Creating a 20-Minute Neighborhood: Assessing Walkability in Redmond, Oregon

Fall 2015 • Advanced GIS

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UNIVERSITY OF OREGON

SCI
Sustainable Cities Initiative

REDMOND THE HUB

Acknowledgements

The author wishes to acknowledge and thank the Redmond City Council, Redmond City Engineer's office, and the Redmond Community Development Department for making this project possible. We would also like to thank the following for their assistance and contributions that were instrumental to the completion of this report:

Mike Caccavano, City Engineer

Heather Richards, Community Development Director

Mark Chambers, GIS Analyst

Cover photo courtesy of Redmond Chamber of Commerce

About SCI

The Sustainable Cities Initiative (SCI) is a cross-disciplinary organization at the University of Oregon that promotes education, service, public outreach, and research on the design and development of sustainable cities. We are redefining higher education for the public good and catalyzing community change toward sustainability. Our work addresses sustainability at multiple scales and emerges from the conviction that creating the sustainable city cannot happen within any single discipline. SCI is grounded in cross-disciplinary engagement as the key strategy for improving community sustainability. Our work connects student energy, faculty experience, and community needs to produce innovative, tangible solutions for the creation of a sustainable society.

About SCYP

The Sustainable City Year Program (SCYP) is a year-long partnership between SCI and one city in Oregon, in which students and faculty in courses from across the university collaborate with the partner city on sustainability and livability projects. SCYP faculty and students work in collaboration with staff from the partner city through a variety of studio projects and service-learning courses to provide students with real-world projects to investigate. Students bring energy, enthusiasm, and innovative approaches to difficult, persistent problems. SCYP's primary value derives from collaborations resulting in on-the-ground impact and expanded conversations for a community ready to transition to a more sustainable and livable future.

SCI Directors and Staff

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Nico Larco, SCI Co-Director, and Associate Professor of Architecture, University of Oregon

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About Redmond, Oregon

Redmond, located in Deschutes County on the eastern side of Oregon's Cascade Range, has a population of 27,427 and is one of Oregon's fastest growing cities. The City's administration consists of an elected mayor and city council who appoint a City Manager. A number of Citizen Advisory Groups advise the City Manager, mayor, and city council.

From its inception, Redmond has had its eyes set firmly on the future. Redmond was initially founded in 1905 in anticipation of a canal irrigation project and proposed railway line. Redmond is on the western side of the High Desert Plateau and on the eastern edge of the Cascade mountain range. Redmond lies in the geographic heart of Oregon. Redmond focuses on its natural beauty, reveling in the outdoor recreational opportunities (camping, hiking, climbing, biking, and skiing) offered by the Cascade mountain range, four seasons climate, and 300+ days of sunshine annually.

Redmond has been focused on innovative, sustainable growth and revitalization while preserving the city's unique history and culture. In 1995, the City of Redmond began to make critical investments in revitalizing its downtown core. The initial phase of renovations strove to balance growth, livability and historic preservation by rerouting Oregon State Highway 97, improving critical infrastructure, and improving the facades of over 100 buildings in the historic center. The City of Redmond has worked with local businesses to revitalize retail, job creation and housing. To facilitate private sector buy-in, Redmond offers innovative incentive programs such as the Façade Rehabilitation and Reimbursement Grant and the "Downtown Jumpstart" loan competition, as well as Design Assistance.

Often referred to as "The Hub" of Central Oregon, Redmond is situated at the crossroads of US Highway 97 and US Highway 126. It is served by the Burlington Northern Sante Fe Railway, Cascades East Transit Regional Public Transportation Service, as well as a state of the art regional airport served by multiple commercial airlines and FedEx and UPS. In addition to its geographic location, Redmond is viewed as central to business growth in the region. In 2014, Central Oregon Community College opened a 34,300 square foot Technology Education Center to recruit new businesses and expand existing businesses in Central Oregon. Above all, Redmond prides itself on being a family-friendly city which was the motivation for the work presented in this report.

Course Participants

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i. Executive Summary

The City of Redmond aims to revitalize its neighborhoods by improving the walkability of the city and creating an inviting environment for pedestrians. As a part of the Sustainable City Year Program, students in the Geography Department at the University of Oregon participated in an Advanced GIS class that partnered with Redmond to highlight areas within the city where gaps, or holes, exist in the pedestrian infrastructure. Students analyzed Redmond for “20-minute neighborhoods,” which consist of places where residents have easy access (a 20-minute walk) to frequently used goods and services. These analyses were then used to conduct a walkability study of areas containing points of interest. This report includes the analyses performed by the students, descriptions of the methods, the results of each student, overall findings, and final recommendations to improve the walkability of Redmond.

Students used GIS and CAD data provided by the Redmond City Engineer. The class used this data in conjunction with the ArcGIS program to create an interactive website, network service area maps, density maps, and generate weighted overlay maps to find the holes and highlight “20-minute neighborhoods” around several different points of interest. These points included schools, restaurants, city buildings, parks, and places of worship. The level of ease pedestrians encounter when trying to reach these points of interest without a car determines the area’s walk score.

The outcomes of these maps illustrated several factors that contribute to a low walk score, such as high traffic counts and speeds with no sidewalks, non-connecting sidewalks, and sidewalks in areas that could be deemed unsafe for people to walk, such as on Highways 97 and 126. Class recommendations to create a more walkable Redmond include painting crosswalks in these areas, which allows sidewalks to become connected, and enhancing walking areas by planting low maintenance and drought tolerant vegetation, as well as possibly creating shelters and benches. By implementing these changes, the walk score for the City of Redmond could be raised.

I. Introduction

In The Great Neighborhood, by Jay Walljasper, Walljasper writes:

> "Indeed, we are in the midst of a walking renaissance as millions of people discover a daily stroll can prevent disease, boost energy, ease stress, connect us with our communities, and is just plain fun. The number of us who regularly take a walk has risen six percent in the last decade, according to the US Centers for Disease Control and Prevention. Eighty-four percent of Americans–even higher for those under 35–want to live in a place that's walkable, according to a new study from the National Association of Realtors."

The "walking renaissance" highlights the increase in people who are looking for ways to be more active by moving to areas that are more inclusive of pedestrian services. In order to better meet this need, Redmond seeks to revitalize its neighborhoods through projects that acknowledge this interest in community health, such as increasing a pedestrian's ability to walk around the city easily. In addition, city officials are seeking to improve the existing transportation infrastructure to include alternative transportation methods like walking. Mike Caccavano, City Engineer, noticed that Redmond had a poor walkability score, which spurred the development of a walkability project. With the help of Heather Richards, Community Development Director, the idea of creating 20 minute neighborhoods in Redmond was born.

City officials in Redmond asked students in the Advanced Geographic Information System (GIS) class to focus on city infrastructure, specifically where the "holes" in infrastructure were located. These infrastructure holes are areas characterized by a lack of sidewalks, a lack of connections between sidewalks, or the existence of sidewalks located in areas not conducive to walking. The latter of the three occurs when these sidewalks are next to streets with high speed limits or traffic counts. By determining where the gaps are within the system, students could then develop suggestions that would enable Redmond to create neighborhoods that could be walked in 20 minutes.

In partnership with Redmond, the class examined the current network of sidewalks, streets, and points of interest to determine walkability of the community. The class used GIS and CAD data provided by the City of Redmond and the U.S. Census Bureau to create networks that show existing sidewalk locations and where holes are located. Students also highlighted areas, neighborhoods, and points of interest where walking would be a convenient form of transportation.

This report addresses the findings of each analysis and provides detailed information on recommendations for achieving improved walkability in Redmond.

Background

Walking enables individuals and communities to stay active and become healthier. Residents can gain a sense of belonging to their community when they physically connect with their surroundings. To develop a greater sense of community and increase walkability, Redmond asked students to identify areas within the city that were not conducive to walking. The class took many factors into consideration when performing this analysis, including road network design, street layout, and the presence of cul-de-sacs.

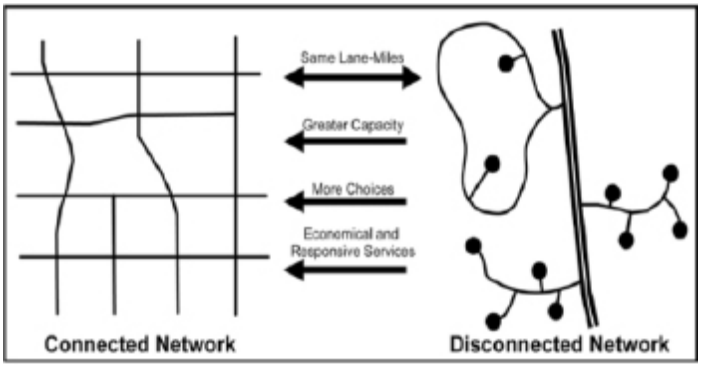

Figure 1: This figure represents examples of a gridded, or connected, street network and a cul-de-sac, or disconnected, street network.

For many cities across the United States, a determining factor in walkability is road network design. Older cities, such as Boston and Denver, use gridded street networks. These streets form a grid pattern with streets connecting at regular intervals similar to a north/south and east/west orientation. After World War II, American cities began to expand outward, creating suburbs and subdivisions. These expansions included roads with little to no connectivity for long stretches, and road networks that do not connect to the main assembly of roads (Figure 1). As a first step, students identified areas in Redmond with existing disconnected networks.

Street layout and cul-de-sacs can inhibit walking due to the inconsistent connections between streets. Conversely, a well-developed and connected street layout can help create a network of sidewalks that allows a person to walk anywhere, and potentially walk rather than drive to their destination. This connection between sidewalks is a common theme throughout many different walkability studies reviewed by the class. In one case study from Olomouc City in the Czech Republic, researchers studied what made a city walkable, specifically the number of connections that an intersection has and how this positively impacts walkability (Dobesova and Krivka, 2012). This study found that intersections with more streets converging led to intersections with better walk scores. For example, the corner of Southwest 6th Street and Southwest Evergreen Avenue in Redmond would be better suited for walking than the corner of Southwest Canyon Drive and Southwest Evergreen Avenue because Southwest 6th Street is more connected (Figure 2). Cul-de-sacs score very low in connectivity due to the fact that they do not offer direct routes for pedestrians to travel. Students sought to identify these areas as well.

Figure 2. This figure illustrates the two intersections noted above; the disconnected street network of SW Canyon Drive and W Evergreen Avenue is circled in red, while the connected street network of SW 6th Street and SW Evergreen Avenue is circled in green. The lack of other street connections near SW Canyon Drive makes this a difficult area for pedestrians to walk around. Photo courtesy Google Maps.

II. Methodology

In order to study the walkability and pedestrian accessibility in Redmond, many points of interest were provided by the city engineer's office. These points of interest include parks, schools, and city buildings such as public works, library, and city hall. Other points of interest that were added by students include restaurants, churches, and childcare centers (See Appendix A). These additional points were created using online searches via the Redmond Chamber of Commerce website, the State of Oregon's Department of Human Services website, and Google Maps. Using these web services, the addresses and geographic locations were established and were then used as origin points for creating the network service areas.

These network service areas were created using the network service analysis tool in ArcMap. Students created a 20-minute neighborhood, or half-mile service area, using these points. Service areas are detailed buffers around a central location, which in this case are the points of interest. A buffer around a point is an equally set distance, in this case a half-mile radius, encircling that point. The network service analysis uses a specific region around a point determined by a specific distance or time to encompass all streets that can be reached based on that distance or time. Because it is hard to express distance in time, the half-mile distance was used as the distance parameter for the network analysis tool. A quarter-mile service area was also included for those who are younger or older than the average walker and can only walk short distances. The quarter-mile service area also works well for assessing quick runs, such as a walk to lunch or a coffee break during business hours.

Before these service areas could be created, a network of sidewalks was needed. The network analysis tool relies on a network set such as a street or sidewalk network to determine how easily a person can travel a given length. In this case, the students used a distance with a radius of one-half mile from a particular point. Aside from the street or sidewalk network, the network analysis tool needs points in the form of locations. These points are used as a starting point in which to begin the measuring of how far one can travel. The result of this task is the network service area. The service area follows the sidewalks until it can no longer continue. This usually happens when the distance has been measured. However, the service area could be cut short due to the lack of connectivity from one sidewalk to another. The distance from the point to the end of the service area could also be the end of a stretch of sidewalk in the middle of a block.

An overview of all of the points of interest (Figure 4) shows that these points are heavily concentrated in the downtown portion of the city.

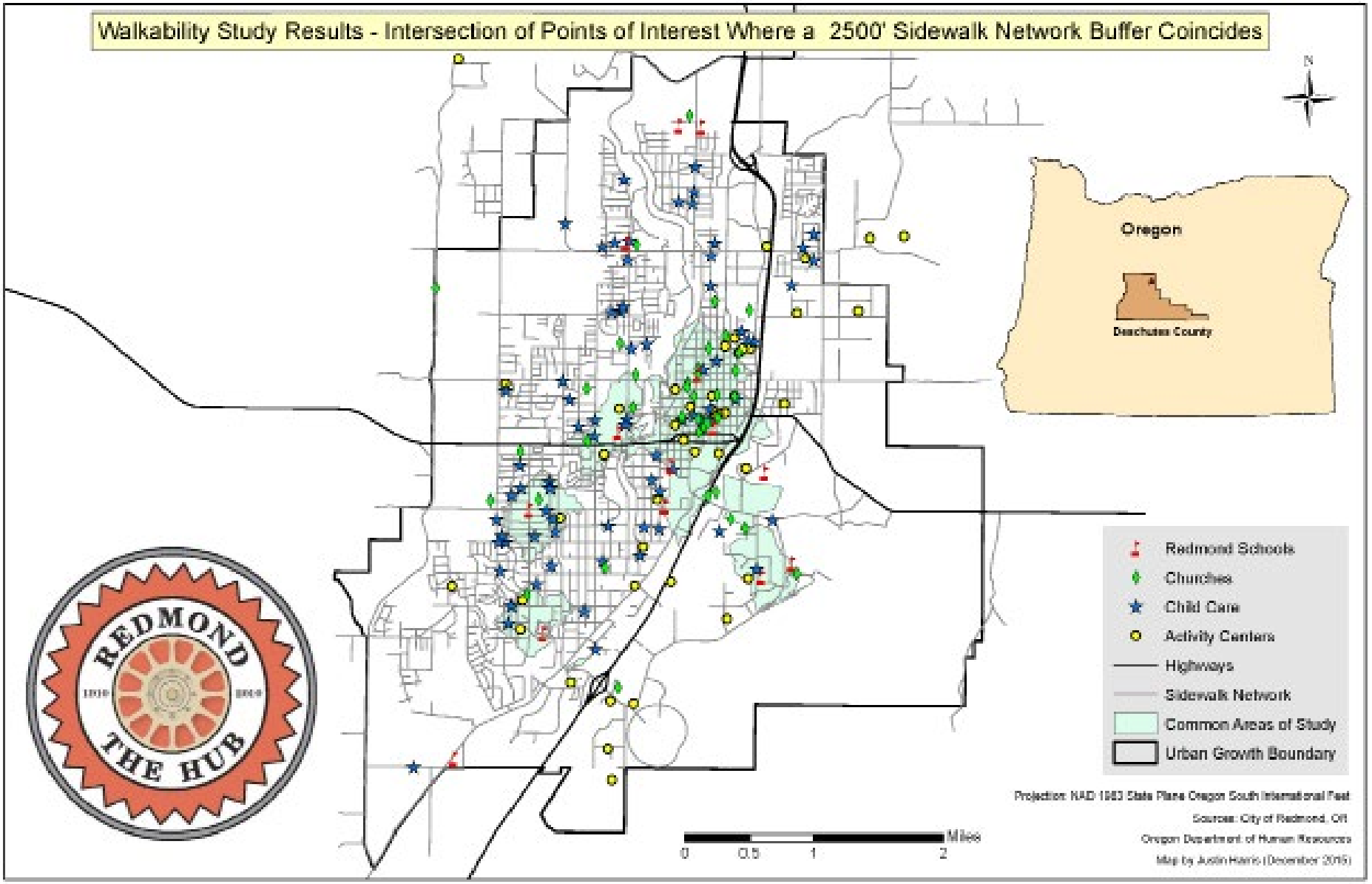

Figure 4: This map shows the intersection of points. The common areas of study in this map are service areas that intersect with each other. The points used for these service area intersections were churches, schools, child care, and activity centers. Created by Justin Harris.

In addition, students used density maps to illustrate the location of the majority of these points of interest across town. Density maps represent where the majority of interesting places are located. A kernel density tool was also used for these maps because the tool has the ability to show a sharper, more detailed image of what parts of town have more places to walk to, from, and around. The kernel density tool finds the direction and length from point A to point B. This shows that the downtown area of Redmond has a higher density due to the availability of many points of interest.

With this methodology and these tools in mind, the Advanced GIS class performed several different analyses, including sidewalk connectivity analysis, K-12 school sidewalk and crosswalk analysis, and speed zone analysis to assess the walkability of Redmond.

III. Results

The following section describes the analyses completed by each student using the points of interest and various other layers, including roads, highway counts, and speed limit data. These analyses include sidewalk connectivity, K-12 school analyses, and walkability and sidewalk analysis of restaurants, coffee shops, grocery stores, and parks. A web resource was also created as a helpful tool for residents and other users to select different factors and discover how they can impact the walk score.

i. Sidewalk Connectivity Analysis

An overview of sidewalk connectivity (Figure 5) illustrates the combination of land use mix, such as commercial or industrial, and the accessibility of sidewalks throughout Redmond. The pink lines depict roads that lack sidewalks, while the grey-blue lines show the roads that include sidewalks. The blue polygons show the density of the points of interest in Redmond. The darker the color of the polygon, the higher the number of points of interest within that area.

There are several areas within Redmond, such as the downtown region, that have high numbers of points of interest, shown in the density analysis overlay below. Comparing the density overlay to the pink lines that show roads without sidewalks, there are several areas where pedestrians are unable to use sidewalks to access the parks, restaurants, and schools that may be located there. Because of the lack of sidewalks in a desirable area, people are less likely to walk to or from these areas, and will instead opt to drive or take other means of transportation.

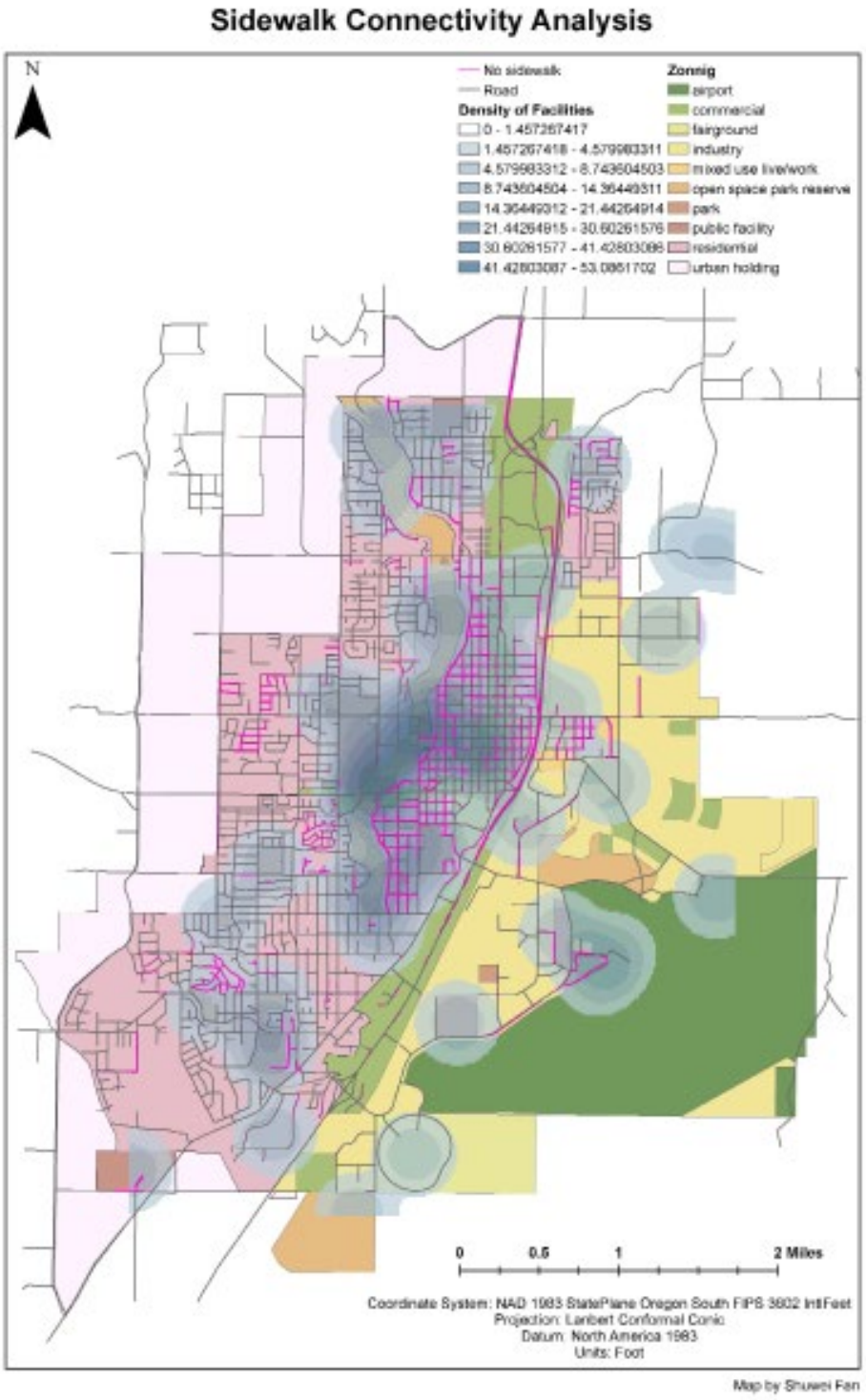

Figure 5: This map represents the density of the points of interest combined with a land use map provided by Redmond officials. Map by Shuwei Fan.

ii. K-12 School Analyses in Redmond

An analysis comparing speed zones to the sidewalk density around Redmond schools (Figure 6) displays density of sidewalks in shades of blue, speed zones of roads divided by color, and schools as graduated symbols based on the average number of sidewalks. The larger symbols correspond to schools that have more sidewalks on average. The schools with more sidewalks are located closer to downtown, while schools with fewer sidewalks are located farther from downtown. The speed zones situated around some of the schools located near downtown have speeds up to 35 mph, while others have speeds up to 40 mph, both of which are high speeds for walking school children. These schools tend to have a higher number of crosswalks than the schools farther from downtown, but they also generally have higher densities of sidewalks (darker blue).

Though there are some areas of concern when it comes to the speed limits around schools, most schools are located in relatively safe speed zones. The number of crosswalks, however, vary and tend to be concentrated around schools with a higher density of sidewalks.

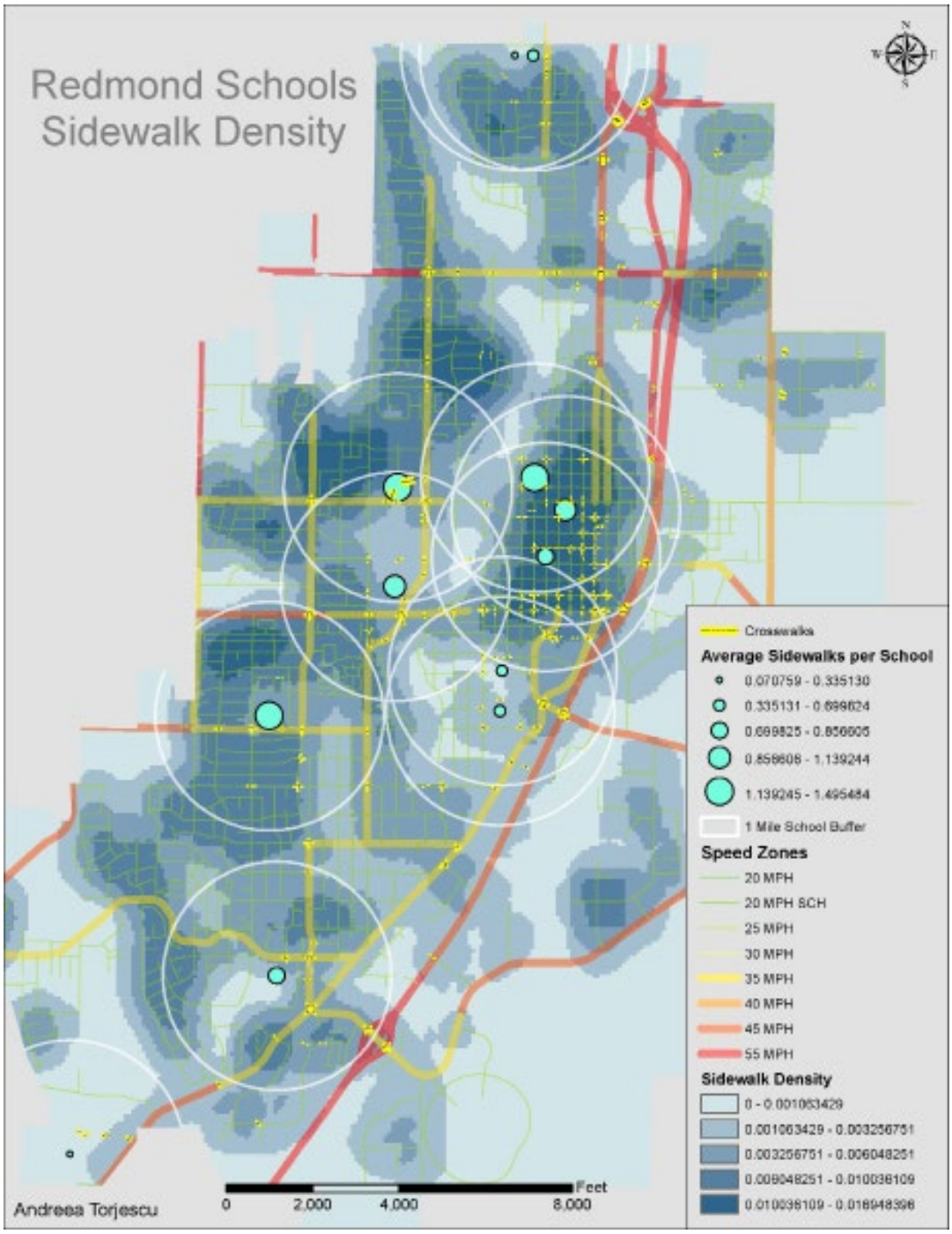

Figure 6: This map shows that the highest density for sidewalks is in the downtown portion of Redmond with some hotspots in other parts of town where there are schools. Created by Andreea Torjescu.

Sidewalk Network Analysis within Redmond School Neighborhoods

An exploration of walkability and sidewalk connectivity (Figure 7) within each school neighborhood shows each school location, shown with green outlines within each buffer, crosswalk density, and the density of areas without sidewalks. The areas that have the highest densities of sidewalks, shown with darker blue, are located in the school neighborhoods near downtown. The areas that have the least dense sidewalks seem to increase as further away from downtown. The school neighborhoods closer to the exterior of Redmond tend to have fewer crosswalks and fewer sidewalks, which would dissuade pedestrians from walking to and from school, and instead encourage the use of other means of transportation.

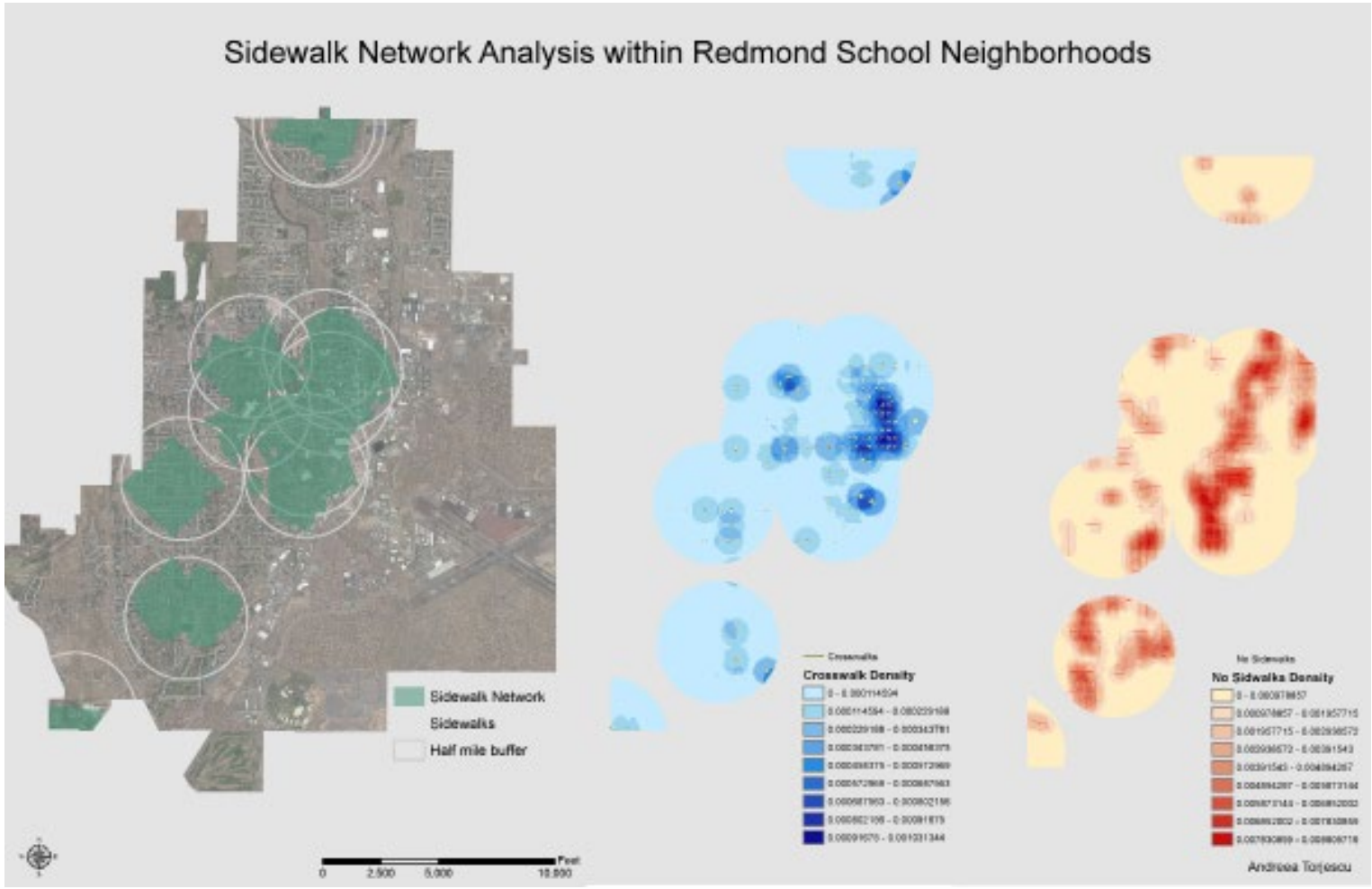

Figure 7: This map of Redmond school neighborhoods displays the density of crosswalks and the density of areas lacking sidewalks. Created by Andreea Torjescu.

20-Minute Walks in School Neighborhoods

An overview of the 20-minute walks (Figure 8) displays the ratio of roads to sidewalks in each of the school neighborhoods, as well as the types of zones present within each area. Ideally, the city would have sidewalk length totals greater than the road lengths in order to have a city conducive to walking. In all but one school, the sidewalk to road length ratio exceeds 50%. Almost all of the schools reach 60%, while Ridgeview High School is the only school that is slightly under 50%. John Tuckerman High School has the highest residential land use type in its service area, while Ridgeview High School has the least. The speed zones are also noted on this map, with the lightest colors corresponding to lower speeds and the darkest colors corresponding to the higher speeds.

Students and parents that attend schools with a lower sidewalk-to-road ratios are more likely to use other means of transportation, such as driving or bussing, instead of walking. This is also true in cases where land use is not conducive to easy or fast travel, so using roads is sometimes the most convenient for residents. Roads with higher speeds also discourage walking due to the danger it poses to pedestrians.

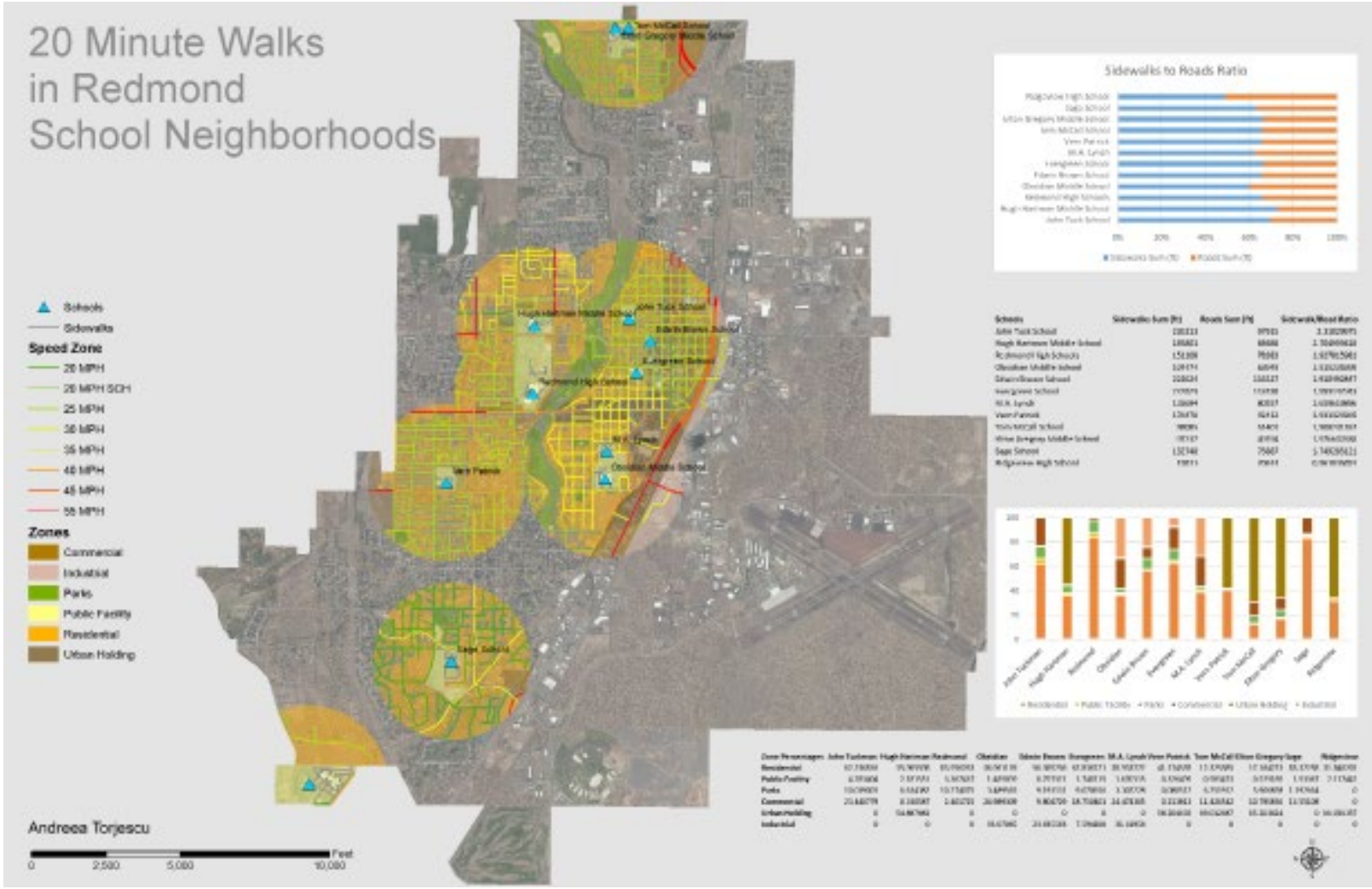

Figure 8: The sidewalk-to-road ratios, speed zones, and land use type for each of the schools in Redmond give important information regarding the likelihood of pedestrian use. Schools that are surrounded by higher speeds, less sidewalks, and less convenient land use zones are less likely to be used by pedestrians. Map created by Andreea Torjescu.

iii. Walkability and Sidewalk Analysis of Restaurants, Coffee Shops, Grocery Stores, and Parks

An overview of the walkability of food and recreation locations (Figure 9) within Redmond shows each of the location's service areas along with the presence, or lack thereof, of sidewalks. Many points of interest fall within the same areas, such as the downtown portion of the city, and are highlighted by the darker shade of orange. Examining the downtown area, it is possible to notice the presence of sidewalks, shown in the map on the left. This same area also seems to have a higher absence of sidewalks, shown in the map on the right. This could be caused by the presence of high traffic and high-speed streets, which would dissuade pedestrians from traveling by foot to grab a cup of coffee or run to the store.

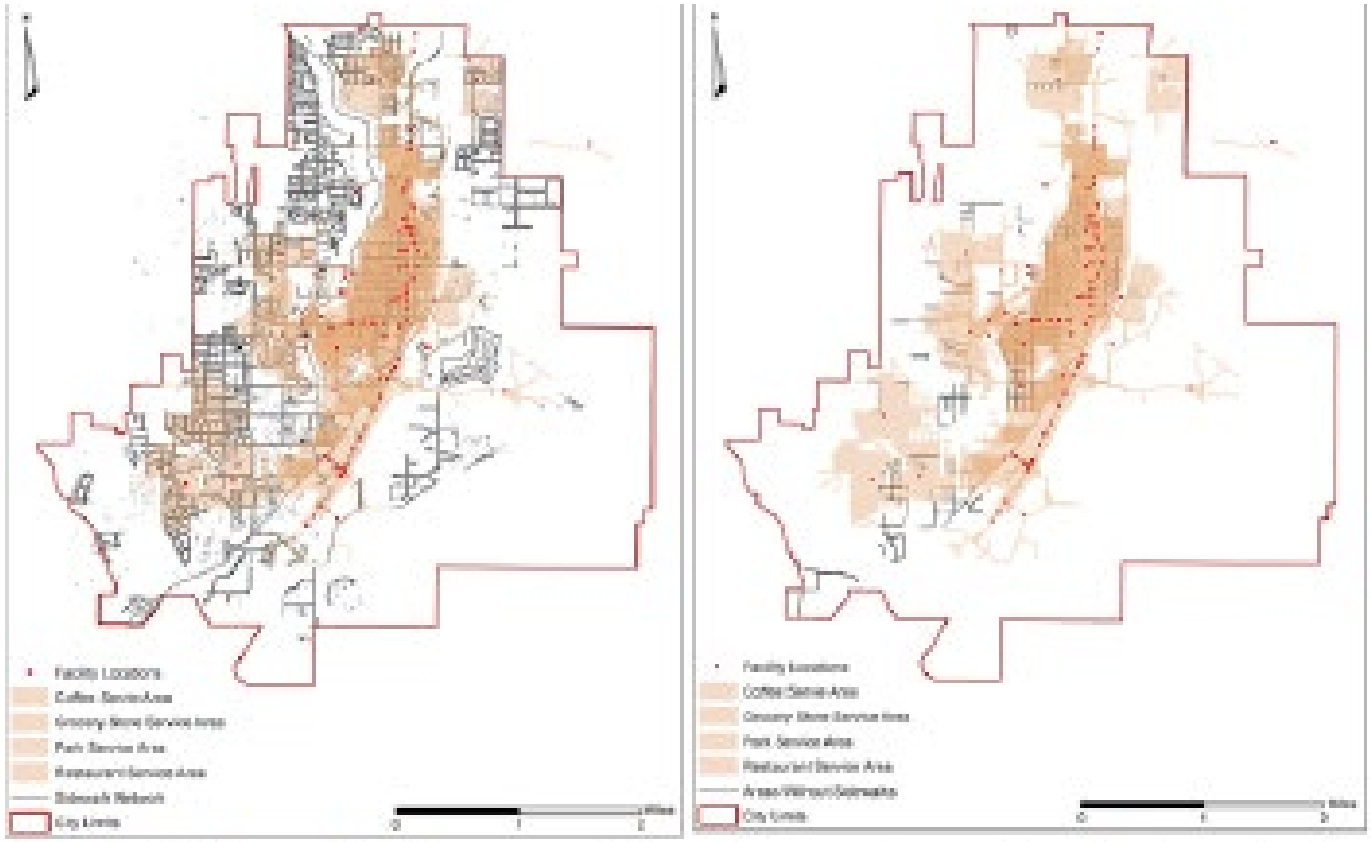

Figure 9: These maps represent the services areas around grocery stores, coffee shops, restaurants, and parks. The map on the left shows the sidewalks available for people to walk along with the overlap of equally weighted data layers. The map on the right shows the non-sidewalk areas within each overlap of equally weighted data layers. Created by Thomas Barber.

iv. Examining the Safety of Redmond

Another analysis was conducted that examined the safety and walkability of the city, which are directly connected to the amount and speed of traffic. In order to accomplish this, the roads within land use zones, traffic amount, and traffic speed were compared to sidewalk connectivity in Redmond (Figure 10). The roads, speed, and type were combined and weighted, then used to divide the roads into areas that are and are not suitable for walking, shown below in the map on the left. The lack of sidewalks, shown with a blue line in the map on the right, was used to help determine the safety of the areas in the previous map. Examining these two maps, the roads that are deemed unsuitable or unsafe are the roads with heavy traffic and higher speeds. The areas that lack sidewalks near downtown are the same areas with a lower suitability score of four out of seven. The best areas for walking seem to be in residential land use zones, which also have the most suitable traffic speeds, traffic amounts, and sidewalks for walking.

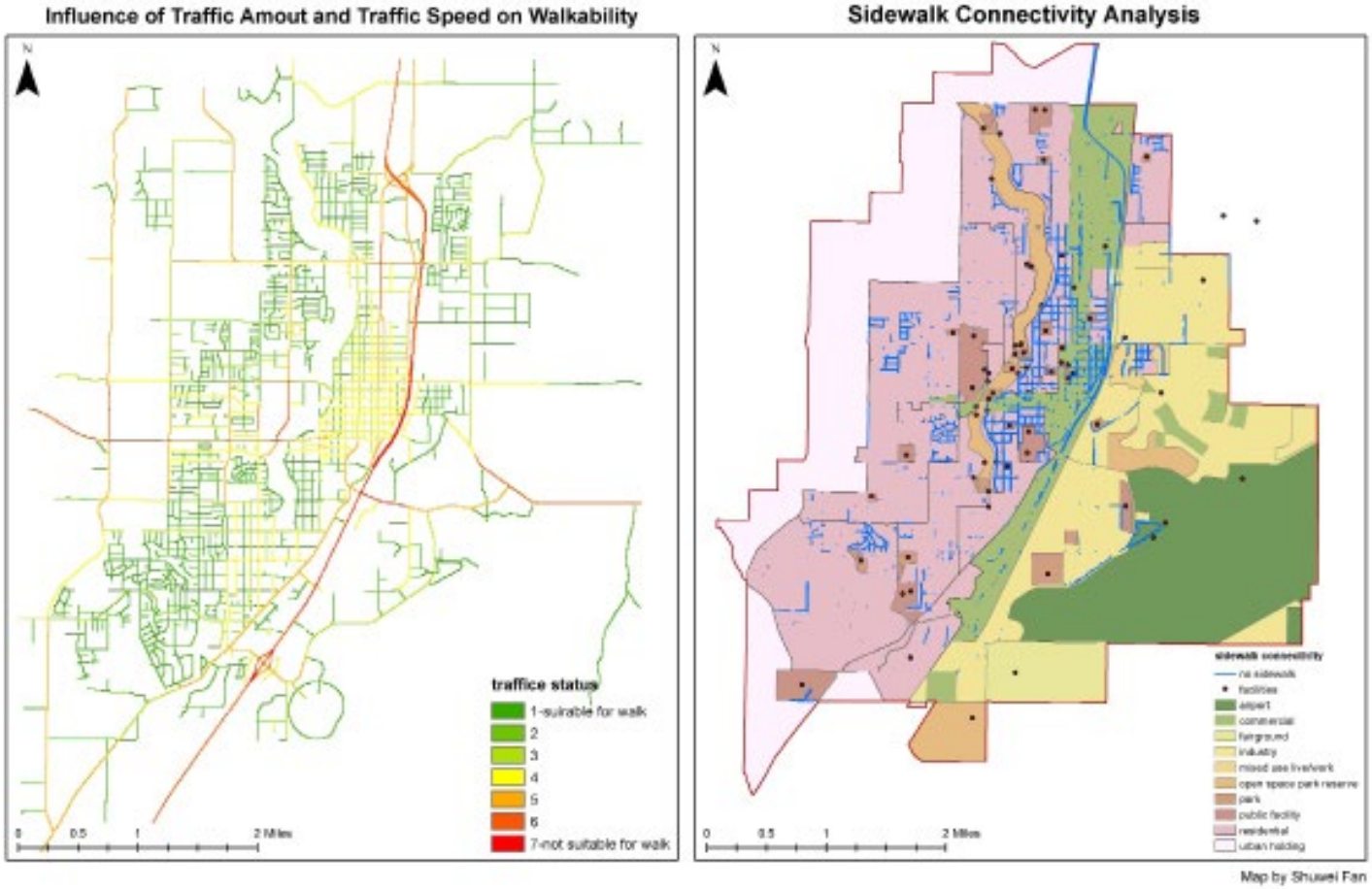

Figure 10: The walkability and safety of Redmond were analyzed using several factors, including traffic speed, traffic amount, and roads within land use type (left). The resulting analysis was then compared to the sidewalk connectivity, which shows the lack of sidewalks in Redmond in blue (right). Map by Shyuwei Fan.

v. Web Resource

In addition to the maps generated for this report, a graduate student in this class created an interactive website that brings together several walkability elements (Figure 11). The interactive web map combines many different data layers, including dwelling density, sidewalk density, perceived safety, and land use mix. This online map allows the viewer to examine what parts of town are walkable by individually selecting each data layer. The viewer can also combine all of the data layers together to see which areas have the highest walkability scores. The website is set so that the user can scroll over each hexagon and see the resulting score based on one or more criteria that determine the walk score.

For example, one of the data layers that can be selected is cul-de-sac density. This layer corresponds to the number of cul-de-sacs within a single area. The more cul-de-sacs present, the lower the walkability score becomes. Typically, there is little-to-no connection between these and other streets, which causes a decrease in the walk score.

The website, created by Rudy Omri, can be found here: http://rudyomri.com/interactive/redmond/map.html

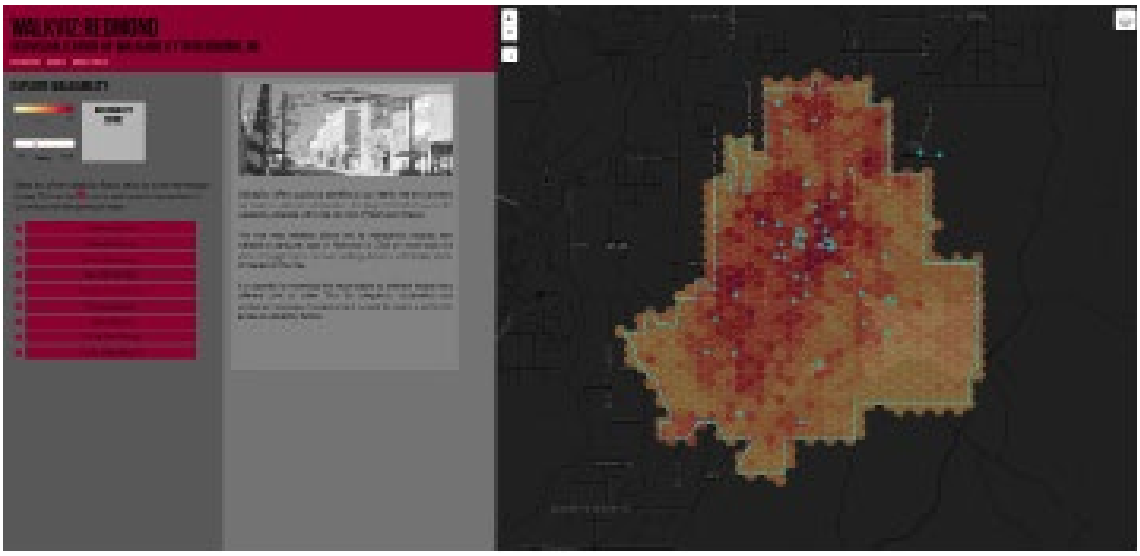

Figure 11: This screen shot of Rudi Omri's interactive website of Redmond, Oregon can be found at the site noted above. Each hexagon has a score that is determined by one or more factors depending on the user's preference.

IV. Discussion

While the City of Redmond has a few select areas that are fairly walkable, the majority of the city is not easily accessible to residents. According to walkscore.com, which gives cities a score between 0 and 100 based on several factors, Redmond has a walk score of 28. This means that it is a car-dependent city, so most residents will need a car to accomplish errands. The low walk score most likely results from the lack of sidewalks and crosswalks, as well as some of the higher speed and land use zones noted in the previous sections. Using these factors, several analyses were conducted in order to discover problem areas for possible improvements, included in the Results section.

The walkability of downtown Redmond is high due to the land use mix, presence of sidewalks and crosswalks, and the location of points of interest. However, moving away from the city center, where the original town was established, walkability becomes more challenging. This happens because there is less variety in land use mixture, not to mention that many businesses and establishments reside within the downtown portion of Redmond. Leslie et. al. mentions that with more land use mix comes more people who are willing to forgo the use of a vehicle to run errands[1]. This in turn creates more businesses in the area and brings in more people who want to live there.

Looking at the density of the points of interest, the connectivity of sidewalks, and traffic information, it is interesting to note that most of the facilities lie within the center of town, which has low connectivity, and higher traffic counts and traffic speeds. It could also be a good idea to try to lower the traffic speed and increase sidewalk connectivity in this area so that passersby could enjoy the many wonderful improvements that Redmond is making. With current conditions, there is little incentive for people to get out and walk around town. However, the improvement of sidewalk connectivity and lower traffic speeds could help increase walkability.

Overall, the City of Redmond has several areas, including the downtown area and the locations on the outskirts of the city, that could be improved so that pedestrians consider the area safe and convenient for walking.

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1 Leslie, Eva, Iain M. Butterworth, and Melissa Edwards. “Measuring the Walkability of Local Communities Using Geographic Information Systems Data.” ResearchGate. October 25, 2006.

V. Conclusion

The City of Redmond wants to rejuvenate its community through the development of more pedestrian friendly areas. In order to accomplish this, the city partnered with the Sustainable City Year Program at the University of Oregon and asked the students in an Advanced GIS course to examine the walkability of their city and suggest possible improvements that would allow pedestrians a safe and convenient environment to travel.

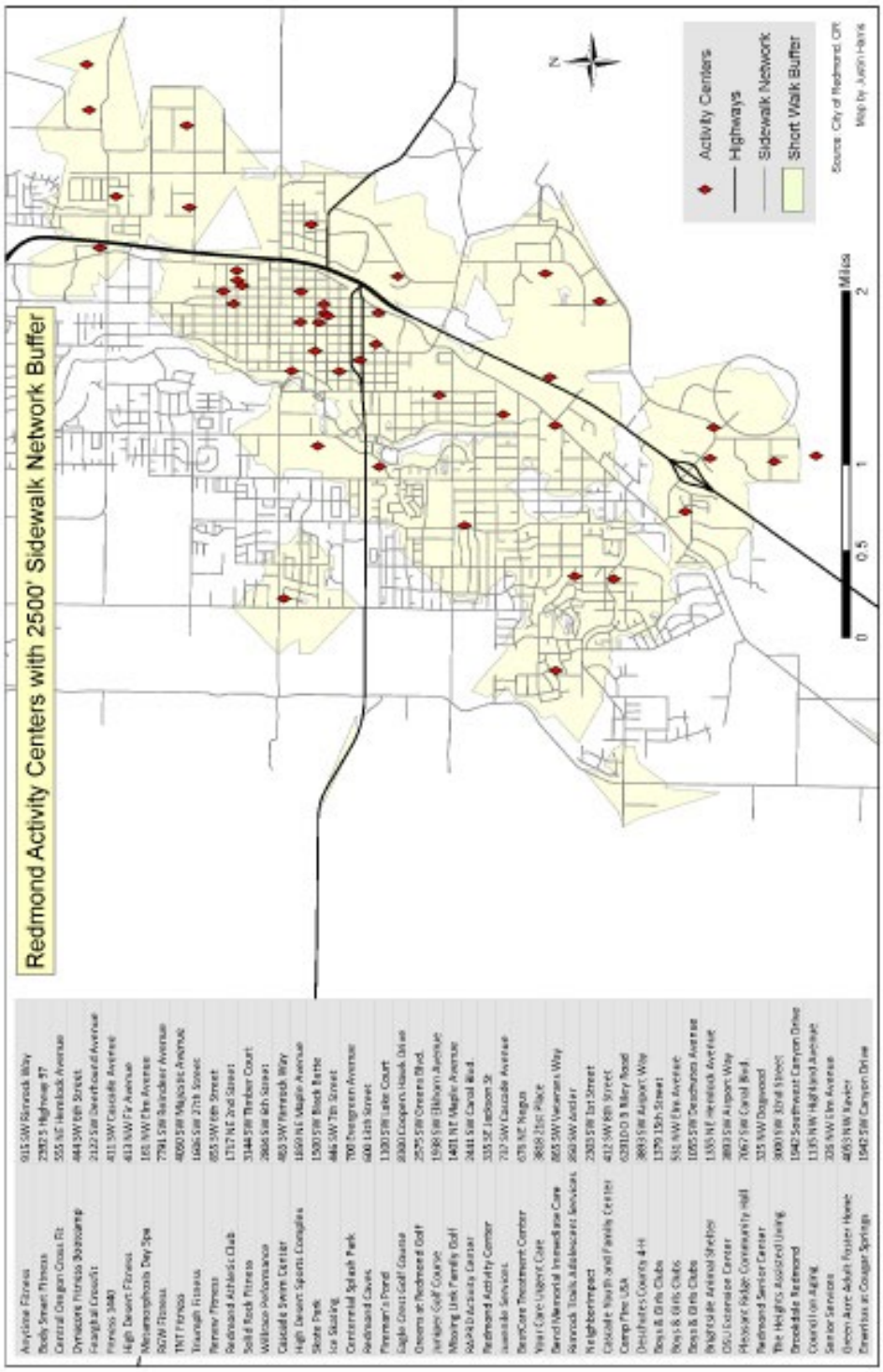
Each of the students analyzed a subject relating to points of interest, including examining walkability around schools, restaurants, coffee shops, and parks. After the analyses were completed, there were several suggestions that would make Redmond a more walkable city, including:

- Adding new sidewalks and crosswalks, particularly near schools
- Developing a connected street network
- Reducing speed limits in school zones
- Improving city streets with vegetation and art
- Encouraging local restaurants and coffee shops to provide outdoor seating
- Adding bike lanes
- Mixing land use zones
- Implementing new programs that promote walking to and from school, such as a “walking school bus”

Walking can be an important and healthy way for people to connect with their community, but without the opportunity or infrastructure to support a safe and convenient environment, it can be hard for many people to feel comfortable walking. By creating an atmosphere that supports walking and bicycling, Redmond can cultivate a positive reputation as one of the most walkable cities in Oregon.

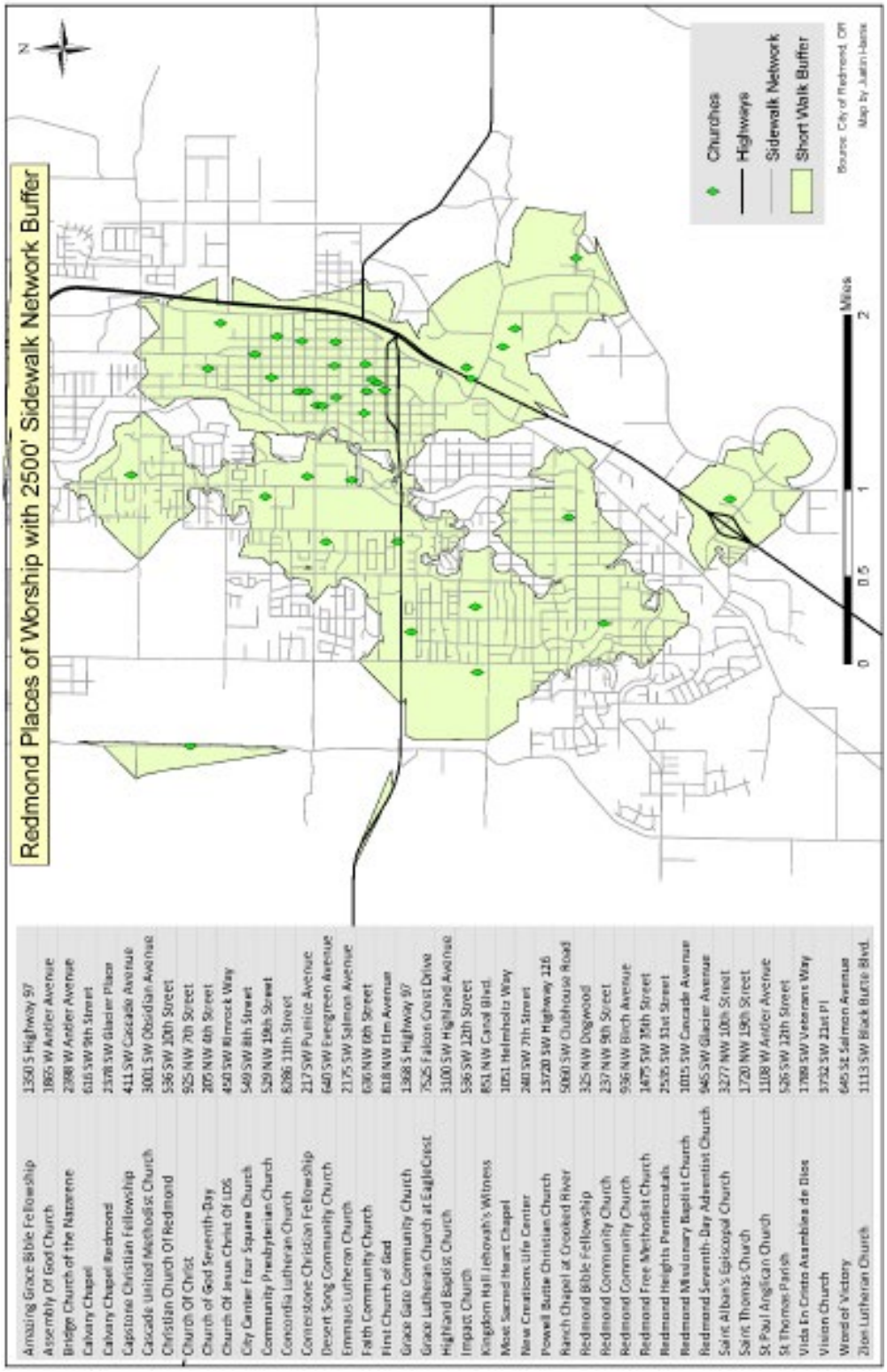
Appendix A | Points of Interest

Activity Centers



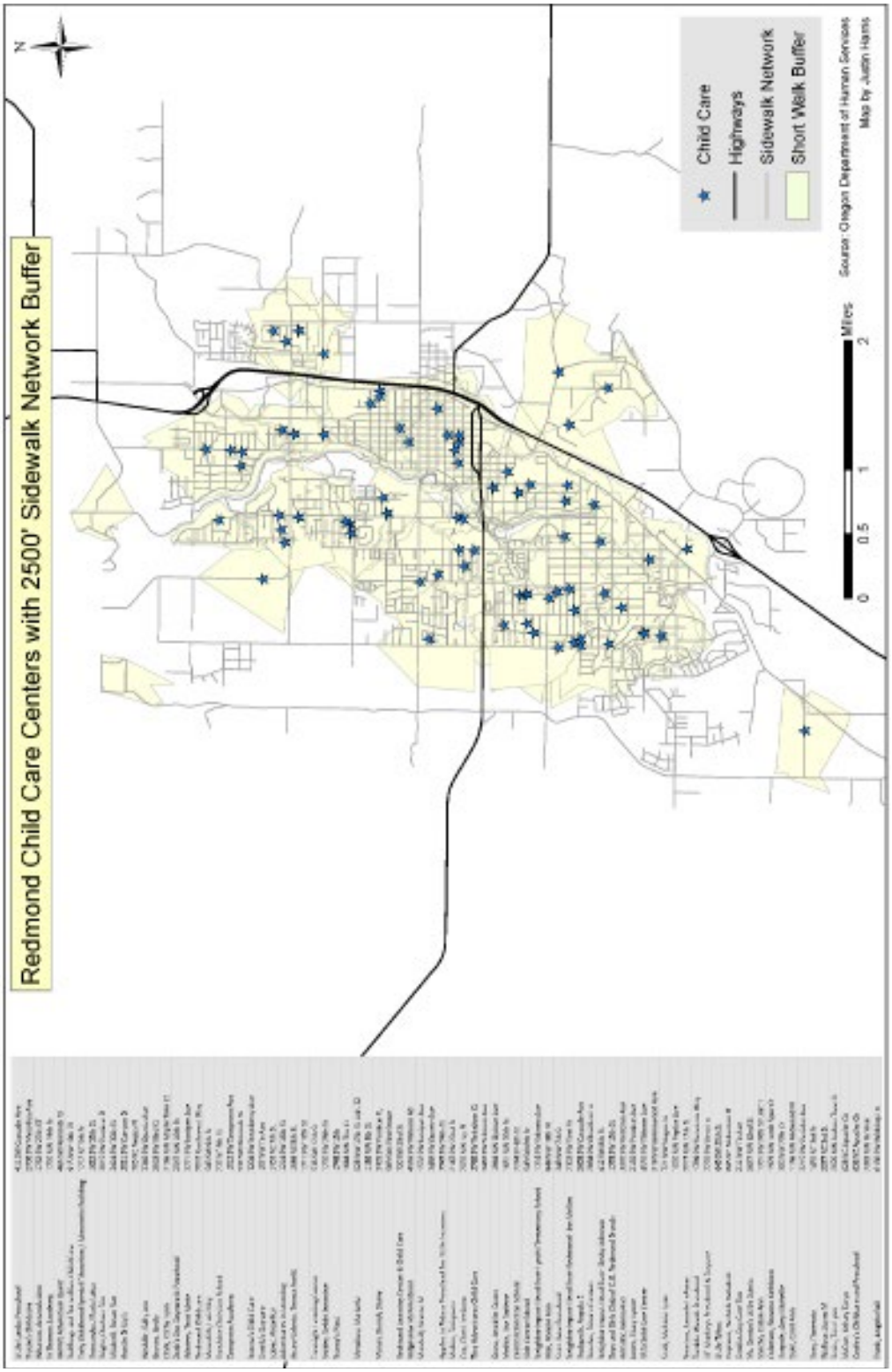
List 1: This list includes the majority of activity centers used in many of the analyses. They include fitness centers, spas, animal shelters, recreational locations, and family centers.

Places of Worship



List 2: This list includes the places of worship used in the points of interest data. They include churches, chapels, and life centers.

Child Care Centers



List 3: This list includes child care centers, which include schools and other activity centers.

References

Dobesova, Zdena, and Tomas Krivk. “Walkability Index in the Urban Planning: A Case Study in Olomouc City.” Advances in Spatial Planning, March 21, 2012, 179-96. Accessed February 23, 2016.

Clapp, J. and Rodgriquez, M. “Using a GIS for Real Estate Market Analysis: The Problem of Spatially Aggregated Data.” Journal of Real Estate Research 16, no. 1 (1998): 35-55.

Leslie, Eva, Iain M. Butterworth, and Melissa Edwards. “Measuring the Walkability of Local Communities Using Geographic Information Systems Data.” ResearchGate. October 25, 2006. Accessed February 23, 2016. https://www.researchgate.net/publication/241592167_Measuring_the_walkability _of_local_communities_using_Geographic_Information_Systems_data.

Rattan, Arjun, Anthony Campese, and Chris Eden. “ArcUser.” Modeling Walkability. Winter 2012. Accessed February 23, 2016. http://www.esri.com/news/arcuser/0112/modeling-walkability.html.

“Walk Score Data Services - Walkability, Real Estate, and Public Health Data.” Walk Score Data Services - Walkability, Real Estate, and Public Health Data. Accessed February 23, 2016. https://www.walkscore.com/professional/research.php.

“Why Walk Score? Important to Shoppers, Raises Home Values.” Why Walk Score? Important to Shoppers, Raises Home Values. Accessed February 23, 2016. https://www.walkscore.com/professional/why-walkscore.php.

“The Walking School Bus: Combining Safety, Fun and the Walk to School.” SRTS Guide:. The Pedestrian and Bicycle Information Center, n.d. Web. Dec. 2015.