HEALTH IMPACT ASSESSMENT (HIA)

of Proposed "Road Diet" and Re-Striping Project on Daniel Morgan Avenue in Spartanburg, South Carolina

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHS AND CHARTS

LIST OF MAPS

EXECUTIVE SUMMARY

Improving the health of individuals and communities results in improved quality of life and increases economic competitiveness. A 2011 study conducted by the Urban Institute found that the U.S. health care system spends about $238 billion per year on individuals who have preventable diseases including Type II diabetes, hypertension, stroke, and heart disease. By implementing prevention programs, preventable disease can be slowed, thereby decreasing medical costs, decreasing absence from work, and improving overall worker productivity (Robert Wood Johnson Foundation, 2011; Waidmann et al., 2011).

The HIA Steering Committee examined the potential health impacts of the proposed re-striping and "road diet" of a downtown Spartanburg arterial road, Daniel Morgan Avenue (DMA). A road diet is a technique to reduce the number of lanes on a roadway to provide safe space for pedestrians and cyclists. The implementation of road diets can benefit different types of transportation and tend to be most successful on roads where fewer than 19,000 vehicles travel daily (The City of Pasadena, 2001; Rosales, 2008). Road diets allow for the creation of bike lanes, sidewalks, street parking, and/or turn lanes (Roth, 2010). This not only benefits those who are driving motor vehicles by reducing the speed and therefore increasing safety, but it also makes roads safer for pedestrians and bicyclists (USDOT, 2004; Rosales, 2008; Burden and Lagerwey, 1990). Pedestrians are safer when crossing the street because traffic is not moving as quickly. Also, there is an increase in visibility and a decrease in crossing distance due to the transformation from four to two lanes (USDOT, 2007; USDOT, 2004; Rosales, 2008; Burden and Lagerwey, 1990; The City of Pasadena, 2001). By promoting multiple modes of transportation, road diets help to improve the accessibility, mobility, and overall health of the community.

The less central part of DMA would be re-striped under the proposed plan, providing space for bicyclists on either side of the road. It is the hope of the Steering Committee that this HIA will serve as a tool to demonstrate the potential impact of the proposed re-striping and road diet on traffic safety, opportunities for physical activity, access to goods and services, and air quality.

The proposed road diet in Spartanburg would reduce the roadway, currently two lanes in each direction, to one travel lane in each direction with a center turn lane. The freed-up space would be used to provide sidewalks for pedestrians on each side of the roadway and a physically separated bicycle lane on one side. It would allow for multi-modal transportation options on this arterial and enhance Spartanburg's bicycle network by connecting to three roads that already have bicycle lanes. Please see Appendix A for a visual representation of the proposed road diet.

The completed bicycle lane network will create safe transportation links between the neighborhoods surrounding DMA, existing greenways and trails, five schools and colleges, five parks (including a recreation center and a swim center), several transit stops, two libraries, a number of bicycle racks, downtown Spartanburg, a farmer's market, and a convention center/hotel. In addition, the bicycle lanes in the proposed road diet will provide safe transportation options for low-income and transit-dependent residents living in adjacent neighborhoods. The proposed re-striping and road diet project has an estimated cost of $400,000.

The research questions identified by the HIA Steering Committee to support decisions related to implementation of the proposed project are as follows:

1. What is the expected effect of the proposed road project on the safety of motorists, bicyclists, and pedestrians on DMA?

2. What is the expected effect of the proposed road project on opportunities for physical activity for the residents of Spartanburg, and in particular, the residents of neighborhoods surrounding DMA?

3. What is the expected effect of the proposed road project on opportunities for improved access to goods and services supportive of a healthy lifestyle for the residents of Spartanburg, and in particular, the residents of neighborhoods surrounding DMA?

4. What is the expected effect of the proposed road project on air quality for the residents of Spartanburg, and in particular, the residents of neighborhoods surrounding DMA?

Overall, the HIA findings, as represented in summary form in the following table, suggest that the proposed road diet and re-striping could not only improve the health of many people but it may also prevent death, injury, and/or serious illnesses. The proposed improvements to the road design would allow for increased safety for motorists, bicyclists, and pedestrians. Through increased opportunities for physical activity and access to goods and services that support a healthy lifestyle, many chronic diseases can be prevented on the community and individual level. Potential improvements to air quality could have a positive effect in preventing and controlling respiratory illnesses.

Table 1: HIA Analysis Summary of Findings

Health Determinant	Direction	Magnitude	Significance	Likelihood	Distribution
Traffic Safety	↑	High	High	Very Likely	Affects whole community relatively equally
Physical Activity	↑	Medium	Medium/High	Very Likely	Impacts neighboring vulnerable community and whole community via expanded access
Access to Goods and Services	↑	Medium	Medium/High	Very Likely	Disproportional effect on low income, transit-dependent communities around DMA
Air Quality	↑	Low	Low	Possible	Affects whole community relatively equally

Legend:

Direction of Impact:

Positive = Changes that may improve health
Negative = Changes that may detract from health
Uncertain = Unknown how health will be impacted
No effect = No effect on health

Magnitude of Impact: *(realizing the proposed project is a 2.1 mile stretch of road, so the comparison or point of perspective is those who currently use DMA)*

Low = Causes impacts to no or very few people
Medium = Causes impacts to wider number of people
High = Causes impacts to many people
Note that this is relative to population size

Significance of Impact:

Low = Causes negative impacts that can be quickly and easily managed or do not require treatment or causes positive impacts that are not serious/significant
Medium = Causes negative impacts that necessitate treatment or medical management and are reversible or positive impacts that provide opportunity for improved health
High = Causes or prevents death or serious illness

Likelihood of Impact:

Very Likely = it is very likely that impacts will occur as a result of the proposal
Likely = it is likely that impacts will occur as a result of the proposal
Possible = it is possible that impacts will occur as a result of the proposal
Unlikely = it is unlikely that impacts will occur as a result of the proposal
Uncertain = it is unclear if impacts will occur as a result of the proposal

Distribution of Impact:

The community surrounding DMA has a large minority population (37.4% in the 29303 zip code and 70.8% of the population in the 29306 zip code). When it comes to economic characteristics, in the 29303 zip code 18.1% of individuals live below the poverty line and in 29306 28.8% of individuals live below the poverty line.

INTRODUCTION

The implementation of a road diet creates safer communities by reducing the number of car lanes to allow for the creation of bike lanes, sidewalks, street parking, and/or turn lanes (Roth, 2010). Utilizing this technique benefits the safety of motor vehicle drivers, pedestrians, and cyclists by increasing visibility and decreasing crossing distance (USDOT, 2007; Rosales, 2008; Burden and Lagerwey, 1990; The City of Pasadena, 2001).

A proposed road project in Spartanburg, South Carolina includes a road diet of one portion of a downtown arterial road, Daniel Morgan Avenue (DMA); the other portion of the proposed road project involves re-striping the road to decrease the width of the car lanes and create bicycle lanes. In the proposed Spartanburg road diet, the road would be reduced from four lanes to two and a center turn lane, sidewalk for pedestrians, and a physically separated bike lane would all be added. This would allow for and encourage different modes of transportation which could lead to healthier lifestyles for the community and decreasing medical costs. To assess the different health effects of a road diet, a Health Impact Assessment (HIA) was conducted, the first ever in South Carolina.

An HIA is a research approach that can be used to anticipate and predict the different health effects of a proposed policy or program on a particular population. In addition to being a prospective research tool, HIA is also an engagement tool, designed to increase input of a variety of stakeholders into decisions that impact them. HIA is a process with the following components: screening, scoping, assessment of risks and benefits, development of recommendations, reporting, and evaluating (Centers for Disease Control and Prevention, 2011). An HIA can be used on different geographic levels including local, regional, national, or international (World Health Organization, n.d.). HIAs are most appropriate when the proposed policy or program concerns at-risk or vulnerable populations. An HIA can provide those involved with beneficial recommendations that enhance positive health outcomes and highlight the negative health effects with mitigation techniques to decrease these negative effects (Centers for Disease Control and Prevention, 2011). When highlighting the positive anticipated impacts on health of the proposed policy or program, HIAs can help gain support for implementation (World Health Organization, n.d.). The recommendations developed as part of an HIA are evidence-based and allow for improved decision-making based on the qualitative and quantitative information presented.

The goals of the Spartanburg road diet HIA were defined at the beginning of the process as follows:

- Provide decision makers with information to help determine the benefits of prioritizing the road diet project
- Include health in transportation planning discussions and decision-making and encourage a "health in all policies" approach among other stakeholders in the community
- Build evidence that including health considerations in decision-making helps communities
- Build local and state-level capacity to replicate the HIA process

TIMELINE

In November of 2010, most members of the Steering Committee participated in an HIA training session sponsored by the Association of State and Territorial Health Officers (ASTHO) and conducted by Human Impact Partners, a non-profit organization that trains others in HIA and conduct HIAs. During the training, the Steering Committee determined that an HIA on the proposed DMA project would be feasible and add value to the decision-making process related to prioritizing road projects in the Spartanburg community. The scoping process, completed in March of 2011 by the Steering Committee, identified the key potential health effects of the proposed project and the populations likely to be affected. During the assessment phase of the HIA, conducted April through July of 2011, the baseline data (representing current conditions) that was identified in the scoping phase was collected and analyzed. The Steering Committee examined the direct, indirect, and cumulative pathways for each health determinant identified in the scoping process: traffic safety, opportunities for physical activity, access to goods and services, and air quality. Utilizing the baseline data and a literature review of the impact of road diets on these health determinants as well as a review of the impact of these determinants on health, the team be-

gan to develop recommendations related to implementation of the proposed road project during the late summer and fall of 2011. This report was written in late 2011 and early 2012.

BACKGROUND & SCREENING PROCESS

HIA Partners

The South Carolina Department of Health and Environmental Control's (SC DHEC) Division of Nutrition, Physical Activity, and Obesity (within the Bureau of Community Health and Chronic Disease Prevention) is the lead organization for this project and the recipient of the capacity-building grant from ASTHO that supported this work. This division is represented on the Steering Committee by the Division Director, Erika Kirby, and the Physical Activity Coordinator, Jill Pfankuch. The division's goal is to decrease obesity and related diseases through promotion of physical activity and improved nutrition. SC DHEC's Bureau of Community Health and Chronic Disease Prevention is represented on the Steering Committee by the Director of the Chronic Disease Epidemiology Office, Khosrow Heidari. The Steering Committee also included Matt Petrofes, the SC DHEC Region Director for the area of the state that includes Spartanburg (Region 2).

There are a number of additional individuals serving on the Steering Committee from a variety of organizations and agencies. One key partner in this process is the Spartanburg Area Transportation Study (SPATS) which is represented by Senior Planner Lisa Bollinger and Special Project Manager Chris Lambka. SPATS plans and creates programs which aid in the transportation of people and goods in and through the Spartanburg area. The other key local partner is Partners for Active Living (PAL), represented by Executive Director Laura Ringo. PAL is a nonprofit community organization that works to encourage active and healthy lifestyles by educating the community and its residents. An additional partner and advisor for the HIA is the Berkeley-Charleston-Dorchester Council of Governments (BCDCOG), represented by Vonie Gilreath, Mobility Manager. The BCDCOG is a voluntary agency that was created in order to aid the local government in identifying opportunities, removing duplication, and making decisions related to community planning and growth. Their involvement served to bring ideas from another area of the state into the planning process and to share lessons learned, as the Berkeley-Charleston-Dorchester area has been on the forefront of creating active transportation options.

Project management was provided by the South Carolina Institute of Medicine and Public Health (IMPH), represented by Associate Director, Research and Strategic Initiatives, Maya Pack, with support from Research Associate Jeanette Ball. IMPH serves as a convener to assemble evidence-based information relevant to policy decisions and other actions impacting the health and well being of all South Carolinians. IMPH highlights public health issues by bringing together academic institutions, government agencies, and community based organizations.

Screening

The proposed road diet and bicycle lane re-striping project was chosen for South Carolina's first HIA for the following reasons:

1. Local communities often struggle to demonstrate the impact that multi-

modal transportation options can have on the health of a community and make the case for the costs involved in implementing them.

2. This project takes into consideration factors that are specific to South Carolina, such as policies of the South Carolina Department of Transportation (SC DOT). DMA was on the SC DOT re-pave list, and this provided an opportunity to support potentially health-promoting changes to the road configuration.

3. The proposed project would connect DMA to existing bike lanes and paths and support access for many community residents to a number of destinations.

4. The project was hypothesized to have strong health benefits to a fairly large number of Spartanburg residents. Negative health impacts were hypothesized to be minimal.

5. The project had not yet obtained final approval but was being seriously considered by decision-makers, and additional data was expected to aid in moving the project forward.

6. The process and results of this HIA can be utilized when considering other statewide transportation policies, such as Complete Streets.

7. The Steering Committee is dedicated to building capacity to perform HIAs in South Carolina and feels that providing a pilot HIA is a critical step in this process.

8. There were many private, nonprofit, and public agencies already partnering in the Spartanburg area to support the proposed project.

HIA RESEARCH QUESTIONS & SCOPE

The Steering Committee developed the scope of the HIA based on the following research questions:

1. What is the expected effect of the proposed road project on the safety of motorists, bicyclists, and pedestrians on DMA?

2. What is the expected effect of the proposed road project on opportunities for physical activity for the residents of Spartanburg, and in particular, the residents of neighborhoods surrounding DMA?

3. What is the expected effect of the proposed road project on opportunities for improved access to goods and services supportive of a healthy lifestyle for the residents of Spartanburg, and in particular, the residents of neighborhoods surrounding DMA?

4. What is the expected effect of the proposed road project on air quality for the residents of Spartanburg, and in particular, the residents of neighborhoods surrounding DMA?

The scope of the Spartanburg HIA (see *Appendix B* for scoping worksheet) was developed in a work session of the Steering Committee. For each of the four health determinants considered in the research questions, the Steering Committee determined what baseline data should be collected to inform the prediction of the impact of the proposed project on these health determinants. Baseline data was also determined based on its ability to inform the evaluation of the effect of the project, if implemented, on health.

For traffic safety, the Steering Committee decided to examine the average annual daily traffic count on DMA; pedestrian and bicycle counts on DMA; the number and location of collisions on DMA; bicycle levels of service surrounding DMA; and traffic speed on DMA. To measure improved opportunities for physical activity, the Steering Committee decided to quantify the pedestrian and bicycle count on DMA; the number of bicycles in bicycle racks near DMA; the trends of the PAL bicycle lending program; and the average level of physical activity experienced by residents of the zip codes surrounding DMA.

The third section of scoping collects information related to access to goods and services. The selected indicators include the number and location of outlets for healthy food, educational, and health and public services; the number of locations of and connections to safe bicycle and pedestrian pathways; the location of transit connections; and the ridership of existing public transit systems. The final area of the scoping process is for air quality indicators. To examine this determinant, the Steering Committee looked at the average annual daily traffic, bicycle, and pedestrian counts; pollution levels; and hospital utilization

rates for asthma-related admissions and visits. For more information about the data collection methods and sources, please refer to the scoping worksheet in *Appendix B*.

Several considerations determined what data was collected. Primarily, the Steering Committee selected data that was most relevant to measuring each health determinant. Data availability and the time and cost of primary data collection were also considered. Since the HIA was done with a limited budget, data collection needs had to be prioritized. Several additional health determinants, such as social cohesion, were considered for the scope of the research but due to resource constraints, the Steering Committee decided to focus on the four health determinants already described. Within each health determinant, the Committee also chose to focus on a limited numbers of indicators, as described above, in order to minimize the need for primary data collection. To simplify the HIA, it was also decided that the team would not consider the construction period of the proposed project because it was felt that the long-term positive effects would outweigh the short-term negative effects of the construction period.

HIA ASSESSMENT

Demographics

A full analysis of demographic data for Spartanburg County and the two zip codes surrounding DMA can be found in *Appendix C*. When it comes to racial composition, zip code 29303 has a higher percentage of white residents (63.8%), while zip code 29306 has a higher African American population (68.7%). In comparison, South Carolina has a higher population of white residents (67.2%) as does Spartanburg County (75.1%) (U.S. Census, 2000), thus the study area contains a higher proportion of minorities, who are typically more vulnerable to poor health outcomes.

Other important demographic information to consider includes educational attainment and income level. In the 29303 zip code, 63.6% of residents have at least a high school degree and only 10.8% have a bachelor's degree or higher. For the 29306 zip code, 63.6% of residents have at least a high school diploma and only 11.7% have a bachelor's degree or higher (U.S. Census, 2000). Both zip codes have lower rates of people with a high school diploma than the national average (80.4%); the same trend exists when comparing the rate of the population with a bachelor's degree or higher (24.4% in the U.S.) (U.S. Census, 2000).

When it comes to income level, the median household income levels are significantly higher at the state and county level than for the identified zip codes within Spartanburg. Specifically, in South Carolina the average household income is $37,082 and in Spartanburg County it is $37,579. In zip code 29303, the average household income is $28,343, and in zip code 29306, it is $22,672 (U.S. Census, 2000).

The vulnerability of the population around DMA is also highlighted by the fact that in zip code 29303, 13.3% of families are living below the poverty level and in 29306, 25.3% of families are living below the poverty level (the state average is 10.7%) (U.S. Census, 2000).

Health Data

The 2011 County Health Rankings, compiled by the Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute, provide a health analysis of Spartanburg County based on two major categories: health outcomes and health factors. These two measures are then assigned a rank which is based on several different variables. The table below outlines the overall ranks for health outcomes and health factors as well as the six variables' rankings. For health outcomes, Spartanburg County ranks 19 out of 46 counties within South Carolina, with the best health ranking being number one. The morbidity rank was created based on the percentage of adults that reported poor health days (17%), poor physical health days (3.9%), and poor mental health days (3.8%).

When it comes to health factors, Spartanburg has an overall rank of 12; this rank was determined by variables related to health behaviors, clinical care, social and economic factors, and the physical environment. One important statistic is the percentage of adults who are obese; 30% of adults in Spartanburg County have a Body Mass Index (BMI) of 30 or more, which is the same percentage for South Carolina.

TABLE 2: Spartanburg County Rankings, 2011

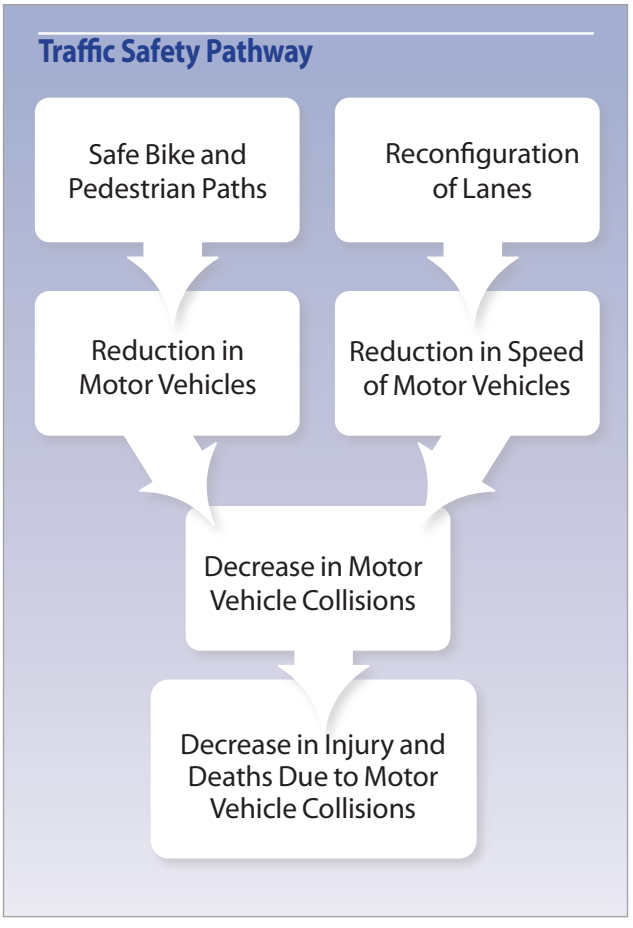
Variables	Rank
Health Outcomes	19
Mortality	21
Morbidity	18
Health Factors	12
Health Behaviors	12
Clinical Care	8
Social and Economic Factors	11
Physical Environment	45

**Rank out of 46 South Carolina Counties*
(Data Source: County Health Rankings, 2011)

Spartanburg County ranks 45 out of 46 in the physical environment factor. This ranking is determined by fifteen days of unhealthy air in Spartanburg a year due to ozone levels and two days of unhealthy air due to the amount of fine particles in the air. The statistics in the County Health Rankings also show that 80% of Spartanburg residents have access to healthy foods, which is higher than the average for South Carolina (65%), and for every 100,000 people there are eleven recreation facilities available, which is also higher than the average for South Carolina.

Research Questions, Literature Review and Data Collected for Traffic Safety Indicators

Research Question #1: Traffic Safety: What is the expected effect of the proposed road project on the safety of motorists, bicyclists, and pedestrians on Daniel Morgan Avenue?



Rationale:

As the number of motor vehicles is reduced, so does the likelihood of collisions. With fewer lanes (one in each direction and a middle turn lane instead of two lanes in each direction) speeds will be reduced, which will also help prevent collisions. An increase in bicycle and/or pedestrian use causes an increase in safety even if there are no fewer cars because drivers have a heightened sense of their surroundings.

Supporting Literature:

Injuries caused by motor vehicle accidents are the leading causes of death for children, adolescents, and young adults (Williams et al., 2007). Re-configuration of roads is often found to be beneficial when attempting to reduce the speed of motor vehicles. The

US DOT indicates that for urban areas, narrow lane width can create a shorter distance for pedestrian crossings as well as help control motor vehicle speed. For example, decreasing a lane width from 12 feet to 10 feet can decrease free-flow speed by 6.6 miles per hour (USDOT, 2007). Lane re-configuration, specifically from four to two lanes, not only reduces speed but could also reduce drive time because there will likely be fewer vehicles on the road (Worden and Curtis, 2009). Besides lowering speeds, motor vehicle drivers tend to be less aggressive when driving on narrow streets. They may not feel as safe driving due to the narrow lanes and therefore they might drive more cautiously (Ewing et al., 2006).

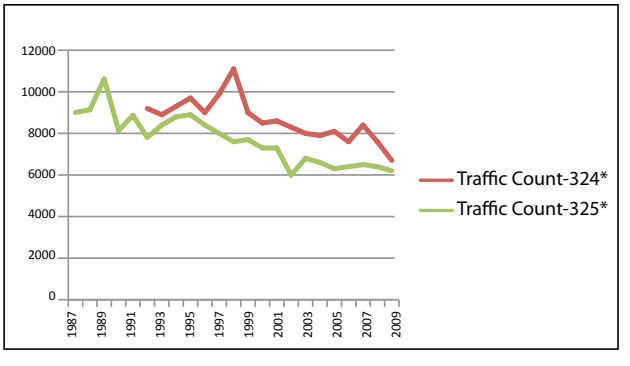
In relation to speed reduction, motor vehicle collisions could also be reduced as a result of the road re-configuration. A study conducted by SMARTRISK and the Regional Niagara Road Safety Committee (RNRSC) found that there were three main actions that lead to collisions, one of which is speeding. Therefore, to reduce collisions, drivers should not only concentrate more on the road but also reduce their speed and avoid distractions (Regional Niagara Road Safety Committee, 2009). In reducing motor vehicle collisions, the injuries and deaths caused by these collisions would be reduced. Therefore, the combination of re-configuring lanes, decreasing speed, and reducing collisions could lead to a decrease of deaths and injuries related to collisions.

The decrease of motor vehicle collisions, injuries, and deaths can also be achieved through safe bicycle and pedestrian pathways and a reduction of the number of motor vehicles. A study conducted in Boston's Chinatown, looking at nine different intersections, concluded that with an increase of 1000 vehicles, there will be an increase of 3-5 injuries per year (Brugge et al., 2002). According to the National Complete Streets Coalition, by encouraging different modes of transportation and encouraging use of safe bicycle and pedestrian pathways, the community will not only become healthier through increased physical activity, but it can also reduce the number of motor vehicles on the roads (National Complete Streets Coalition, 2005-2011). Other than the multiple health benefits that can result from increased physical activity, a decrease in motor vehicles can reduce vehicle emissions, noise, and motor vehicle collisions (Heller & Bhatia, 2007). By reducing motor vehicle collisions, injuries to bicyclists, pedestrians, and drivers will inevitably be reduced (Heller & Bhatia, 2007). Also, a study conducted by Jacobsen (2003) found that the more people who participate in biking or walking activities, the less likely a motor vehicle is to collide with a pedestrian or cyclist. Essentially, the findings show that there is safety in numbers (Jacobsen, 2003).

Average Annual Daily Traffic Count

The details of the average annual daily traffic count for DMA are included in *Appendix D*. This data demonstrates trends in traffic volume on DMA between 1987 and 2009. The traffic count decreased between 1987 (count of 9,009) and 2009 (count of 6,200) for one point of mea-

Graph 1: Average Annual Daily Traffic Count, DMA



**Traffic Count-324 and Traffic Count-325 represents the station number where the data was recorded*
(Data Source: SPATS; SC DOT)

surement. The primary reason for this decrease is that in 2001, the US 29 bypass route was constructed so that it was no longer necessary to travel on DMA to get downtown.

Impact prediction: The proposed road diet will help continue the decrease in the amount of traffic on DMA. By encouraging other modes of transportation and limiting traffic to one lane in each direction, the number of motor vehicles will decrease and the health of the community will be improved.

Bicycle Level of Service (BLOS)

This map shows Daniel Morgan Avenue in two shades of blue, light and dark, in context with the bicycle level of service (BLOS) and location of local food, shops, and other destinations. The BLOS is an evaluation of perceived bicyclist safety and comfort with respect to motor vehicle traffic while traveling in a roadway corridor. It identifies the quality of service for bicyclists that currently exists within the roadway environment. The map shows the BLOS in a graded format from A to F, with A being perceived as the safest route and F being perceived as the least safe route. Criteria that support increased safety include physically separated bike lanes, reduced motor vehicle speed, and identified bike turn lanes. Most of DMA is rated at E or F BLOS *(Data Source: SPATS).*

Impact prediction: The proposed re-striping and road diet for DMA would enhance BLOS because it would create specific lanes for bicyclists. The physically separated bicycle pathway (for the road diet section) coupled with the reduced speed of motor vehicles and less traffic (for both sections) improves access for cyclists and supports bicyclist safety.

Speed

In order to determine vehicle traffic speed on DMA, a study was performed by the City of Spartanburg between June 9, 2011 and June 16, 2011. The study ran for a total of 168 hours with data being recorded every 60 minutes at different sections of the road. The average speed of motor vehicles traveling on the different sections of the road was 21 miles per hour (mph), 28 mph, 30 mph, 33 mph, 34 mph, 38 mph, 38 mph, 42 mph, 44 mph, 44 mph, 46 mph, and 46 mph. All of these speed rates, except for one, exceed the posted speed limit of 25 mph *(Data Source: City of Spartanburg).*

Impact prediction: With the proposed road diet, the speed of traffic will likely be reduced overall due to the narrower lanes and inclusion of other traffic calming devices which cause heightened caution of the drivers. Since most of the drivers travel above the posted speed limit, the road diet can help to bring their traveling speeds closer to the posted speed limit.

Collisions

The following table represents data collected for collisions on DMA between 2007 and 2010. During this time period, the average annual daily traffic count for 2009 is 6,700 at station 324 and 6,200 at station 325. The data also shows that since 2007, the number of calls for service for collisions decreased from 74 annual calls to 59 annual calls. It is also important to note that there have been 5 accidents involving pedestrians and none involving bicycles on DMA since 2005.

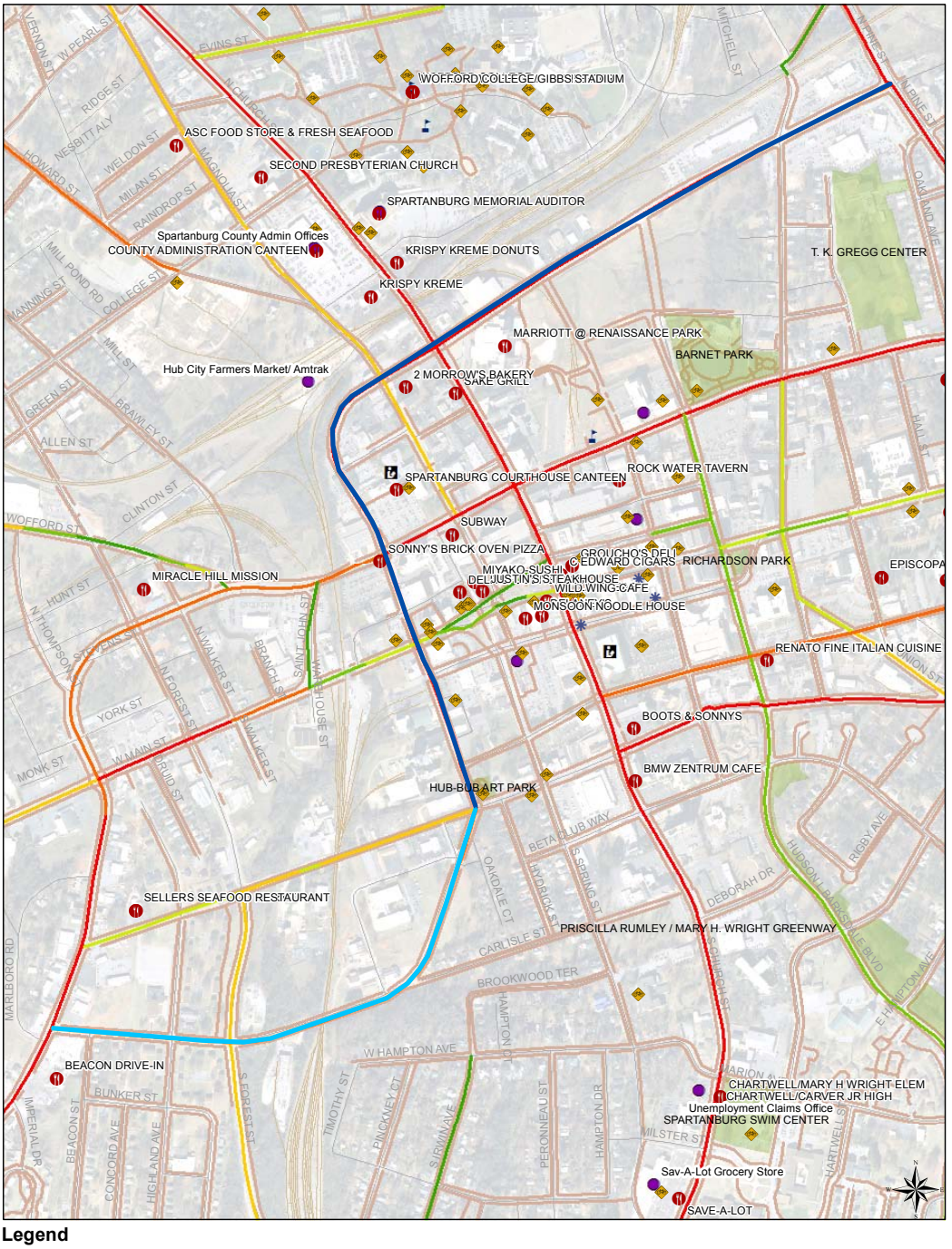
Table 3: DMA: Calls for Service for Collisions

Year	2007	2008	2009	2010
Calls	74	69	55	59

(Data Source: SCDOT Public Safety Crash Data)

Impact prediction: The proposed road project on DMA would aid in the reduction of motor vehicle-related collisions. The reduction in collisions would be an effect of the reduced motor vehicle speed, the reduced motor vehicle traffic, and heightened awareness of drivers. If the road project is implemented, the number of collisions is expected to continue to decrease in the coming years.

Map 1: Daniel Morgan Connectivity & Bicycle Level of Services (BLOS) Map



Legend

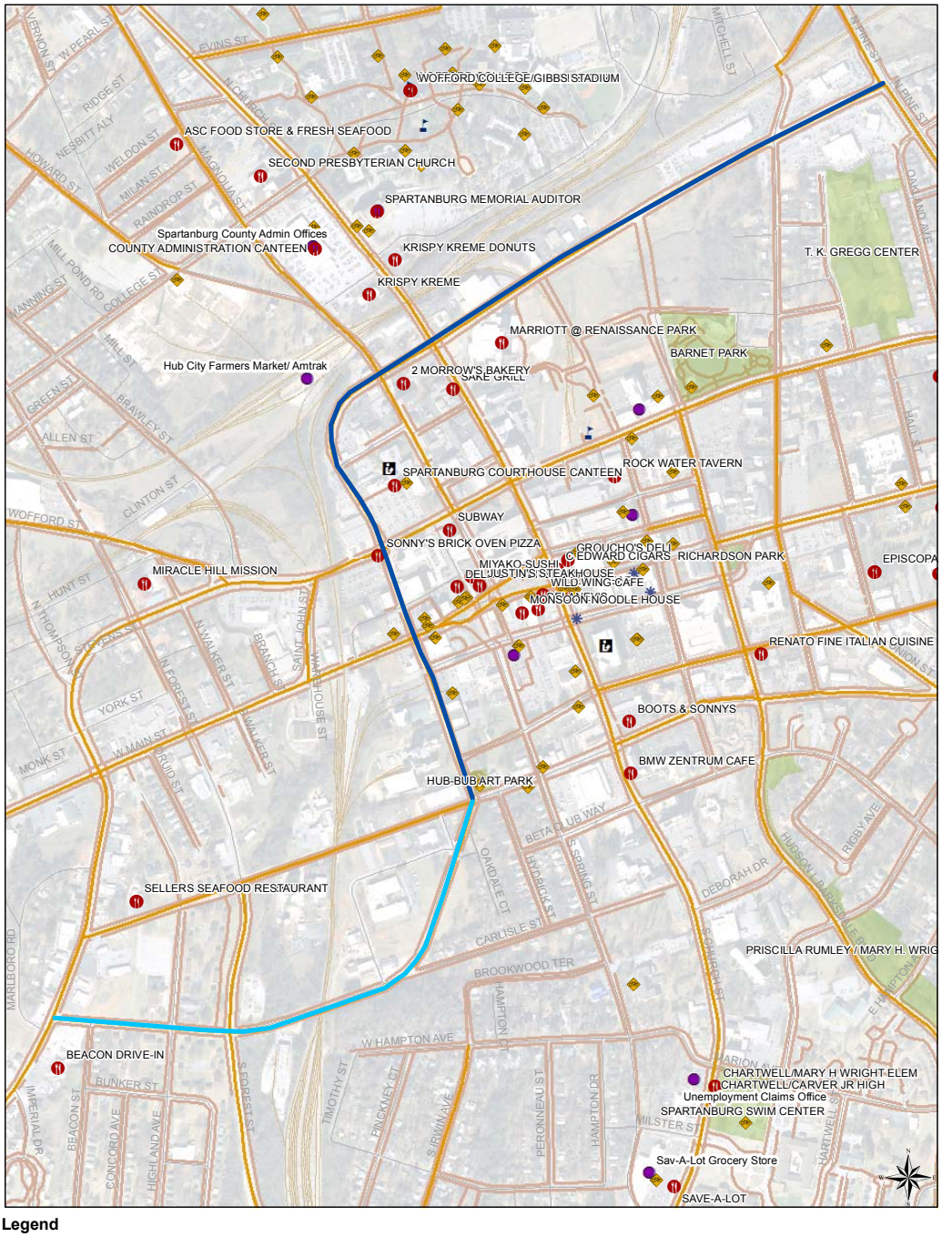
- Daniel Morgan Proposed Bike Lane
- Daniel Morgan Proposed Road Diet
- Park
- School
- Library
- Bike Rack
- Restaurant
- Shop
- Other Points of Interest

Bicycle Level of Service Grade

- A
- B
- C
- D
- E
- F
- Sidewalk
- Street
- Railroad Tracks

Spartanburg Area Transportation Study

Map 2: Daniel Morgan Connectivity & Existing Bike Lanes Map



Legend

- Daniel Morgan Proposed Bike Lane
- Daniel Morgan Proposed Road Diet
- Bike Lane
- Bike Rack
- Park
- Restaurant
- Shop
- School
- Library
- Other Points of Interest
- Sidewalk
- Street
- Railroad Tracks

Spartanburg Area Transportation Study

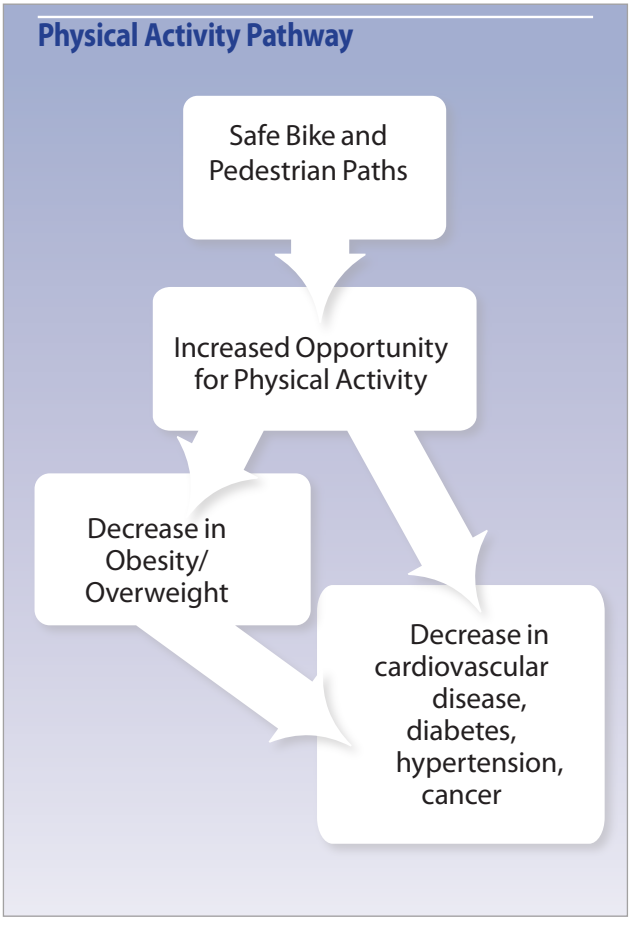
Research Questions, Literature Review and Data Collected for Physical Activity Indicators

Research Question #2: Physical Activity: What is the expected effect of the proposed road project on opportunities for physical activity for the residents of Spartanburg, and in particular, the residents of neighborhoods surrounding Daniel Morgan Avenue?

Rationale:

1. Safe bike and pedestrian paths support physical activity by providing an incentive and destination for walking and biking, improving physical access to parks and trails, and by connecting to existing bicycle and pedestrian infrastructure. Physical activity can lead to weight loss which leads to a lower incidence of chronic disease.

2. Safe bike and pedestrian paths support physical activity by providing an incentive and destination for walking and biking, improving physical access to parks and trails, and by connecting to existing bicycle and pedestrian infrastructure. Physical activity can lead to a lower incidence of chronic disease (regardless of weight loss).



Supporting Literature:

Many communities have created safe bicycle and pedestrian pathways to increase opportunities for physical activity and to encourage healthy lifestyles. Sallis and Glanz (2006) found that a lack of safe bicycle pathways and pedestrian walkways tends to decrease physical activity in a community. Creating pathways and walkways tends to increase rates of physical activity (Sallis & Glanz, 2006). To ensure that people will take advantage of the walkways and pathways, they should be designed to enhance the urban environment (Heath et al., 2006). This idea is supported by The Guide to Community Preventive Services, which identifies "community-scale urban design land use policies and practices" that support a change to the physical environment in an urban area, of several square miles or more, as a method to encourage physical activity (The Guide to Community Preventive Services, 2011). Urban design and land use policies can effectively increase physical activity and opportunities for physical activity in communities and can be associated with residents being less likely to be overweight or obese (Sallis & Glanz, 2006). Kumanyika et al. (2008), in association with the American Heart Association, support the idea that physical activity is an important part of a healthy lifestyle and maintenance of a healthy body weight; those who are overweight or obese are more likely to develop health-related issues such as hypertension, Type 2 diabetes, high blood pressure, and cardiovascular disease (NCABR, 2007). A decrease in the proportion of residents being overweight and obese is likely to result in a decrease in the rates and

severity of diseases associated with being overweight or obese. After creating a Community Health Improvement Plan that promoted physical activity and good nutrition for its residents, Burlington County in New Jersey found that physical activity and good nutrition aid in the reduction of obesity, high blood pressure, and diabetes and increase healthy growth and development for people of all ages (Burlington County, 2011).

While the second pathway has the same connection between safe bicycling and pedestrian pathways and increased physical activity, this pathway suggests that physical activity directly prevents multiple chronic diseases and also aids in the reduction of premature death (Warburton, Nicol and Bredin, 2006). It is important to note that physical activity promotes health even if it does not result in weight loss. Participating in at least one hour of moderate level physical activity each day lowers the risk of mortality (Physical Activity Guidelines Advisory Committee, 2008).

Number of Bicycles on Nearby Bicycle Racks

The data for the number of bicycles on nearby racks was collected through manual observation of the bicycle racks. The racks included in the analysis were those located within a .25 mile radius of DMA and those located within a .5 mile radius of DMA. The total number of slots available in these bicycle racks is 252; the bike rack observations showed that there is plenty of space in existing bicycle racks for a number of additional riders to store their bicycles.

Table 4: Bicycles on Nearby Bicycle Racks, April 2011

Date/Day	Time	Miles Away	Number of Bicycles	Miles Away	Number of Bicycles	Total Number
4/14-Thursday	3-5pm	.25	16	.25-.5	27	43
4/20- Wednesday	3-5pm	.25	11	.25-.5	11	22
4/28- Thursday	7-9pm	.25	16	.25-.5	22	38
4/29- Friday	7-9pm	.25	15	.25-.5	18	33

(Data Source: Partners for Active Living)

Impact prediction: Since a number of bicycle racks with extra capacity already exist, people are more likely to take advantage of the new opportunities to ride a bicycle that would result from the proposed project. Bicycle racks will provide a safe place for people to store their bikes at or near their destination or if they decide to walk around the community or use public transit.

Number and Trend of Users of Partners for Active Living's (PAL) Bicycle Lending Program

Partners for Active Living has a bicycle lending program which loans donated bicycles and bicycle equipment to individuals for a three-month period. Table 5 outlines the number of bicycle rentals, renewals, exchanges, and donations to PAL's bicycle lending program. The annual number of rentals, renewals, and exchanges has increased significantly since the program's inception in 2006/2007 (35) to 2010/2011 (149). However, the number of donations has decreased over time. The highest proportion of those borrowing bicycles earn less than $15,000 per year, suggesting that many residents need or desire bicycles for transportation and/or physical activity and cannot afford the purchase of a bicycle.

Table 5: PAL Bicycle Rentals, Renewals, Exchanges, and Donations

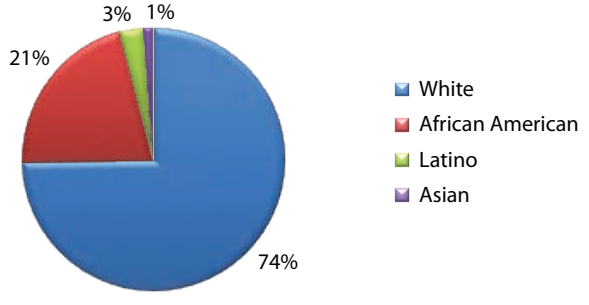
Year**	Rentals, Renewals, and Exchanges*	Donations*
2006-2007	35	94
2007-2008	99	50
2008-2009	90	34
2009-2010	145	51
2010-2011	149	34

**Individuals may be counted more than once*
***Counted on a 12 month period (not a calendar year)*

(Data Source: Partners for Active Living)

Impact prediction: The proposed project will allow residents more opportunities for physical activity in a safer environment. Thus, with continued marketing of

Chart 1: PAL Bicycle Borrowers by Race and Ethnicity



**Results from start of program to September 2010; Includes rental, renewals and exchanges*

**N=391[2]*

(Data Source: Partners for Active Living)

[2] Populations may vary due to lack of responses from those who participated in the survey

[3] Populations may vary due to lack of responses to some questions by those who participated in the survey

the bicycle lending program, numbers of rentals, renewals and exchanges are likely to increase.

Chart 1 demonstrates the proportions of bicycle borrowers in different ethnic/racial and chart 2 demonstrates the income levels of borrowers.

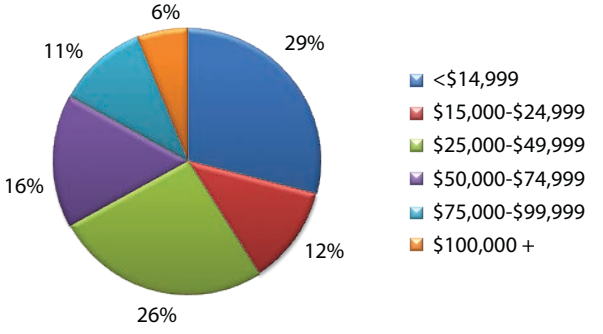
The two Spartanburg zip codes surrounding DMA are 29303 and 29306. Since the inception of the bicycle lending program, located in the 29306 zip code, there have been 75 bicycle rentals and renewals from people who live in the 29303 zip code (which represents 12% of the total) and 98 rentals and renewals in 29306 (which represents 16% of the total). Also interesting to note is that there were 225 male renters and 169 female renters as of September 2010.

2011 Average Daily Bicycle and Pedestrian Count, Daniel Morgan Avenue (data collected March, 2011)

The average number of pedestrians and bicyclists on DMA is 365 (316 pedestrians and 49 bicyclists). This is in line with the average one hour weekday count of 345 daily users and the average one hour weekend count of 390 daily users. Methodology for the bicycle and pedestrian counts comes from SPATS' participation in the National Bicycle and Pedestrian Documentation Project. These counts are calculated using the Adjustment Factors guide, a national effort coordinated by Alta Planning and commissioned by the Institute of Transportation Engineers. The impetus for using this specific tool was to conform to a standard currently used in the field of bicycle and pedestrian data collection. For more information see: http://bikepeddocumentation.org/

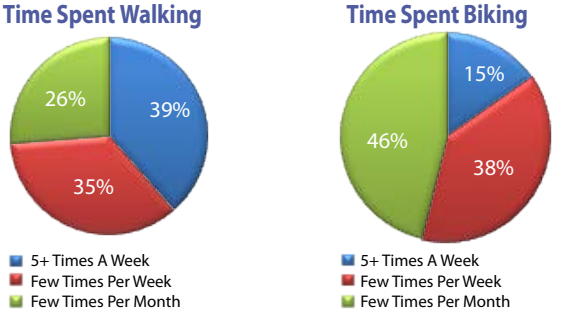
Impact prediction: The average daily bicycle and pedestrian counts will likely increase with the proposed road diet. In creating safer bike and pedestrian pathways, more people will be encouraged to utilize them for transportation as well as for leisure and exercise.

Chart 2: PAL Bicycle Borrower by Annual Income Level



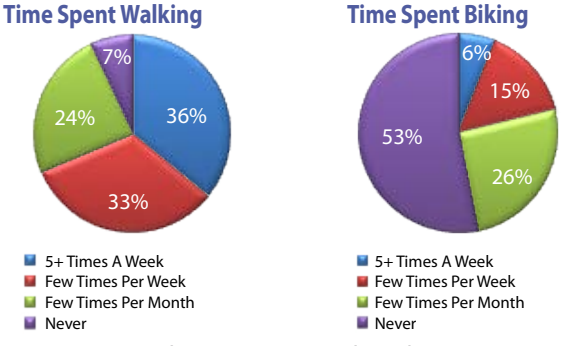
*Results from start of program to September 2010
*N=234[3]
(Data Source: Partners for Active Living)

Chart 3: Time Spent Walking or Biking in Zip Codes 29303 and 29306



(Date Source: Spartanburg County Bicycle Pedestrian Master Plan Survey, 2009)

Chart 4: Time Spent Walking or Biking For Recreation in Zip Codes 29303 and 29306

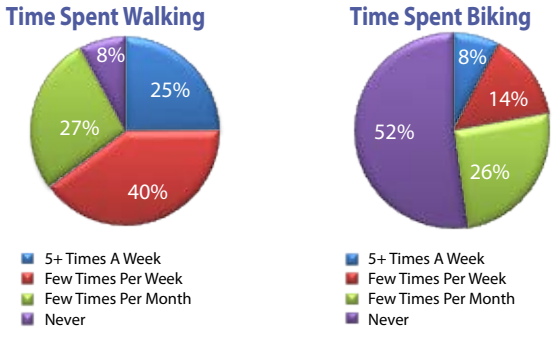


(Date Source: Spartanburg County Bicycle Pedestrian Master Plan Survey, 2009)

Time Spent Biking and Walking

Data for residents of the 29303 and 29306 zip codes in chart 3 reflect levels of physical activity. While 39% of respondents reported walking five or more times a week, 46% of respondents reported biking only a few times per month.

Chart 5: Spartanburg County Time Spent Walking or Biking For Recreation



(Date Source: Spartanburg County Bicycle Pedestrian Master Plan Survey, 2009)

For time spent bicycling or walking for recreational purposes, 36% of respondents reported walking five or more times a week but only 6% reported biking five or more times a week (53% of respondents reported never using a bicycle for recreational purposes).

Chart 5 displays data representing all of Spartanburg County. The data show that 40% of respondents reported walking a few times per week for recreation. In summary, many residents of the target zip codes walk often; not very many residents bicycle.

Impact prediction: The proposed road diet reconfiguration will create a safer environment (see previous Traffic Safety section) that will encourage physical activity as more people are likely to utilize the new bike and pedestrian pathways for physical activity and/or transportation.

Research Questions, Literature Review and Data Collected for Access to Goods and Services Indicators

Research Question #3: Access to Goods and Services: What is the expected effect of the proposed road project on opportunities for improved access to goods and services supportive of a healthy lifestyle for the residents of Spartanburg, and in particular, the residents of neighborhoods surrounding Daniel Morgan Avenue?

Access to Goods and Services Pathway

Rationale:

1. Good health requires access to resources such as retail establishments that sell healthy food, health care providers, employment, education, parks and recreation facilities, publicly accessible gathering spaces, and social services. Good nutrition and physical activity leads to healthy weight, which supports a lower incidence of chronic disease.

2. Good nutrition and physical activity also lead to lower incidence of chronic disease, regardless of weight loss.

Supporting Literature:

Safe bicycle and pedestrian pathways support increased access to grocery stores, farmer's markets, and recreation areas such as parks and trails. By increasing access to different modes of transportation, such as public transportation, safe sidewalks, and bicycle pathways, the health of community residents can be greatly impacted. Recreation areas such as open and active parks and community gardens encourage residents to be outdoors and participate in physical activities. The more people engage in physical activity in these areas, the less likely criminal activities will take place due to the large number of individuals watching out for the community. These types of physical activities and participation in the community increase when there are more accessible, safe sidewalks and bicycle pathways (Zborel & Rozsa, 2011).

Because a lack of physical activity is a leading factor in obesity, an increase in physical activity is likely to lead to a decrease in obesity (Zborel & Rozsa, 2011). In support of this, Active Living Research (2011) suggests that regular physical activity for adults and children is beneficial when fighting obesity. A decrease in obesity rates supports a decrease in rates of diseases such as cardiovascular disease, diabetes, high blood pressure, and cancer. This idea is supported by Van Baal et al. (2008), who found that obesity prevention programs can lead to a decrease in obesity-related diseases.

Another outcome for safe pedestrian and bicycle pathways and increased access to grocery stores, farmer's markets, parks, and trails is the idea that increased opportunity for physical activity in parks and trails can lead directly to a decrease in cardiovascular disease, diabetes, high blood pressure, and cancer, regardless of weight loss. Essentially, people with any physical activity have better health outcomes than those who have no physical activity (Physical Activity Guidelines Advisory Committee, 2008). A report by Roper Starch found that 90% of Americans mostly or strongly agree that the best physical activity comes from participation in outdoor activities (Roper Starch, 2000). This fact was incorporated into a report that supported The Clean Water Land and Legacy Amendment, passed in 2008, that supports the creation of opportunities for regular physical activity and the resulting decrease in diseases such as cardiovascular disease, diabetes, and high blood pressure (CWLLA, 2010).

A third pathway supporting safe bicycle and pedestrian pathways and increased access to grocery stores, farmer's markets, parks, and trails is the increase in access to healthy foods. More than 77% of Spartanburg County adults do not eat the recommended servings of fruits and vegetables each day (Brady, 2009) and more than 70% of Spartanburg County residents are overweight or obese (Brady, 2009).

The U.S. Department of Agriculture conducted a study in 2009 and discovered that 23.5 million people in the U.S. do not have access to a supermarket within one mile of them (PolicyLink & The Food Trust, 2010). Lack of access to healthy foods, such as fruits and vegetables, can negatively impact the lives of both children and adults (Bell & Standish, 2009). The Food Trust and PolicyLink report that there is strong evidence to connect access to healthier foods with better eating habits (PolicyLink and The Food Trust, 2010).

To provide communities with access to healthier food options, the Healthy Food Financing Initiative was created. The Healthy Food Financing Initiative (HFFI)

is a $400 million initiative that aims to increase access to healthy foods by bringing grocery stores and farmer's markets to urban and rural communities that lack healthy food options (U.S. DHHS, 2010). HFFI promotes healthy eating, healthy lifestyles, and community-level economic development (Investigating in Community, 2011). With the increased availability and access to healthy food, community level obesity rates can decrease. By making healthy choices available, creating awareness of these healthy choices, and supporting those who would like to become healthier, communities can work towards lowering their obesity rates (Centers for Disease Control, 2011). As previously referenced, a decrease in obesity can lead to a decrease in disease.

Table 6: Retail Food Environment Index (RFEI)[4]

	Numerator		Denominator		RFEI
	# fast food restaurants	# convenience stores	Grocery stores*	Produce vendors**	
Inman	15	7	3	0	7.33
Boiling Springs	26	10	5	0	7.20
Pacolet	2	3	2	0	2.50
Woodruff	8	5	2	0	6.50
Spartanburg City	85	34	14	0	8.50

**Does not include small specialty ethnic grocery stores*
***Must be open at least once weekly, year-round*
(Data Source: Spartanburg County Community Food Assessment Prepared For Hub City Farmers' Market, August 5, 2009)

The final pathway related to safe bicycle and pedestrian pathways and increased access to parks, trails, grocery stores, and farmer's markets is the idea that increased accessibility to healthy foods can lead directly to a decrease in cardiovascular disease, diabetes, high blood pressure, and cancer. As discussed above, access to and availability of grocery stores and farmer's markets is essential in supporting a healthy diet. By eating healthy foods, especially plant foods, individuals can reduce their risk of developing a number of diseases such as high blood pressure and cardiovascular diseases (Institute for Alternative Futures, 2008; Dietary Guidelines Advisory Committee, 2010) regardless of weight loss.

Number and Location of Healthy Food and Services

Findings of a food assessment suggest that "food deserts" exist in Spartanburg County. Food deserts are defined as areas where residents have limited access to supermarkets and other dependable and affordable sources of fresh food, or neighborhoods with no, or distant, grocery stores but an abundance of fast food and other retail outlets offering little or no nutritious food. These areas do not support a healthy diet. Although eating habits are a matter of individual choice, available and affordable food options clearly affect choice.

The Retail Food Environment Index (RFEI) for five areas within Spartanburg County is listed in table 6. After a physical count of all food retailers in each target area was made, the RFEI is calculated by dividing the total number of fast food restaurants and convenience stores by the total number of grocery stores and produce vendors (California Center for Public Health Advocacy, 2008) within the census tract (for municipalities) or city boundary (for the City of Spartanburg). The RFEI is an indicator of the density of food outlets that are less likely to stock fresh fruits and vegetables and other healthy foods relative to food outlets that are more likely to stock such healthy foods. The higher the RFEI, the greater the number of fast food outlets and convenience stores in relationship to grocery stores and produce vendors. For example, an RFEI of 3.9 means that for every grocery store within a given area, there are almost four fast food outlets or convenience stores. An RFEI of 5.0 or above is considered "high". An important aspect to note that was not included in the table above is the RFEI for South Carolina and Spartanburg County as a whole. Based on the 2011 South Carolina Obesity Burden Report, the RFEI for the state (5.9) is lower than that for Spartanburg County (6.8).

Clearly, all but one target area within Spartanburg have high RFEIs. Pacolet has the lowest RFEI, equating to two and one-half fast food and convenience stores for every grocery store. The City of Spartanburg has the highest RFEI, equating to eight and one-half fast food restaurants and convenience stores for every grocery store. DMA is located within the city of Spartanburg. By providing access to other areas through safe bicycle and pedestrian pathways, more people will have access to outlets that sell fresh produce and healthy foods.

[4] Numbers subject to change due to market changes

Impact prediction: The proposed project will not impact the number of grocery stores or number of fast food outlets, but it will impact bike and pedestrian access to more healthful food options.

Number and Location of Connections including Transit Stops

Providing public transportation options is a good way to encourage physical activity. A recent research brief produced by Active Living Research stated that on a national scale, 29% of individuals who use public transportation are physically active for at least 30 minutes a day. Connecticut found that other benefits to utilizing public transportation include reducing traffic congestion, fuel consumption, and access to goods and services such as grocery stores and health care facilities (Connecticut Association for Community Transportation, 2010).

Map 1 (page 11) shows DMA in two shades of blue, light and dark, in context with the City of Spartanburg's existing bike lanes and location of local food, shops, and other destinations. The map shows existing bike lanes in orange. The map also shows that DMA is a vital artery in connecting the West and East sides of the city's downtown core.

Impact prediction: The proposed bike lane will clearly help connect other bike lanes and prevent riders from having to traverse a road that is not marked as a bike lane, thereby providing a safer option to those trying to get from one side of town to the other on a bicycle.

Transit Ridership

There is only one bus route that has any significant amount of coverage on DMA. The Crestview route runs along DMA from Henry Street to SC 296/Reidville Road/ John B. White Blvd. The Dorman Center route runs along Daniel Morgan from St. John Street to Broad Street (outbound only) and only crosses it inbound. Westgate crosses DMA inbound and outbound, but has no significant service along the road. Based on the conclusions from Grabow et al. (2011), we see that there are significant health and economic benefits when individuals choose to ride bicycles and/or walk instead of riding in a vehicle for short trips.

Average daily counts for these three routes are:
Crestview - 204 weekday, 103 Saturday
Dorman Center - 211 weekday, no Saturday service
Westgate - 241 weekday, 216 Saturday
(Data Source: Spartanburg Area Regional Transit Agency (SPARTA))

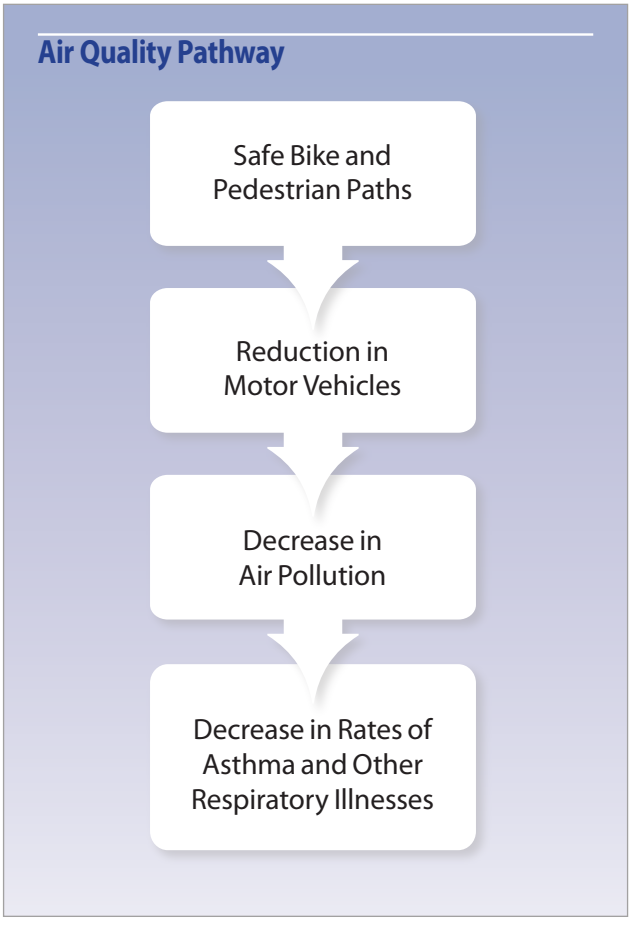
Impact prediction: The proposed project would encourage different modes of transportation; therefore people are encouraged to not only use public transportation but also walk or bike to their destinations. By creating a safe walking and biking route for residents to travel, they will be more likely to use different modes of transportation.

Research Questions, Literature Review and Data Collected for Air Quality Indicators

Research Question #4: Air Quality: What is the expected effect of the proposed road project on air quality for the residents of Spartanburg, and in par-

[5] shared bus with S. Liberty route: cannot separate the ridership, so this is half of the average Saturday ridership

ticular, the residents of neighborhoods surrounding DMA?



Rationale:

On-road vehicles are primary sources of hazardous air pollutants and play a part in creating ozone. Short term exposure to ozone (O^3) can lead to irritation of the nose, throat, and lungs and can cause increased airway resistance and decreased efficiency of the respiratory system. For individuals involved in strenuous physical activity and for people with pre-existing respiratory disease, ozone exposure can cause sore throats, chest pains, coughing, and headaches. Long-term exposure can cause significant breathing problems, such as loss of lung capacity and increased severity of both childhood and adult asthma.

Supporting Literature:

The addition of safe bicycle and pedestrian paths will ultimately lead to some changes in motor vehicle travel. A study done in the city of Copenhagen found that once bicycle lanes were created, motor vehicle traffic decreased by 10% (Copenhagenize, 2007). In support of this concept, Kentucky Youth Advocates (2011) found that providing an alternative to motor vehicle transportation reduced the number of motor vehicles, which could reduce the risk of injury to pedestrians by 28% and also cause a reduction of air pollution. The ability to control or decrease air pollution is closely related to a decrease in the use of motor vehicles.

The United States Environmental Protection Agency (US EPA) found that for every one minute a motor vehicle is left to idle, 23 grams of carbon dioxide are released. In San Diego, a study found that children who live within 550 feet of a high traffic area are more likely to have more medical visits due to asthma (English et al., 1999). By decreasing the exhaust emissions from vehicles, air pollution in areas of heavy traffic will decrease (Eastern Research Group, Inc., 2007). Jerrett et al. (2008) found that air pollution from motor vehicles contributes to the development of asthma. Decreasing air pollution is also associated with a decrease in airway inflammation, which can cause asthma symptoms (Renzetti et al., 2009).

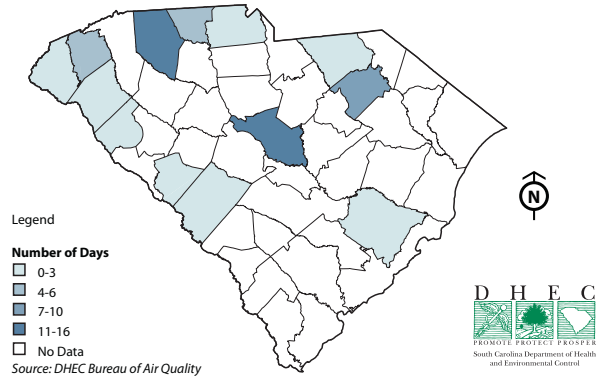
2011 Average Daily Bicycle and Pedestrian Count DMA (data collected March, 2011)

See same indicator on page 15 under Physical Activity Indicators, 2011 Average Daily Bicycle and Pedestrian Count for DMA.

Pollution Levels: Days Ozone is Above Level of the Standard

It is clear that Spartanburg is facing serious air quality issues, with double and sometimes triple the amount of days where ozone is above the air qual-

Map 3: South Carolina Annual Number of Pollution Days



(Data Source: Bureau of Air Quality, SC DHEC)

ity standard. While ozone is only one of the air pollutants collected at air quality monitoring stations, we chose it as an indicator in this report because the data on county and state levels for South Carolina counties was readily available for use.

Impact prediction: With the addition of the road diet and a reduction in motor vehicles and an increase in bicycling and walking, it is expected that air pollution will be reduced.

Table 8 displays data for two Spartanburg zip codes (29303 and 29306), Spartanburg County, and South Carolina for asthma-related hospital visits. The zip codes surrounding DMA have a significantly higher rate of utilization of inpatient and emergency hospital services for asthma-related diagnoses.

Table 7: Spartanburg County and South Carolina Pollution Levels: Number of Days Ozone is Above Level of the Standard

	Total Population (2000 Census)	2005	2006	2007	2008
Spartanburg County	253,791	16	15	10	12
South Carolina Average*	4,012,012	7	5	5	5

**Only the thirteen counties in South Carolina that had an air monitoring station each year between 2005 and 2008 are included in this analysis.*
(Data Source: Bureau of Air Quality, SC DHEC)

Table 8: Hospital Visits with Asthma as Primary Diagnosis, 2009

		Inpatient			Emergency Department		
	Population	Visits	Charges	Utilization Rate*	Visits	Charges	Utilization Rate*
Spartanburg County Zip Code 29303	24,843	64	$2,112,900	25.7	156	$185,100	62.7
Spartanburg County Zip Code 29306	15,932	44	$1,133,000	27.6	163	$238,500	102.3
Spartanburg County	253,791	550	$13,894,300	21.6	1,153	$1,694,500	45.4
SC Total	4,012,012	6,166	$112,195,900	15.3	23,058	$39,379,100	57.4

** Per 10,000 people*
(Data Source: SC State Budget & Control Board Office of Research & Statistics; US Census)

Impact prediction: With a decrease in motor vehicles, the air quality will increase due to the decrease in vehicle emissions. With improved air quality, it is anticipated that asthmatic residents will suffer fewer medical problems.

Some motor vehicle drivers may choose to take other routes, thereby increasing air quality issues in other areas. However, since the two zip codes surrounding DMA have a high utilization rate for asthma any decrease will be good for these communities. Also, if individuals choose to walk or bike instead of drive, there will be an overall improvement in air quality.

RECOMMENDATIONS

The primary recommendation is that the City of Spartanburg implements the proposed road diet and re-striping as follows:

Road Diet Section: The proposed road diet on DMA in the City of Spartanburg will run from SC 296 (John B. White Boulevard) to West Main Street. The

road diet will take the existing 48' four lane road and turn it into a three-lane road. There will be two travel lanes, one in each direction, and a center turn lane that will help facilitate turning movements without disrupting traffic flow. A 4' planted median will be placed on one side of DMA to physically separate the bicycle pathway from the motorists. The two-lane shared-use path will be 10' wide and accommodate bicyclists and runners in both directions. The rationale for placing the path on one side of the road is that bicycle/pedestrian facilities physically separated from motorists may be perceived as safer and be used more often than those without a physical barrier. A 5' sidewalk will replace existing 4' sidewalks on both sides of the road in order to bring them up to current standards. This project will also serve as a scientific control to study the use of a physically separated bike lane versus a non-separated bike lane.

Re-stripe Section: The proposed re-stripe section on DMA will run from West Main Street to Pine Street. A simple stripe is proposed for both sides of the road to create a 4' bike lane going in each direction. A re-stripe is proposed for this section because of funding constraints and because most destinations are on the latter half of the road.

Partners for Active Living (PAL) has a bicycle lending program called Hub Cycle. The program loans out refurbished bicycles with a helmet and lock for a $15 refundable deposit for three months. Borrowers have the option of renewing for three additional months and are not expected to make another deposit. As Spartanburg residents have become more comfortable on bicycles, the organization has seen an increase in use. In order to feel more comfortable on a bicycle, users must feel safe, and providing bicyclists with their own space on the road is essential to creating safety. The feeling of safety is even more significant when there is a separated bicycle lane, as proposed on a portion of DMA (road diet portion). Including bicycle lanes that connect to other lanes and destinations is essential for creating a multi-modal transportation network. If the proposed road project is implemented, it is suggested that this program is expanded and marketed more widely.

It is recommended that the new additions are suitable for those who are taking on cycling as a form of transportation for the first time and that there are ample signs to remind motorists, pedestrians, and bicyclists about road safety. We recommend that a public education campaign is initiated to educate motorists, pedestrians, and bicyclists about the rules of the road.

In relation to this, we recommend encouraging those who are interested in making cycling a primary mode of transportation to take a safety class. By establishing a cycling safety class in a community center, individuals will have the ability to educate themselves on proper traffic laws and regulations for cycling safety. This will in turn provide them with a greater sense of security when riding alongside motor vehicles.

Although DMA is no longer the City of Spartanburg's highest priority for bicycle lanes, the City plans to add bicycle lanes to West Main Street from Forest Street to DMA. Forest Street is west of and parallel to DMA and already has bicycle lanes, so adding bicycle lanes to West Main Street will further expand the bicycle network. West Main Street intersects DMA and makes the need for bicycle lanes on DMA even stronger since an additional connector and destinations are likely to be added.

MONITORING & EVALUATION

Monitoring and evaluation of the impact of the HIA is a key component when determining whether or not all goals have been met. Once the proposed project is implemented, SPATS will monitor traffic patterns on DMA and PAL will monitor bicycle and pedestrian activity in the area to ensure that the road diet and re-striping have served their intended purposes. Also, SPATS will consider collision and injury rates involving vehicles and pedestrians. In doing this, they will be able to determine if the road redesign was successful and encourage other communities to use similar methods to increase physical activity, increase safety, improve air quality, and decrease traffic in their community.

CONCLUSIONS

An HIA is a valuable asset when considering community projects and proposals. It provides valuable information synthesized into one document that people can reference for evidence-based research on a proposed project or policy. HIAs have the ability to communicate potential negative and positive effects

of community reconfiguration, target policies and programs for communities that are in great need, and be used by a multitude of people (policy makers, government agencies, interested stakeholders, and community members) (National Research Council of the National Academies, 2011). A key benefit of HIAs is that they can be used across a range of levels including small local projects to large national projects (National Research Council of the National Academies, 2011).

Specifically for this HIA, the value of the proposed project can be understood through its potential impact on a number of health determinants: traffic safety, physical activity, access to goods and services, and air quality. Based on the literature reviewed, we believe that the recommendation to implement the proposed road diet and re-striping will benefit the community in several ways that will not only affect individuals but the community as a whole. Traffic safety will increase due to the decrease in motor vehicles because individuals are being encouraged to utilize different modes of transportation. In relation to this, physical activity levels are predicted to increase as well as access to goods and services and thereby increasing and encouraging healthy behaviors in the community. A final outcome of the proposed road diet is improvements to air quality due to a reduction in motor vehicles. These improvements could directly lead to a decrease in hospital visits due to asthma within the communities surrounding DMA. The impact of the proposed project is anticipated to not only directly support a healthier community but will also aid in the community's economic growth and sustainability.

The Steering Committee believes the HIA process is useful in giving decision-makers the tools they need to help citizens be more safely connected, efficiently mobile, environment and health conscious, and economically accountable. Partners have shared resources to complete the time-intensive portions of the process and have worked together to overcome barriers such as loss of organizational funding and changes in organizational priorities. We believe the HIA process can stimulate citizen involvement and political will to support policies that improve the environment for all residents and in particular for pedestrians and bicyclists.

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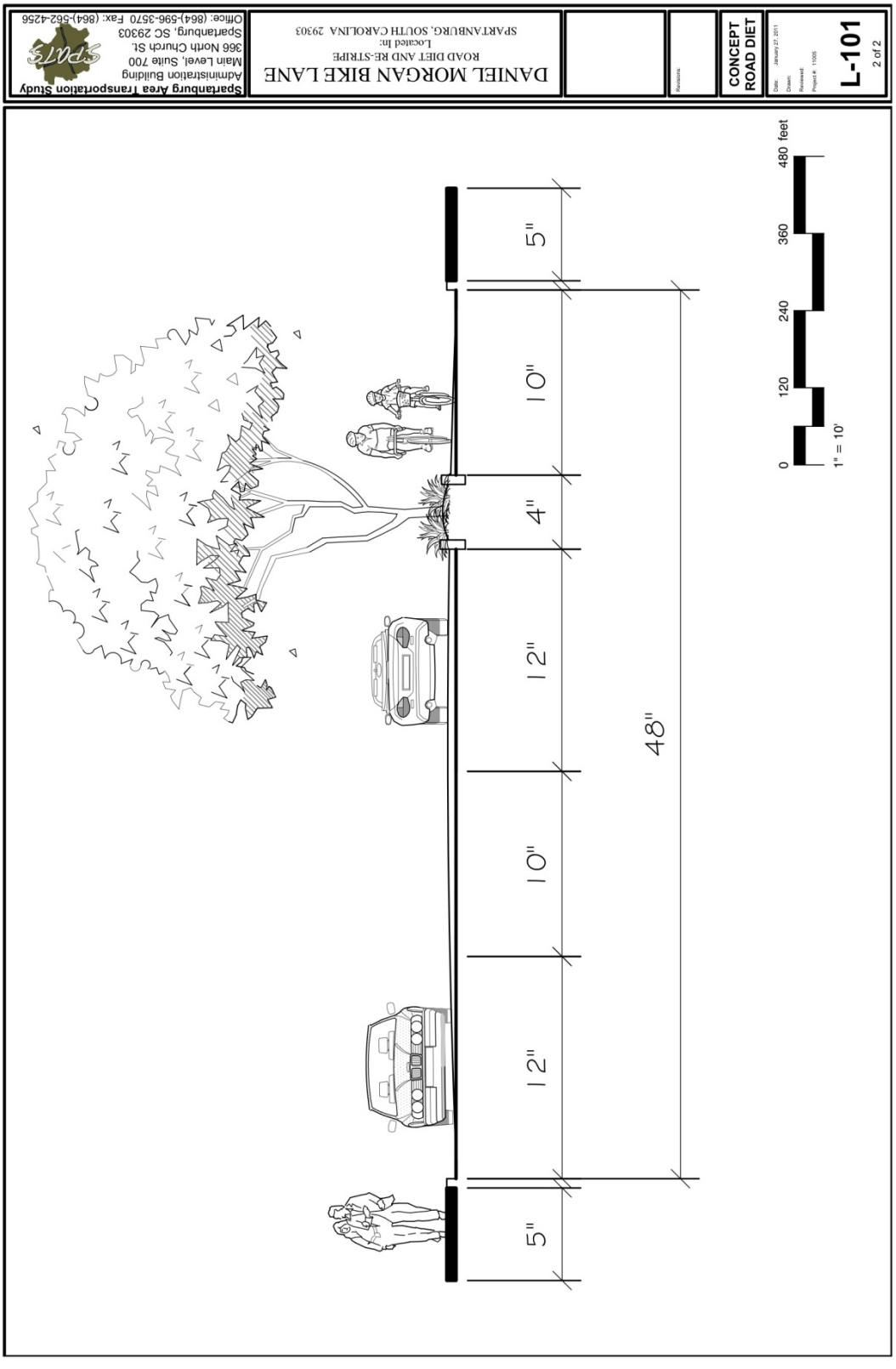
APPENDICES

APPENDIX A: IMAGE OF PROPOSED ROAD DIET CROSS SECTION



APPENDIX B: SCOPING WORKSHEET

Project: Road Diet/Re-Striping of Daniel Morgan Avenue (DMA), Spartanburg, SC
Health Determinant: Traffic Safety
Geographic Scope: Stretch of DMA included in proposed project

Existing Conditions	Impact Research Questions	Indicators	Data Sources	Methods
What is the existing traffic count on DMA?	How will the new pedestrian and bicycle lanes affect the number of cars on DMA?	Average Annual Daily Traffic count	SCDOT/SPATS	Pneumatic road tube
How many pedestrians and bicyclists travel on DMA each day?	What is the anticipated change in the number of bicyclists and pedestrians?	Pedestrian and bicycle counts	PAL	Manual observation
What is the current motor vehicle collision rate on DMA?	How will the proposed road re-configuration affect motor vehicle collision rates?	Number and locations of collisions	SCDOT Public Safety Crash Data	Review of incident reports
What is the current Bicycle Level of Service (BLOS) on DMA?	How will the Bicycle Level of Service (BLOS) be affected by the proposed bicycle lane?	Bicycle Level of Service (BLOS)	SPATS	Map review
What is the average rate of speed on DMA?	To what extent can it be anticipated that installing the road diet will reduce vehicle speed?	Speed	SCDOT	Radar

Project: Road Diet/Re-Striping of Daniel Morgan Avenue (DMA), Spartanburg, SC
Health Determinant: Physical Activity
Geographic Scope: Stretch of DMA included in proposed road diet Spartanburg/Half-mile radius around DMA/ City of Spartanburg/Spartanburg zip codes 29303 and 29306 (depending on the data)

Existing Conditions Research Questions	Impact Research Questions	Indicators	Data Sources	Methods
How many pedestrians and bicyclists travel on DMA each day?	How will the new pedestrian and bicycle lanes affect the number of pedestrians and bicycles on DMA each day?	Pedestrian and bicycle count	PAL	Manual observation
How many bicycle riders are there each day within a half-mile radius around DMA?	What is the expected increase in the number of bicycle riders within a half mile radius of DM Avenue each day?	Number of bicycles on bicycle racks within a half-mile radius of DMA	PAL	Manual observation
What is the utilization of PAL's bike lending program?	What is the anticipated impact on usage of the PAL bicycle lending program?	Number and trend of users of bike lending program	Documentation through PAL bike lending records	Record review
How many minutes/day of physical activity do residents of the zip codes surrounding DMA get on average?	How will the average number of minutes/day of physical activity be affected?	Minutes/day on average of physical activity	Spartanburg Bicycle Pedestrian Master Plan Survey, 2009	Secondary Data Analysis by zip code

Project: Diet/Re-Striping of Daniel Morgan Avenue (DMA), Spartanburg, SC
Health Determinant: Access to Goods and Services
Geographic Scope: City of Spartanburg

Existing Conditions Research Questions	Impact Research Questions	Indicators	Data Sources	Methods
Where are locations in the City of Spartanburg that provide access to healthy food? Educational institutions? Healthcare services? Public services?	How will the proposed project affect access to healthy food and educational, health, and public services?	# and location of outlets for healthy food and educational, health, and public services	Food desert study, SPATS maps	Secondary data collection
What trails, bicycle lanes, and sidewalk connections exist in the areas adjacent to DMA?	How will new pedestrian and bicycle lanes on DMA provide access to existing pedestrian and bicycle infrastructure?	# and location of connections	SPATS maps	Secondary data collection
What transit connections are near DMA?	How will the proposed pedestrian and bicycle lanes on DMA improve access to transit services in the downtown Spartanburg area?	Location of transit connections; transit ridership	SPATS maps, SPARTA	Secondary data collection

Project: Road Diet/Re-Striping of Daniel Morgan Avenue (DMA), Spartanburg, SC
Health Determinant: Air Quality
Geographic Scope: Spartanburg zip codes 29303 and 29306/Stretch of DMA included in proposed road diet (depending on the data)

Existing Conditions Research Questions	Impact Research Questions	Indicators	Data Sources	Methods
How many pedestrians, bicyclists, and motor vehicles travel on DMA each day and what are existing levels of air pollution?	How will the new pedestrian and bicycle lanes affect the number of pedestrians, bicycles, and cars on DMA each day and how will this affect air quality?	Average Annual Daily Traffic count; pedestrian and bicycle count; "Pollution levels, days above the standard level"	SCDOT; PAL; DHEC	Pneumatic road tube; manual observation Air quality monitor measurements
What are the current inpatient and emergency department utilization rates for asthma-related visits compared to the state average?	How would changes in air quality resulting from the project be expected to impact asthma prevalence?	Hospital utilization rates for asthma-related admissions and visits	Hospital emergency department and admissions data through ORS	Secondary Data Analysis by zip code

APPENDIX C: DEMOGRAPHIC DATA FOR ZIP CODES 29303 and 29306, SPARTANBURG COUNTY, AND SOUTH CAROLINA

Population by Poverty Level

	29303		29306		Spartanburg County		South Carolina	
Measure	**Population**	**Percentage**	**Population**	**Percentage**	**Population**	**Percentage**	**Population**	**Percentage**
Families Below Poverty Level	761	13.30%	1,069	25.30%	6,401	9.20%	115,899	10.70%
Individuals Below Poverty Level	4,026	18.10%	4,568	28.80%	30,394	12.30%	547,869	14.10%

Source: U.S. Census Bureau 2000

Population by Income Level

Income Level	29303	29306	Spartanburg County	South Carolina
Median Household Income	$28,343	$22,672	$37,579	$37,082
Median Family Income	$36,002	$27,729	$45,349	$44,227

Source: U.S. Census Bureau 2000

Population by Educational Attainment

	29303		29306		Spartanburg County		South Carolina	
Measure	**Population**	**Percentage**	**Population**	**Percentage**	**Population**	**Percentage**	**Population**	**Percentage**
High School Graduate or Higher	9,930	63.60%	6,457	63.60%	122,659	73.10%	1,981,731	76.30%
Bachelor's Degree or Higher	1,681	10.80%	1,186	11.70%	30,486	18.20%	530,055	20.40%

Source: U.S. Census Bureau 2000

Population by Race and Ethnicity

	29303		29306		Spartanburg County		South Carolina	
Measure	**Population**	**Percentage**	**Population**	**Percentage**	**Population**	**Percentage**	**Population**	**Percentage**
White	15,846	63.80%	4,649	29.20%	190,569	75.10%	2,695,560	67.20%
African American	7,298	29.40%	10,952	68.70%	52,775	20.80%	1,185,216	29.50%
Hispanic or Latino	1,433	5.80%	192	1.20%	7,081	2.80%	95,076	2.40%
Other	555	2.20%	137	0.90%	4,293	1.70%	49,732	1.20%

Source: U.S. Census Bureau 2000

Population by Age

	29303		29306		Spartanburg County		South Carolina	
Measure	**Population**	**Percentage**	**Population**	**Percentage**	**Population**	**Percentage**	**Population**	**Percentage**
Under 5	1,531	6.20%	1,176	7.40%	16,739	6.60%	264,679	6.60%
5 to19	5,069	20.40%	3,816	23.90%	53,326	21.20%	871,099	21.70%
20 to 64	14,937	60.10%	8,814	55.30%	151,986	59.80%	2,390,901	59.60%
65 +	3,306	13.30%	2,126	13.40%	31,740	12.40%	485,333	12.10%
Median Age	33.1		34.8		36.1		35.4	

Source: U.S. Census Bureau 2000

Population by Gender

	29303		29306		Spartanburg County		South Carolina	
Measure	**Population**	**Percentage**	**Population**	**Percentage**	**Population**	**Percentage**	**Population**	**Percentage**
Male	12,177	49.00%	7,118	44.70%	123,338	48.60%	1,948,929	48.60%
Female	12,666	51.00%	8,814	55.30%	130,453	51.40%	2,063,083	51.40%
Total	24,843	100%	15,932	100%	253,791	100%	4,012,012	100%

Source: U.S. Census Bureau 2000

APPENDIX D: AVERAGE ANNUAL DAILY TRAFFIC COUNT, DANIEL MORGAN AVENUE, 1987-2009

Station Number	Road	Location	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
324	S. Daniel Morgan	W. Henry St. to SC 296						9,200	8,900	9,300	9,700	9,000	9,900	11,100	9,000	8,500	8,600	8,300	8,000	7,900	8,100	7,600	8,400	7,600	6,700
325	Daniel Morgan Ave	N. Church St. to US 176	9,009	9,136	10,617	8,141	8,863	7,800	8,400	8,800	8,900	8,400	8,000	7,600	7,700	7,300	7,300	6,000	6,800	6,600	6,300	6,400	6,500	6,400	6,200

Data Source: SPATS; SCDOT

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