Health Impact Assessment

Red Line Regional Rail

A Health Impact Assessment detailing the potential health impacts of the proposed Red Line Regional Rail project from Charlotte to Mooresville, North Carolina.

November 2012

A project of Davidson: Design for Life in collaboration with a Regional Advisory Commission and funded by the Centers for Disease Control and Prevention: Healthy Community Design Initiative.

Davidson Design for Life

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Executive Summary

Public transit opportunities, such as the proposed Red Line Regional Rail project, are large investments that communities can make to significantly impact the lifestyle, well-being, and health of citizens. The proposed Red Line Regional Rail project would upgrade an existing Norfolk Southern rail line to connect Mooresville to Charlotte and offer commuter rail service as well as increased freight business. Transit oriented and freight oriented development is proposed along the rail line with higher density, mixed-use development expected around the 10 proposed transit stops and freight-supporting businesses located strategically along the rail line.

The Town of Davidson, a small community located 20 miles north of Charlotte, North Carolina, has come to realize the fact that the way communities are designed can have an immense impact on its residents' physical, mental, and social health. Over the last 20 years it has implemented health-promoting community design principles including complete streets, smart growth, main-street protection, form based code, and new urbanism.

Key Findings

1. Accessibility to transportation, housing, employment opportunities, and open space could be enhanced through the proposed project. Social and health equity can either be promoted or discouraged through this increased accessibility.
2. Negative health impacts could occur during the rail line renovations and construction of new development surrounding the stations as a result of increased air and noise pollution.
3. Planned improvements to railroad crossings and additional bicycling and pedestrian amenities surrounding transit stations can increase safety and physical activity levels.
4. The commuting experience could be improved for highway users and transit users resulting in less stress, greater time savings, and additional resources for health-promoting activities.

As part of the town's goal to promote the health of its residents, in 2011 Davidson applied for and received a grant from the Centers for Disease Control and Prevention: Healthy Community Design Initiative in order to develop a program to conduct health impact assessments (HIAs) and incorporate innovative design principles into its planning processes. Davidson Design for Life (DD4L) was created to carry out this initiative, with the mission **"to help Davidson be a community that is healthy today and even healthier tomorrow while serving as a model for other small towns by implementing healthy design."**

Through this HIA, the *Davidson 2012 Station Area Plan*, and its leadership role on the Red Line Task Force, Davidson continues to strive for innovative approaches to solving complex challenges and to serve as a model for healthy community development.

Definition of Health Impact Assessment

The purpose of an HIA is to provide information about the potential health implications of a decision being made outside of the health sector to decision makers, stakeholders, and the community affected in the hopes that health will be taken into consideration.

According to the National Research Council HIA is a "systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects."

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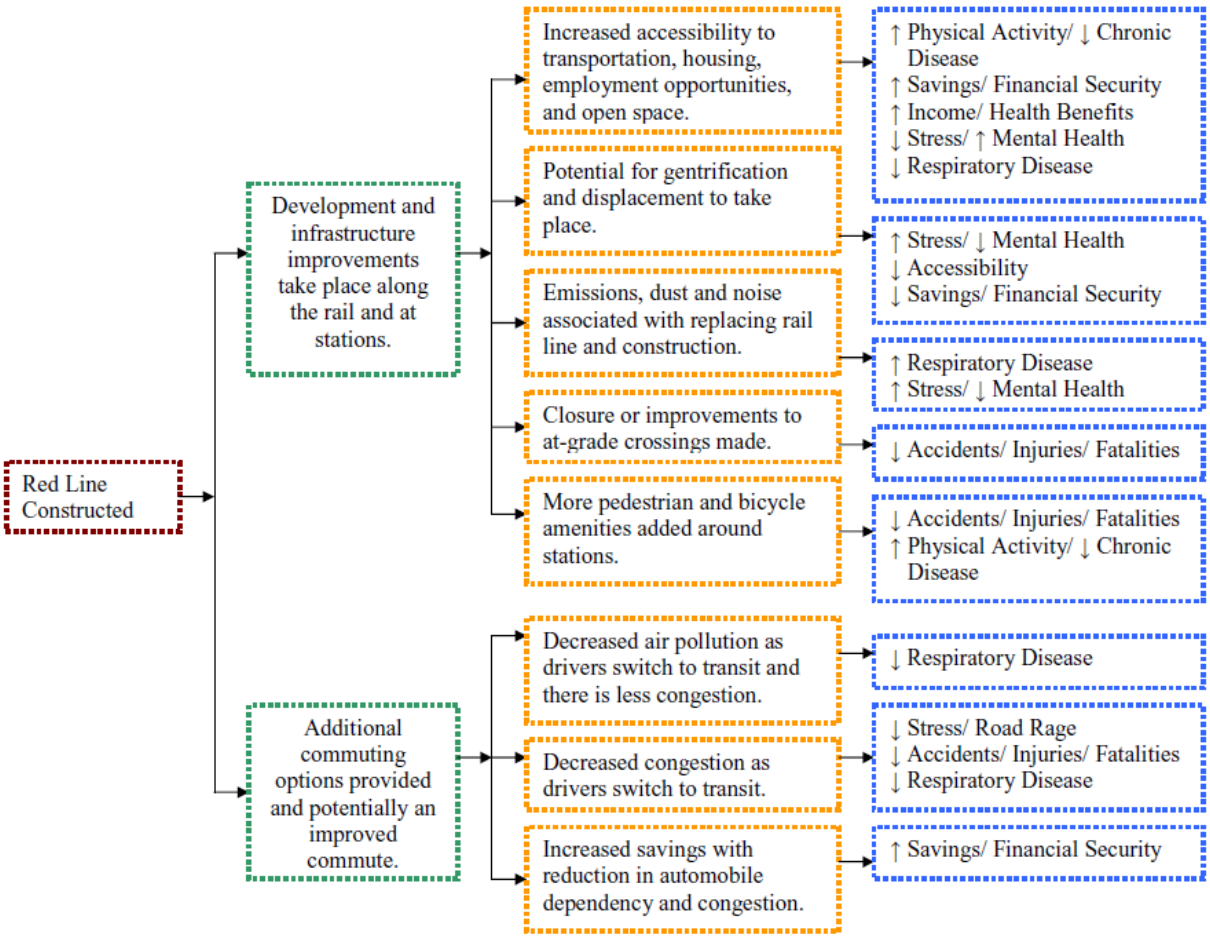


Figure ES1: Logic model of health impacts examined

Health Profile for Mecklenburg and Iredell County

Accessibility: Health Equity

- Increased accessibility to transportation, employment, housing, and open space can improve the health of residents in many ways (increased mobility, income, health benefits, financial security, physical activity, mental health) and promote health equity if access is equal.
- Close to16,700 households within the study area have no vehicle access. Over 110,000 households have only 1 vehicle.
- Approximately 13% of individuals within the study area live below the poverty level. 27% of single mothers live below the poverty level.
- Close to 214,000 people within the study area are either too young or too old to drive and may benefit from increased transit opportunities and the mixed use development around the proposed rail stations.
- 13% of Mecklenburg adults and 21% of Iredell adults have a disability that may limit access.

Air Pollution: Respiratory and Cardiovascular Disease

- Air pollution can trigger asthma attacks, acute bronchitis, heart attacks, and arrhythmias.
- In 2008, 12% of Mecklenburg adults had asthma; 8% of adults in Iredell had asthma in 2010.
- In 2010, heart disease was the second leading cause of death in Mecklenburg (970 deaths) and Iredell (301 deaths).

Motor Vehicle Accidents: Injuries and Fatalities

- Motor vehicle injuries are the 10th leading cause of death in North Carolina and the leading cause of death for those between 5 and 24 years old.
- On average, Mecklenburg County experiences 322 pedestrian crashes and 63 bicycle crashes each year including 14 pedestrian fatalities and 1 bicyclist fatality. Iredell County experiences 26 pedestrian crashes and 13 bicycle crashes each year including 4 pedestrian fatalities.
- Crashes cost Mecklenburg and Iredell Counties $981 million annually.

Physical Activity: Chronic Disease Prevention

- Achieving the recommended physical activity levels can help with weight management and decrease the risk of chronic disease including heart disease, cancer, and diabetes.
- 20% of adults in Mecklenburg and 23% in Iredell report participating in no physical activity in the last month.
- Sedentary activities are high with 42% of teens in Mecklenburg and 51% of adults in Iredell participating in 3 or more hours of sedentary activities each day.
- 64% of adults in Mecklenburg and 67% in Iredell are overweight or obese.
- In 2008, cancer, heart disease, and diabetes were responsible for 2,235 deaths in Mecklenburg. In 2010, these diseases resulted in 651 deaths in Iredell County.

Summary of Recommendations

1. Use the Red Line Regional Rail project as a means of promoting accessibility and social equity instead of increasing socioeconomic gaps.

2. Be mindful of the potential negative health effects associated with the construction surrounding rail stations and the renovation of the rail line to protect sensitive populations from air and noise pollution.

3. Carefully plan the location of the transit stations and the rerouting of bus networks to promote social equity and improve level of service for current and future transit riders.

4. Work with the private sector to maximize transit ridership and savings experienced by commuters.

5. Increase safety along the rail corridor and surrounding the stations by closing or improving at-grade crossings and providing increased bicycling and pedestrian amenities.

6. Encourage increased ridership and energy efficient trains to improve regional air quality.

7. Conduct additional research on freight oriented development– in particular the health implications of this type of development.

8. Provide technical assistance and encourage site-specific plans to address concerns over safety, air pollution, and traffic congestion.

9. Continue to support a participatory process throughout every stage of the Red Line Regional Rail project planning and development, focusing particularly on vulnerable populations and broadening the list of stakeholders to include public health experts.

1. Introduction

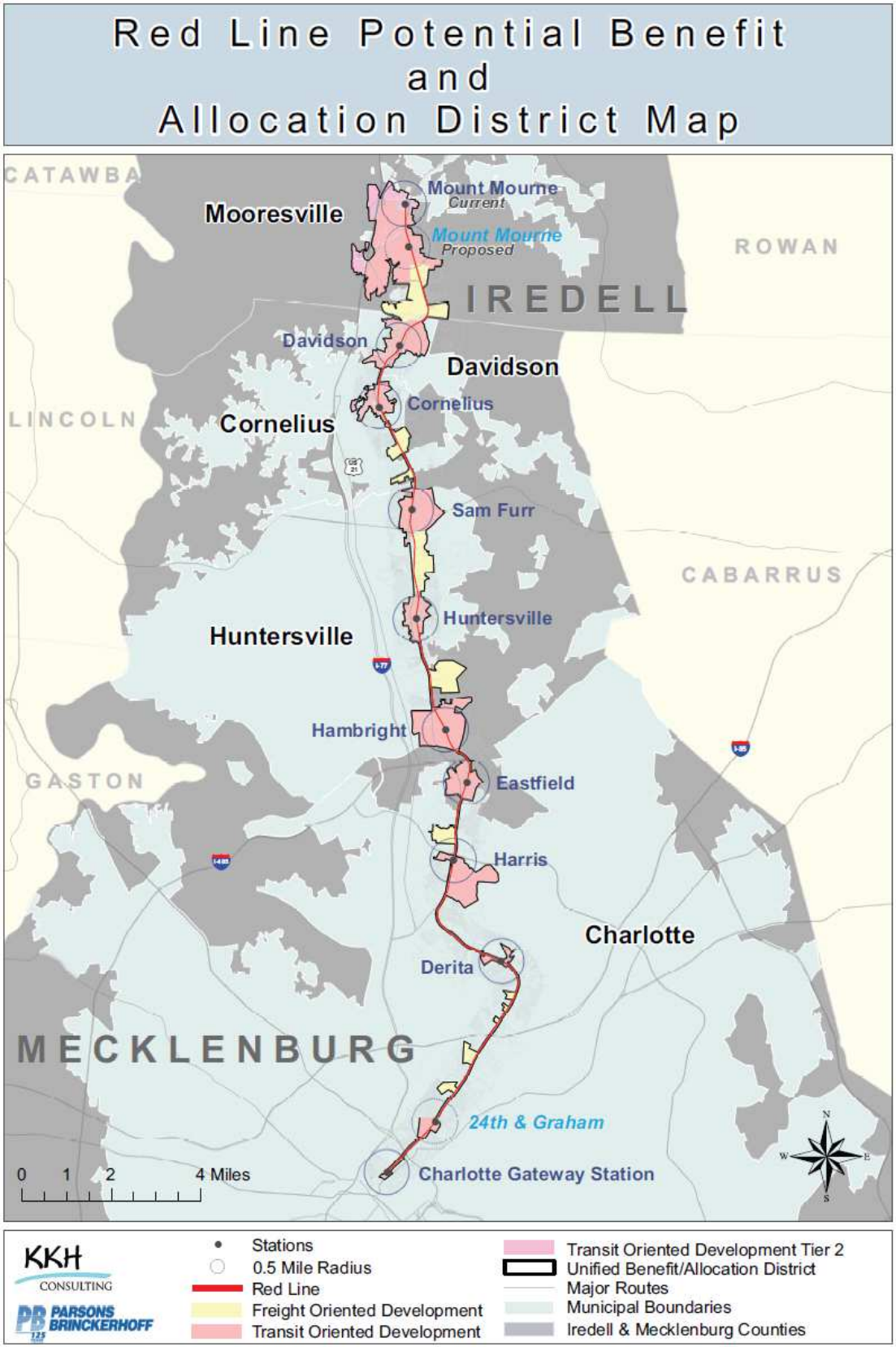
1.1 Vision of the Red Line Regional Rail

The Red Line Regional Rail project is a proposed initiative to upgrade an existing section of freight rail line between Charlotte and Mooresville to facilitate the use of the line for increased freight as well as introducing commuter travel to the line. The 25-mile section of track is currently owned by Norfolk Southern Railroad as a portion of its "O" Line. The improved line would have 10 stops for commuter access connecting the Charlotte Gateway Station to the Mount Mourne station in Southern Iredell County.[1]

The Red Line Regional Rail project was initially proposed over 15 years ago and was included as part of the 2030 Transit Corridor System Plan adopted by the Metropolitan Transit Commission (MTC) in 2006. In September of 2010, there was renewed interest in the project and the Red Line Task Force was formed by the MTC. The Task Force consists of a representative from the Lake Norman Transportation Commission and government policy-makers and executives from the seven jurisdictions which the line passes through (Mooresville, Davidson, Cornelius, Huntersville, Charlotte, Iredell County, and Mecklenburg County).[2]

As a commuter rail, the anticipated schedule for passenger service is every 30 minutes during peak morning and afternoon hours as well as an hourly service during mid-day, non-peak hours. There is no weekend service expected. There will be 16 to 28 trains daily and the top speed of the train is expected to reach 60mph. [1] Travel time between Mt. Mourne and Charlotte (the entire length of the track) is expected to be approximately 40 minutes. Operations are expected to begin in 2017 and estimated ridership is between 4,000 and 5,000 riders daily. Estimated fare rate is $0.18 per passenger mile making a trip from Mount Mourne to Charlotte cost $4.50.[3]

Map 1: Proposed Red Line Regional Rail Project[1]



The total project is estimated to cost $452 million (in 2018 dollars) for various services and improvements to the main track as well as supporting structures such as station development, vehicles, and a vehicle inspection facility.[4] The North Carolina Department of Transportation (NCDOT) and the Charlotte Area Transit System (CATS) have both agreed to pay 25% of these costs with the local governments being responsible for funding the rest of the estimated cost.[2]

Table 1: Estimated costs of Red Line Regional Rail Project [4]

Project Component	Estimated Cost (millions, in 2018 dollars)
Main Line Track	$70.5
Grade Crossings	$44.9
Vehicles	$58.3
Stations	$56.6
Charlotte Terminal Area & Vehicle Inspection Facility	$66.0
Systems	$25.8
Professional Services	$40.9
NS Licensing Agreement	$28.1
Freight Rail Rationalization	$5.7
Project Reserve	$11.6
Station Area Improvements	$43.6
Total	**$452.0**

1.2 Regional Overview

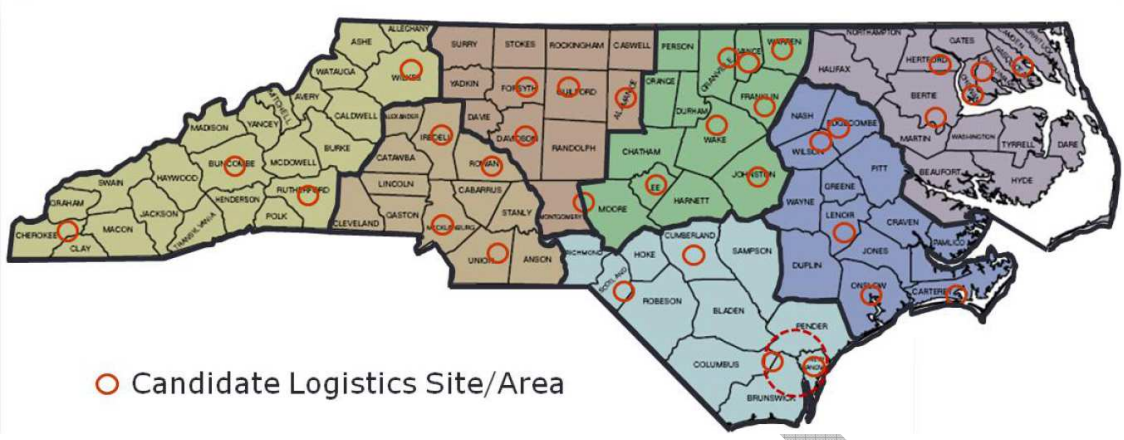
In 2011, a study was sponsored by the North Carolina Department of Transportation and conducted by a team of professors and consultants to examine the potential to increase economic growth by making infrastructure improvements.[5] This report includes valuable background information on population, economic, employment, and transportation statewide as well as a regional profile of the greater Charlotte region (See Map 2).

Charlotte Regional Partnership

Considered on of the nation's major transportation and distribution centers, the greater Charlotte region consists of 12 counties in North Carolina (Mecklenburg, Cleveland, Gaston, Lincoln, Anson, Stanly, Cabarrus, Rowan, Iredell, Union, Catawba, and Alexander) and extends south into 4 counties in South Carolina (York, Chester, Lancaster, and Chesterfield).[6]

The region is home to over 2.6 million people and is strategically located in the center of the East Coast making it accessible to over 60 percent of the nation's population and industrial base by a 2-hour flight or a day's worth of motor freight. [5]

Map 2: Seven regional commerce partnerships in North Carolina [5]



Population Growth Rate

The South Atlantic region, which includes North Carolina, is projected to grow by 31% by 2030 from 59.8 million to 78.1 million people. [5] Charlotte is also part of the Piedmont Atlantic Megaregion stretching east from Atlanta to Raleigh and west to Birmingham, Alabama. These megaregions are expected to become the nation's new competitive engines in the global economy, characterized by their inter-regional and international movement of goods, people, and capital. They are also expected to face major problems of "growing highway congestion, overcrowded airports and seaports, loss of open space, and aging infrastructure systems" which will be compounded by growing populations and rapidly expanding international trade.[7]

Within North Carolina, the Piedmont region which includes Charlotte and the Triangle (Raleigh, Durham, Chapel Hill) is expected to continue to grow rapidly. [5] In 2010, the Charlotte region's population was 2,687,799. By 2015, the projected population is 3,008,096 representing a growth of 12% or over 320,000 people.[6]

Economic/ Employment Opportunities

There are nine Fortune 500 company headquarters in the region including Lowe's, Nucor, Duke Energy and Sonic Automotive. [6] Since 1990 new and expanding businesses have invested more than $18 billion and created more than 170,000 new jobs.[5] In 2010 alone, 9,463 jobs and a total investment of over $1.6 billion were announced. [6] The region's employment base is approximately 1.1 million jobs. Charlotte is also considered the second largest banking and financial center in the United States, second only to New York City.[5]

Charlotte is well connected to the global economy with one-third of the more than 1,800 foreign-owned companies in the Carolinas being located in the Charlotte Region. These companies employ more than 350,000 people and rely on the Charlotte Douglas International Airport for quick and convenient access to the global company. With direct flights to Frankfurt, London, Munich, Paris, Rome, Rio de Janeiro and Sao Paulo, the Charlotte region is at most one connecting flight away from any important business destination in the world. [6]

Major Roads, Rail Service, and Congestion

Two major Interstates cross in Charlotte–I-77 and I-85. I-77 provides a north-south access primarily to the North Central states. I-85 provides an east-west route through North Carolina and a north-south route from Atlanta to Richmond. The region is also served by two Class 1 railroads, Norfolk Southern and CSX. Continued efforts to improve rail services through the Charlotte region include: an emerging multi-modal transportation network in urbanized areas, a concentrated effort to improve operational capacity from Charlotte to Raleigh, and a focus on capturing the expected growth in container freight (expected to triple over the next 20 years).[5]

According to the Seven Portals Study:

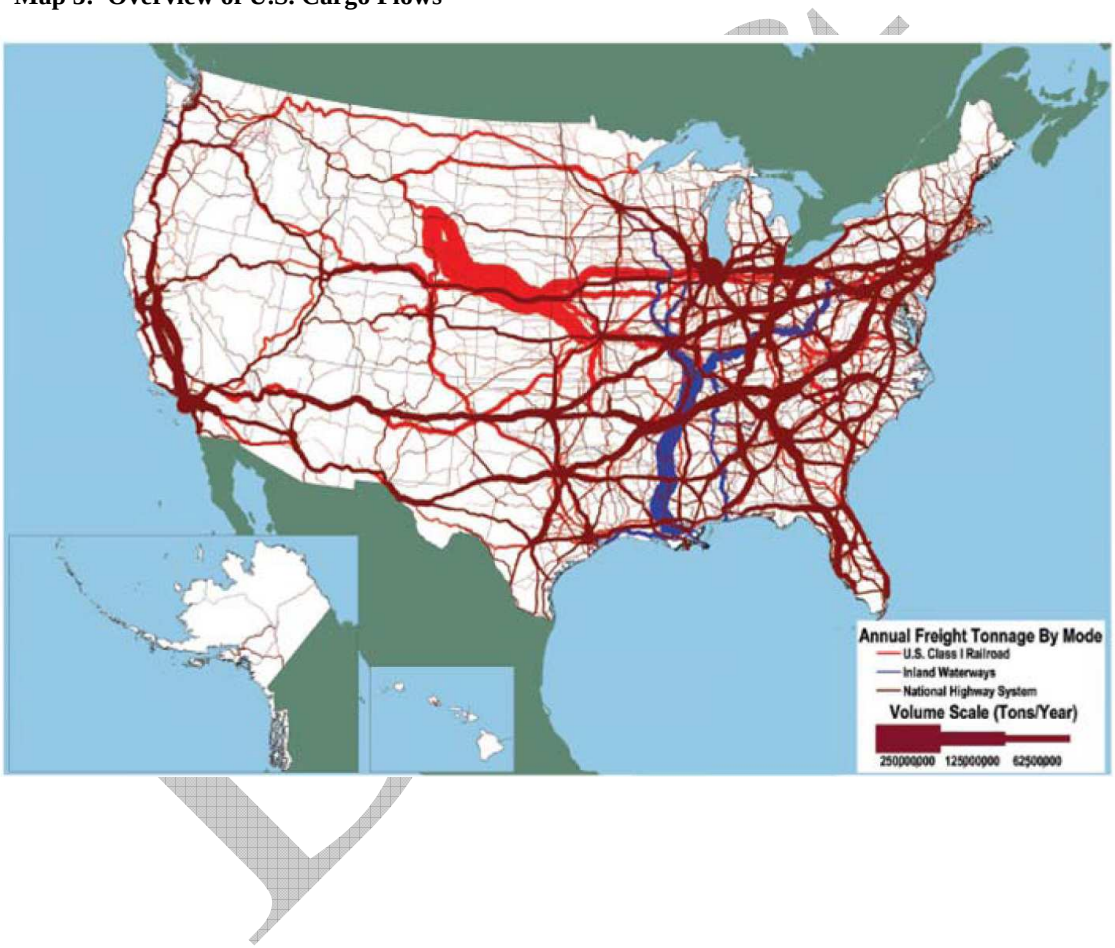
> The Charlotte regions' economic growth over the past two decades has resulted in ***overall traffic demand beyond the capacity of our highway and rail infrastructure***. Bottlenecks in the flow of goods by truck and rail affect scheduled deliveries both in the region and in locations in distant markets. Major highway routes including the ***Interstates are particularly congested during morning and afternoon peak hours***, and Charlotte is usually evaluated by the annual Texas Transportation Institute Congestion Index as the ***first or second most congested*** municipality in the 500,000 to one million population range.

Investment to improve rail productivity and efficiency are already underway. Efforts to relocate an intermodal yard operating beyond peak capacity by Norfolk Southern to a larger property adjacent to the airport are currently in progress. With air cargo volume expected to double over the next 15 years, Charlotte Douglas International Airport will play a central role in the region's freight infrastructure growth. The Charlotte Railroad Improvement & Safety Program (CRISP) is also expected to alleviate conflicts between Norfolk Southern and CSX, improving rail production and efficiency. Southeast High Speed Rail (SEHSR) investments should add capacity to the north-south corridor. [5]

Area Rail and Truck Cargo Activity

The majority of cargo shipments take place using rail, truck, or a combination of the two. Nationwide, rail cargo (represented by the bright red line in the map below) accounts for 3.7% by value and 40.2% of the ton-miles shipped. Approximately half of the rail ton-miles are coal shipments. Truck cargo (represented by the maroon line) accounts for 71.3% by value and 40.1% of the ton-miles shipped. Multi-modal (rail and truck) accounts for 1.6% by value and 5.9% by ton-miles shipped. [5]

Map 3: Overview of U.S. Cargo Flows[5]

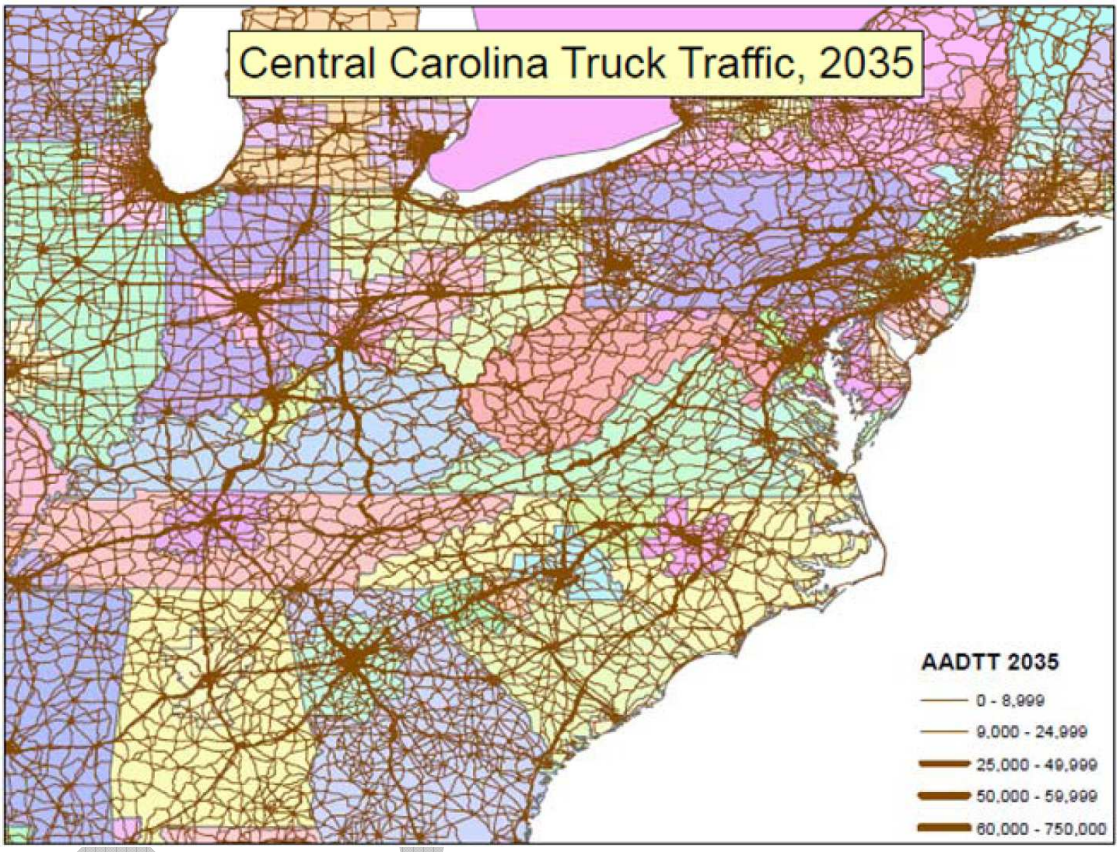


The demand for intermodal routes is expected to grow with increased global shipping to the Carolina ports of Wilmington and Charleston. It could be possible for these goods to be moved through the Norfolk Southern system at Roanoke, providing connections to other major rail corridors including lines out to the Midwest. Norfolk Southern's Crescent Corridor currently connects New Orleans to New York City and has stations in Charlotte and the Triad. [5]

Map 4: Emerging Intermodal Rail Corridors[5]

By 2035, Interstates 40, 85, and 95 are expected to be the most heavily used corridors. Most of the increase in truck traffic is expected within the Piedmont region on select interstates. [5]

Map 5: Projected Central Carolina Truck Traffic, 2035[5]



1.3 Description of the Proposed Joint Powers Authority

Creating a joint powers authority (JPA) is one way to provide collaborative leadership to a project of regional significance such as the Red Line. A JPA is a limited-purpose governance structure where participating jurisdictions voluntarily agree to be a member of the JPA and are granted only the powers necessary to carry out the defined project. In the case of the Red Line, a JPA has been proposed to provide leadership to the planning, construction, and operation of the rail line to maximize regional value creation, value capture, and value distribution. The JPA would consist of 18 members including a senior executive (staff) and a citizen leader (not an employee or government official) from each of the seven jurisdictions as well as 2 representatives from CATS and the State of North Carolina. It is recommended by the consultants working on the Business and Financial Plan that the JPA agreement to be at least 30 years in duration to cover the full financing period and continuous after the 30 years unless the members of the JPA decide to terminate the agreement.[4]

Table 2: Description of the proposed Joint Powers Authority[4]

JPA Function	Type	Personnel / Notes
Strategic Planning	Internal	Board
Administration / Governance, including Legal and Intergovernmental Affairs	Internal	Executive Director
Financial Management, including Budgets and Annual Reports	Internal	Finance Director. Must also appoint treasurer and auditor.
Operations & Maintenance	Contract	Member jurisdiction or third party. Ongoing, long-term.
Planning for both Phase I and II	Contract	Member jurisdiction or third party. Some ongoing functions, some discrete projects.
Project Development / Execution, including Design and Construction Management	Contract	Third party, discrete projects
Communications / Public Relations	Contract	Third party, as-needed
Legal / Bond Finance / P3 Procurement	Contract	Third party. Heaviest at JPA inception (2013).

1.4 Transit Oriented Design

Transit oriented design (TOD), also referred to as transit supportive development (TSD), is an approach to development that focuses land uses around a transit station or transit corridor.[8,9] TOD typically takes place within a half mile of a station which is considered an easy walking distance. Commonly the goal of TOD is to create compact neighborhoods with housing, jobs, shopping, community services, and recreational opportunities within walking distance of a transit stop in order to reduce dependency on personal vehicles and make transit use more convenient.[9]

In order to accomplish this goal, multiple sustainable development principles are used including the following:

Mixture of Complementary Transit Supportive Uses- a mix of residential, office, service-oriented retail, and civic uses that support the use of transit, increase the attractiveness of the area, and increase trip options for transit users. Successful TODs typically have uses on the ground floor level that promote pedestrian activity, special generators of pedestrian traffic such as cultural, educational, recreational, or entertainment uses near the transit station, and a mixture of housing types and costs. [8, 9]

Increased Land Use Density- concentrated development including densities of at least 12-15 units per acre for dwelling units within half a mile of the transit station and even higher densities within a quarter mile (Charlotte-Mecklenburg Planning Commission recommends 20 units or greater) to encourage pedestrian activity and the use of transit.[9] Transit stations located in already developed areas with abandoned or underutilized sites and buildings offer an opportunity for area revitalization and infill development with greater densities which supports compact development.[8]

Pedestrian and Bicycle Oriented Streetscape and Street System- the provision of a connected system of sidewalks and bicycling facilities surrounding the station as well as amenities such as street trees, on-street parking, and bicycling parking encourage active transportation and safe transit use. [8, 9]

Reduced Parking- minimizing the number of parking spaces available (especially in surface parking lots) and increasing the cost of parking will reduce vehicular traffic around the transit station and enhance the pedestrian environment. [8, 9]

Connected Street Network- designed around a block system with interconnected streets making travel distances shorter and providing multiple routes and modes of travel. Intersections should be designed for safe and comfortable pedestrian and bicycle crossing including mid-block street crosswalks in congested areas and areas with long distances between signalized crossings. [8, 9]

High Quality Building and Site Design- buildings should have entrances on public streets or open spaces, with minimal setbacks, and windows and doors at street level instead of expansive blank walls. Parking structures should have active uses on the ground floor

street frontage and surface parking lots should be to the rear of the building with pedestrian paths to transit where necessary. [8, 9]

Open Space- the provision of open spaces can act as development catalysts, serve as focal points around transit stations, and be centers of activity. Surrounding buildings should be oriented onto the open space and items such as benches, fountains and public art should be included to make the space inviting. [9]

Figure 1: Transit Oriented Design

1.5 Freight Oriented Development

Freight oriented development (FOD), also referred to as cargo oriented development (COD), concentrates manufacturing and distribution businesses at a location where they benefit from efficient access to multiple modes of freight transportation, the presence of complementary businesses, and an available industrial workforce. [10] Macro-economic trends are causing more freight to be shipped longer distances and passed through strategic locations, making FOD a viable option for communities with the necessary assets such as a concentration of current and projected economic activity, constrained roadway system with heavy freight and passenger movement, and an abundance of promising industrial sites. [10, 11]

Figure 2: Freight Oriented Development

1.6 A Health Impact Assessment of the Red Line Regional Rail

The National Research Council's Committee on Health Impact Assessment defines HIA as:

> a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects. [12]

HIA is typically done prospectively or prior to the decision being made. It is used to inform the decision and provide recommendations to mitigate negative health outcomes and encourage health promoting aspects of the decision. Health outcomes are changes in the health status of an individual, group or population, which are attributable to a planned intervention or series of interventions (as opposed to incidental exposure to risk), regardless of whether such an intervention was intended to change health status.[13] This HIA uses a broad definition of health as defined by the World Health Organization and considers the social determinants of health and health inequities that may be impacted by the construction and operation of the Red Line Regional Rail project.

The primary goal of this HIA is to inform taskforce working on the Red Line Regional Rail project to include decision makers in the affected localities, representatives from the Charlotte Area Transit System, and the North Carolina Department of Transportation. This HIA seeks to add the dimension of public health to the discussion currently being had surrounding the Red Line Regional Rail project which has primarily focused on the expense of constructing the rail and the potential land use development opportunities around the improved rail system. Furthermore, this HIA will showcase the relationship between public transportation opportunities and health by:

- presenting relevant health information in regards to the construction and operation of a commuter rail system;
- linking public transportation opportunities to larger social determinants of health such as employment, mobility, and health equity; and,
- summarizing the current health status of residents of Iredell and Mecklenburg counties as well as Davidson, North Carolina.

Davidson: Design for Life (DD4L) received a grant from the Centers for Disease Control and Prevention, Healthy Community Design Initiative in August 2011 to conduct this HIA. The screening stage of this HIA took place from October to November 2011.

Sections 2 through 7 of this report document the six-step process and findings of the HIA. Relevant research data and resources are listed in the Appendices.

Glossary of Terms

Health: A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. [13]

Social Determinants of Health: The circumstances, in which people are born, grow up, live, work and age, and the systems put in place to deal with illness. These circumstances are in turn shaped by a wider set of forces: economics, social policies, and politics. [13]

Health Inequities: Avoidable inequalities in health between groups of people within countries and between countries. These inequities arise from inequalities within and between societies. Social and economic conditions and their effects on people's lives determine their risk of illness and the actions taken to prevent them becoming ill or treat illness when it occurs. [13]

Health in All Policies: An innovative approach to address complex health challenges and improve population health through designing healthier communities, integrating public health actions with primary care, and by pursuing healthy public policies across sectors.[13]

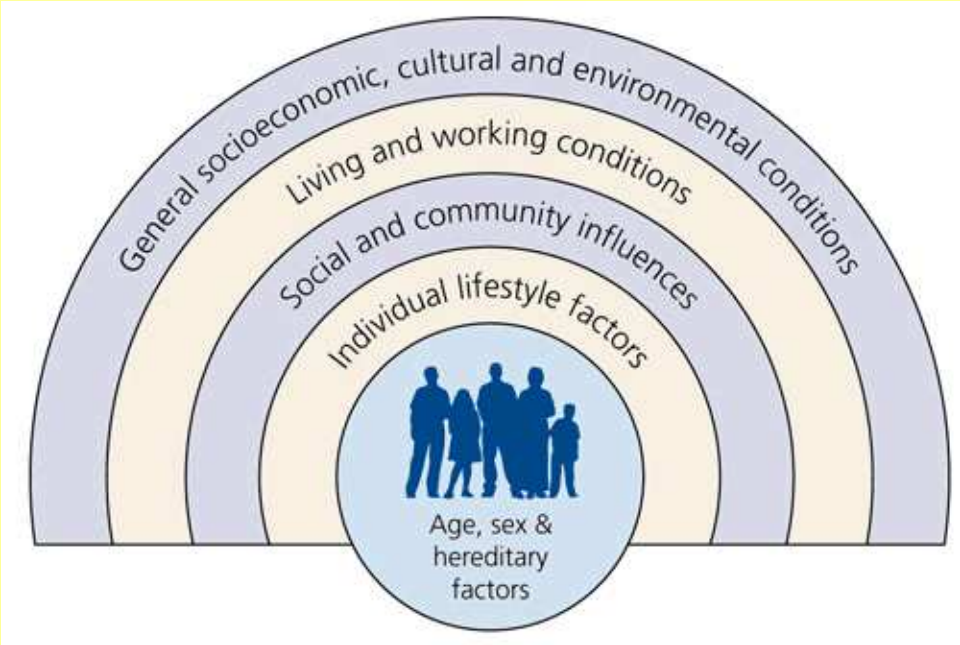


Figure 3: Social determinants of health[14]

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2. Screening

Screening establishes the need for and value of conducting an HIA. Screening considers:

- whether a proposed policy, plan, project, or program will potentially have substantial adverse or beneficial health effects (even if there is a low likelihood);
- if the information from the HIA could alter a decision or help decision-makers choose between alternatives;
- if there could be a disproportionate burden placed on vulnerable populations;
- if there is public concern or controversy surrounding the policy or program;
- whether there is an opportunity to incorporate health information into the decision-making process that would otherwise not occur; and,
- if there is the ability to complete the assessment prior to the decision being made with available resources.

At the conclusion of the screening step, the HIA team should have:

- a complete description of the proposed policy, program, plan or project including a timeline for decision and the political and policy context;
- a preliminary opinion on the importance of the proposal for health and the opportunities for the HIA to inform the decision;
- a statement of why the proposal was selected for screening;
- an outline of expected resources needed to conduct the HIA; and,
- a recommendation on whether the HIA is warranted.[1]

2.1 Screening Process Followed

The screening of this HIA took place from October to November 2011. After the Town of Davidson received the grant from the Centers for Disease Control and Prevention and DD4L became a formal entity, the committee met to discuss what would be the topics for the three HIAs in year 1. The topic of the Red Line Regional Rail was suggested as a regional transit project that if implemented could have a significant impact on the health of residents and workers in the region.

2.2 Results of Screening

At the end of the screening step it was determined that an HIA on the Red Line Regional Rail project was warranted and that committee members would speak further with members of the Red Line Task force to determine how the HIA would fit into the overall planning process for the project and if members of the task force would be interested in the findings of the HIA.

Stakeholder Identification and Community Engagement

Stakeholder Identification: There are many stakeholders associated with the Red Line Regional Rail Project including: those who currently live or own property around the existing rail line, future residents of the transit oriented developments, future rail commuters, commuters that use the surrounding highway system (I-77 and NC-115), business owners in the region, freight oriented businesses that may come to the area, schools along the rail line, the municipal leaders and residents of the impacted region, Charlotte Area Transit System, NC Department of Transportation, Norfolk Southern Railroad, and many more.

Community Engagement: Due to the broadness of stakeholders, DD4L relied on existing documents, networks, public events, and meetings to gather comments about the Red Line Regional Rail Project. Staff examined the *2012 Davidson Station Area Plan* which had extensive public engagement including a charrette, public meetings, and "jump teams" which focused on mobility and open space opportunities in the plan. DD4L Project Coordinator, Katherine Hebert will present initial findings to the Red Line Task Force and other boards and commissions as necessary in the upcoming months. A copy of the draft report will be included on the DD4L website for public review and an electronic newsletter describing the project, findings of the HIA, and ways to learn more will be distributed as the Red Line Commuter Rail decision approaches.

Figure 4: Public meeting for the Davidson Station Area Plan

Section References

1. *Improving Health in the United States: The Role of Health Impact Assessments*. (2011). Washington, DC: National Research Council.

Images
http://www.ci.davidson.nc.us/DocumentView.aspx?DID=2057

3. Scoping

Scoping develops the work plan for conducting an HIA. Scoping considers:

- which potential health impacts will be analyzed within the HIA;
- what populations will be affected, the socioeconomic and health characteristics of those population groups, and if there are any particularly vulnerable subgroups;
- what research questions will be examined and what data and methodology will be used to answer those questions;
- who will be involved in the HIA process and what types of community or stakeholder engagement will be used;
- how information will be shared with stakeholders and decision-makers; and,
- how the HIA process will be evaluated.

At the conclusion of the scoping step, the HIA team should have:

- a list of team members and expected roles within the HIA;
- a diagram of potential health impacts to be analyzed within the HIA and what data, literature, or expert opinion is available to examine these impacts;
- a community profile of the geographic area and populations expected to be impacted by the decision;
- a list of key deadlines and activities that need to be completed; and
- plans for community engagement, communication of findings, and evaluation of the HIA process.[1]

3.1 Scoping Process Followed

Once the decision was made to conduct an HIA on the Red Line Regional Rail project, a scoping worksheet was filled out by DD4L Coordinator Katherine Hebert and approved by the DD4L Committee with additional edits (See Appendix 3). The scoping worksheet was also shared with the DD4L Regional Advisory Commission by email and discussed at their next meeting along with a progress report on the HIA efforts concerning the transit project.

3.2 Potential Health Impacts

The potential health impacts that were identified within the scoping process and considered within the HIA include:

- Increased social equity and accessibility to transportation, employment opportunities, housing, and open space and the associated physical, mental, and social health impacts.
- Health concerns during the construction of the Red Line and surrounding development.

- Potential for economic savings and increased employment opportunities for low-income populations resulting in increased health equity.
- Expected ridership and effects on regional air pollution.
- Safety around the rail corridor- particularly improvements at at-grade crossings and bicycle and pedestrian amenities around the station.

The recommendations made within this report address these potential health impacts examined and suggest additional research to provide site-specific recommendations to improve the safety, traffic congestion, and potential for noise and or vibration due to increased rail traffic. Due to the limited knowledge of the health impacts of freight oriented design, the focus of this study will be on the expected transit oriented development expected surrounding the rail stations and the overall health impacts of the commuter rail. However, it is reasonable to expect that with increased freight oriented development there will be additional rail and truck traffic and therefore additional air pollution, traffic congestion, and safety concerns. General recommendations to address these concerns will also be made.

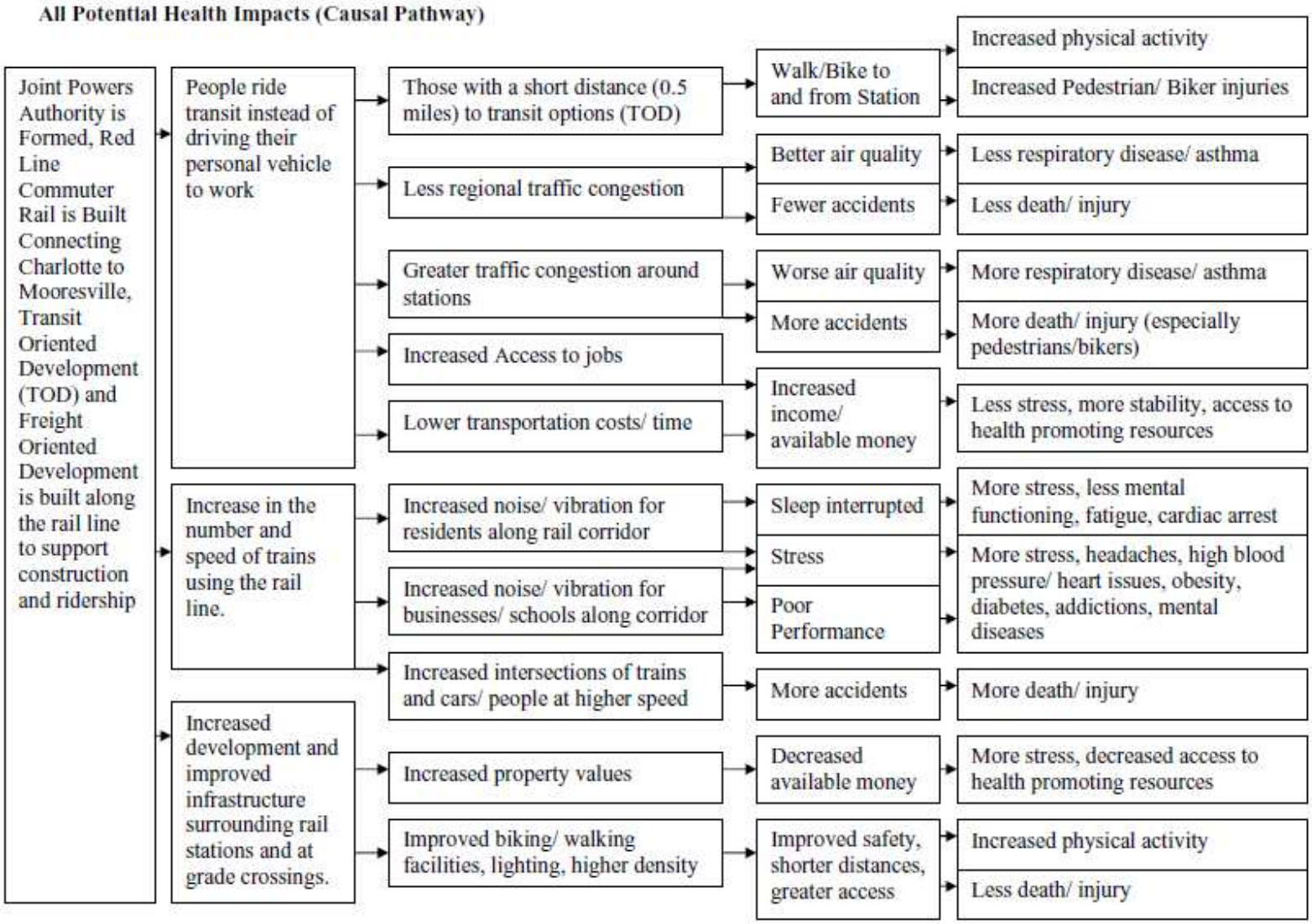


Figure 5: Potential health impacts of the Red Line Regional Rail Project

3.3 Health Profile (North Carolina, Mecklenburg County, Iredell County)

Motor Vehicle Accidents: Injuries and Fatalities

Mecklenburg County

Mecklenburg County has been consistently ranked within the middle of North Carolina's 100 counties in County Crash Rankings based on a multitude of criteria including the total crash rate, fatal crash rate, and non-fatal injury crash rate. Its best ranking was in 2010 with a ranking of 64 and its worse ranking was in 2007 with a ranking of 45.[2] Charlotte's crash rates influence this score greatly—from 2008 to 2011, Charlotte has ranked within the 6 worst ranked cities with populations of 10,000 or more (See Table 3). The other towns within Mecklenburg County have fared better with Cornelius and Davidson scoring in the top 15% and Huntersville consistently ranking between 44 and 48.[3]

On average, Mecklenburg County experiences 322 pedestrian crashes and 63 bicycle crashes each year including 14 pedestrian fatalities and 1 bicyclist fatality.[4] The total cost associated with both fatal and non-fatal crashes in Mecklenburg County, based on the 5 year average crash rates (2004-2008) and 2010 Standardized Crash Cost Estimates in North Carolina, was over $815 million. This estimate includes expenses associated with medical care, public services, victim work loss, employer costs, travel delay, property damage, and reduction in quality of life.[5]

Iredell County

Iredell County has fared better than Mecklenburg County with its best ranking being in 2011 with a ranking of 81 and its worse ranking of 56 in 2008. [2] On average, Iredell County experiences 26 pedestrian crashes and 13 bicycle crashes each year including 4 pedestrian fatalities. [4] The total cost associated with both fatal and non-fatal crashes in Iredell County, based on the 5 year average crash rates (2004-2008) and 2010 Standardized Crash Cost Estimates in North Carolina, was over $166 million.[5]

Table 3: 2009 Ranking of Cities with Populations of 10,000 or More (Based on All Reported Crashes from January 1, 2009 through December 31, 2011- Out of 85)[3]

City	Total Crashes	% Alcohol Related Crashes	Fatal Crashes	Non-Fatal Injury Crashes	2008 Ranking	2009 Ranking	2010 Ranking	2011 Ranking
Charlotte	73,740	3.30%	175	21,664	2	4	6	6
Mooresville	4,796	3.02%	3	1094	30	31	17	33
Huntersville	3,253	4.67%	6	783	46	48	44	46
Cornelius	1,149	5.74%	1	249	70	71	72	77
Davidson	381	3.15%	1	85	---	82	83	81

Physical Activity: Chronic Disease Prevention

Chronic diseases, such as heart disease, stroke, cancer, diabetes, and arthritis, are among the most common, costly, preventable and deadly health problems in the United States. Common causes of chronic disease include a lack of physical activity, poor nutrition, tobacco use, and excessive alcohol consumption.[6]

Health Benefits of Physical Activity

The health benefits of meeting recommended physical activity levels include:

- Weight management,
- Reduced risk of cardiovascular disease,
- Reduced risk of type 2 diabetes and metabolic syndrome,
- Reduced risk of certain cancers,
- Stronger bones and muscles,
- Improved mental health and mood,
- Improved ability to do daily activities and prevent falls,
- Improved quality of life and length of life.

Figure 6: Biking or walking to transit can help you meet recommended physical activity levels!

North Carolina

In 2010, the leading cause of death in North Carolina was cancer (17,476 deaths) followed closely by heart disease (17,133 deaths). Diabetes, another chronic disease that can be prevented through proper diet and physical activity, was the 7th leading cause of death (2,107 deaths).[7] Hospitalization expenses in North Carolina associated with cardiovascular, circulatory diseases, and diabetes totaled $9.6 billion in 2009.[8]

Mecklenburg County

Similar to the state and the nation, chronic diseases are the leading causes of death in Mecklenburg County. Nine out of ten of the leading causes of death in Mecklenburg are chronic diseases or have chronic components. In 2010, cancer was the leading cause of death in Mecklenburg (1,252 deaths) followed by heart disease (970 deaths).[9, 10] Similar to North Carolina's mortality rates, diabetes was also the 7th leading cause of death in Mecklenburg (104 deaths).[11] Hospitalization expenses in Mecklenburg County associated with cancer, cardiovascular diseases, and diabetes totaled $338 million in 2008.[12]

Iredell County

Chronic diseases are also the leading causes of death in Iredell County with cancer (313 deaths in 2010) being the leading cause followed by heart disease (301 deaths in 2010).[9, 10] Diabetes was also the 7th leading cause of death in Iredell County with 37 deaths in 2010.[11] Hospitalization expenses associated with cancer, cardiovascular diseases, and diabetes was not available for Iredell County.

Inactivity

Inactivity can lead to chronic disease. There are many health benefits to being physically active including managing weight, reducing the risk of many chronic diseases such as heart disease, cancer, and diabetes, and living a longer and happier life.[13] According to the *2008 Physical Activity Guidelines for Americans*, it is recommended that adults do two types of physical activity each week to improve health- aerobic and muscle strengthening activities.[14]

Figure 7: Inactivity like watching too much television can lead to chronic disease

There are two levels of aerobic activity- moderate-intensity aerobic activity such as brisk walking and vigorous-intensity aerobic activity such as jogging or running. Many daily activities that are not typically considered exercise (gardening, yard work, cleaning the house, playing chase with the kids) are physical activity and should be counted if done in at least 10 minute intervals. Muscle strengthening activities should work all the major muscle groups (legs, hips, back, abdomen, chest, shoulders, and arms) and is extremely important to retain muscle mass and prevent falls in older adults. [13]

Children and teens also need to be physically active including 60 minutes a day of age-appropriate aerobic, muscle strengthening, and bone strengthening activities.[15]

Table 4: Physical Activity Recommendations for Adults and Children[13,15]

Age Group	Physical Activity Recommendation
Adults	2 hours and 30 minutes of moderate-intensity aerobic activity every week and muscle strengthening activities on 2 or more days a week **OR**
	1 hour and 15 minutes of vigorous-intensity aerobic activity every week and muscle strengthening activities on 2 or more days a week **OR**
	An equivalent mix of moderate and vigorous aerobic activity and muscle strengthening activities on 2 or more days a week.
Children	Aerobic activity should make up most of a child's 60 minutes of physical activity a day and can include moderate and vigorous-intensity activities. Be sure to include vigorous-intensity aerobic activities such as running on at least 3 days per week.
	Muscle strengthening activities, such as gymnastics or sit ups, should be done at least 3 days per week as part of the daily hour of activity.
	Bone strengthening activities such as jumping rope or running should also be done at least 3 days a week.

North Carolina

In North Carolina, 64% of adults do not meet recommended levels of physical activity defined as 2 hours and 30 minutes of moderate-intensity activity or 1 hour and 15 minutes of vigorous-intensity activity each week.[16] Furthermore, 26% of adults in North Carolina reported participating in no physical activity over the last month.[17]

Inactivity is not limited to adults. As part of the Youth Risk Behavior Surveillance System, high school students in North Carolina were asked how often they participated in physical activity, and sedentary activities such as watching television or using a computer.

- 15% of youth did not participate in the recommended 60 minutes of physical activity on any day.
- 74% were physically active at least 60 minutes per day on less than 7 days.
- 35% watched television 3 or more hours per day on an average school day.
- 28% used computers 3 or more hours per day on an average school day.[18]

Mecklenburg County

In Mecklenburg County, 46% of adults reported participating in moderate physical activity on a regular basis and 28% indicated participation in vigorous activities. In 2009, one fifth of Mecklenburg County adults reported not exercising in the past 30 days. [12]

Mecklenburg teens are less active than the state average. Over 43% of Mecklenburg teens reported being physically active for a total of 60 minutes or more per day on five or more days in the past week (compared to the state average of 46%). Forty-two percent of teens participated in sedentary activities such as watching three or more hours of TV on an average school day. Only a quarter of teens attended physical education classes daily during the school year. [12]

Iredell County

In 2010, 23% of Iredell County adults reported that they had not participated in any physical activity or exercise within the last 30 days.[19] In a survey administered by the Iredell County Health Department, 51% of 938 respondents indicated that they engage in sedentary activities (playing on the computer, watching television, working on the computer, reading, talking on the phone, texting, playing video games) more than 4 hours a day.[20]

Overweight and Obese

Figure 8: Being overweight or obese can increase the risk of disease

Overweight and obese both describe weights that are greater than what is considered healthy for a given height and have been associated with an increase risk of certain diseases and other health problems. For adults, overweight and obesity ranges are determined using a number called the "body mass index" (BMI) which is calculated using a person's weight and height. An adult with a BMI between 25 and 29.9 is considered overweight and an adult with a BMI of 30 or higher is considered obese. BMI tends to correlate with the amount of body fat in most adults but can sometime be an inaccurate measure of body fat (such as in the case of athletes with large amounts of muscle mass) because it does not directly measure body fat. [21]

BMI is also used to estimate overweight and obesity rates in children; however, it is determined using an age and gender specific percentile for BMI rather than the BMI categories for adults. Because children's body composition varies as they age and varies between boys and girls, overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex and obesity is defined as a BMI at or above the 95th percentile.[22]

Being overweight or obese is a result of an energy imbalance involving eating too many calories and not burning enough calories through physical activity. Body weight and problems maintaining body weight are a result of multiple factors including genes, metabolism, behavior (such as eating and physical activity patterns), environment, culture, and socioeconomic status. Behavior and environment play a large role in weight management efforts and have been identified as the greatest areas for prevention and treatment actions.[23]

The potential health consequences of being overweight or obese include increase risk of:

- Coronary heart disease
- Type 2 diabetes
- Cancers (endometrial, breast, and colon)
- Hypertension (high blood pressure)
- Dyslipidemia (high total cholesterol or high levels of triglycerides)
- Stroke
- Liver and gallbladder disease
- Sleep apnea and respiratory problems
- Osteoarthritis
- Gynecological problems[23]

North Carolina

North Carolina has the 12th highest percentage of obese adults and the 14th highest percentage of obese and overweight children in the United States.[24] According to the 2010 Behavioral Risk Factor Surveillance System, 65% of adults are overweight or obese. Adult obesity rates have doubled since 1990 from 13% to 30% in 2009. [8] According to America's Health Rankings, North Carolina's obesity related healthcare cost are estimated to be an average of $4.3 billion by 2013 (approximate $620 annually per capita).[8]

According to the North Carolina Nutrition and Physical Activity Surveillance System (NC-NPASS), obesity prevalence is also on the rise in children and young adults. In 2009, 15% of children ages 2-4, 26% of children ages 5-11, and 28% of children ages 12-18 were classified as obese based on their Body Mass Index (BMI). An additional 15 to 18 percent were considered overweight for their age-group. It is likely that the unhealthy habits learned in childhood will continue into adulthood and additional chronic diseases such as diabetes and cardiovascular disease will impact these children later in life. [8]

Mecklenburg County

Over 64% of Mecklenburg adults are overweight or obese (slightly lower than state average).The distribution of obesity is not equal by race/ethnicity or by gender. African-Americans were more likely to be overweight than White or Hispanic adults. Adult males were more likely than females to be overweight (67% compared to 53%). Approximately 17% of Mecklenburg teens surveyed are overweight (at or above the 85th percentile but below the 95th percentile) and over 12% are considered obese (at or above the 95th percentile for body mass index, by age and sex). [12]

Iredell County

Over 67% of Iredell adults are overweight or obese (higher than the state average). Approximately 16% of Iredell children aged 2-4 are considered obese and 17% are overweight (slightly higher than the state average). Twenty five percent of children ages 5 to 11 are obese and an additional 18% are overweight (similar to the state averages of 26% and 17% respectively).[20]

Diabetes

Figure 9: Diabetes is approaching epidemic proportions in North Carolina [8]

Diabetes is a disease where blood glucose levels are above the normal level. Glucose or sugar is found in food and is broken down by the body for energy. The pancreas is the organ responsible for producing a hormone called insulin that helps the body's cells absorb glucose. With diabetes a person's body either does not make enough insulin or can't use its own insulin as well as it should and sugar builds up within the person's blood. Diabetes can cause serious health complications including heart disease, blindness, kidney failure, and lower-extremity amputations. Risk factors for type 2 diabetes (formerly know as late-onset diabetes and accounting for 90-95% of diabetes cases) include: older age, obesity, family history of diabetes, prior history of gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity. In most cases diabetes can be prevented and treated through healthy eating and physical activity. Frequent blood glucose testing, medication, and insulin injections are required for many cases of diabetes.[25]

North Carolina

According to the 2011 North Carolina Health Profile, "with a greater prevalence of obesity and an increasing elderly population, diabetes is approaching epidemic proportions in North Carolina." In 2009, 9.6% of the adult population had been diagnosed with diabetes (an increase of 50% since 1998). Another 7% of respondents indicated that they had been diagnosed with pre-diabetes and the actual prevalence may be twice as high given the estimate that there is an undiagnosed case of diabetes for every 2.7 cases that are diagnosed.[8]

In 2009, diabetes was the seventh leading cause of death in North Carolina (causing 2,107 deaths) and a large contributing factor to other leading causes of death such as heart disease, stroke, and kidney failure. Diabetes can also lead to amputations, kidney disease, and blindness. The total hospitalization costs associated with diabetes in 2009 were more than $4.4 billion. [8]

Mecklenburg County

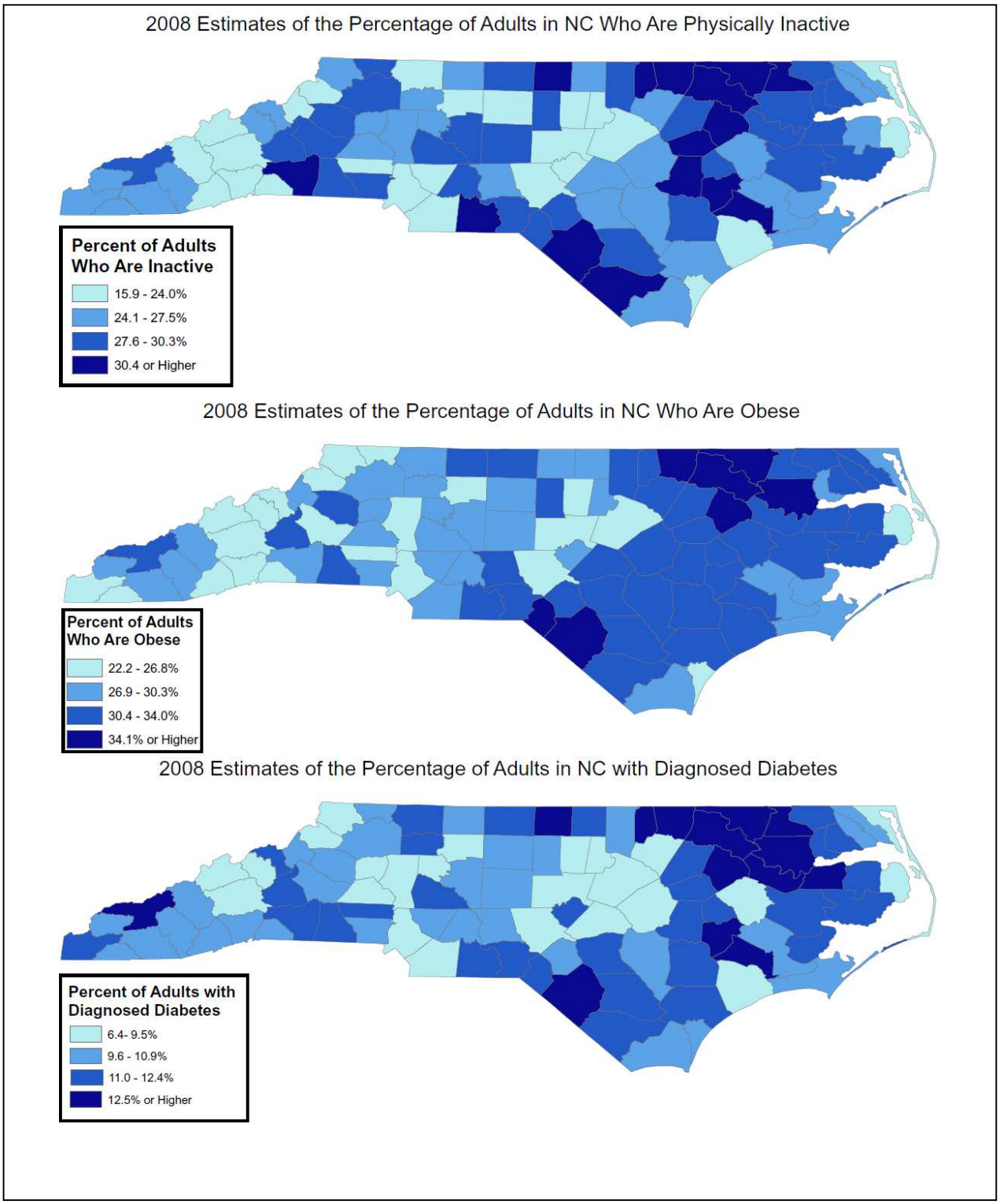
In 2010, diabetes was the 7th leading cause of death in Mecklenburg County (resulting in 104 deaths).[11] The rate of deaths as a result of diabetes has increased 11% from 2005 to 2008, due largely to Mecklenburg's aging population. Mecklenburg's rate of diabetes is lower than the North Carolina average (15.4 compared to 23.5). According to the 2009 Mecklenburg Behavioral Risk Factor Surveillance System, 6% of the population reported being told by a doctor that they had diabetes and another 3% is estimated to have the

disease and not realize it. In 2009, the inpatient hospitalization charges for diabetes in Mecklenburg County were over $23 million.[12]

Iredell County

Diabetes was also the 7th leading cause of death in Iredell County in 2010 with 37 deaths attributed to the disease.[11] The rate of deaths as a result of diabetes has increased steadily from 1994, with the age-adjusted death rate of 18.3 for the years 1994-1998 and the rate of 25.5 for 2004-2008.[20] Iredell's rate of diabetes is slightly higher than the North Carolina average (25.5 compared to 25.2 for 2004-2008). According to the 2010 Behavioral Risk Factor Surveillance System, 5.8% of Iredell adults have been told by a doctor that they had diabetes and 32% of those are currently on insulin for their diabetes.[26, 27]

Map 6: Rates of physical inactivity, obesity, and diabetes in North Carolina (2008)[28]



Air Pollution: Asthma

Asthma is a disease that affects a person's lung capacity causing wheezing, breathlessness, chest tightness, and coughing. Asthma attacks can be triggered by multiple factors including tobacco smoke, dust mites and cockroach allergens, mold, pet dander, smoke from burning wood, grass clippings, and outdoor air pollution. During an asthma attack, a person's airways swell and less air can get in and out of their lungs making it difficult to breath. Asthma can be treated through various medications and by avoiding triggers to asthma attacks.[29]

Figure 10: Air pollution can trigger asthma attacks[24]

North Carolina

The state of North Carolina has consistently ranked below the national average for asthma rates. The average prevalence rate for asthma in North Carolina from 2001 to 2010 was 7.2% compared to the national average of 8.1%. In 2010, only Tennessee, Louisiana, Mississippi, West Virginia, and Texas had lower prevalence rates for asthma than North Carolina. The distribution of asthma is not equal among socioeconomic factors or race/ethnicity.[30] According to the 2009 Behavioral Risk Factor Surveillance System, 12.9% of those surveyed had been told by a doctor that they had asthma.[31] Native Americans and African Americans had higher rates of asthma (20% and 15.6% respectively). Those with less education and lower household incomes also had higher rates of asthma. An average of 7.8% of the population reported still having asthma in 2009.[32]

A possible contributing factor to North Carolina's recent decrease in an already low asthma rate is legislation passed in 2010 requiring nearly all restaurants and bars to be smoke-free. [30] Thanks to North Carolina's Smoke-Free Restaurants and Bars law all enclosed areas of restaurants and bars, as well as parts of hotels, motels, and inns where food and drink are prepared, are required to be smoke-free.[12] This legislation removes a major trigger to asthma attacks- tobacco smoke.

Mecklenburg County

In 2008, it was estimated that 76,100 people (12% of the adult population) within Mecklenburg County had asthma. Asthma is considered a leading chronic illness among children and youth and a major cause of school absenteeism. In the 2009 Charlotte-Mecklenburg Youth Risk Behavior Survey, 19% of students had been diagnosed with asthma. On average these students missed 8.8 days of school and 426 Mecklenburg children ages 0-14 years old had been hospitalized because of asthma. [12]

Air quality in Mecklenburg County has also improved from having 10 days of elevated ozone in 2005 to zero in 2009 within the Charlotte Metro Area. Several initiatives have been formed to address air quality in Mecklenburg County including Mecklenburg Air Quality Program, Clean Air Works!, and Clean Air Carolina. [12]

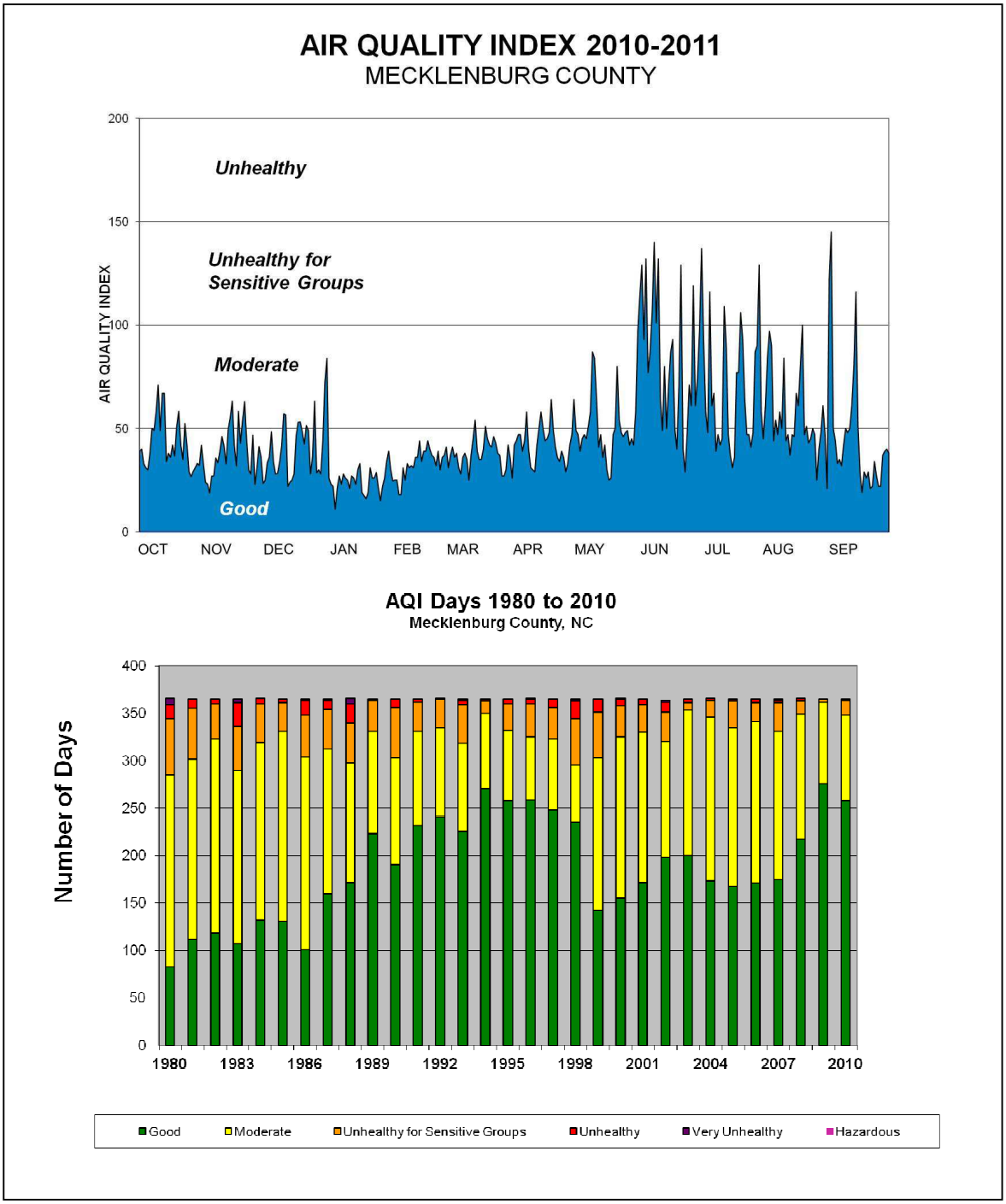


Figure 11: Air quality in Mecklenburg County 1980-2011[33]

Iredell County

According to the 2010 Behavioral Risk Factor Surveillance System, 8% of Iredell adults have ever been told by a health professional that they have asthma and 6% currently have asthma.[34,35] Hospital discharge rates for asthma in Iredell County have been consistently higher than state average although the rate has been decreasing since 2007. For children ages 0-14, there were 211discharges for asthma per 100,000 persons in 2009 compared to 344 in 2007. [20]

In 2011, there were 6 days where the air quality was unhealthy due to ozone.[20]

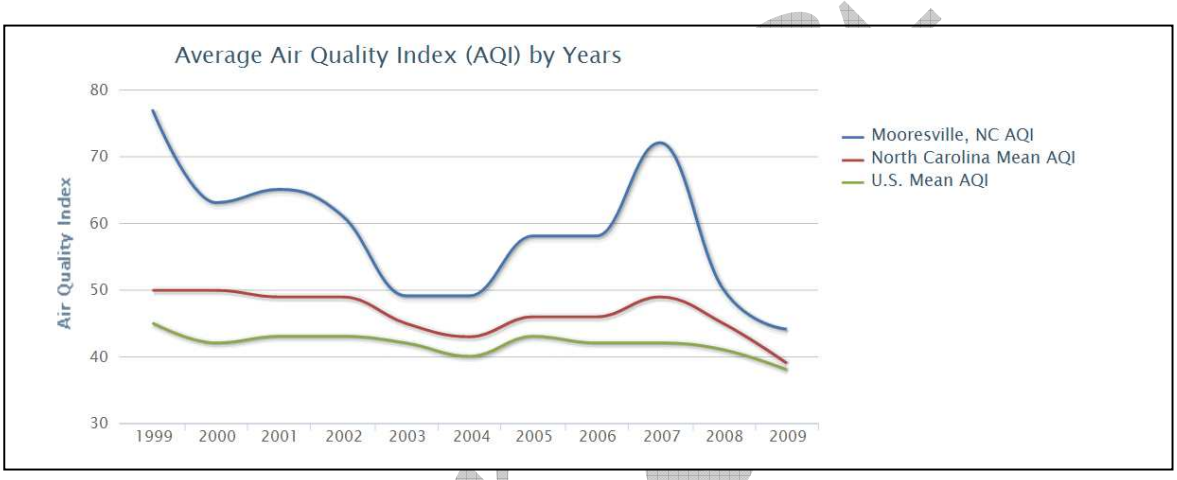


Figure 12: Air quality in Mooresville 1999-2009 [36]

Mobility: Health Equity

Accessibility is a crucial component to promoting health equity and a healthy community. Mobility- the ability to move or travel from one place to another- is a key element of accessibility.[37] If a community is designed solely for vehicular access-void of sidewalks, public transit, and bicycling facilities- then the mobility of those who cannot afford a car or cannot drive due to age or circumstance will be limited. In order to determine what percentage of the population may have limited mobility the indicators of vehicle ownership, poverty levels, age, and physical disability were examined for municipalities in Mecklenburg and Iredell.

Vehicle Ownership

Whether by choice or economic hardship, not having access to a vehicle can limit mobility if a community does not have alternative modes of transportation such as public transit or bicycling.

Table 5: Vehicle Ownership by Household [38]

	No Vehicle Number of Households (%)	**One Vehicle** Number of Households (%)
Charlotte	15,586 (6%)	99,555 (35%)
Cornelius	233 (3%)	2,517 (27%)
Davidson	78 (2%)	978 (26%)
Huntersville	388 (2%)	4,425 (25%)
Mooresville	408 (4%)	2,661 (25%)
Total	**16,693**	**110,136**

Poverty Levels

Properly designed transportation systems can link poor people to opportunity. According to a policy brief by Policy Link and the Prevention Institute, 33% of poor African Americans, 25% of poor Latinos, and 12.1% of poor whites lack automobile access. Also cars owned by low-income people tend to be older, less reliable, and less fuel-efficient which makes commuting to work unpredictable and more expensive.[39] According to a study done by the Brookings Institute, only a quarter of jobs in low to middle- skill industries are accessible via transit within a 90 minute commute compared to one third of jobs in high skilled industries. This demonstrates the higher concentration of high skilled jobs within city centers and shows a potentially large accessibility problem for workers in the growing low-income suburban communities.[40] Poverty and limited transportation access is of particular concern for single mothers in our region which are significantly more likely to be living under the poverty level than married couples with families.

Table 6: Poverty Levels, 2006-2010 American Community Survey 5-Year Estimates [41]

	Persons below poverty level	**Families below poverty level**	**Married couple families below poverty level**	**Families with female householder/ no husband**
Charlotte	13.9%	10.4%	4.3%	26.2%
Cornelius	4.6%	2.6%	1.9%	7.6%
Davidson	8.8%	3.7%	1.9%	17.2%
Huntersville	5.7%	4.1%	1.9%	19.1%
Mooresville	9.6%	7.7%	3.9%	24.7%
Iredell	12.4%	9.3%	5.0%	30.6%
Mecklenburg	12.5%	9.2%	3.9%	25.1%
North Carolina	15.5%	11.4%	5.2%	32.4%
United States	13.8%	11.3%	5.6%	30.3%

Age

Although the Red Line is planned to be a commuter rail line with limited hours of operation, it could still provide transportation to or from Charlotte for youth (who are legally unable to drive) and the elderly (who may be physically unable to drive or would prefer not to drive especially into the city).

Table 7: Age Limitations on Driving, 2010 Census Demographic Profile Data [42]

	Under the Age of 15 Number of Individuals (%)	**Over the Age of 75** Number of Individuals (%)
Charlotte	155,898 (21%)	27,448 (3.8%)
Cornelius	4,870 (20%)	871 (4%)
Davidson	2,130 (20%)	636 (6%)
Huntersville	11,690 (25%)	1,193 (3%)
Mooresville	7,680 (24%)	1,534 (5%)
Total	**182,268**	**31,682**

Disability

There is no reliable data on disability at the local level. However, according to the 2010 Behavioral Risk Factor Surveillance System, 12.5% of Mecklenburg County and 20.8% of Iredell County adults are limited in some form of activity such as driving by a physical, mental, or emotional problem.[43, 44]

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Images

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4. Assessment

Assessment is the actual analysis of the potential health impacts on the selected population and can take many forms depending on the subject of the HIA. Assessment considers:

- the literature and data available to suggest the likelihood of a particular health impact occurring, the severity of that impact, and the magnitude of the impact;
- expert opinions from those knowledgeable in the field relevant to the health impact being examined and the project, policy, plan, or program being analyzed;
- stakeholder concerns and local knowledge; and,
- the different potential impacts of multiple alternatives being considered within the HIA.

At the conclusion of the Assessment step, the HIA team should have:

- the baseline health status of the populations expected to be impacted;
- a description of the data and analytical methods used;
- findings from the literature review, quantitative modeling, interviews or focus groups with experts, or stakeholder engagement;
- a list of any limitations or assumptions made during the assessment; and,
- a summary of the findings of the assessment.[1]

4.1 Literature Review

Accessibility and Social Equity

The Red Line Regional Rail Project and the expected transit and freight oriented development associated with the project could have positive implications on residents' accessibility to transportation, housing, employment opportunities, and open space. Increased access to these items promote health by allowing individuals and families to meet their basic needs of food, water, and shelter as well as their mental and physical health needs of social interactions, economic security, and physical activity.

Historically, low income and minority populations suffer from a disproportionate burden of disease due in part to limited accessibility to resources to meet their daily needs. For example, minority women have higher rates of physical inactivity than men and African Americans and children in low-income households have been found to have higher rates of obesity than the population at large. [2, 3] Age can also be a determining factor of health outcomes and put the elderly and children at higher risk for disease due to higher exposure or underdeveloped/ weakened biological systems such as developing lungs or pre-existing conditions like heart disease. [4, 5, 6]

Transportation

Many people rely on public transportation to meet their daily needs and participate in essential activities such as working or gaining access to adequate healthcare. [7, 8] Labor participation rates have been shown to increase in areas that have access to public transit.[9,10] Due to many factors such as steady income and healthcare benefits, those who are employed generally have better health than those who are unemployed. [10]

Commuters who take transit to work are also more likely to meet recommended physical activity levels as a result of walking to and from transit. [11,12] In a study examining the effects of the Charlotte light rail system on the body mass index of riders, researchers estimated that riders would walk an additional 1.2 miles a day in order to get to and from transit stations. By solely participating in this additional activity every work day it was estimated that the average commuter would lose approximately 6 pounds each year. Transit riders also had 9% higher odds of meeting weekly recommended physical activity levels and had 81% reduced odds in becoming obese over time. [13]

According to a study by the American Public Transportation Association in 2010, a person in a two car household could save an average of $9,242 annually by getting rid of one of their vehicles and using public transit. This average is based on a cost of $2.75 per gallon for gasoline and monthly parking costs of $154. Other costs factored into vehicle ownership include: gas, maintenance, tires, insurance, license registration, depreciation, and finance charges. This study assumed that a person would drive an average of 15,000 miles per year. Transit costs were estimated based on the average cost of purchasing 12 monthly passes to transit options across the nation. Although this study did not include Charlotte as one of the top twenty cities with the highest transit ridership, it did include Atlanta (average monthly savings of $722 or $8,658 annually) which would have similar expenses with automobile travel and similar transit fares. [14]

The health and economic benefits of access to transit are well documented. Unfortunately, the uneven distribution of transportation benefits across socioeconomic groups due mainly to the prioritization of highway funding over public transit funding, marginalizes minorities and low income individuals who tend to be transit dependent.[15, 16, 17]

Housing

Access to housing plays a significant role in human health. The provision of housing is more than just providing shelter. It also “means adequate privacy; adequate space; physical accessibility; adequate security; security of tenure; structural stability and durability; adequate lighting, heating, and ventilation; adequate basic infrastructure, such as water-supply, sanitation and waste-management facilities; suitable environmental quality and health-related factors; and adequate and accessible location with regard to work and basic facilities: all of which should be available at an affordable cost.”[18]

In addition to the actual dwelling unit, there is the immediate environment, neighborhood, and community to consider. A healthy housing unit is in good condition, free from pollutants and excessive noise, temperature, and humidity, safe, and not overcrowded. A healthy neighborhood promotes active living, buffers residents from unhealthful things, and offers affordable and appropriate housing choices regardless of a person's stage in life.

Gentrification, or the process of increasing land values in traditionally poor areas through redevelopment and renovation, displaces existing residents as the affordable housing stock decreases over time. [19] There are several health impacts of gentrification including: overcrowding or living in substandard housing, moving away (typically resulting in increased travel costs to employment opportunities and social networks), or spending too much on housing (resulting in less money available for health-promoting items such as nutritious food, health care, education, and recreational opportunities). [20, 21, 22]

Negative Health Impacts of a Poor Housing Unit

- Poor ventilation, cheap or old building materials, and inadequately functioning appliances can cause the release of toxic substances that can contribute to asthma, headaches, acute intoxication, lung cancer, hypertension, and bronchial obstruction. [23, 24]
- Allergens produced by pests such as rats, dust mites, and roaches are associated with increased asthma attacks, particularly in children and the elderly. [23]
- High temperature can lead to heat exposure. Cold temperatures can lead to increased risk of cardiovascular disease and arthritic problems. [23]
- Dampness and mold contribute to asthma, sore throat, skin problems, and headaches and can also attract rats, mites, roaches, and other pests. [23]
- Excess noise can contribute to depression and impacts on respiratory, cardiovascular, neurological, and muscular-skeletal systems. [25]
- Lack of light or poor lighting can lead to negative effects on psychological well-being, learning ability, and motivation and can contribute to falls and feelings of isolation, apprehension, and fear. [23, 25]
- Crowded housing conditions increase transmission of respiratory infections and ear infections in children. [23] Crowding can also contribute to noise and lack of space for play which leads to physical and mental development issues for children. [25]
- Inadequate food storage and disposal facilities feed pests infestations which contribute to respiratory ailments and other pest-borne diseases. [23]
- Lack of safe drinking water, lack of hot water for washing, and poor sewer facilities contribute to the spread of infectious diseases. [23]

Figure13: Negative Health Impacts of a Poor Housing Unit

Employment Opportunities

According to a study done by the Brookings Institute in 2011, nearly 70% of large metropolitan residents nationwide live in neighborhoods with access to transit services of some kind. [26] However, transit coverage in the Southern region is ranked the worst with only 55% of residents having access to transit. Those with access tend to live in low-income neighborhoods in cities versus suburbs. [26] This could be due to transit agencies placing more effort in serving those communities who are less likely to own cars and depend more on transit than other groups.[27] The presence of more transit systems in cities than suburbs reflects: the age of the rail systems (many were built prior to suburbanization), the hub-and-spoke model of rail design which feeds suburban riders into the urban core versus suburb to suburb, and the increase in efficiency of operating transit in areas with more population density. [28]

Due to the design of the rail system and the location of high-skill industries in the city core, access to employment opportunities via transit varies greatly by employment type and whether commuting from a suburban or urban area. According to the Brookings Institute, "about one-quarter of jobs in low- and middle-skill industries are accessible via transit within 90 minutes for the typical metropolitan commuter, compared to one-third of jobs in high-skill industries." [26] This points to a potentially large accessibility problem for workers in the growing number of low-income suburban communities (suburbs now contain more than two-thirds of working-age residents) trying to access the low- and middle-skilled jobs for which they are most qualified. [26] As employment has decentralized from the urban core to suburban employment centers (nearly half of all jobs are located more than 10 miles outside of downtown) and poverty has drifted into the suburbs (one-third of America's poor live in the suburbs of large metropolitan areas), the problems of employment accessibility and congestion has increased significantly over the last decade. [29, 30]

The Charlotte-Gastonia-Concord metropolitan area (includes the Charlotte Area Transit System and Gastonia Transit) ranked 75 out of 100 for combined access, 82 for coverage, 60 for service frequency, and 63 for job access. On average, 6.4% of jobs are accessible by a 45 minute transit ride, 13.4% are accessible within 60 minutes, and 29.7% within 90 minutes for a total of approximately 275,000 jobs being accessible by transit. [26]

Table 8: Transit accessibility metrics for Charlotte-Gastonia-Concord, NC-SC[26]

	All (%)	Rank	Low Income (%)	Middle Income (%)	High Income (%)
Coverage	86.7	82	100	85.8	68.4
Service Frequency (minutes)	12.9	60	12.3	13.9	12.0
Job Access	35.5	63	39.0	33.1	31.1

Table 9: Share of jobs accessible on average via transit by time threshold for Charlotte-Gastonia-Concord, NC-SC [26]

	Total Jobs Reachable	Access Rate (%)	Access Rate Rank (Out of 100)
45 minutes	59,587	6.4	54
60 minutes	123,990	13.4	43
90 minutes	274,983	29.7	49

Open Space

Open space− parks, trails, greenways, natural resource areas− provide opportunities for physical activity and social interaction and can result in stress relief. As the intensity of development surrounding the rail stations take place it will be of increasing importance to offer additional open space opportunities and ensure access to these opportunities to all residents. Davidson focused on open space as part of its *2012 Station Area Plan* in order to protect critical watershed and sub-basin habitats and to meet its goal of providing its residents with access to adequate recreational opportunities.[31]

A considerable amount of physical activity takes place in parks (30% of physically active individuals recreate in a park) and park activity should take many forms to serve a wide variety of populations. [32] Parks can help individuals reach recommended levels of physical activity, with those using the park even 1-5 days per a month being 1.2 times more likely to reach the recommended levels. [33] Those who use parks more frequently are even more likely to reach physical activity goals- those using a park 6-10 days were 2.1 times more likely and those who used the park more than 10 times per month were 4.3 times more likely to reach the recommended physical activity levels. [33]

Numerous factors determine whether or not people will use a park including individual characteristics (age, gender, ethnicity), location and access to the park (distance from house, transportation system, proximity of land uses), and the characteristics of the park itself (size, amenities, safety). [34, 35, 36]

Those who live within one mile are more likely to use the park and have higher frequency of park use. A park survey in Los Angeles determined that 81% of park users in urban areas lived within a mile of the park and those living within one mile of a park were four times more likely to visit the park at least once a week. Of those living within a quarter mile of the park, 65% went to the park ate least once a week and the majority of park users walked to the park. [37]

The attractiveness and safety of a park is especially important in low-income neighborhoods. Even in situations where the number of facilities is roughly equal, if physical activity resources have a higher number of incivilities−litter, graffiti, stray dogs, or unsafe traffic conditions− then park use and physical activity will be discouraged. [38] This is of particular importance for adolescents and teenagers who are more likely to be physically inactive if they do not have access to safe and attractive parks. [39, 40]

The size of a park and the amenities offered will also affect park usage. Having access to large attractive open public spaces increases the likelihood that a person will walk regularly. [41] Different amenities will attract different park users. In a study conducted in Chicago, Asians, Latinos and whites valued the natural environment where as African Americans favored cultural facilities. Whites participated in higher rates of jogging, biking, and walking than the other ethnicities which tended to participate in more passive activities. [42] This may correspond with cultural differences or different socioeconomic status and work environments (those with desk jobs versus jobs involving manual labor will use parks to meet the different needs of exercising or relaxing). [43]

Age is also a determining factor in park use with older adults being less likely to use parks than younger adults. [44] However, those older adults who do use parks, tend to use them more frequently. [45] In order to attract the greatest park use it is important to keep all potential users in mind and offer different amenities to meet the needs of all people regardless of age, race/ethnicity, or socioeconomic status.

There are many additional health benefits to park usage beyond increasing levels of physical activity. Walking or running in natural areas versus in an urban setting, has been shown to increase psychological restoration and reduce mental fatigue. [46, 47] Views of nature have been associated with better performance in students, lower levels of stress, higher job satisfaction and reduced absenteeism, quicker healing rates and reduced pain, longer lifespans, reduced depression and anxiety, and improved attention spans. [48, 49, 50, 51, 52]

Figure 14: Open space opportunities

Health Concerns During Construction

Upgrading the current railway to tracks suitable for commuter travel will require a certain amount of construction along the rail line as will increasing residential and commercial development around the rail stations. Health concerns associated with construction include increased noise and dust, and the stress from living or working in a construction zone.

Noise

Equipment used during construction is significantly louder than ambient noise levels (set at 70 decibels). Despite the intermittent use of construction equipment, exposure to loud noise can have a number of negative health effects on those trying to live or work around the construction zone. Research shows that there is an association between noise and levels of annoyance, disruptions in school children's performance, sleep disturbance, mood, heart rate, hearing loss, and stress-related health effects. [53, 54] Short-term exposure to high noise levels (such as a jackhammer) or long-term exposure to lower levels can result in hearing damage. [55] Sleep disturbance as a result of the construction can also interrupt brain restoration and cardiovascular respite that occur during sleep having a negative impact on shift workers, children, the elderly, and the ill who may be trying to sleep during regular construction hours. [56]

Air Quality and Dust

The U.S. Environmental Protection Agency considers emissions from construction equipment (including non-road diesel engines that release particulate matter and nitrogen oxides into the air) as a significant source of air pollution. [57] In addition to the emissions from construction equipment, the dust caused by earth moving activity, concrete pouring, or asphalt removal will also affect air quality in neighborhoods where construction is taking place. Pollution and dust can trigger asthma attacks and aggravate other breathing problems especially for youths and the elderly (See Air Pollution: Asthma in Section 3.3 for more information).

Figure 15: Spraying water can reduce construction dust

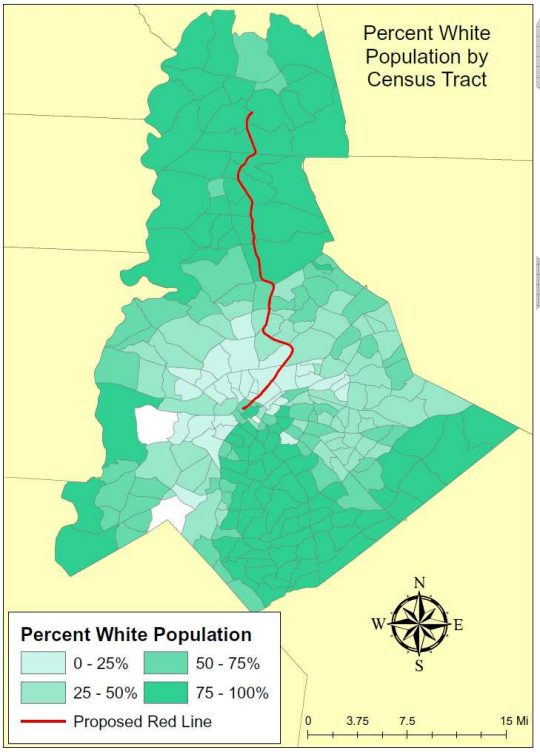
4.2 Review of Census Data/ Regional Commuting Patterns

The U.S. Census Bureau is a great resource for population, travel, and socioeconomic data that can be used as indicators for public health. The following maps were made using the 2010 American Community Survey 5 Year estimates for Means of Transportation to Work by Selected Characteristics broken down by census tract and with the population being workers 16 years and over. [58] In each map if the census tract is white, data was either not available or the percentage of black commuters was so low that they could not be further broken down by commuting type.

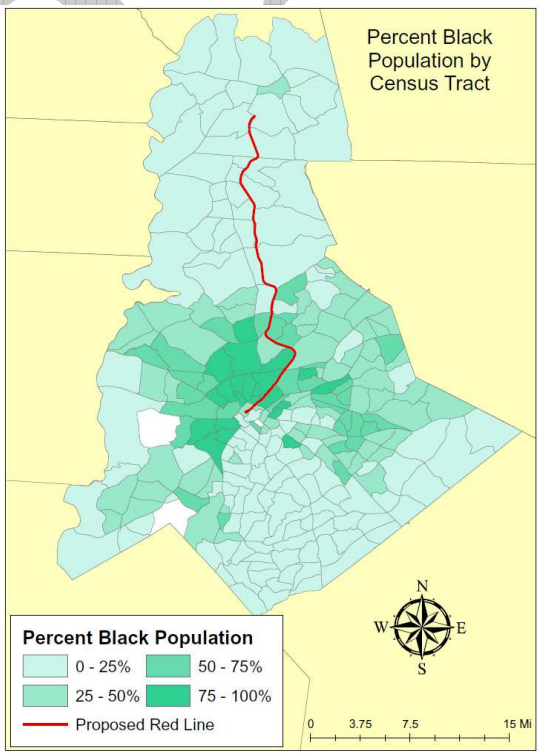
Race/ Ethnicity

The distribution of racial and ethnic minorities by census tract is shown in Maps 7 and 8. The total population of Iredell County is 82% white and 12% black or African American, whereas Mecklenburg County is 58% white and 30% black or African American. [59] The majority of African American commuters live in Northwest Charlotte.

Map 7: Percent white population by census tract [59]



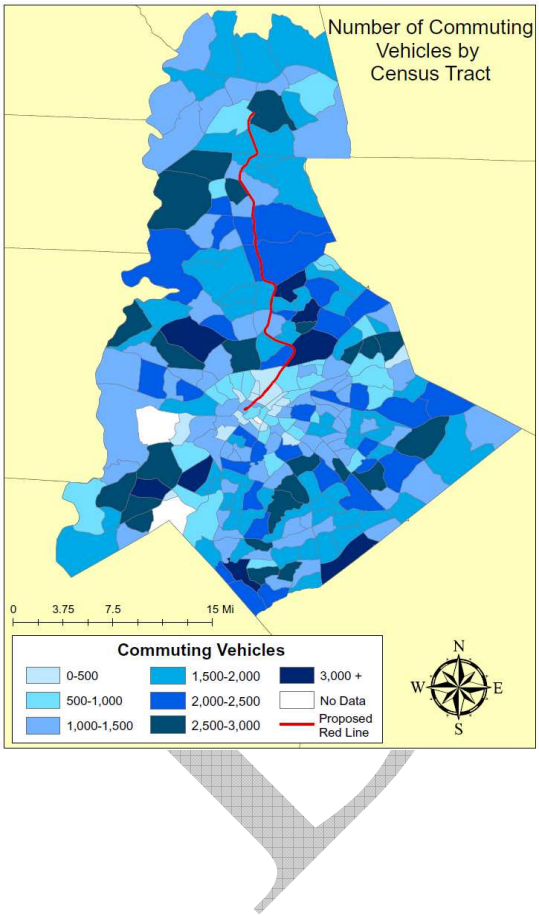
Map 8: Percent black population by census tract [59]



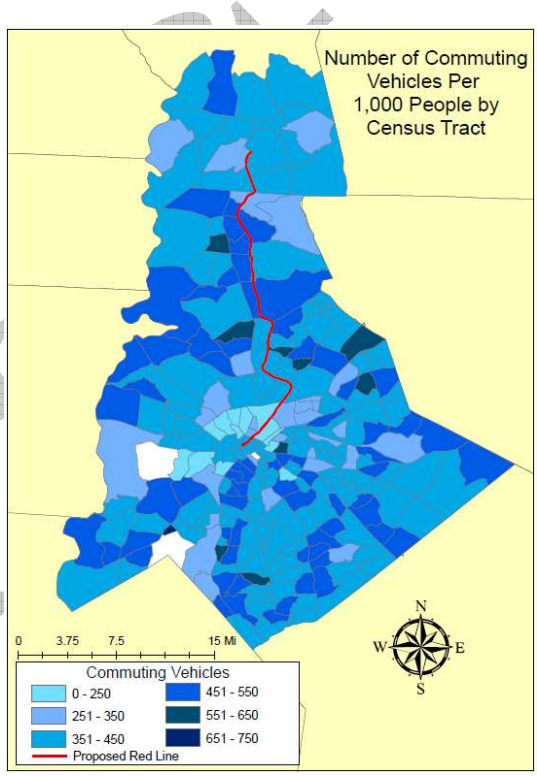
Commuting Vehicles

Maps 9 and 10 show the distribution of commuting vehicles and the number of vehicles per 1,000 people by census tract.[60] There are two stations planned in census tracts with 3,000 plus commuting vehicles- the Derita station and the Eastfield station. The Mount Mourne and Cornelius stations are also in areas of high commuting traffic with 2,500-3,000 vehicles.

Map 9: Number of commuting vehicles by census tract [60]



Map 10: Number of commuting vehicles per 1,000 people by census tract [60]

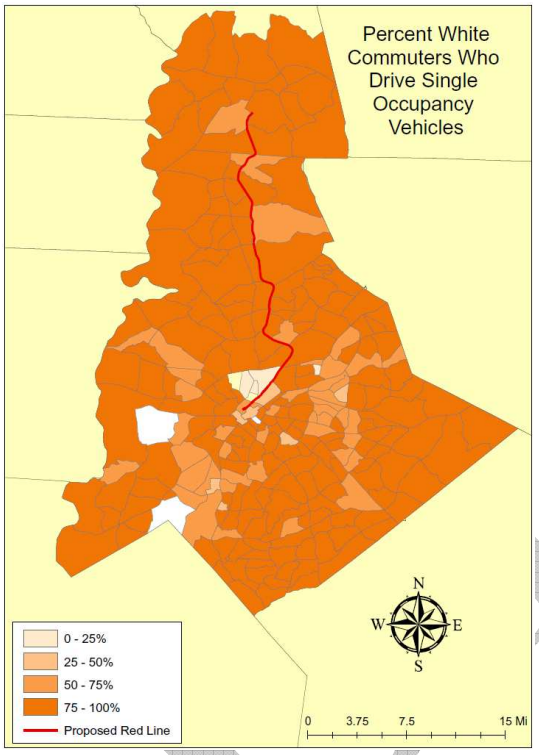


Commuting Type

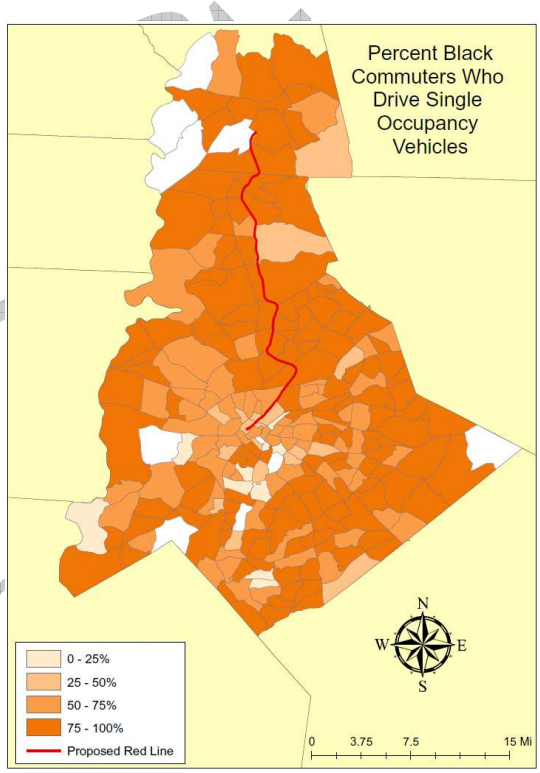
Single Occupancy Vehicle

The majority of commuter travel in the study area is taking place by single occupancy vehicle. Seventy-eight percent of commuters travel by single occupancy vehicle in Mecklenburg County and 84% in Iredell County.[61]

Map 11: Percent of white commuters who drive single occupancy vehicles [61]



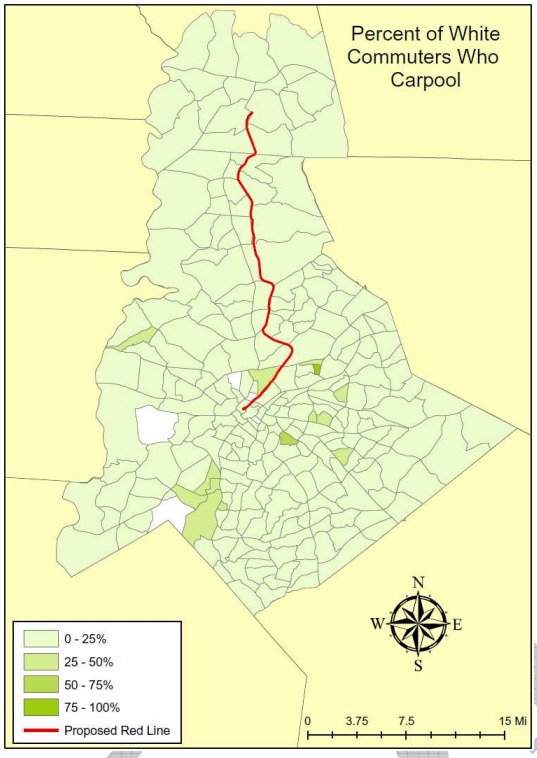
Map 12: Percent of black commuters who drive single occupancy vehicles [61]



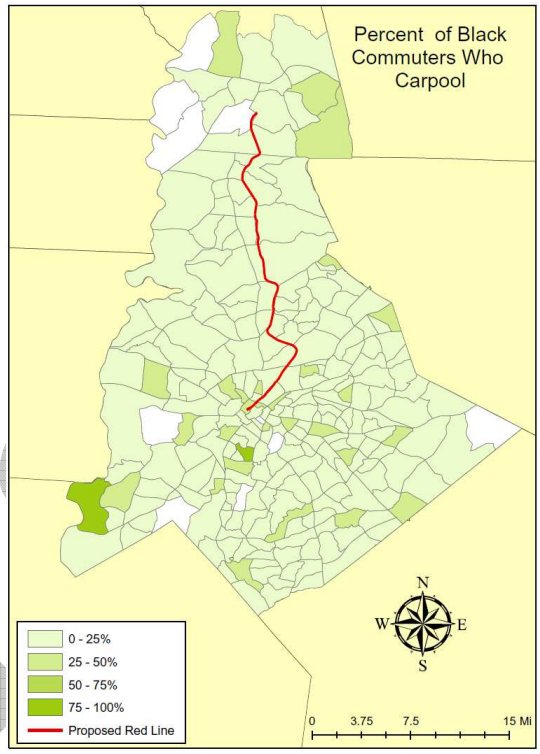
Carpool

Nine percent of commuters carpool in Mecklenburg County and 10% in Iredell County. The distribution of carpoolers is pretty equal throughout the study area. [61]

Map 13: Percent of white commuters who carpool [61]



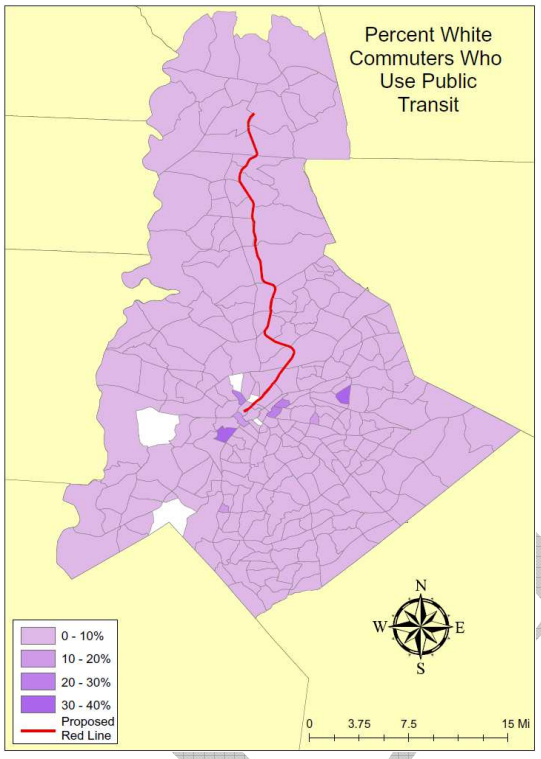
Map 14: Percent of black commuters who carpool [61]



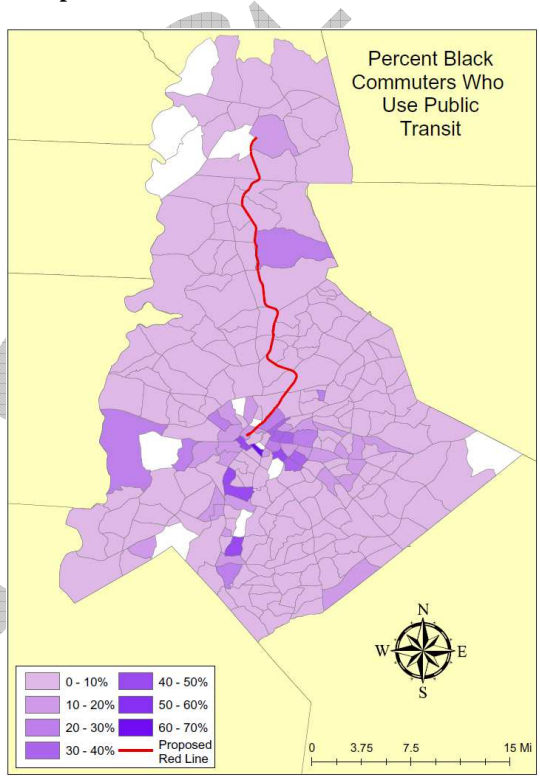
Public Transit

Four percent of Mecklenburg County uses public transit (bus, light rail, and trolley) to commute to work and 0.5% of Iredell County. Transit use increases near downtown Charlotte and by African American populations in Huntersville and Mooresville. A higher percentage of African Americans commuters use public transit than white commuters. [61]

Map 15: Percent of white commuters who use public transit [61]



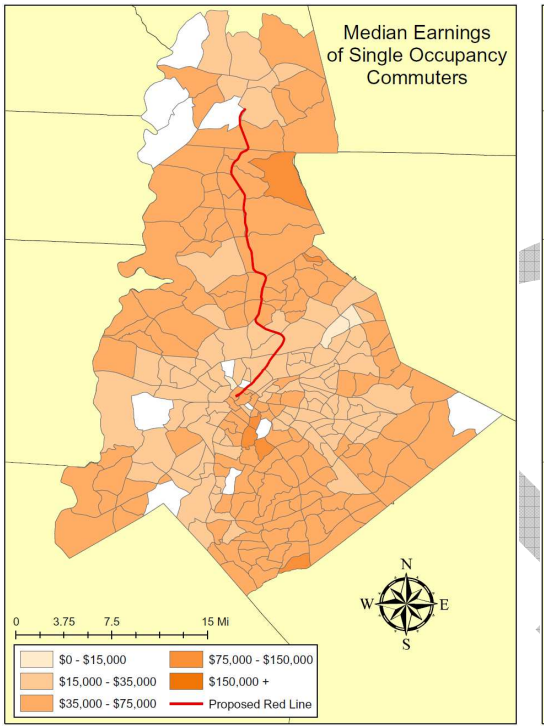
Map 16: Percent of black commuters who use public transit [61]



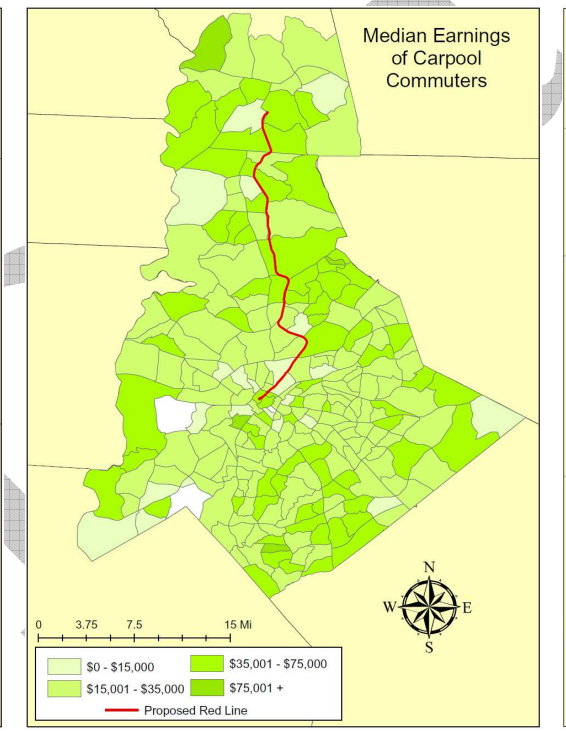
Median Earnings by Commuting Type

As expected, the median earnings of those carpooling and using public transit tend to be lower than single occupancy commuters. The average median earnings of those commuting by single occupancy vehicle in the study area was $39,734 compared to carpoolers ($31,337) and public transit commuters ($38,736). A note on the public transit average median earnings–due to a limited number of public transit riders in each of the census tracts there were a large number of tracts with no riders and a few outliers with one rider making over $150,000 and skewing the results. The median earnings range for transit riders was less than $2,500 to greater than $250,000 with a median of $24,857. [61]

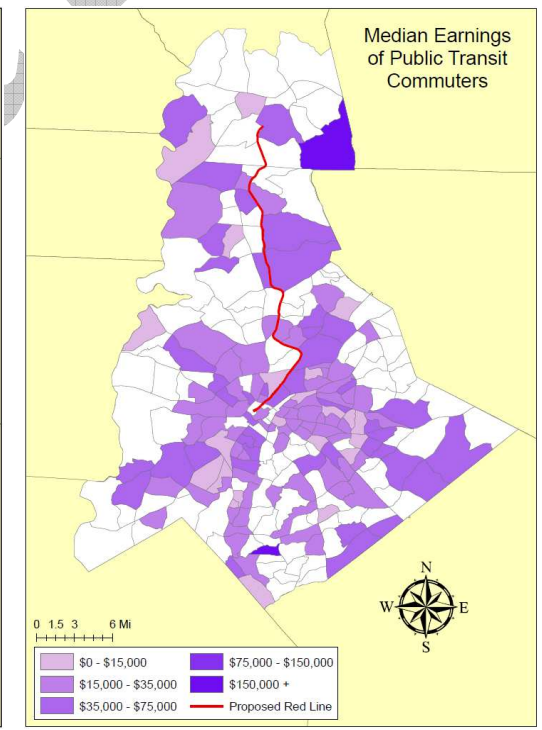
Map 17: Median earning of single occupancy commuters [61]



Map 18: Median earning of carpool commuters[61]



Map 19: Median earning of public transit commuters [61]



4.3 Analysis of Expected Ridership and Air Pollution Reduction

According to the cost benefit and economic analysis conducted by the Charlotte Area Transit System (CATS) as part of an application for Tiger funding submitted in 2009, it is expected that 5,000 trips will be made daily to or from Charlotte by 2030 (See Table 10 below). [62] The majority of these rides will take place during the morning and afternoon rush hour period when service headways are every 20-30 minutes. It is expected that these rides will be diverted mainly from commuters driving single occupancy vehicles (3,500) and have a daily reduction in vehicle miles traveled (VMT) of 48,182 miles. [62]

Table 10: Estimated Daily Ridership, Vehicle Miles Traveled Reduction, and Trip Reduction [62]

	2012	2030	2042
Total Daily Trips	2,600	5,000	7,129
Diverted from Auto	1,820	3,500	4,990
Diverted from Bus	780	1,500	2,139
Daily VMT Reduced	25,055	48,182	63,600
Daily Trips Reduced	2,364	4,545	6,000

Over the lifecycle of the Red Line, switching from automobile travel to train is expected to avoid using over 16 million gallons of gasoline and reduce emissions by over 1.4 million tons. [62]

Table 11: Emissions Reductions per VMT, Monetized Value Per Ton, Expected 2012 and Lifecycle Savings [62]

	Opening Year Grams Reduced per VMT Avoided*	Monetized Value per Ton (Discounted $2009)	2012 Savings (Discounted $2009)	Lifecycle Savings (Discounted $2009)
NOx	0.54	$4,112	$6,388	$88,505
SO_x	11.71	$16,447	$40,689	$669,778
CO_2	368.1	$33.92	$13,877	$157,812
CO	0.50	$513.98	$13,082	$264,892
PM	0.01	$172,697	$756	$15,287
VOC	0.01	$1,748	$84,453	$1,709,703
Total:			$159,246	$2,905,976

*Expected opening year for these calculations was 2012. Expected opening year for the revised Red Line Project proposal is 2017.

Air pollution is a major trigger for asthma attacks and other respiratory diseases. For additional information on air quality and asthma rates in Mecklenburg and Iredell Counties review the Health profile in Section 3.3 of this report.

4.4 Review of Cost Benefit and Economic Impact Analysis

Benefits mentioned within the *Cost Benefit and Economic Impact Analysis (*conducted by the Charlotte Area Transit System (CATS) in 2009) related to the health impacts examined within this report include: increased short and long term employment output and income, economic development, livability, sustainability (explained in the previous section on air quality improvements) and safety. [62] For additional information on how these topics impact health see the literature review in Section 4.1 and the description of the social determinants of health in Section 1.6.

Short and Long Term Employment Output and Income

Short-term job growth is expected with the construction of the transit line and includes direct, indirect, and induced employment opportunities. The construction of the transit line is expected to generate 5,530 cumulative job years (one year of one job) and generate close to $195 million in economic benefit. Table 12 below shows employment growth and the total estimated benefit by sector. [62]

Table 12: Short-term direct, indirect, and induced employment by sector[62]

	Total Employment	Total Estimated Benefit
Agricultural, Forestry, Fish & Hunting	56	$1,410,427
Mining	50	$1,811,215
Utilities	13	$413,494
Construction	1,793	$58,748,996
Manufacturing	509	$14,547,256
Wholesale Trade	142	$6,864,494
Transportation & Warehousing	203	$5,348,043
Retail trade	403	$8,074,314
Information	76	$5,542,896
Finance & insurance	206	$11,844,390
Real estate & rental	161	$10,210,933
Professional- scientific & tech services	512	$27,717,836
Management of companies	48	$4,644,020
Administrative & waste services	297	$8,991,835
Educational services	78	$2,885,312
Health & social services	362	$13,218,651
Arts- entertainment & recreation	83	$3,128,621
Accommodation & food service	272	$4,649,823
Other services	231	$3,553,556
Government & non NAICs	35	$1,272,409
Total	**5,530**	**$194,878,521**

Long-term job creation is expected through the operation of the commuter rail, increased property development around the rail stations, and the redistribution of savings enjoyed by rail commuters. It is estimated that 37,117 jobs will be created throughout the life cycle of the Red Line Rail Project through annual operations and maintenance of the rail line and new development surrounding the rail stations. [62]

Table 13: Long-term job creation [62]

	Value (millions)	Direct &Indirect Jobs per Year	Induced Jobs per Year	Total Jobs per Year	Life Cycle Jobs Created
Annual Operations and Maintenance Expenditures	$10.4	162	129	291	8,730
Average Annual New Development	$145.3	1,009	568	1,577	28,387
Total	**$172.5**	**1,171**	**697**	**1,868**	**37,117**

Economic Development

Development around the train stations (typically within a quarter to a half mile of the station) is expected to increase the number of residential and commercial properties being built and increases land value. Increased demand for residential units around the station is expected due to easy access to the train station and additional amenities found in transit oriented development. The increase in accessibility and foot traffic of increased residential density will further promote commercial development around the train stations. [62]

The economic benefits of increased development are estimated as a short-term, extra, or premium rate of property appreciation above and beyond the general rate of appreciation. The *Cost Benefit and Economic Analysis* uses the relatively low premium of 4% in order to ensure that the analysis is not affected by an overly optimistic expectation of development and to avoid the possibility of accounting for travel benefits twice. The premium is applied only to the estimated incremental new construction values with complete build out expected in 2027. [62]

Table 14: Incremental economic development benefits [62]

	2009 (Current $2009)	2012 (Current $2009)	Lifecycle (Current $2009)
Total Economic Development Benefit	$408,335	$4,100,473	$189,673,349

Livability

Livability benefits associated with the rail project are measured in terms of vehicle operating costs (VOC) savings, travel time savings, and increased employment opportunities especially for low-income users. VOC is the savings experienced by drivers switching from personal vehicles to transit and include the costs of owning, operating and maintaining a vehicle. In order to calculate VOC savings the cost of commuter fares was subtracted from the VOC. [62]

Table 15: Vehicle operating costs savings in 2012 and lifecycle savings [62]

	2012	Lifecycle
Fuel	$610,113	$21,209,760
Oil	($9,932)	($173,914)
Tires	$657,999	$13,485,765
Maintenance	$1,487,202	$44,485,824
Depreciation	$125,682	$3,321,894
Commuter Rail Fares	($1,458,806)	($32,389,237)
Total VOC Savings	**$1,412,258**	**$49,940,091**

Travel time savings include both rail users and reduced travel times for remaining highway users. These savings are estimated by measuring the difference between projected travel time costs if the rail was not built and travel time costs for both rail and roadway users if the rail is built. The factors involved in estimating speeds and travel times include:

- estimates and forecasted levels of average annual daily traffic (AADT) for the current and future years;
- ridership estimates and growth rates, based on population growth patterns;
- and, average trip length based on forecasted congestion and speeds. [62]

Table 16: Vehicle operating costs savings and travel time savings for the project life cycle[62]

	7% Discount Rate (2009 USD Millions)	3% Discount Rate (2009 USD Millions)
Highway Users	$47,506,358	$105,310,647
Rail Users from Auto	$12.104,675	$27,231,190
Rail Users from Bus	$10,022,421	$28,428,518

In addition to time and VOC savings, the construction of the rail for commuter rail will increase job access and affordable housing opportunities for low-income populations. Employment growth is expected in low and medium-skill industries that typically employ

low-income populations. A total of 3,127 job years is expected generating $133.4 million in income and benefits. [62]

Table 17: Short term employment increases in low-income industries[62]

	Job Years	Labor Income (2009 USD Million)
Agriculture, forestry, fishing and hunting	56	$1.2
Construction	1,793	$94.3
Retail trade	405	$12.4
Truck transportation	79	$3.7
Administrative and support and waste management and remediation services	297	$9.2
Nursing and residential care facilities, home health care services	182	$5.6
Accommodation and food services	272	$5.9
Personal and laundry services	43	$1.0
Total	**3,127**	**$133.4**

Safety

Safety benefits of the rail line are associated with less highway usage as a result of auto users switching to commuter rail as well as the closure and improvements planned for 66 at-grade crossings associated with the existing rail line. In this analysis an average net accident savings of $2.9 million was calculated based on the reduction of vehicle miles and a weighted average of fatal, injury, and property damage only accidents. Using tools from the Office of Safety Analysis, the study also estimated that 10 fatalities could be avoided through the closure of or scheduled improvements to at-grade crossings resulting in $20.9 million in additional safety benefits. [62]

4.5 Review of the Davidson Station Area Plan

Following the inclusion of the North Corridor as part of the 2025 Integrated Transit Land Use Plan adopted by CATS in 1998 and the 2030 Transit Corridor System Plan accepted by the Metropolitan Transportation Commission in 2002, Davidson initiated a study to identify the potential redevelopment sites, station platform locations, and transportation improvements that would be needed.[31] The first Davidson Station Area Plan was completed in 2006 and the ideal platform location was determined to be at the intersection of the railroad and Depot Street. With renewed interest in the Red Line Commuter Rail and the formation of the Task Force in 2010, Davidson began updating the original station area plan to include components of the 2010 Comprehensive Plan which called for the redevelopment of the Village Center within a half mile of the transit platform to include mixed-use development.

The 2012 Station Area Plan Update includes recommended infrastructure improvements to accommodate the proposed transit station and examines the need for additional green space, the opportunity for public-private partnerships, and the necessary ordinance changes to promote the desired development. The plan update process consisted of: two public information workshops; a 4-day planning charrette; multiple citizen advisory "jump team" meetings; presentations to Davidson Planning board, Board of Commissioners, and Livability Board; and interviews with priority property owners. Over 100 residents and property owners attended workshops. The "jump teams," a group of educated, dedicated citizens that have volunteered to study specific topics in detail and offer recommendations, focused their discussion on transportation and open space needs in the station area.

Plans Reviewed

- Beaty Street Plan 1996
- Town Center Plan 1998
- Griffith Street Plan 2002
- Station Area Plan 2006
- North of Griffith Plan 2009
- Eco-Industrial Plan 2009
- Comprehensive Plan 2010

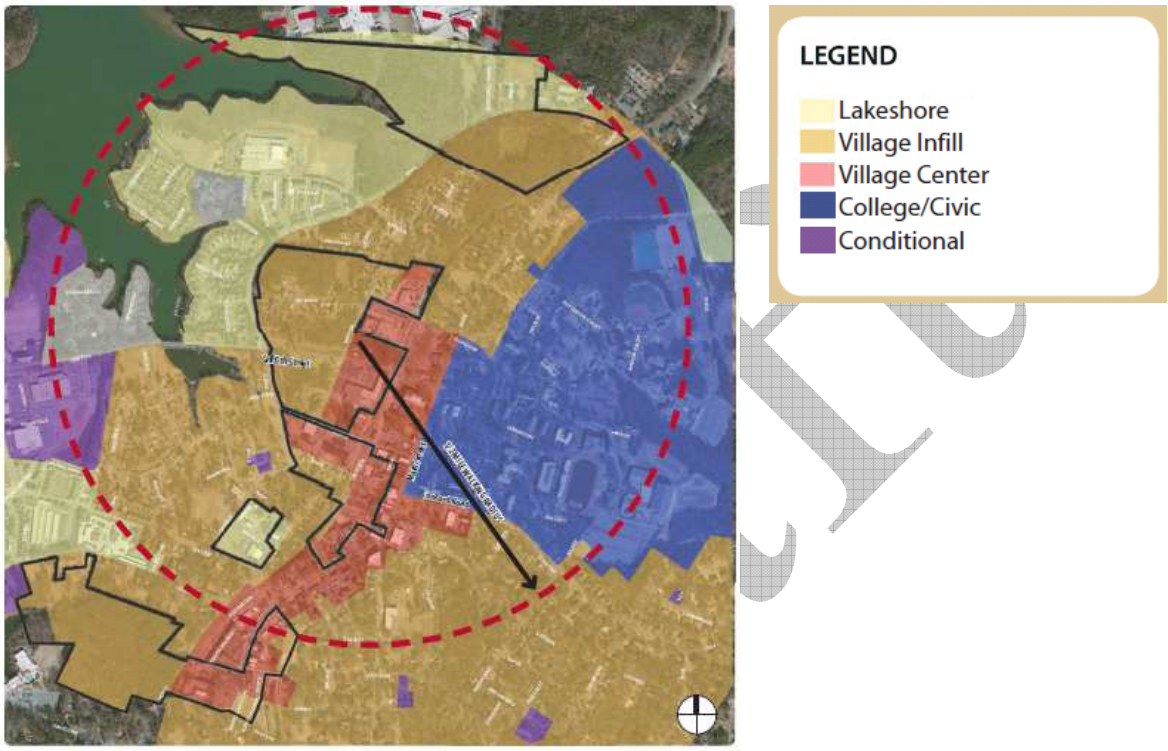
Figure 16: Plans Reviewed as Part of the Davidson Station Area Plan Update

The plan provides build out statistics for housing and commercial development based on expected population and job growth. It also details the existing conditions in the areas of zoning, land use, civic infrastructure, open space, and mobility. Overall, the redevelopment is expected to create over 1,700 residential units, 89,500 square feet of civic space, 543,000 square feet of commercial or office space, and 16.5 acres of open space. Over 2,000 parking spaces are also expected to accommodate the new development with the majority of parking being located in parking decks on Jackson Street, at the Metrolina Warehouse, and around Sadler Square.

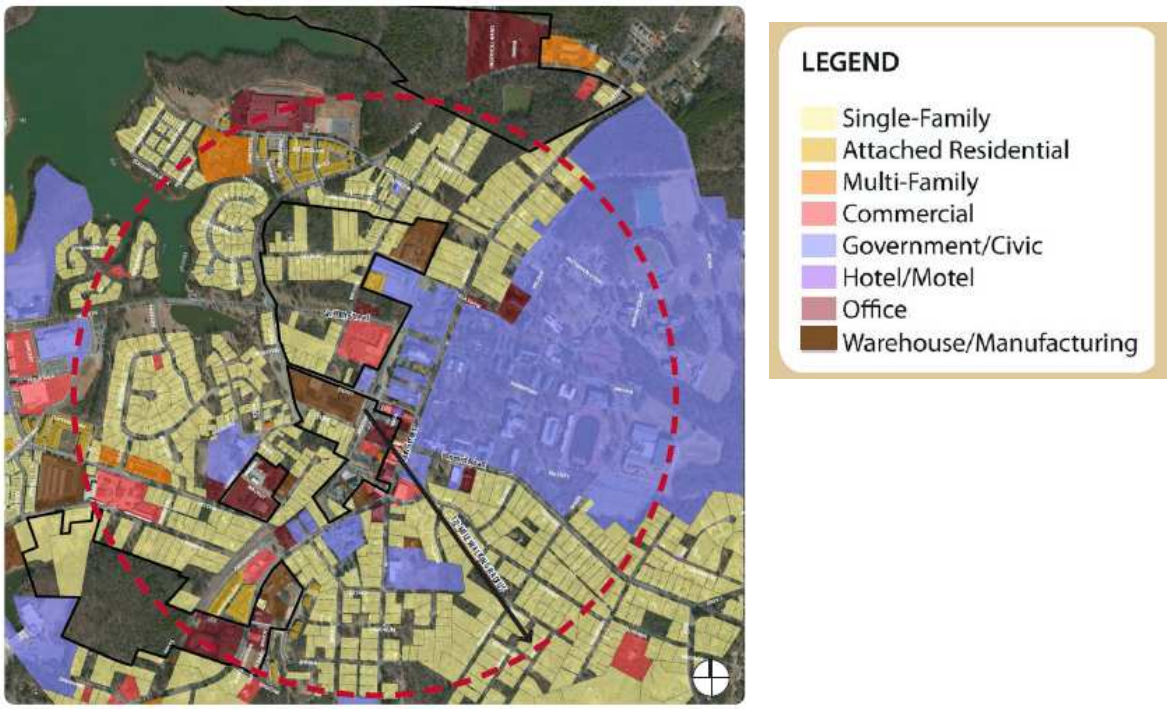
Existing Conditions

The existing conditions for zoning and land use are displayed in Maps 20 and 21 below.

Map 20: Zoning within the Station Area Plan study area [31]



Map 21: Land use within the Station Area Plan study area [31]



Guiding Principles of the Station Area Plan

- Higher density housing focused in specific locations proximate to major gateways and the future commuter rail station.
- Mixed-use development in nodal locations on Main Street at Beaty Street, Main Street from Depot Street to Jackson Street and Main Street in the South Main District.
- Preserving usable open space, both active and passive, including walking trails along Lake Davidson and Lake Cornelius and both active and passive park space.
- Building off of the town's prior successes, which includes additional community gardens, multifamily units, and small single family lots in focused neighborhoods.
- Waterfront access in several locations within walking distance to neighborhoods and other community amenities.
- New housing options that appeal to a broad spectrum of buyers including young adults, young families, and baby boomers.

Figure 17: Guiding Principles of the Station Area Plan

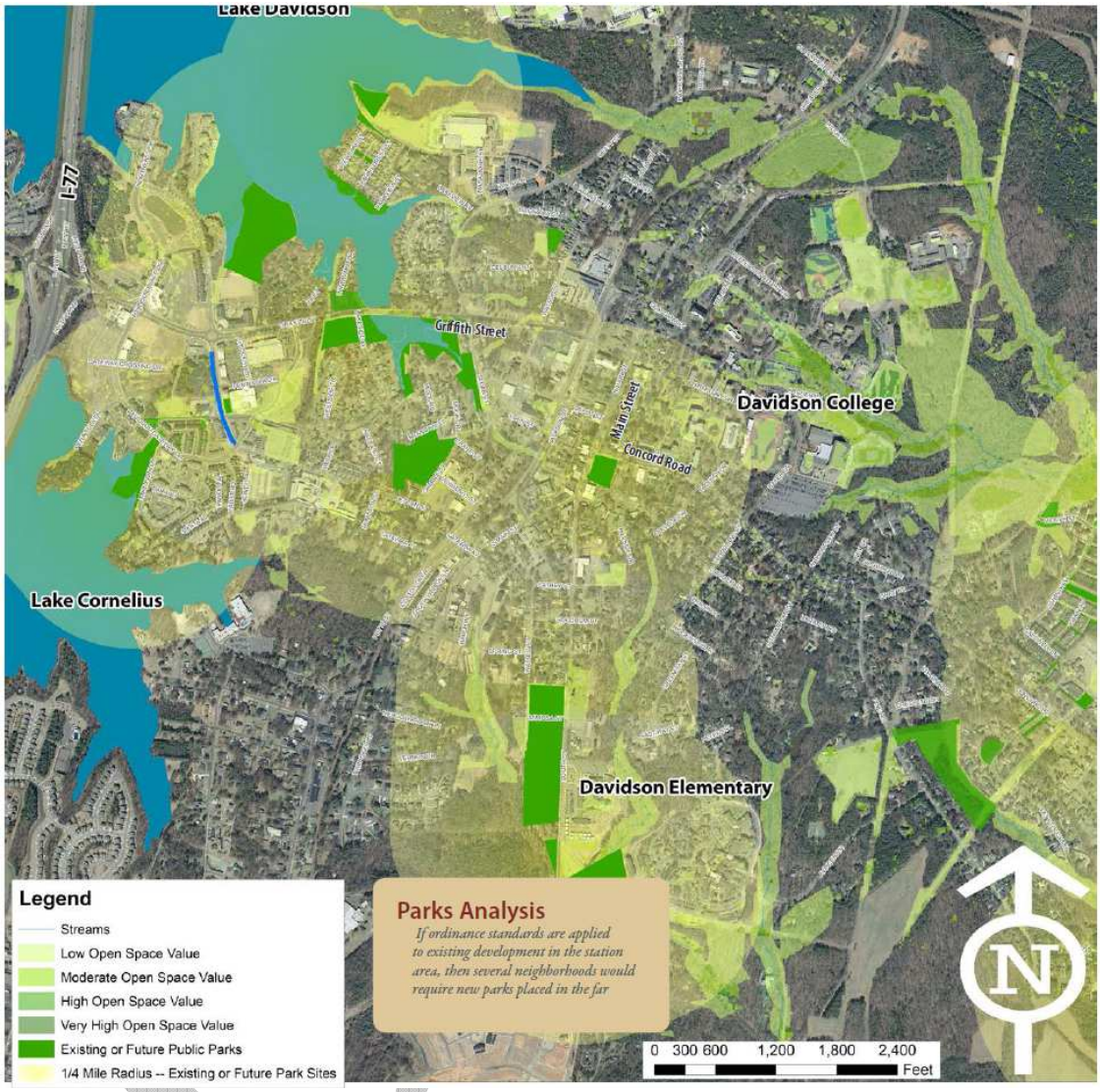
Open Space

The "jump team" focused on open space protection and mobility as its two key items to examine. Part of the open space focus included identification of critical and protected watersheds and the permeability requirements for development in these areas. The water quality of stormwater runoff in this area is extremely important because Lake Norman serves as the Town's water supply. Based on critical watershed protection areas and important sub-basin habitats, the following Open Space Analysis Map was created and areas of high open space value identified.

Public parks are also an important part of open space planning and promoting public health. Davidson established a goal to have a public park within ¼ mile of all residents. Existing deficiencies within the plan's study area include: an area north of Delburg Street, a small deficiency near the Lake Norman YMCA, and with a number of properties along Concord Road and Lorimer Road between Woodland Street and Pat Stough Drive.

Davidson also set a goal that there would be 1 acre of open space per 250 people. It is expected that there will be a need for an additional 15-20 acres of new public park space in order to serve the expected household growth of the proposed 1,500-2,000 households (3,000-5,000 people). Recommendations stated in the plan include regional parks on waterfront properties, several small neighborhood parks, enhanced landscape buffer along public streets in station area, and an unlimited number of pocket parks.

Map 22: Parks Analysis within the Station Area Plan study area[31]



Mobility

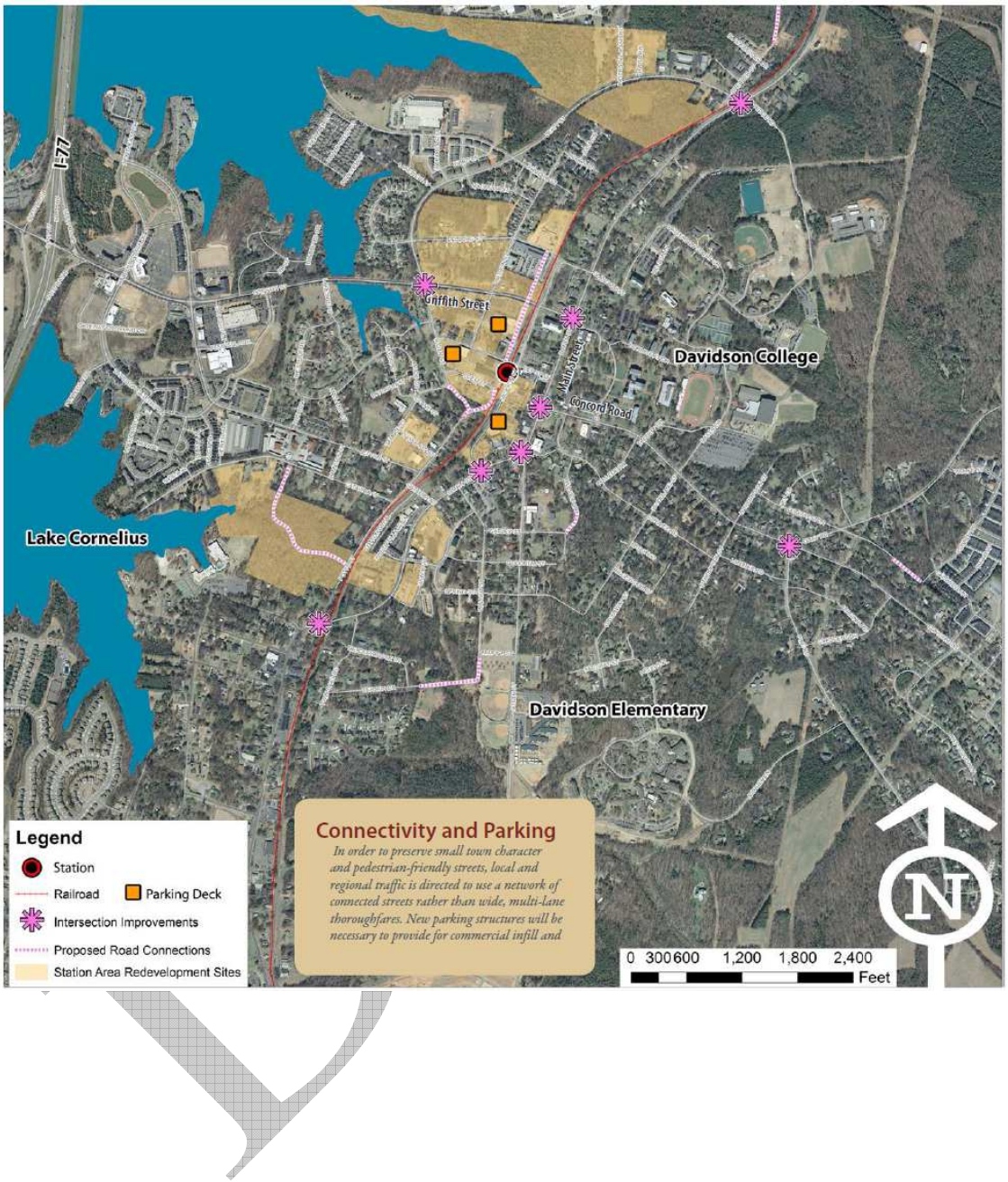
To identify mobility needs, the "jump team" reviewed existing plans including the *2003 Circulation Plan, 2004 Connectivity and Traffic Calming Plan, 2005 Davidson Transit Station Small Area Plan, 2007 Potts-Sloan-Beaty Street Corridor Land Use Plan* and the *2008 Bicycle Master Plan*. The team suggested modifications to the circulation plan to reduce the number of in town neighborhood connections, replacing these connections with an off-road bicycle and pedestrian route particularly around Lorimer Road and South Street. They also identified a number of street improvements and intersection modifications including:

- re-signaling the intersections along NC 115 between Griffith and South Street

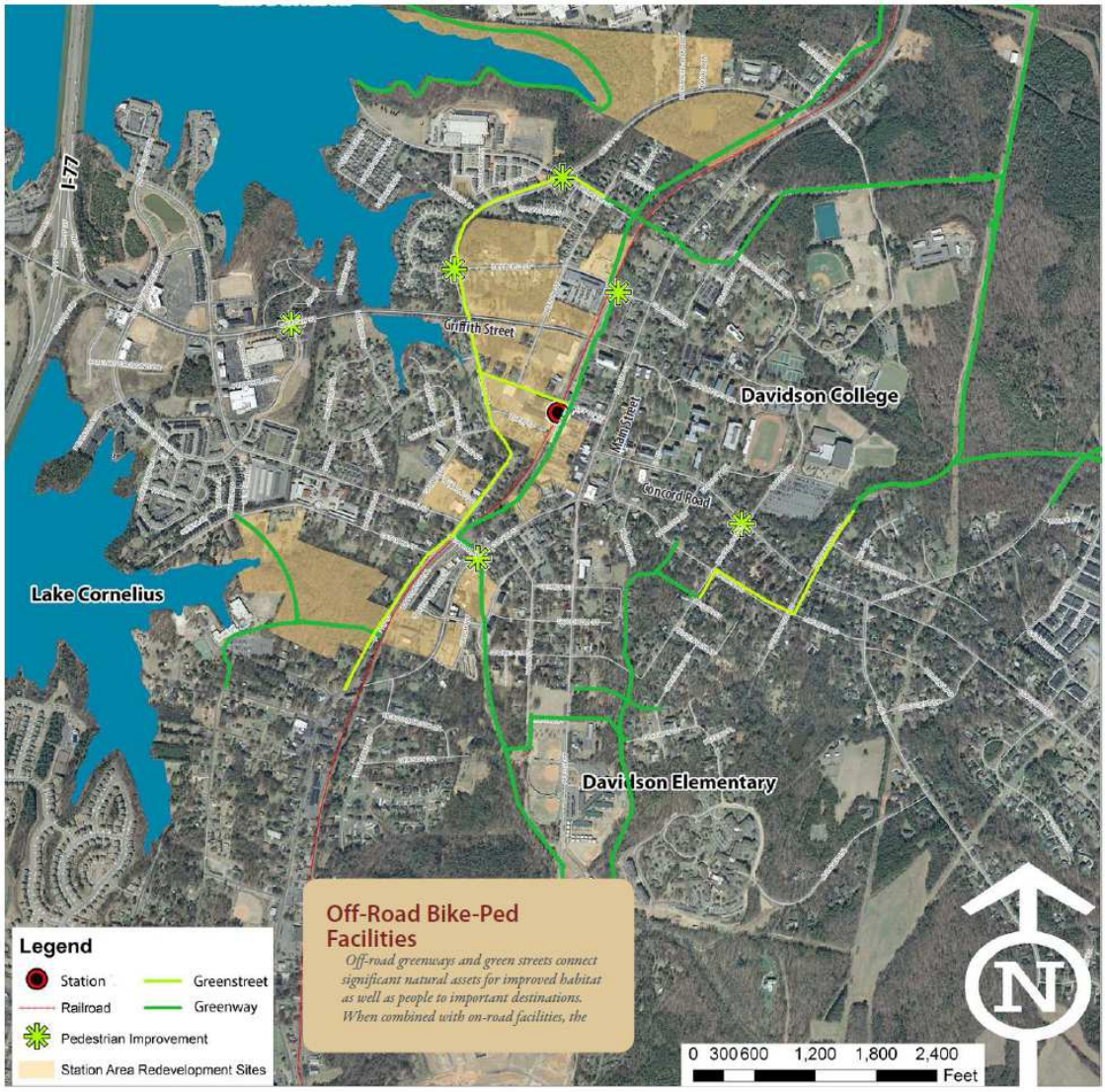
- pedestrian improvements at intersection connecting schools or commercial centers to neighborhoods
- putting in a crosswalks on NC 115
- using Beaty Street crosswalks as green connections between parks and natural resource areas to neighborhoods or commercial areas
- re-aligning the Beaty Street and NC 115 intersection from 80 to 90 degree T-intersection with a traffic signal
- making Beaty Street a multi-modal street with streetscape improvement from Griffith to NC115 including bike lanes, sidewalks, and on-street parking at the proposed mixed use center near intersection of Beaty and NC 115
- implementing neighborhood street improvements on Delburg Street including sidewalks on both sides, street trees, improved drainage, and curb and gutter
- putting in a roundabout at Beaty/Sloan/Griffith to improve flow of traffic
- making improvements to Watson Street from Griffith Street to Depot Street including sidewalks, on-street parking, street trees, drainage and pavement improvements
- turning Griffith Street (main entrance into Davidson College and the Town) into a parkway including landscaping, a community garden, water feature, and sculpture garden
- putting in two connector streets to improve circulation by connecting Potts and Sloan Streets and Concord Road to Eden Street
- continuing Potts Street improvements for a safe pedestrian connection to Cornelius including sidewalks, street trees, on-street parking, curb and gutter
- straightening the alignment of the Jetton-Catawba-South Main corridors to create a single slow-speed connection from Griffith Street to South Main Street
- changing Depot street from a cut through street paralleling Main Street to a “festival street” with businesses and activities aligning the street

The plan also calls for a number of transit platform enhancements to enhance riders’ experience and increase ridership including ticket kiosk, a covered structure, a pick-up/ drop off lane, a permanent structure for the Davidson Farmers’ Market and the rail station beside a public plaza.

Map 23: Connectivity and parking within the Station Area Plan study area [31]



Map 24: Bicycle and pedestrian facilities within the Station Area Plan study area [31]



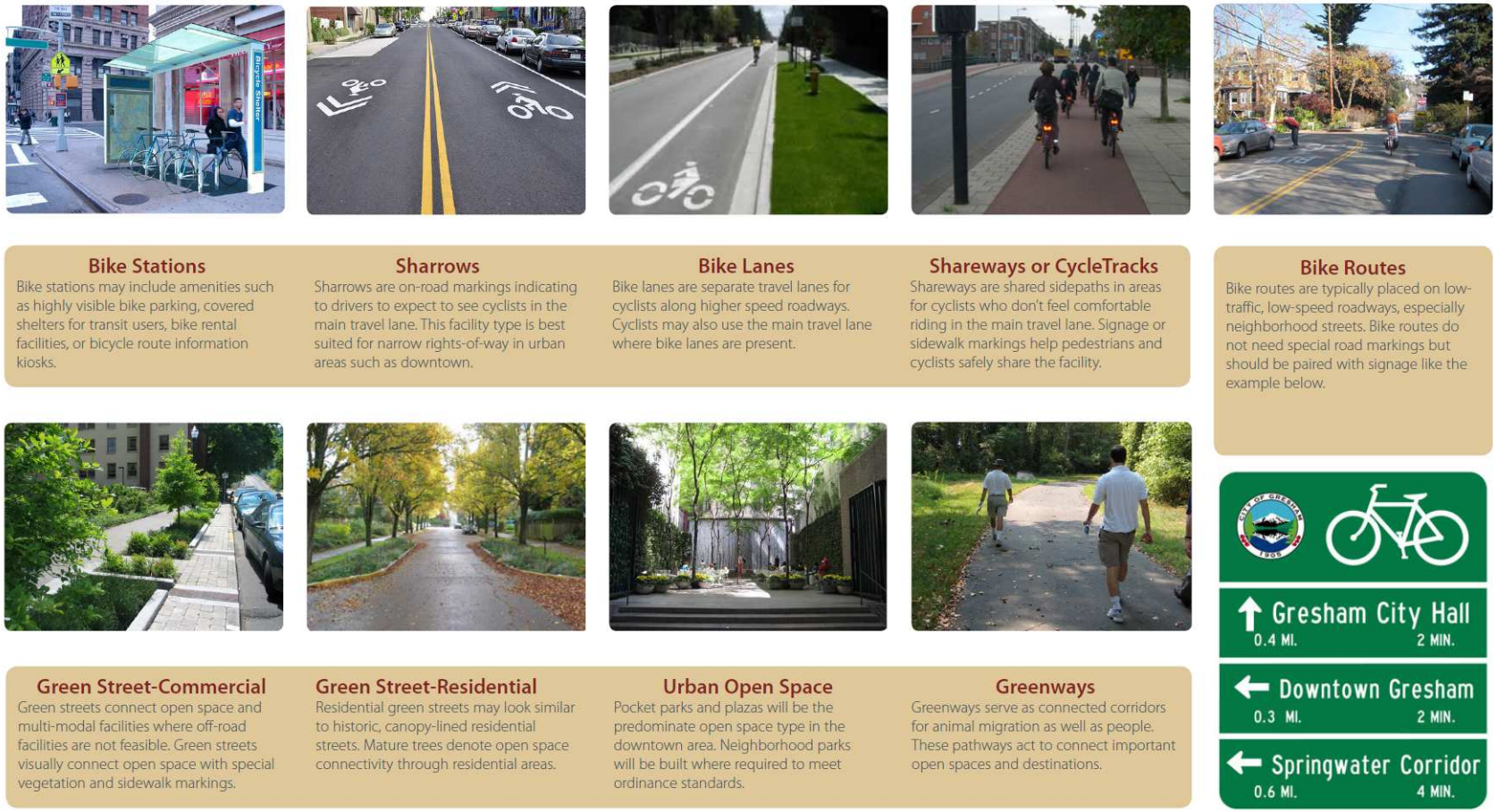


Figure 18: Definitions and examples of open space facilities

Housing

At full build-out, there is expected to be an addition of 1,763 residential units– a maximum of 1,573 multifamily units and 190 single family units. According to Davidson inclusionary zoning policy, 12.5% of these units (197 units) must be affordable. The Station Area Plan is designed to place higher density housing closer to the transit station. If these affordable units are placed the closest to the transit station then residents will receive the dual benefits of affordable housing and transportation options.

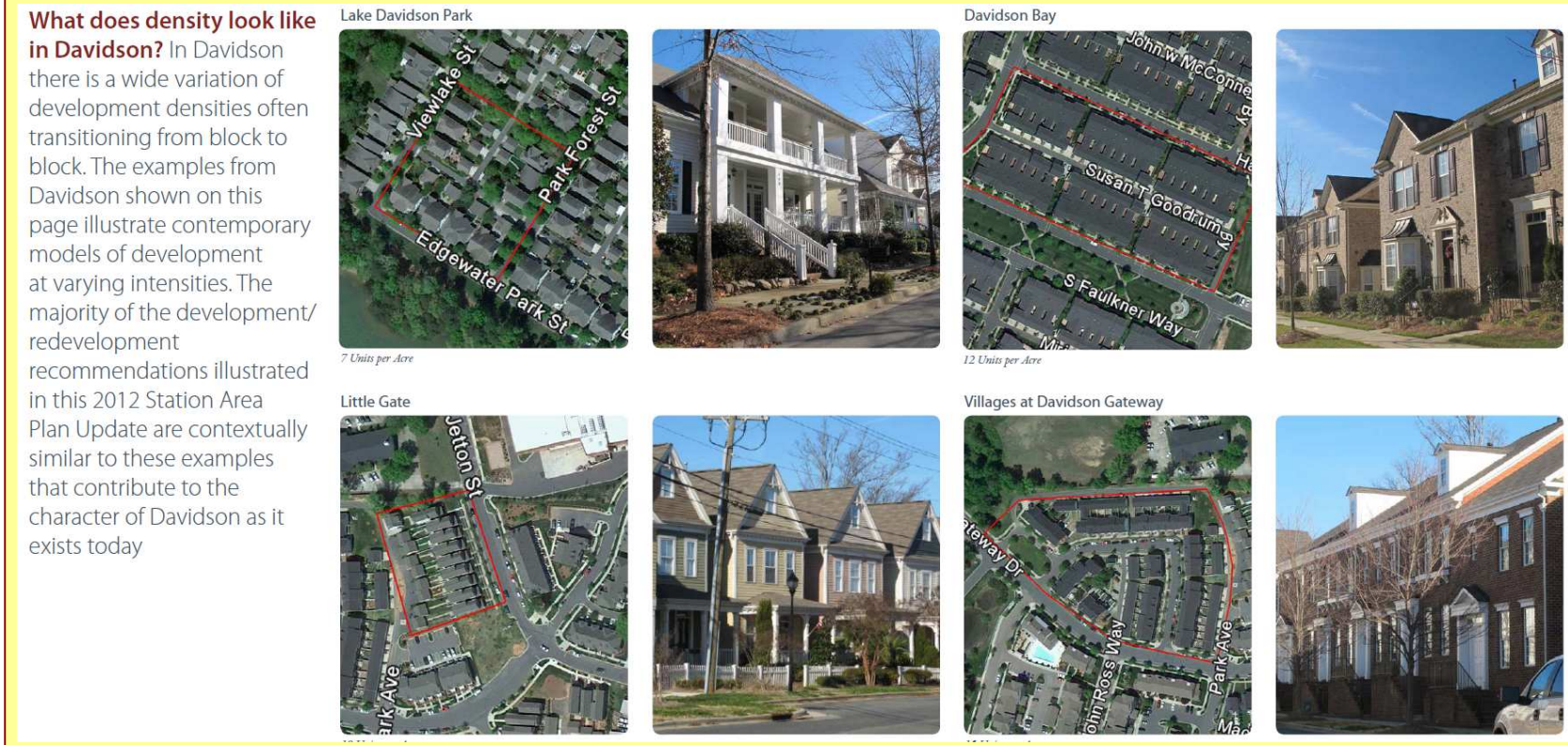
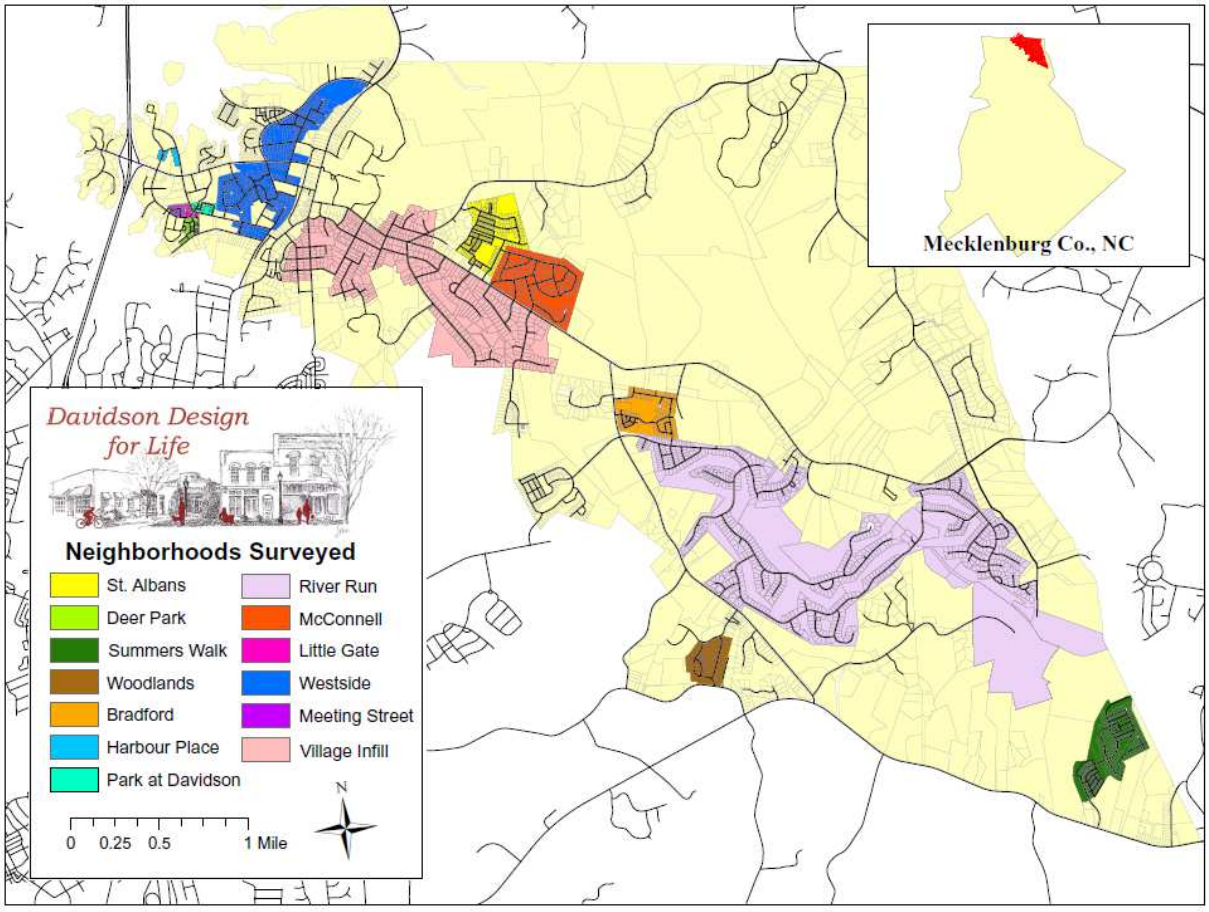


Figure 19: Density in Davidson, NC

4.6 Neighborhood Survey

In February 2012, a brief survey was mailed to 700 homes located in Davidson, North Carolina in order to receive local data concerning neighborhood choice, barriers to walking and biking, and physical activity levels (See Appendix 4). There was a response rate of 32% and a wide diversity of neighborhoods captured as part of the survey including older homes in downtown Davidson, new urbanist style homes in New Neighborhood in Old Davidson, upscale custom housing in River Run, as well as townhomes and affordable housing units found throughout Davidson. The findings of this survey were used to inform this HIA on average modes of commute, commute times, and stress levels during commute.

Map 25: Neighborhoods surveyed in Davidson, North Carolina.



Modes of Commute

According to the neighborhood survey, 93% of participants drive their personal vehicle to work, 4% walked to work, and another 3% biked, used public transit, or carpooled to work. Nationally, 76% drive to work alone, 10% carpool, 5% use public transportation, and 3 % walked to work.[63] In Mecklenburg County, 79% drove alone, 10% carpooled, 3% used public transportation, and 2% walked. In Iredell County, 85% drove alone, 8% carpooled, 0.4% used public transportation, and 1% walked. [64]

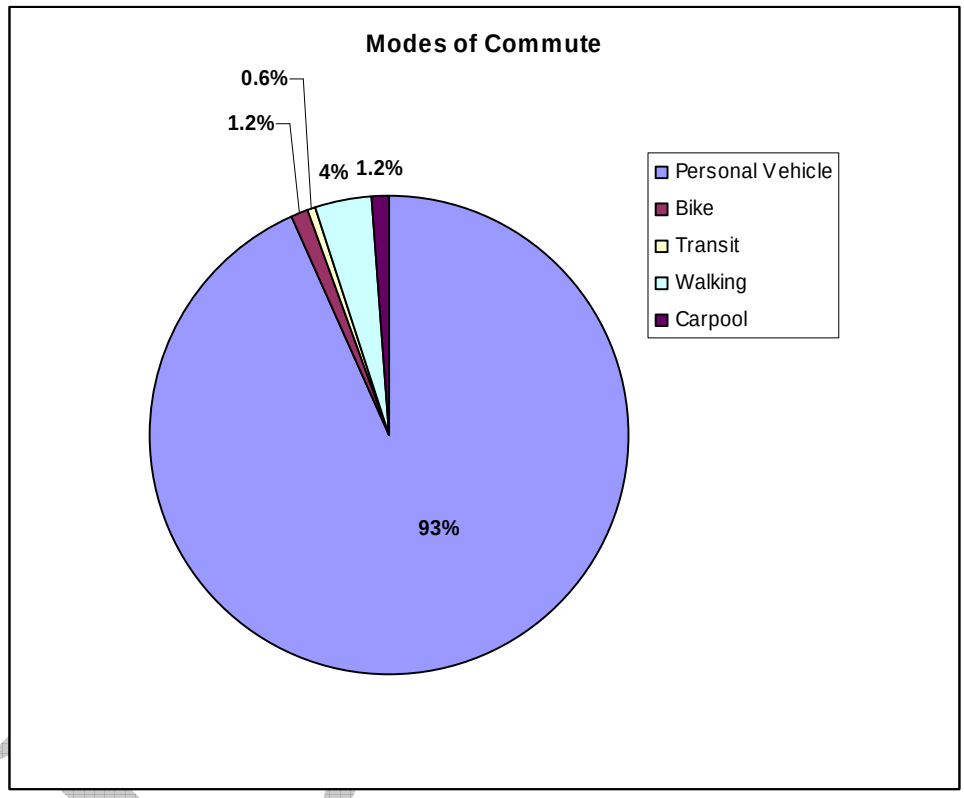


Figure 20: Modes of commute in Davidson, NC

Commute Times

The majority of survey participants spent less than 30 minutes commuting: 44% spent less than 15 minutes, 26% spent 15 to 30 minutes, 27% spent 30 minutes to an hour, and 3% took more than an hour. In 2009, the national mean travel time was 25 minutes. [63] This was also the mean travel time for both Mecklenburg and Iredell County. [64]

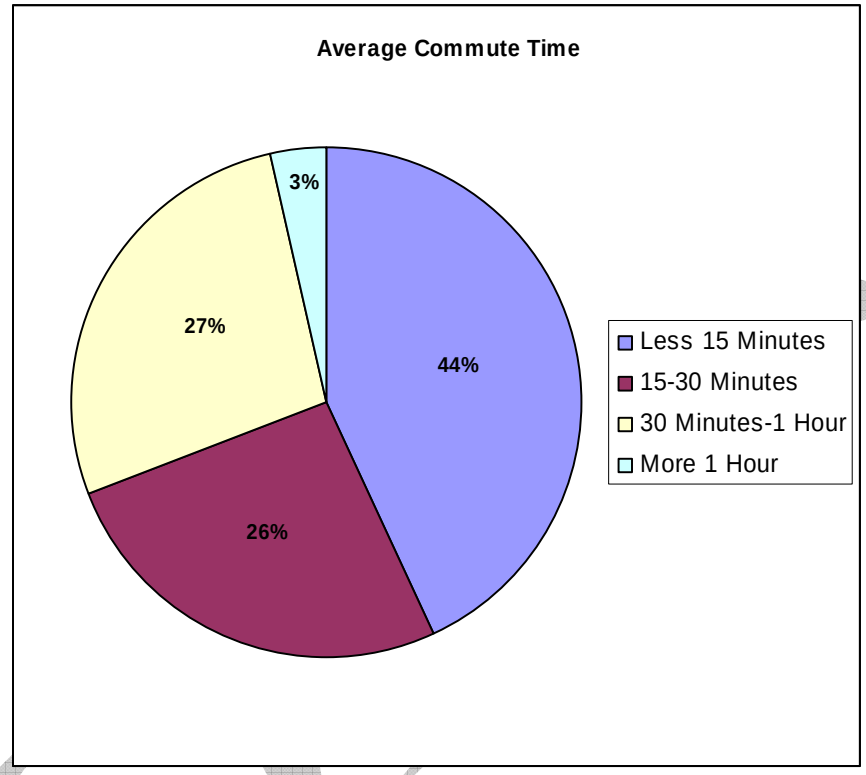


Figure 21: Average commute time in Davidson, NC

Commuting Stress as Related to Commute Time

Long commute times and stress while commuting can lead to road rage defined as an act of aggression on the part of one driver directed toward another driver, passenger, or pedestrian. [65]

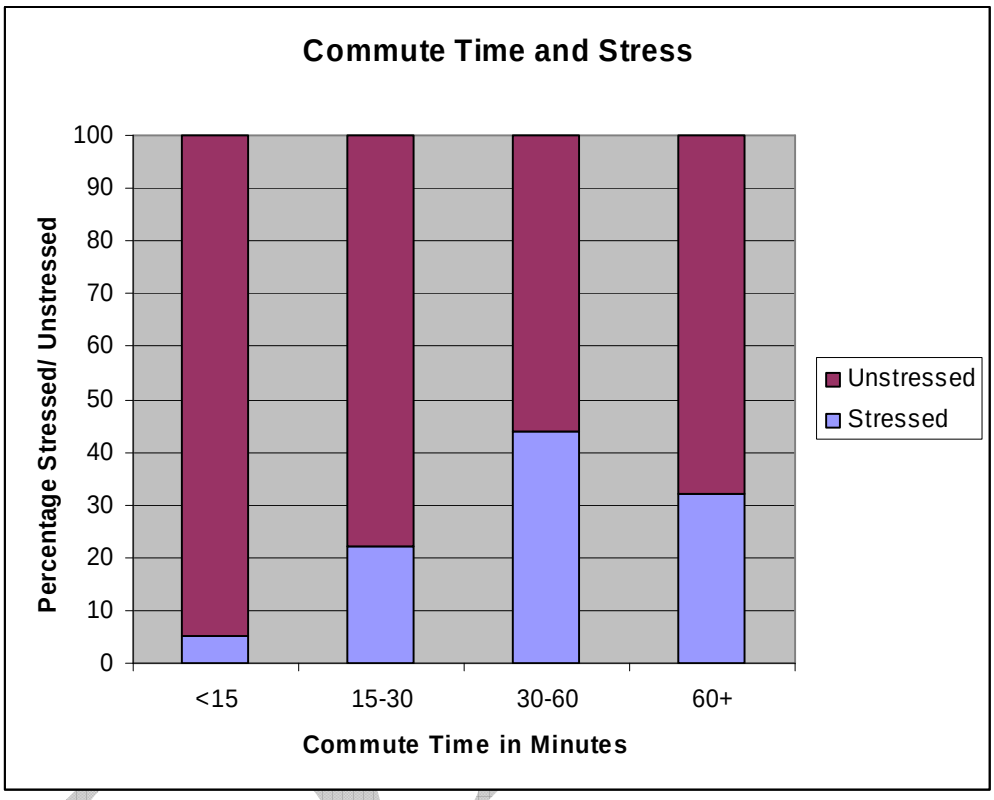


Figure 22: Commute time and levels of stress in Davidson, NC

4.7 HIA Training Activity

During an HIA training held at Davidson College in April of 2011, participants were asked to think about the potential health impacts of the Red Line Regional Rail project using a scoping activity (See Appendix 5). Participants identified the following as potential health impacts:

Positive:

- More people walking around (eyes on the street/ social cohesion)
- Access to more resources and activities
- Better sidewalks and biking facilities
- Improved safety
- Increased physical activity
- Less congestion and improved over all air quality
- Better work-life balance with shorter commute
- Positive interaction with others
- Car-free access to other urbanized areas
- Higher density/ more housing/ more options and lower prices
- Decrease cost of travel and more money available to do other things
- "Aging in Place" opportunity
- Less stress with traffic
- Increased employment opportunities (especially service related jobs)
- Increased transportation options

Negative:

- Increase in property values/ taxes- less disposable income
- Increase in cars/ people/traffic around station
- Noise/vibration/ construction of the rail and surrounding development
- Stress
- Air quality if diesel train- right near stop in particular
- Speeds of train and safety concerns
- Freight interference with commuter rail- un reliable
- Lack of connectivity at end point
- Increase in bedroom communities around Charlotte
- Safety of young children around rail

4.8 Summary of Findings

- If constructed, the Red Line Regional Rail project could potentially impact a citizen's ability to access the resources needed to lead a healthy life and social equity may be influenced.

  - Transportation:
    - The Red Line could increase mobility by offering an additional mode of transportation to those who cannot afford an automobile, cannot drive due to age or disability, or who would prefer to take transit versus driving.
    - Increased transit opportunities can lead to additional physical activity as riders walk or bike to stations.
    - Households could save a significant amount of money, which could be used for other health promoting activities, by switching from a two vehicle to a one vehicle home.

  - Housing:
    - Housing plays a significant role in health and includes the housing unit, neighborhood, and the surrounding community.
    - Access to additional affordable housing options could be made available through increased residential development around the proposed train stations.
    - If property values increase significantly along the rail corridor and surrounding the stations then gentrification could take place, resulting in the displacement of current residents.

  - Employment Opportunities:
    - Access to public transit can increase economic growth and access to employment opportunities.
    - The design of rail systems from suburbs to downtown, the location of employment centers in suburban areas, and the growing poverty in suburban areas has led to a mismatch in employment opportunities and low income populations.
    - The Charlotte-Gastonia-Concord metropolitan area is ranked 75 out of 100 metropolitan areas for public transit access to jobs.

  - Open Space:
    - Open space–parks, trails, greenways– serve important functions within a community and have been linked to increased levels of physical activity and better mental health.
    - Accessibility to parks and park usage is determined by many factors including proximity to park, amenities at the park, park appearance/ safety, and the size of the park.
    - Transit oriented design incorporates open space into development around stations in order to offset the higher density needed for efficient transit operation and to provide recreational opportunities for riders and residents.

- There are additional health concerns regarding the renovation of the rail line to accommodate commuter rail and additional freight traffic as well as during construction of the residential and commercial properties surrounding the transit station.

    - Exposure to loud noises common with construction equipment can cause stress, sleep disturbance, hearing loss, and lower performance in children and employees.
    - The emissions from construction equipment and the dust created by earth moving activities, concrete pouring, or asphalt removal can increase local levels of air pollution and trigger asthma attacks and other respiratory challenges particularly in children and the elderly.

- Commuting patterns can be used to estimate transit ridership and locate stations to best serve regional commuting needs and promote social equity.

    - The racial distribution of commuters within the study area is uneven with a higher black population towards Charlotte.
    - There is a large number of commuting vehicles in the census tracts containing the proposed Derita station and the Eastfield station.
    - A larger percentage of white commuters drive single occupancy vehicles than black commuters.
    - A larger percentage of black commuters carpool or use public transit than white commuters.
    - The median earnings of a single occupancy vehicle commuter is typically higher than carpooler or public transit user.

- Rail ridership is expected to increase to 5,000 trips by 2030 diverting trips from single occupancy vehicles and bus riders and resulting in significant environmental benefits.

    - Over the lifecycle of the Red Line, switching from automobile travel to train is expected to avoid using over 16 million gallons of gasoline and reduce emissions by over 1.4 million tons.
    - Savings from the reduction in emissions over the lifecycle of the Red Line is expected to reach $2.9 million in 2009 U.S. Dollars.

- The construction of the Red Line and surrounding development is expected to generate short-term and long-term employment opportunities.

    - Short-term direct, indirect, and induced employment opportunities will increase in every sector with an estimate of 5,530 cumulative job years and over $194 million in estimated benefits.
    - Long-term job creation– 37,117 jobs and $172 million in benfits– is expected through the operations and maintenance of the train and new development being constructed around the station.

- The livability benefits associated with the rail project include lower vehicle operating costs, travel time savings, and increased employment opportunities for low-income populations and apply to transit riders and highway users.

    - Lifecycle vehicle operating savings for drivers switching to transit (including a reduction in savings due to transit fares) are estimated at $49.9 million.
    - Vehicle operating cost savings and travel time savings are expected to be improved for both transit riders and remaining highway users as congestion is decreased.
    - Increased economic growth in low-skill industries–3,127 job years and $133.4 million in benefits– is expected to improve employment levels for low-income populations.

- Safety along the rail corridor and surrounding the stations will be increased through improvements to or closure of at-grade crossings, increased pedestrian opportunities around the stations, and with the reduction in traffic congestion as drivers switch to riding transit.

- The *2012 Davidson Station Area Plan Update* follows the principles of Transit Oriented Design and focuses on open space preservation and improving mobility.

    - The plan recommends higher density housing, mixed use development, preserving open space, building off the town's existing resources, increasing waterfront access, and providing new housing options.
    - The open space designated as part of the plan would help the town reach its park accessibility goals and preserve important watersheds.
    - The plan's recommendations to improve mobility include intersection improvements and offering additional pedestrian and bicycling amenities to improve safety and increase access.

- Davidson's commuting patterns are similar to county and national averages.

    - The majority of commuters in Davidson drive their personal vehicle and have commute times of less than 15 minutes (better than the national average of 25 minutes).
    - Those who commute greater than 30 minutes are more likely to feel stressed while commuting than those who have shorter commutes.

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5. Recommendations

The recommendations stage identifies alternatives to the proposal or actions that can be taken to minimize the negative health impacts and maximize positive health outcomes. This stage considers:

- community input in recommendation development to encourage solutions that will work in the local context;
- feedback from decision makers to ensure that the recommendations are feasible and within the legal and policy framework governing the decision; and,
- the development of a health management plan with indicators to monitor and a breakdown of who is responsible for each measure and the procedure for monitoring each indicator.

At the conclusion of the recommendations step, the HIA team should have:

- a preferred alternative of those identified within the scoping stage or a list of actions to improve the proposal to promote positive impacts and minimize negative health impacts;
- a plan for who will be responsible for implementing and monitoring each recommendation; and,
- the initial comments from the decision making body on the feasibility of the draft recommendations.[1]

5.1 Recommendation Tables

If the Joint Powers Authority is formed and construction of the Red Line Regional Rail Project proceeds, the following is recommended to increase the potential positive health outcomes and mitigate any negative health impacts.

Table 18: Accessibility and Social Equity Recommendations

Key Findings	Recommendations
Transportation Transit oriented development can lead to increase access to transportation options for residents, in particular low-income individuals, the disabled, youth, and the elderly.	– Offer vouchers or reduced fares for low-income riders. – Realign the existing bus routes to better service low-income neighborhoods and connect riders with the rail transit system. – Make sure all buses and trains are American with Disabilities Act accessible. – Place senior and affordable housing options within walking distance of the train station.

Housing Affordable housing, properly maintained, and well built can have many positive health impacts.	– Build additional affordable housing units in close proximity to transit stations. – Offer a variety of housing types that are affordable. – Make sure that new houses are properly built. – Ensure homes are reasonably soundproof and buffered from the sounds of increased rail traffic.
Transit oriented development can cause property values to increase around the stations, causing displacement of existing residents.	– Involve existing residents in plans for station area planning. – Whenever possible, avoid using eminent domain to remove existing housing stock. – When displacement is unavoidable, offer a 1 to 1 replacement ratio, including a variety of affordable housing options. – Exclude residential properties from special tax assessment districts.
Housing close to a mixture of land uses can increase physical activity, eyes on the streets, and foot traffic to businesses.	– Encourage mixed use development around the stations. – Install pedestrian and bicycle amenities around the stations to encourage additional physical activity. – Orient housing and businesses to provide views of streets and courtyards.
Employment Access to public transit can increase economic growth and employment opportunities across all industry sectors.	– Partner with private industry to provide the necessary infrastructure needed for freight oriented development. – Increase the number of low and middle-skilled industry job opportunities particularly along the corridor to assist low income individuals. – Reroute the existing bus system to connect employment cents within suburban areas and feed commuters to the rail stations. – Work with employers to establish transit ridership programs and offer alternatives to single occupancy vehicle commuting.

Open Space Open space-parks, trails, greenways- serve important functions within a community and have been linked with increased levels of physical activity and better mental health.	– Plan to preserve open space surrounding each transit station in order to serve the expected increase in residential and commercial activity. – Protect critical natural resources including views of nature during construction along the corridor and around the stations.
Many factors determine park accessibility and usage including proximity, amenities, park appearance and safety, and the size of the park.	– Locate parks within walking distance of new and existing housing around the rail stations. – Offer a variety of park sizes and park amenities. – Provide adequate lighting, views of the park, and policing to enhance the safety of parks.

Table 19: Recommendations for Minimizing Negative Health Impacts During Construction

Key Findings	Recommendations
Noise Exposure to loud noises common with construction equipment can cause stress, sleep disturbance, hearing loss, and lower performance in children and employees.	– Provide residents with information as far as when construction will take place and measures they can take to reduce noise disruptions. – Phase construction around the stations to decrease the likelihood that schools will be affected by construction noise. – Limit construction to during the day. – Use equipment that produces less noise when possible.
Air Pollution Emissions from construction equipment and dust created by earth moving activities, concrete pouring, or asphalt removal can increase local levels of air pollution and trigger asthma attacks and other respiratory challenges particularly in youth and elderly populations.	– Be aware of areas with high populations of asthmatic children and elderly residents with respiratory diseases. – Encourage more environmentally friendly construction practices including spraying areas of water to reduce dust, no idling, and more fuel efficient construction equipment. – Phase construction around the stations to decrease the likelihood that these populations will be near active construction sites.

Table 20: Commuting Patterns and Potential Vehicle Operating Cost Savings

Key Findings	Recommendations
Commuting Patterns Patterns in commuting can be used to estimate ridership and locate stations to best serve regional commuting needs and promote social equity.	– Conduct additional studies to determine where commuters live, what mode they use to commute, their route, and their destination. – Use existing commuting information and the location of current and future employment centers to best locate the stations. – Reroute bus lines to serve the transit needs of current riders who do not live within close proximity of the rail line.
The racial distribution of commuters within the study area is uneven with a higher black population towards Charlotte.	– Promote racial and socioeconomic diversity around transit stations by offering a variety of housing types, higher density, and a more urban environment.
There is a large number of commuting vehicles in the census tracts containing the proposed Derita and Eastfield stations.	– Examine further and if warranted prepare to accommodate a larger number off transit users and local congestion around station areas.
A larger percent of white commuters drive single occupancy vehicles than black commuters. A larger percent of black commuters carpool or use public transit than white commuters.	– Promote social equity by ensuring that the level of service for current transit users (bus riders) does not decline due to the introduction of the rail transit. – Encourage increased transit ridership through targeted marketing.
The median earnings of a single occupancy vehicle commuter is typically higher than a carpooler or transit user.	– Offer vouchers or reduced fares for low-income riders. – Identify why higher income commuters are not taking transit and address those concerns/ encourage increased ridership through targeted marketing.
Livability Benefits The estimated lifecycle vehicle operating savings for drivers	– Partner with employers to encourage employees to take transit. – Offer alternatives to vehicle ownership such

switching to transit (including a reduction in savings due to transit fares) is $49.9 million.	as emergency shuttles and car share programs. – Provide information on the potential savings associated with transit ridership.
Vehicle operating costs savings and travel time savings are expected to be improved for both transit riders and remaining highway users as congestion is decreased.	– Factor in the effects of induced demand when determining future transportation investments and consider possible increases in ridership/ rail services as an alternative to widening interstates.

Table 21: Ridership and Air Quality Benefits

Key Findings	Recommendations
Ridership Rail ridership is expected to increase to 5,000 daily trips by 2030, diverting trips from single occupancy vehicles and bus riders.	– Focus on diverting riders from single occupancy vehicles and chaining bus and train trips to serve the total transit needs of residents.
Air Quality Benefits Over the lifecycle of the Red Line, switching from automobile travel to train is expected to avoid using over 16 million gallons of gasoline and reduce emissions by over 1.4 million tons.	– Encourage increased ridership through targeted environmental marketing. – Invest in the most fuel efficient trains available to capitalize on this reduction in gas consumption.
Savings from the reduction in emissions over the lifecycle of the Red Line is expected to reach $2.9 million in 2009 U.S. Dollars.	– Partner with the Environmental Protection Agency to document emission reductions and reinvest savings in additional environmentally friendly technology within the stations.

Table 22: Safety Along the Rail Corridor and Stations

Key Findings	Recommendations
Rail Corridor Improvements to or closure of at-grade crossings are expected to improve safety.	– Be mindful of the potential loss in connectivity by closing at-grade crossings and design improvements to protect the safety of all users- drivers, transit riders, pedestrians, and bicyclists.
Stations Increased pedestrian and bicycle facilities around the transit stations will increase safety.	– Carefully plan and design these facilities to increase pedestrian and bicycle activity, connect into existing networks, and protect users from increased automobile traffic around stations.
Congestion Reduction Reduction in congestion as single occupancy vehicle drivers switch to transit riders should improve safety.	– Encourage increased ridership.

Table 23: Additional Recommendations

Key Findings	Recommendations
Freight Oriented Development There is not a lot of research available on freight oriented development, logistic centers, or freight villages in the United States.	– Examine models of freight oriented development in Europe for how they are constructed and operated. – Research further activity in Chicago as far as their planned logistic centers are concerned. – Do a pilot logistic center following the recommendations in the *Seven Portals* study.
It is reasonable to expect that with increased freight oriented development there will be additional rail and truck traffic and therefore additional air pollution, traffic congestion, and safety concerns.	– Carefully plan and locate freight supportive facilities to avoid areas with a high level of vulnerable populations, high levels of local air pollution, and/or high local traffic congestion and accidents. – Design these facilities to blend into the communities they are a part off and are aesthetically pleasing to commute riders and neighboring uses. – Implement a no idling policy for trucks and offer truck docking stations to reduce air

	pollution emissions. – Focus infrastructure improvements around these villages to increase traffic safety and accommodate multiple uses.
Site-Specific Recommendations Particular issues of safety, traffic congestion, and the potential for noise and or vibration due to increased rail traffic can only be addressed with site-specific recommendations.	– Encourage site-specific plans and analysis to address concerns of safety, traffic congestion, and noise and vibration. – Provide technical assistance for encouraging transit oriented design and freight oriented development. – Coordinate planning efforts among the different municipalities to have a unified approach to station design that allows for site flexibility while having cohesive elements.
Participatory Process Involve existing residents in every stage of planning with additional outreach efforts to vulnerable populations and main stakeholders.	– Survey existing residents for thoughts on the Red Line and current health status. – Poll current transit users to determine why they use transit, what improvements they would like to see, and any concerns they have over the introduction of rail transit. – Continue to involve stakeholders within the planning process and expand the list of stakeholders to include experts in public health.

5.2 Summary of Recommendations

- Use the Red Line Regional Rail project as a means of promoting accessibility and social equity instead of increasing socioeconomic gaps.
- Be mindful of the potential negative health effects associated with the construction surrounding rail stations and the renovation of the rail line to protect sensitive populations from air and noise pollution.
- Carefully plan the location of the transit stations and the rerouting of bus networks to promote social equity and improve level of service for current and future transit riders.
- Work with the private sector to maximize transit ridership and savings experienced by commuters.
- Increase safety along the rail corridor and surrounding the stations by closing or improving at-grade crossings and providing increased bicycling and pedestrian amenities.
- Encourage increased ridership and energy efficient trains to improve regional air quality.

- Conduct additional research on freight oriented development− in particular the health implications of this type of development.
- Provide technical assistance and encourage site-specific plans to address concerns over safety, air pollution, and traffic congestion.
- Continue to support a participatory process throughout every stage of the Red Line Regional Rail project planning and development, focusing particularly on vulnerable populations and broadening the list of stakeholders to include public health experts.

Section References

1. *Improving Health in the United States: The Role of Health Impact Assessments*. (2011). Washington, DC: National Research Council.

6. Reporting

Reporting is how the process, findings, and recommendations of the HIA are shared with stakeholders and decision makers. Reporting can take many forms and should consider:

- the attention span and preferred means of communication of the audience receiving the report;
- the content of the report including a description of the proposed policy, plan, project, or program, the data sources and methodology used during the HIA, a description of the process, and the findings and recommendations of the HIA; and,
- making the report publically available.

At the conclusion of the reporting stage, the HIA team should have:

- publically available forms of reporting such as presentations, policy briefs, executive summaries, and full reports;
- a plan for distributing the findings of the HIA;
- documentation of the HIA process; and,
- a record of the findings, proposed recommendations, and results of the HIA.[1]

6.1 Forms of Reporting Used

Due to the scheduled review of the Draft Business and Financial Plan of the Red Line Regional Rail project being delayed and the negotiation process coming to somewhat of a standstill with Norfolk Southern, there has not been much reporting associated with this HIA. Updates on the HIA process have been provided through presentations to the Davidson Board of Commissioners and the DD4L Regional Advisory Commission.

6.2 Meeting/ Presentation Schedule

Once the draft of this report is completed, it will be sent to members of the Red Line Task Force, DD4L Regional Advisory Commission, and the consultants on the project to review for accuracy and provide feedback. The report will be posted on the DD4L website including a separate executive summary and hopefully will be included on the Red Line Regional Rail project website at http://redlineregionalrail.org/ .Presentations on the findings of the HIA and updates on its progress will be given to the Davidson Board of Commissioners and DD4L Regional Advisory Commission. As public interest continues to grow concerning the project, a Davidson newsletter including the findings of the HIA may be developed.

Section References

1. *Improving Health in the United States: The Role of Health Impact Assessments*. (2011). Washington, DC: National Research Council.

7. Evaluation and Monitoring

The evaluation stage of the HIA consists of three types of evaluation; process, impact, and outcome evaluation. Monitoring is similar to evaluation but specifically involves the tracking of the adoption and implementation of recommendations suggested within the HIA as well as changes in the health indicators identified within the HIA. Evaluation and monitoring considers:

- process evaluation or how well the HIA was done and if there are ways that the process could be improved for future HIAs;
- impact evaluation or whether or not the HIA influenced or informed the decision making process for example were the recommendations accepted by the decision makers; and,
- outcome evaluation or if the implementation of the accepted recommendations has the intended health outcomes.

At the end of the evaluation and monitoring stage, the HIA team should have:

- an evaluation of the HIA process and guidance on how to improve the process for the next HIA;
- an indication of what recommendations were accepted by the decision makers and whether or not the HIA had an impact on their decision; and,
- plans for future outcome evaluation and monitoring of changes in health indicators.[1]

7.1 Process Evaluation

Process evaluation will be completed once there is a decision made on the Red Line Regional Rail project. See the Evaluation Plan as part of the Scoping Worksheet in Appendix 3.

7.2 Impact Evaluation

Impact evaluation will be completed once there is a decision made on the Red Line Regional Rail project. See the Evaluation Plan as part of the Scoping Worksheet in Appendix 3.

7.3 Outcome Evaluation/ Monitoring Plan

Outcome evaluation will be completed once there is a decision made on the Red Line Regional Rail project. See the Evaluation Plan as part of the Scoping Worksheet in Appendix 3.

Section References

1. *Improving Health in the United States: The Role of Health Impact Assessments*. (2011). Washington, DC: National Research Council.

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Appendix 1: Red Line Regional Rail Project Overview

Red Line Regional Rail

North Corridor: Mooresville to Charlotte

Project Overview

Background

- The Red Line Regional Rail (RLRR) project is an initiative to upgrade an existing section of the Norfolk Southern Railroad "O" Line in the North Corridor of the Charlotte metropolitan area. The RLRR is a major regional economic development initiative that will significantly improve the movement of both goods and passengers along a 25-mile section of track running south from Mooresville to Charlotte with potential future extension north from Mooresville to Statesville.

- The current RLRR project is the culmination of a process that began over 15 years ago with the Centers and Corridors planning for regional growth. The North Corridor is one of five (5) rapid transit corridors called for in the 2030 Transit Corridor System Plan, adopted by the Metropolitan Transit Commission (MTC) in 2006.

- Estimates regarding job creation associated with the RLRR suggest that this rail investment would generate approximately 23,000 new jobs in the North Corridor over the life of the project.

Red Line Potential Benefit and Allocation District Map

- In September of 2010, the Metropolitan Transit Commission (MTC) formed the Red Line Task Force, composed of government policy-makers and executives of the seven North Corridor jurisdictions. The Red Line Task Force meets monthly to design and analyze the project's policy and finance approach.

Process Overview

The five-phase process currently underway for the RLRR Project is illustrated in the diagram below.

Funding Partnership

- The capital cost of the RLRR Project is currently set at $452 million based on plans that have undergone detailed design work and collaboration. The total capital and Operating and Maintenance cost is proposed to be funded through a partnership of the State of North Carolina (25% - transit funds), Charlotte Area Transit System (25% - transit funds) and the seven North Corridor jurisdictions (50% - value capture funds).

Updated 11/30/2011

Updated 11/30/2011

Local Share: Value Capture

- Value capture funding is a well-tested method of utilizing development-generated revenue streams to fund public infrastructure. Major transit projects funded using value capture include: the Portland, OR streetcar system; Washington Metro's NY Avenue Station; and improvements to the Dallas Area Rapid Transit System. Value capture revenue is anticipated as the preferred method to fund the 50% local government contribution. To this end, the Red Line Task Force and its working groups have collaborated with the business and development community to identify several value capture revenue streams that will result from infrastructure investment related to the RLRR.

Policy Recommendations

The Red Line Task Force, on August 24, 2011, unanimously approved a set of four policy statements which were subsequently approved by the MTC on October 26, 2011 for use in plan development. These foundational statements are:

1. ECONOMIC DEVELOPMENT FOCUS. The RLRR project is an essential part of the region's economic competitiveness. This rail investment will attract new residents, employment and private business, strengthening the North Corridor as a focal point for the regional economy. Regional collaborations across the country (including Minneapolis, MN; Southern California; Portland, OR; and South Florida) have been the most successful, leveraging transit service delivery to stimulate economic growth. In addition, the RLRR project will focus new development in a pattern that will achieve efficiencies allowing local governments to provide high-quality public services at lower cost.

2. DUAL BENEFIT STRATEGY. The RLRR project must advance a dual-benefit strategy that integrates the efficient movement of both goods (freight) and people (transit). Pursuing a dual-benefiting strategy is essential to achieving corridor-wide economic development potential and supporting traffic mitigation objectives on I-77.

3. UNIFIED BENEFITS APPROACH. A unified benefits approach must be established to maximize regional value creation, value capture and value distribution. Establishing a unified benefit district for the RLRR project will streamline the development process and make for an investment that is more attractive to potential project financiers. This type of unified district approach is often administered via a Joint Powers Authorities (JPA), which is an entity allowing two or more local jurisdictions to operate collectively on projects determined to be of regional need and significance.

4. STATE LEADERSHIP. The Red Line Task Force believes that the State of North Carolina playing a leadership role in the RLRR project will be essential to realize project success. They also recognize that this effort has the potential to set an important precedent for implementation of rail projects elsewhere in the region and across the state. The state, through NCDOT, should take a lead role in positioning the project for strategic statewide logistics inclusion, negotiating partnering agreements with Norfolk Southern, forming a JPA and providing specific financial incentives for regional cooperation.

Next Steps

1. BUSINESS PLAN REFERRAL. The Red Line Task Force, working with its Finance and Economic Development Working Groups and consultants, prepared the preliminary Business/Finance Plan for the RLRR project. The RLTF and MTC have referred the preliminary business plan to all participating jurisdictions for their review and action.

2. REVIEW AND APPROVAL BY ALL PARTICIPATING AGENCIES. Review and approval of the plan and its key components by all RLRR participating jurisdictions is necessary to proceed. The review period is being conducted by each jurisdiction during the first quarter of 2012, culminating in a Consensus Business/Finance Plan to be completed by March 31. Each jurisdiction will then conduct their formal approval process during the second quarter of 2012.

For more information, please contact: **John Woods, Mayor of Davidson & Chair of the Red Line Task Force**
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Appendix 2: Screening Worksheet

HIA #3: Red Line Commuter Rail

An evaluation of the health impacts and costs to operating a commuter rail service between downtown Charlotte and Mooresville

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Background:

In the 1990s, the municipalities in Mecklenburg County jointly adopted General Development Policies (GDP) including several key growth corridors such as the North Corridor (following I-77 and NC 115 from Charlotte to Mooresville) and later recommendations for linking land use and transportation decisions along these corridors. Congestion on I-77 between major employment centers and strong support for Transit Oriented Development in northern Mecklenburg County further prompted interest in developing a commuter rail service along the North Corridor.

Between 2000 and 2010, the Charlotte Area Transit System (CATS) built its first light rail line (the Blue Line along the South Corridor in Charlotte), and significant ridership and redevelopment interest proved the project a success. At the same time, the Metropolitan Transit Commission (the board directing CATS planning and operations) discussed in earnest the mode of transit that best fit each of the other corridors, priorities for implementation and funding opportunities. According to the 2030 Transit Corridor System Plan, the North Corridor is planned as a heavy commuter rail service.

In 201_, the Metropolitan Transit System voted to proceed with two key priority transit projects: the Red Line (the North Corridor) and the Blue Line Extension (the Northeast Corridor). However, the Red Line will not be eligible for federal funding resources, so approximately 50% of the financial burden to fund the Red Line will be the responsibility of the local municipalities along the corridor. For this reason, the nine communities affected by the proposed Red Line (Iredell County, Mooresville, Mecklenburg County, Davidson, Cornelius, Huntersville, Charlotte, CATS and NCDOT) are being asked to make a decision in early summer 2012 to consider alternative funding strategies and a joint powers model for managing the Red Line Regional Rail Project (RLRRP). The RLRRP facilitates economic growth along the North Corridor which in turn will help finance the Red Line commuter rail system.

The implications of the decision to move forward with the RLRPP will have an impact on public health. The RLRPP will provide additional transportation choices via commuter services for current and future residents in these communities. The RLRPP will also encourage significant development and redevelopment along the rail corridor in the form of Transit Oriented Development (TOD) and Fright Oriented Development (FOD). TOD, in particular, is typically designed to facilitate more multi-modal travel including bicycle, pedestrian and mass transit. Increased residential density, improved bicycle and pedestrian infrastructure, and commuter rail services will likely encourage more physical activity, social interaction, and better air quality than if the commuter rail service were not introduced to the communities.

In 2010, the Town of Davidson Board of Commissioners adopted a goal "to enhance the physical, mental and emotional well being of our residents." The Town of Davidson secured grant funding in 2011 from the Centers for Disease Control and Prevention (CDC)'s Healthy Community Design Initiative (HCDI) to conduct a series of Health Impact Assessments (HIA) in order to work toward this goal. The Town of Davidson will conduct a Health Impact Assessment on the proposed Red Line as an alternative to

maintaining existing bus commuter services as the only regional transit option for residents along the North Corridor. The HIA will also consider the health impact of public infrastructure improvements facilitated by redevelopment along the North Corridor as a result of the Red Line Regional Rail Project, but will not evaluate the fiscal impact of constructing or maintaining the Red Line or the economic development initiated by the RLRRP. Existing traffic impact analysis, land use reports, and build-out projections will provide the majority of technical information for the HIA.

Concurrent to this process, the Town of Davidson will also create a Station Area Plan for the ½ mile radius surrounding the future transit station platform and a limited number of vacant parcels located just to the outside of the ½ mile boundary. In the 2004-5 the Town of Davidson created a draft Station Area Plan identifying concepts for redevelopment for a limited number of properties near the station platform. The 2005 plan document was never adopted. Because the Town of Davidson Board of Commissioners will be asked to make important decisions about the RLRRP in June 2012, it is important that decision makers understand and support a vision for how redevelopment should take form in the Station Area. This vision will better inform indirect infrastructure improvements needed to assist residents and visitors to freely and safely move through the Station Area. These indirect infrastructure improvements will prove critical to supporting improved physical activity and public health. The vision will also instruct planning staff and elected leaders to consider zoning ordinance changes to better support Transit Oriented Development.

Proposed Project Timeline:

December 2011	Town of Davidson staff contact stakeholders of interest
	Town of Davidson staff interviews specific stakeholders to collect information
	Town of Davidson initiates charrettes associated with development of Station Area Plan
January 2012	Hold kick-off stakeholder committee meeting to create a scope of work for the HIA
February 2012	Town of Davidson staff drafts HIA report comparing health impacts of alternative scenarios
March 2012	Town of Davidson staff presents draft HIA report to stakeholder committee for review and comment
April 2012	Town of Davidson staff revises HIA report
May 2012 (TBD)	Town of Davidson staff presents HIA report to MTC Town of Davidson staff presents HIA report to Board of Commissioners Board of Commissioners consider adopting Station Area Plan
June 2012	Board of Commissioner consider adopted joint agreements with other agencies to initiate Red Line Regional Rail Project

Stakeholders:

Paul Morris, NCDOT Deputy Secretary of Transit
Red Line Task Force, subcommittee of MTC
Planning manager for Town of Davidson
Planning director for Town of Cornelius

Project Workheet 10/20/2011

Planning director for Town of Huntersville
Planning director, or designee, for City of Charlotte
Planning director for Town of Mooresville
Planning director for Iredell County
Planning staff for Charlotte Mecklenburg Planning Commission
Brian Nadolny, CATS Project manager for Red Line

Decision Makers:

MTC
NCDOT
Communities along North Corridor

Deliverables:

- HIA report
- Station Area Plan

Project Budget:

Item	Cost
Stakeholder Committee (refreshments, reproduction of materials)	$250

Appendix 3: Scoping Worksheet

Health Impact Assessment (HIA) Scoping Worksheet

Title of the Proposed HIA: Red Line Commuter Rail Project

Members of the Scoping Team: Katherine Hebert, Lauren Blackburn, Mary Beth Powell

Key Details of the Proposal being Assessed	
Decision-Maker(s)	Governing Boards for Mooresville, Davidson, Cornelius, Huntersville, Charlotte, Mecklenburg County, Iredell County
Expected Date of Decision	April-June 2012
Summary of the Proposal	In the 1990s, the municipalities in Mecklenburg County identified several key growth corridors including the North Corridor following I-77 and NC 115 from Charlotte to Mooresville. Congestion on I-77 and strong support for developing activity centers with housing and retail near transit stations created an interest in developing a commuter rail service in northern Mecklenburg County. The Red Line Commuter Rail would provide commuter and freight services on a heavy rail system connecting Mooresville to Charlotte. This project would involve: updating the existing rail to support additional rail traffic, facilitating transit oriented development surrounding 10 proposed stations and freight oriented development along the rail corridor, and forming a regional partnership among the 7 affected municipalities, the NC Department of Transportation, and the Charlotte Area Transit System. The expected cost of this project is $452 million with municipalities being responsible for half of this expense and NCDOT and federal transportation dollars matching the other half. The Red Line Task Force is currently exploring ways to coordinate efforts, accept a regional vision for the Red Line, and finance construction. If completed, the rail line is expected to have 16-28 trains daily, reaching a top speed of 60 mph, with a daily ridership of 4,000 to 5,000. During peak travel times (in the morning and around 5pm) a train would come every half hour with an hourly service being offered during non-peak times.
Geographic Boundary	Along the current rail corridor from the Mount Mourne Rail Station in Mooresville to the Gateway Station in Charlotte NC

Health Impact Assessment (HIA) Scoping Worksheet

Non-negotiable Aspects of Proposal	Use of existing rail corridor/ heavy rail system, formation of a joint powers authority, half of investment must come from localities, cap on the project expense at $452 million
Stakeholders	Commissioners of municipalities, residents of municipalities, Norfolk Southern, commuter rail riders, property owners along the rail line, business owners along rail line, commuters
Key Gatekeepers	Paul Morris NCDOT, Mayor Woods Red Line Taskforce Chair, Katherine Henderson KKH Consulting, Brian Nadolny CATS, Other Red Line Taskforce members

Key Details of the HIA/ HIA Process	
Members of the HIA Team	Katherine Hebert, Lauren Blackburn, Mary Beth Powell, Brian Nadolny, Katherine Henderson, Ben McCrary, (avid biker from the station area meeting), others
Key Deadlines	1/25- initial presentation to the Red Line Task Force 2/15- draft of Red Line HIA for review by DD4L 2/22- update to the Red Line Task Force 3/1- final Red Line HIA done for DD4L meeting and inclusion in Consensus Plan 3/28- final presentation to Red Line Task Force April-June- adoption period for the Consensus Plan June-August: Drafting and Reviewing Full Report including Process and Outcome Evaluation 8/30- Full HIA Report Due to CDC
Aims and Objectives of the HIA	• Provide Red Line Task Force members with additional information of the potential health benefits and concerns of converting the existing rail line to a commuter and freight rail line (including the broad effects of additional development along the corridor and increased rail traffic on the corridor). • To identify potential concerns that the Board of Commissioners in the impacted municipalities may have and provide them with additional information to make their decision. • To provide recommendations on ways to improve the design, construction, and operations of the commuter corridor to meet the needs of future riders and protect the interest of existing residents. • To begin the discussion concerning the health implications of increasing transit opportunities throughout the region and the long-term effects of

Health Impact Assessment (HIA) Scoping Worksheet

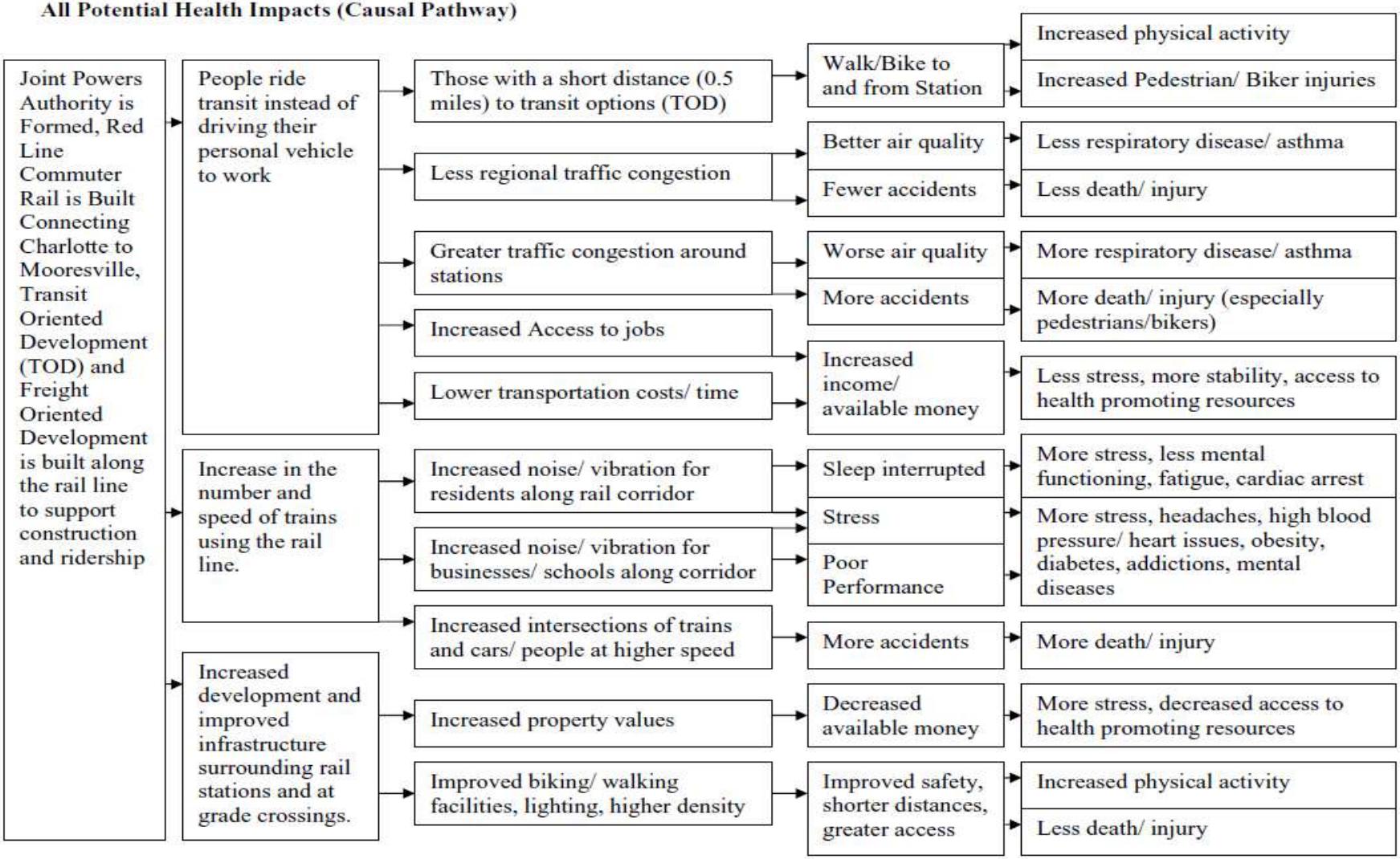
	transportation planning. • To provide an opportunity for public comment on the health implications of the commuter service within the larger Consensus Planning process and station area planning process.
Principles of HIA	• Democracy- the HIA is being done to inform elected decision makers and gather input from a range of stakeholders and agencies representing stakeholders. • Equity- considering the implications of the Red Line Commuter Rail on current property owners along the rail corridor as well as future riders. Particularly of interest are those who cannot drive- low income, elderly, children, and the disabled. • Sustainable Development- considering the needs of future residents of this region and the potential for decreasing air pollution by providing better transit options instead of highway widening. • Ethical Use of Evidence- the HIA will use the best available evidence and be as rigorous, inclusive, and transparent as possible. • Comprehensive Approach to Health- using the wider determinants of health to consider health implications of the proposed commuter rail.
Temporal Boundaries	During construction, initial opening in 2017, and forecasted to 2030 as feasible.
Geographic Boundaries	Within a half mile radius of the red line corridor from Charlotte to Mooresville.
Population Assessed	Residents along the corridor, future riders (2017 and 2030 forecasted)
Scenarios Considered	Build or don't build. (will not be looking at the different funding scenarios for the project)
Forms of Community Engagement	• Introductory public meetings for the station area plan and an overview of the regional rail project were held. • Comments will be collected on the Consensus Plan by the Red Line Task Force. • Interviews and presentations with key stakeholders/ gatekeepers during the HIA process.
Types of Assessment	Review of existing HIAs and similar commuter rail projects, literature review, review of the Red Line Commuter Rail plans and related documents/presentations, interviews with key stakeholders
How will Recommendations be formed, prioritized,	Recommendations will be suggested during the initial reporting period and feedback on the recommendations

Health Impact Assessment (HIA) Scoping Worksheet

approved for inclusion?	will be gathered from DD4L, and select Red Line Task Force members/ consultants- especially Mayor Woods, Paul Morris, Brian Nadolny, and Katherine Henderson
Forms of Reporting	• Monthly presentations to the Red Line Task Force • Presentations to interested Board of Commissioners/ planning staff from the impacted municipalities • Executive summary for inclusion within the Consensus Plan and potential Environmental Assessment documents • Full report to the CDC and on DD4L's website
Timeframe of Evaluation	Process and Outcome evaluation in the Summer of 2012, Full impact evaluation may be incorporated in long-term evaluations of the Red Line Commuter Rail- especially when CATS evaluates ridership levels and operations or if the Task Force/ Joint Powers Agreement Board evaluate the regional impact of the project

Health Impact Assessment (HIA) Scoping Worksheet

All Potential Health Impacts (Causal Pathway)



Health Impact Assessment (HIA) Scoping Worksheet

Potential Health Impacts Not Considered in HIA

Potential Impact	Why Not Included	Approved by Team?
Respiratory disease/ asthma at the local level	Air quality is a regional issue, there is limited data available at the local level, and to many determining factors still unknown such as development patterns around stations	
More income/ available money due to greater access to jobs	Relies heavily on future economic development along corridor, no way of knowing if jobs will meet the skill level of those riding transit and be located within walking distance of the train	
Injury rates associated with increased traffic on the rail corridor	So few accidents along rail lines to begin with, other laws and regulations/ guiding governance to prevent this from happening	

Health Impact Assessment (HIA) Scoping Worksheet

Prioritized Potential Health Impacts with Details for Conducting the HIA

Potential Health Impact	Specific Population Affected (vulnerable group, geographic boundaries, etc.)	Sources of Data/ Literature/ Method	Information Source/ Stakeholders/ Focus Group
Increased physical activity walking and biking to transit stop	Those living within a half mile radius of station	• Charlotte Light Rail Study MacDonald et al. 2010 • Besser and Dannenberg 2005 • Frank, Engelke, Schmid:Health and Community Design pages 131-135, 70-71 • Moudon et al. 1997 • Dannenberg, Frumkin, Jackson: Making Healthy Places pages 152-156, xix • Transportation Research Board 2005 • Saelens and Handy 2008 • Bauman and Bull 2007 • Gebel, Bauman, and Petticrew 2007 • Ewing and Cervero 2010 • LaChapelle and Frank 2009	Andy Dannenberg, Brian Nadolny, local biking/pedestrian advocacy groups
Injury rates associated with improved walking and	Those living within a half mile radius of station or	• Dannenberg, Frumkin, Jackson: Making Healthy	Police department, bicycle/ pedestrian advocacy group, Ben

Health Impact Assessment (HIA) Scoping Worksheet

biking facilities around stations and increased pedestrian activity	walking/biking to the station	Places pages 80-84, 158 • Ewing, Schieber, and Zegeer 2003 • Dumbaugh 2005 • Pucher and Dijkstra 2003 • Retting, Ferguson, McCartt 2003 • Koepsell et al. 2002 • Zegeer 2t al. 2001 • Tester et al. 2004 • Ewing and Dumbaugh 2009 • Bunn et al. 2003 • US DOT 2010	Gerhardstein
Injury rates associated with less congestion on adjacent traffic corridors	Drivers who continue to take I-77, NC 115, or US 21	• Accident Reports/ Red Line Documents • Dannenberg, Frumkin, Jackson: Making Healthy Places page 80, 158 • CDC National Center for Injury Prevention and Control 2011 • Dellinger and Sleet 2010 • Ewing, Schieber, and Zegeer 2003 • Ewing and Dumbaugh 2009	Brian Nadolny, Ben Gerhardstein
Respiratory disease/ asthma associated with air quality (regional level)	Vulnerable populations elderly, youth, sick	• 2010 Mecklenburg County State of the Environment Report	Cindy Houser, CDC Air Quality and Respiratory Health Branch

Health Impact Assessment (HIA) Scoping Worksheet

		• Atlanta Olympics Study • Air Quality and Respiratory Health Branch Resources • Dannenberg, Frumkin, Jackson: Making Healthy Places pages 63-75, 156 • Health Effects Institute 2010 • Frumkin, Frank, and Jackson 2004 • Srinivasan, O'Fallon and Dearry 2003 • Pope et al. 2002 Pope, Ezzati, and Dockery 2009 • Frank, Stone, and Bachman 2000 • Frank et al. 2006 • Ewing et al. 2008	
Stress (and associated health effects) due to noise and vibration for residents, schools, and businesses	Those living, working, or going to school within a half mile radius of the station (both during and following construction)	• Van Kempen et al. 2002 • Porter, Flindell, Berry 1998 • Passchier-Vermeer, Passchier 2000 • Dannenberg, Frumkin, Jackson: Making Healthy Places pages 109-111 • NIOSH publication http://www.cdc.gov/niosh/docs/99-101/#f	

Health Impact Assessment (HIA) Scoping Worksheet

Health impacts associated with lower commuting costs/ time	Expected transit riders	• Besser, Marcus, and Frumkin 2008 • Dannenberg, Frumkin, Jackson: Making Healthy Places pages 113-114, 160 • Putnam 2000 • Freeman 2001 • Koslowsky et al. 1995 • Cost Benefit Analysis for TIGER Application • Federal Highway Administration's Highway Administration Economic Requirement System • National Household Travel Survey	Brian Nadolny
Health impacts associated with greater access (healthy food, recreation, social cohesion, workforce housing etc.)	Those living or working in TOD, especially populations who could not drive (low income, elderly, youth, disabled)	• Calthorpe 1993, 27-8, 41 • Frank, Engelke, Schmid:Health and Community Design pages 131-132, 135 • Dannenberg, Frumkin, Jackson: Making Healthy Places pages 156, 160, 162, 133-134 • Papas et al. 2007 • Sallis and Glanz 2009 • Bullard, Johnson, Torres 2004 • http://www.cdc.gov/health	

Health Impact Assessment (HIA) Scoping Worksheet

		yplaces/healthtopics/accessibility.htm	
Health impacts associated with increased property values	Those currently living within half mile of transit stations, property owners	• Dannenberg, Frumkin, Jackson: Making Healthy Places pages 141 • http://www.cdc.gov/healthyplaces/healthtopics/gentrification.htm	• Affordable Housing Coalition, Ada Jenkins Center

Health Impact Assessment (HIA) Scoping Worksheet

Timeline of Activities and Responsibilities

Activity	Deadline	Who is Responsible?	Who will Help/ Review?
Baseline Health Data (County Level)	1/25	Katherine	Lori Rhew, Earl Mabry
Literature Review	1/25	Katherine	Daniel Rodriguez, Andy Dannenberg, Deb Ryan
Red Line Task Force Introductory Meeting	1/25	Katherine, Lauren	Mayor Woods, Paul Morris, Brian Nadolny, Katherine Henderson
Air Quality/ Update Cost Benefit Analysis	2/8	Katherine	Cindy Houser, Brian Nadolny
Draft of Red Line HIA/ Presentation	2/15	Katherine	DD4L, Mayor Woods
Red Line Task Force Update	2/22	Katherine, Lauren	Mayor Woods, Paul Morris, Brian Nadolny, Katherine Henderson
Final Red Line HIA/ Presentation Review	3/1	Katherine	DD4L, Mayor Woods
Red Line Task Force Final Presentation/ Executive Summary for the Consensus Plan/ Environmental Documents	3/28	Katherine, Lauren	Mayor Woods, Paul Morris, Brian Nadolny, Katherine Henderson
Process and Outcome Evaluation	7/31	Katherine	Kristie Foley
Draft Full HIA Report	8/15	Katherine	DD4L (in particular Megan and Lauren), External Reviewers
Final HIA Report	8/31	Katherine	DD4L, RAC, CDC

Health Impact Assessment (HIA) Scoping Worksheet

Communication/Reporting Plan

When Report?	Who Receives Report?	Who is Submitting the Report/ Leading the Conversation?	Type of Report	Main Message(s)
1/25	Red Line Task Force	Katherine Hebert, Lauren Blackburn	Short Presentation	Introduction to HIA and health impacts being considered with Red Line, request for information/ consideration in decision
2/22	Red Line Task Force	Katherine Hebert, Lauren Blackburn	Short Presentation	Initial Findings of HIA
3/28	Red Line Task Force	Katherine Hebert, Lauren Blackburn	Short Presentation, Executive Summary	Findings of the HIA and recommendations for improving Consensus Plan
Ongoing Updates	DD4L, RAC, Stakeholders	Katherine Hebert	Emails	• Update on process/initial findings/decision
By August 2012	CDC, Placed on website, Stakeholders	Katherine Hebert	Full Report	• Executive Summary • Background information on Red Line and HIA • Process followed • Participants and roles • Findings and Methods of Assessment • Recommendations • Process and Outcome Evaluation

Health Impact Assessment (HIA) Scoping Worksheet

Evaluation Plan

Form of Evaluation	Method	Key Indicators	Timeframe	Person Responsible	Resources
Process	Interview or survey of members of DD4L team, HIA team, stakeholders, and decision-makers	What went well, What could be improved, Did the HIA affect your decision, What were the benefits of the overall process (increased understanding, partnerships, etc.)	Within a month of the decision being made	Katherine	Survey Monkey, phone calls
Impact	Following the news, talking with Red Line Task Force members	What municipalities accepted the joint powers authority, what recommendations were included within the Consensus Plan or environmental documents, were the design, construction, or operations altered due to recommendations within the HIA	Within months to a year of the decision being made	Katherine	Newspaper, Red Line Task Force Members, Documents and Presentations from the Task Force
Outcome	As part of evaluations done on the performance of the Red Line	Ridership, fares collected, tax revenue generated, parking rates, bike/ ped counts around stations, traffic counts on adjacent corridors, regional health data trends	Years after the decision being made	Joint Powers Authority, CATS, NC Department of Health and Human Services	CATS performance measurements, NCDOT traffic counts, Behavioral Risk Factor Surveillance System

Appendix 4: Neighborhood Survey

Davidson: Design for Life
Town of Davidson
PO Box 579
Davidson, NC 28036

Please make sure the return address is visible through the window and return by **February 17, 2012**

What Do You Like About Your Neighborhood?

People choose to live in a neighborhood for many reasons and where you live can affect your well-being. As part of a grant that the Town of Davidson was awarded from the Centers for Disease Control and Prevention, the Davidson: Design for Life program is looking at the relationship between neighborhood design components and overall quality of life. This questionnaire will take about 10 minutes to complete and will inform an assessment of how Davidson's design standards have shaped the character and well being of Davidson. Please answer the following questions and return to the Town of Davidson in the enclosed envelope by **February 17, 2012**. Thank you!

1. When moving into your home, why did you choose that neighborhood? (please rank the following options 0-2 with 0= Did not consider, 1= Somewhat important, 2= Very important)

_____ Price of houses	_____ Size of houses
_____ Age of houses	_____ Design of houses
_____ Proximity to work	_____ Mixture of housing
_____ Quality of school district	_____ Diversity of neighbors
_____ Along CATS bus route	_____ Low crime rates
_____ Proximity to retail/ restaurants	_____ Recreation facilities
_____ Proximity to major thoroughfares	_____ Large yard
_____ Community gardens	_____ Sidewalks
_____ Presence of front porches	_____ Bike lanes
_____ Availability of parking	_____ Proximity to Downtown

_____ Other _____

2. Complete the following sentence: I know the names of _____ of my neighbors (defined as those living within a block of your house).
_____ None _____ 25% _____ Half _____ 75% _____ All

3. On average, how often do you talk with or greet a neighbor?
____Never ____Monthly ____ Every other week ____ 1- 3 times a week ____ Daily

4. Do you have a front porch? (do not include a stoop)
_____ Yes _____ No

5. If you have a front porch, how often do you interact with neighbors from your porch?
____Never ____Monthly ____ Every other week ____ 1- 3 times a week ____ Daily

6. Where is your garage door located?
_____ Don't have a garage
_____ In front of the house, closer to the road than the house's front door
_____ In front of the house, further from the road than the house's front door
_____ To the side of the house
_____ Behind the house

7. Did the location of your garage affect your choice of houses?
_____ Yes _____ No _____ Don't have a garage

8. Do you walk or bike to the following locations? (check all that apply)
_____ Your workplace
_____ Your child's school
_____ Your place of worship
_____ Greenway/trail
_____ Park or recreation center
_____ Public transit
_____ Grocery store/ food market
_____ Downtown
_____ Shops
_____ Pharmacy

9. On average, how often do you walk or bike for transportation purposes?
____Never ____Monthly ____ Every other week ____ 1- 3 times a week ____ Daily

10. What are the barriers to walking or biking to the locations listed in question 8? (check all that apply)
_____ Distance
_____ Poor lighting
_____ No one to walk/bike with
_____ Physical disability
_____ Lack of sidewalk/ bike lane
_____ Traffic on the road
_____ Fear of crime
_____ Increased travel time
_____ Lack of showering facilities/ bike racks/ lockers at destination
_____ Other _____

11. On an average day, how much time do you spend commuting to work (one way)?
_____ Less than 15 minutes
_____ 15 minutes-30 minutes
_____ 30 minutes- 1 hour
_____ More than 1 hour

12. How do you typically get to work?
_____ Personal Vehicle
_____ Carpool
_____ Transit
_____ Bicycle
_____ Walking
_____ Other _____

13. Do you often feel stressed during your commute?
_____ Yes _____ No

14. On average, how often do you walk or bike for recreational purposes?
____Never ____Monthly ____ Every other week ____ 1- 3 times a week ____ Daily

15. When you walk or bike, how often do you go with a friend, neighbor, or family member?
_____ Never _____ Rarely _____Often _____ Always

16. How long have you lived in the Town of Davidson?
___ Less than 1 year ___ 1-5 Years ____5-10 Years ___ More than 10 Year

17. What is your neighborhood? _____

Thank you for your input!

Davidson Design for Life (DD4L) is an initiative of the Town of Davidson to foster healthy community design through the use of health impact assessments (HIA), public participation, and collaborative efforts in Davidson, the Charlotte-Mecklenburg region, and North Carolina.

The connection between how communities are built and public health is a relatively new concept to our region. The activities of DD4L will place Davidson at the forefront of using HIA to inform decisions and help the town grow in a healthy and sustainable manner.

For more information go to **www.townofdavidson.org/DD4L**

Appendix 5: HIA Training Activity

Scoping Activity: How would the introduction of a commuter rail line affect the health of different population groups in Davidson?

Instructions: You have just seen a presentation providing background information on health impact assessments (HIA) and the proposed Regional Red Line Commuter Rail from Charlotte to Mooresville, North Carolina. The second step of the HIA process is scoping which is where you consider the potential health impacts of the proposed project and the distribution of those impacts within a population. There are many tools available to do this including checklists and diagrams (see examples within this packet). This activity will walk you through the scoping process and help you consider links between the built environment and health.

Each table will have a designated facilitator who will lead you through the process. Your group will be assigned one of the individuals described below. As a group read over the description of the individual and consider the potential positive and negative health impacts that the commuter rail may have on the individual. Suggest ways you would assess the impact, what types of information you would need, and which stakeholders you would involve in the HIA. Be sure to identify volunteers to record your thoughts and report back to the larger group.

Individual Descriptions:

Joey is an eight year old that attends an elementary school along the existing rail line. He has Asthma which is triggered by dust and air pollution and treated by an inhaler. The school's playground is located between the school and rail line.

Sarah lives in a rural subdivision of Davidson and commutes 45 minutes to Charlotte Monday through Friday for an 8-5 job. She has a young child who attends an early development childcare center close to the proposed transit station.

Ruby is a seventy year-old widow living on a fixed income in an older home within a quarter mile of the proposed transit station. Although she has limited mobility, every day she walks to downtown Davidson to check her mail at the post office, go to the library, or meet friends for coffee.

Buddy is an avid cyclist who bikes all around Cornelius and Davidson especially on days he does not have to work at his small business in Mooresville. His family is a one-car household which sometimes presents a challenge when organizing transportation to different family activities.

Carline is a young professional who is moving to the area and would like to live in a more walkable, urban environment. She is on a tight budget and looking for an apartment that she can afford that's located in an area where she does not have to drive to everything.

Instructions: You will have 30 minutes to complete this activity and prepare to report back. We recommend you initially spend about 7 minutes on each question and jump back to questions as suggestions come up and time allows. The activity is intended to get you thinking about the what's and who's of an HIA and is not expected to be an exhaustive list or all-encompassing answer to each question.

1. What are the potential health impacts (both positive and negative) on the individual? (Remember the social determinants of health and examples of scoping worksheets available in your packet.)

2. What additional information would you want to know for the similar population group(e.g. youth, elderly, low-income, minority, etc.) in order to make an informed decision?

3. Who would you want to involve in the HIA process? Who would you ask for additional information or input? (Does not have to be the name of a specific person.)