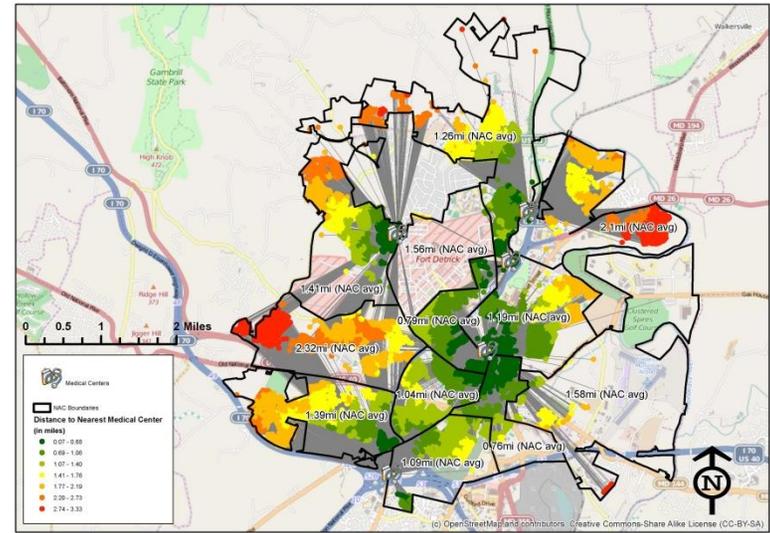
Figure 6: Elementary School Accessibility

Data Sources: Maryland IMAP, City of Frederick, US Census Bureau

Figure 7: Park Accessibility

Data Sources: Maryland IMAP, City of Frederick, US Census Bureau
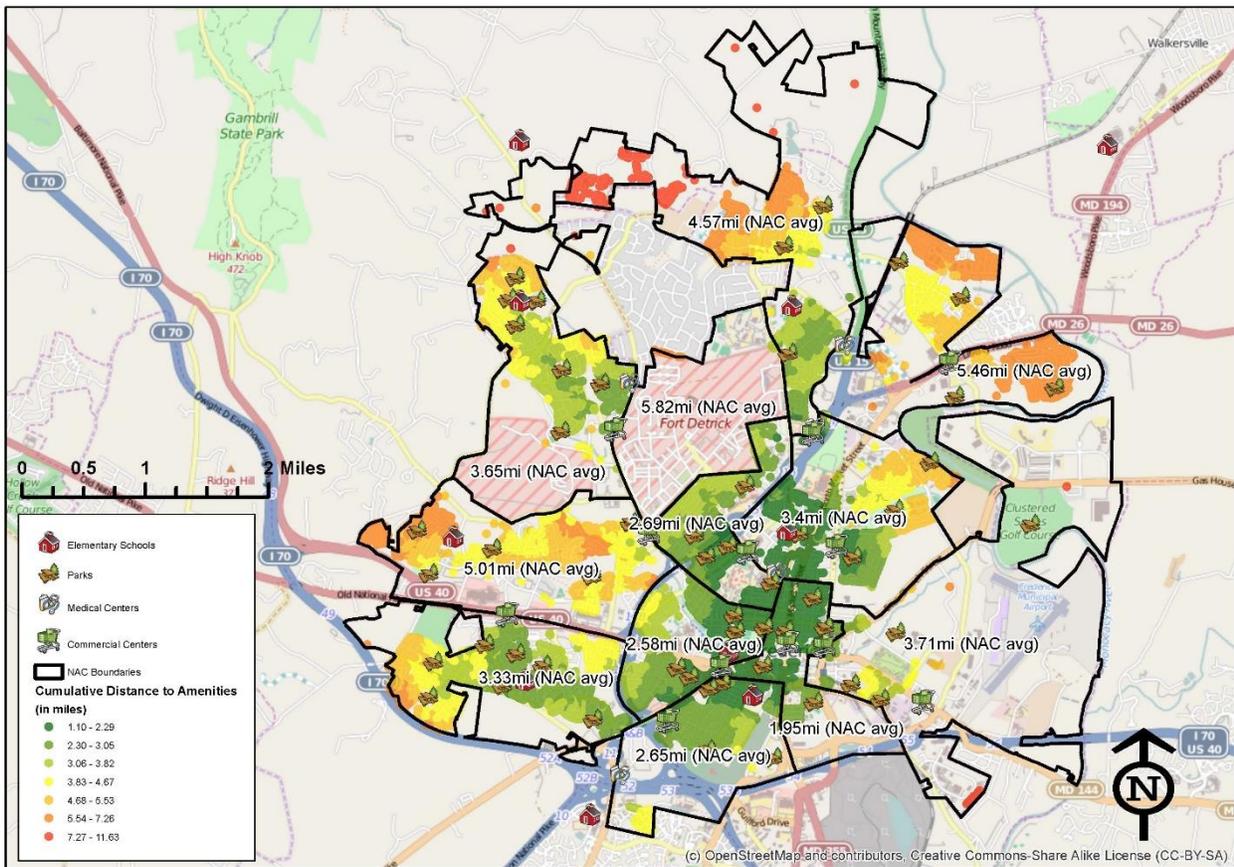
Figure 8: Medical Center Accessibility

Data Sources: Maryland IMAP, City of Frederick, US Census Bureau

Results

In an on-site survey, we analyzed where respondents live and which grocery store and park they most frequently visit. Interestingly, a majority of the eleven survey respondents purchased groceries near to home, whereas ten out of the eleven respondents circled Baker Park as the park most frequently visited despite its distance from their homes (see Figure 10). This differed from our initial theory that more people would commute greater distances to obtain groceries and use a park located closest to their residence. The survey showed that a vibrant park with ample amenities is a reason to travel greater distances.

The aim of this research was to provide the City of Frederick with information regarding neighborhood accessibility to amenities. The Origin-Destination Cost Matrix provides an important tool for measuring and categorizing residential neighborhoods and nearby amenities. As shown in Figures 1-4, the Origin-Destination Cost Matrix identifies the shortest travel distances from various neighborhoods to local amenities such as commercial centers, medical centers, parks and elementary schools. Because there are fewer commercial centers, medical centers and elementary schools, the travel distances for each neighborhood varies significantly, with medical centers having the farthest distances. On the other hand, many of the neighborhoods are adjacent to numerous parks, giving residents multiple options. However, from our survey most residents do not frequent their neighborhood park.
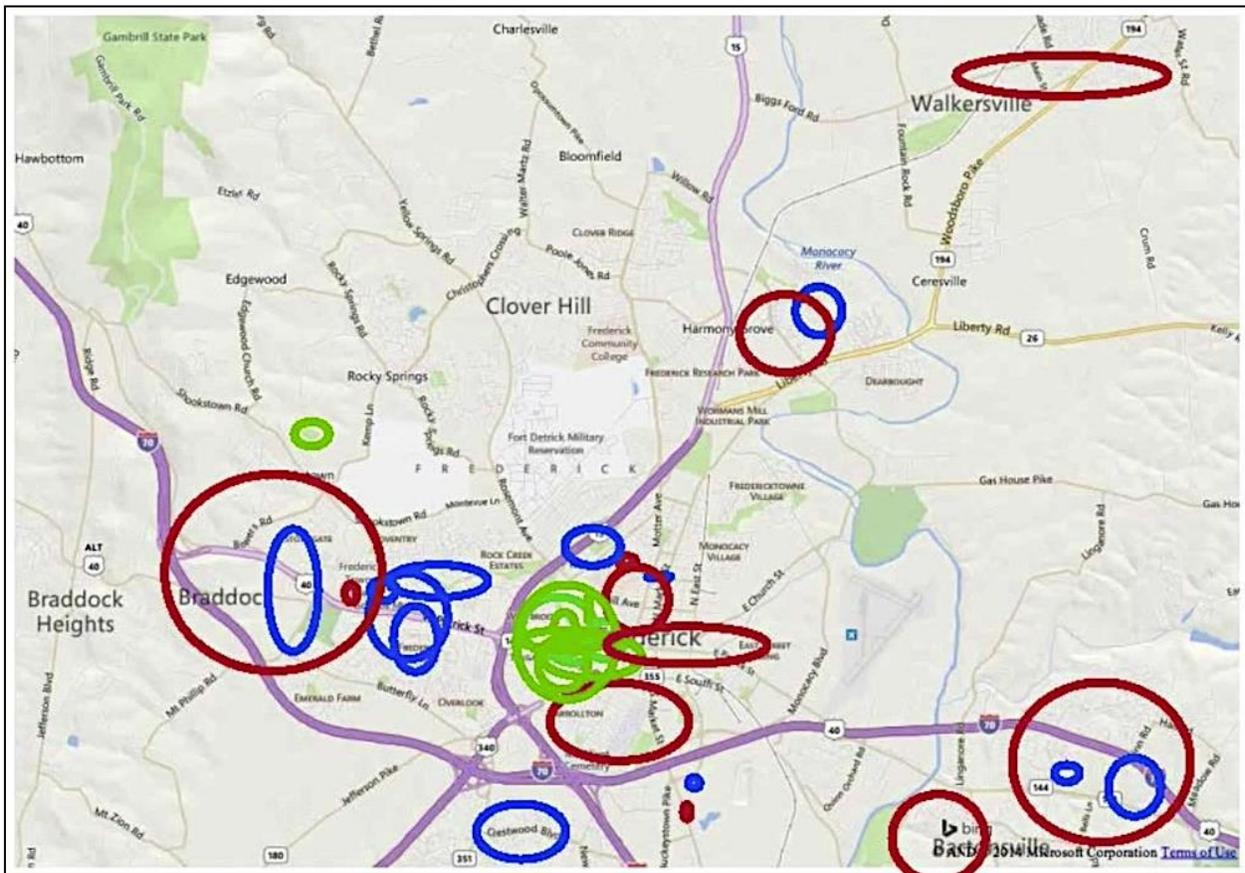
Figure 9: Cumulative Accessibility

Data Sources: Maryland IMAP, City of Frederick, US Census Bureau

Figure 9 depicts the cumulative distance to amenities and shows that neighborhoods closest to downtown are closest to all four amenities. Areas shown in green are closer to amenities and areas in red are farther from amenities. Neighborhoods located near the city limit are farther away from commercial centers, medical centers and elementary schools. Surprisingly, West Patrick Street (Route 40) has only a moderately high average accessibility, an area of Frederick we thought would have a high average accessibility when starting our research.

Figure 10: Survey Results Overlay

Data Sources: On-site surveys of Fredrick area residents

Limitations

It would be remiss not to address the limitations of this research project. The first

limitation was that, with only two site-visits we did not get a large survey sample size. Likewise,

surveys collect data at a single point in time, making it difficult to measure changes unless two or

more surveys are done at different locations at different times. By conducting the survey in

downtown Frederick, the respondents represented a narrow range of socio-demographic

variables, making the case for a second survey in another location. Additionally, instead of only

using an iPad, it may be beneficial to have an identical paper-and-pencil survey available for

those not willing to use an iPad to take a survey.

The second limitation was that, our GIS data needed more detail. Although the data

separated commercial properties from residential properties it didn't show the type of business

and number of employees. Additionally, some of the GIS road network didn't include speed

limits, congestion data, one-way street information, and traffic light locations, and therefore, the Origin-Destination Cost Matrix may have chosen longer routes to amenities.

Recommendations/Future Research

Rather than providing specific recommendations, this research was intended to provide the City with an analytical framework. A much more detailed approach would be needed to truly assess amenity accessibility. The selection of amenity groups in this research was limited by the available data. A detailed, representative survey of residents from each NAC should be conducted to determine which amenities are used, how often they are used and how valuable it is to the residents to have these amenities close-by. This information could provide "weights" for each amenity based on the importance having community access (for example, based on our survey, residents may value having shopping close to their homes, but would travel to go to the park).

With weighted survey information, more detailed amenity data and better network data, a more thorough analysis could be performed. This analysis would allow the City of Frederick to make recommendations for zoning and land use changes to provide more access to amenities in their next master plan.

Appendix

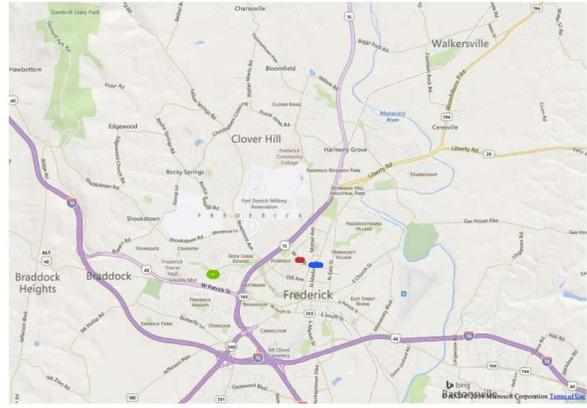## SURVEY RESULTS

Red = Respondent's Home

Blue = Respondent's most frequently used shopping area
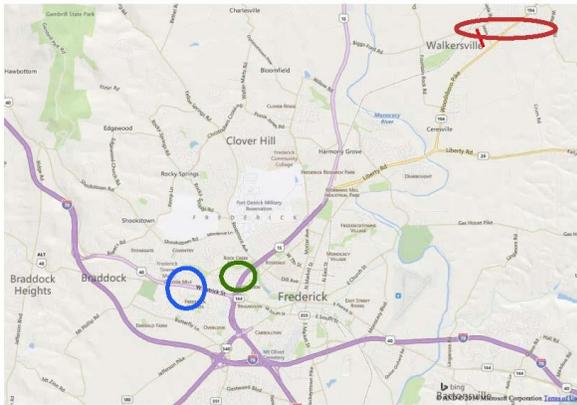
Green = Respondent's most frequently used park
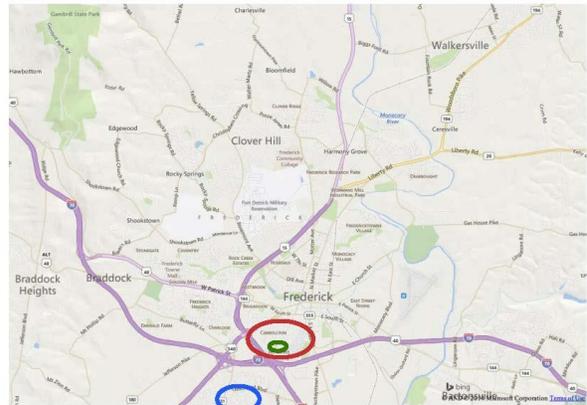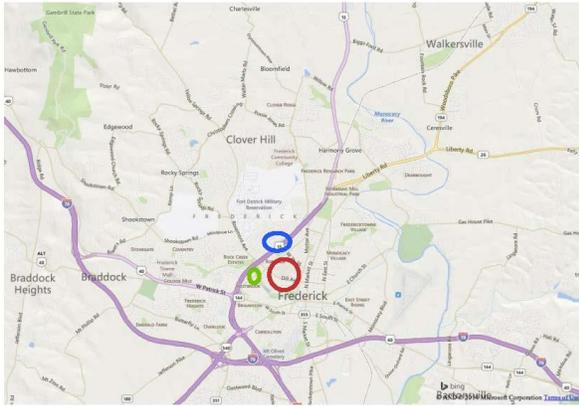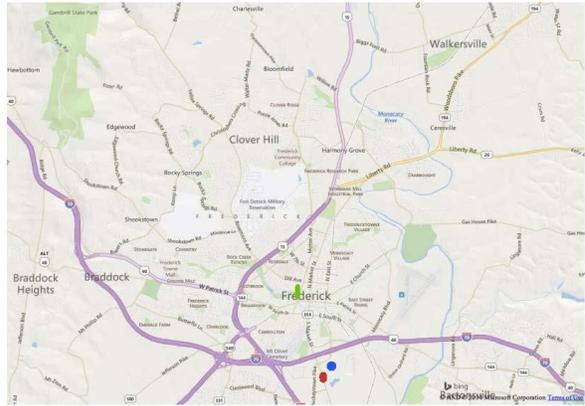
Respondent #1

Respondent #2

Respondent #3

Respondent #4
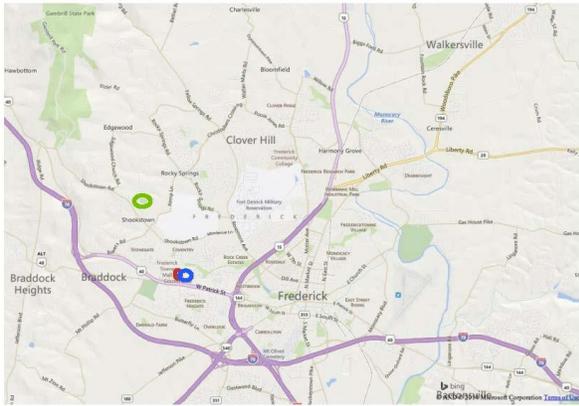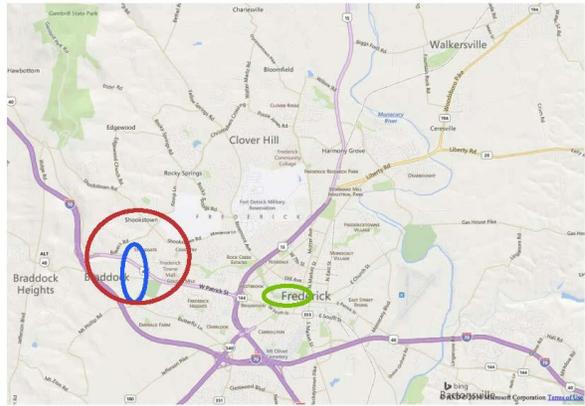
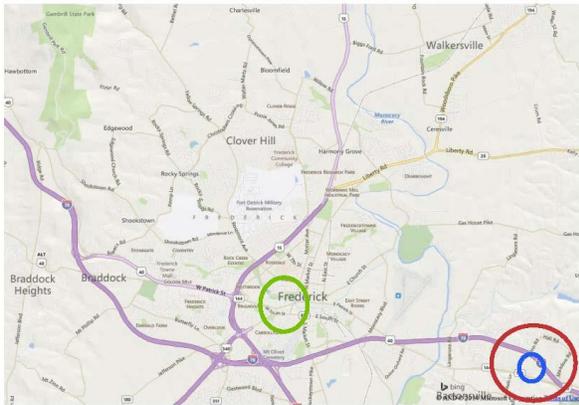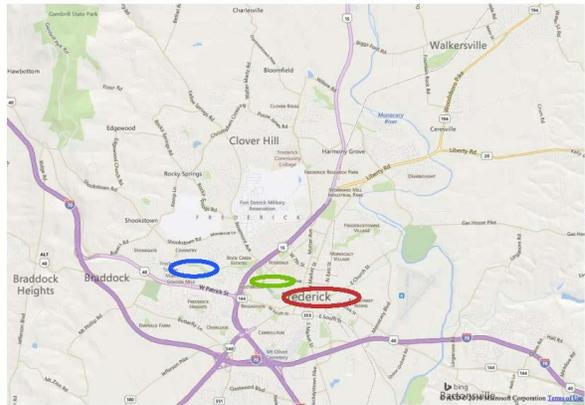Respondent #5

Respondent #6

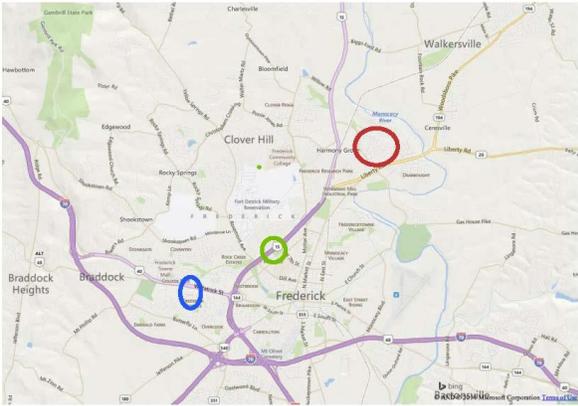Respondent #7

Respondent #8

Respondent #9

Respondent #10

Respondent #11

References

Neighborhood Advisory Council. (2014, December Saturday). Retrieved from The City of Frederick

Maryland: https://www.cityoffrederick.com/index.aspx?nid=316