Atlanta BeltLine

Health Impact Assessment

Catherine L. Ross, Ph.D., Harry West Professor
Director of the Center for Quality Growth and Regional Development

Center for Quality Growth and Regional Development
Georgia Institute of Technology
College of Architecture : City and Regional Planning
760 Spring Street, Suite 213
Atlanta, GA 30308
P: 404.385.5133
F: 404.385.5127
E: cqgrd@coa.gatech.edu
W: www.cqgrd.gatech.edu

Technical Assistance from the
Centers for Disease Control and Prevention

The Atlanta BeltLine Health Impact Assessment, made possible by a research grant from the Robert Wood Johnson Foundation, was conducted by the Georgia Institute of Technology's Center for Quality Growth and Regional Development, with technical assistance from the Centers for Disease Control and Prevention.

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Principal investigator: Catherine L. Ross, Ph.D., Director of CQGRD and Harry West Professor

Core Research Team: Karen Leone de Nie, Research Scientist, Georgia Institute of Technology, Center for Quality Growth and Regional Development (CQGRD); Jason Barringer, Research Scientist, Georgia Institute of Technology, CQGRD; Saskia Benjamin, Research Assistant, Georgia Institute of Technology, CQGRD; Jessica Harbour Doyle, Doctoral Student, Georgia Institute of Technology, CQGRD; Mine Hashas, Ph.D., Post-Doctoral Researcher, Georgia Institute of Technology, CQGRD; Dave Pierce, Research Assistant, Georgia Institute of Technology, CQGRD

Technical Assistance Team: Andrew L. Dannenberg, MD, MPH, Associate Director for Science, Division of Emergency and Environmental Health Services, National Center for Environmental Health, Centers for Disease Control and Prevention (CDC); Laurie Beck, MPH, Epidemiologist, Division of Unintentional Injury Prevention, CDC; Susan Hobson, MPH, ORISE Fellow, Division of Emergency and Environmental Health Services, National Center for Environmental Health, CDC; Sheryl Lyss, MD, MPH, Fulton County Department of Health and Wellness; Mary E. O'Neil, MPH, Association of Schools of Public Health (ASPH) Fellow, Division of Unintentional Injury Prevention, CDC; Bianca R. Perri, MPH, Public Health Prevention Specialist, CDC; Candace Rutt, Ph.D., Division of Nutrition and Physical Activity National Center for Chronic Disease Prevention and Health Promotion CDC; April Vance, MPH, Public Health Advisor, Division of Unintentional Injury Prevention; National Center for Injury Prevention and Control, CDC; and other CDC staff

ACKNOWLEDGEMENTS: Numerous people from several organizations assisted and advised on this project, including Karen Mumford, Ph.D., Emory University; Wendy Scruggs-Murray, Neighborhood Planning Unit & Citizens Participation Coordinator, City of Atlanta, and the advisory committee (see Appendix 1).

June 2007

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Reader's Guide

The Atlanta BeltLine Health Impact Assessment report provides a summary of more than one year of research and analysis on the potential health impacts of the Atlanta BeltLine, a project that will dramatically reshape the City of Atlanta with parks and trails, new transit infrastructure, and significant redevelopment.

This report begins by introducing readers to the BeltLine and the ways in which built environment projects, like the BeltLine, can impact public health. Section 3 describes the methodology that was applied to conduct the HIA and identifies the study area and characteristics of the affected population. Section 4 explores several overarching BeltLine issues that can result in various health impacts. These issues tend to influence many determinants of health, and therefore are considered more broadly in the HIA. Sections 5 through 9 summarize the evidence and analysis to identify ways in which the BeltLine may affect access and social equity, physical activity, safety, social capital, and environmental factors that influence health. This research focuses on specific health issues, as well as examines the distribution of BeltLine benefits and disbenefits to various population groups, either distinguished by socioeconomic group or geographic location. Each section concludes with several recommendations that are intended to expand positive health impacts and remove or mitigate negative health impacts. Section 10 summarized the key findings from the literature review and analysis, identifies affected populations, lists the recommendations, and identifies how each recommendation impacts the various categories of health determinants that are the focus of Sections 5 through 9. The report concludes with Section 11, which provides an overview of the broadly defined impacts of the BeltLine and describes the lessons the project team learned during the course of the HIA.

Throughout this report readers will see terminology and references to various geographic areas that may be unfamiliar. Following are brief definitions of these terms and areas.

BeltLine Study Area: For the purpose of the BeltLine HIA, the research team selected the TAD with a 0.5 mile buffer on both sides as the BeltLine Study Area. This buffer was selected because it represents the outer range of the generally accepted distance people are generally willing to walk to access transit or parks and is supported by the results of a local study of park users, which analyzed the distance people walk to get to parks. The Study Area represents approximately 30,500 acres (see Figure 3.1, page 39).

BeltLine Planning Areas: The City of Atlanta has identified the TAD and the surrounding areas as the BeltLine Planning Area. They have also divided the loop into five segments, the Northside, Northeast, Southeast, Southwest, and Westside (see Figure 3.1, page 39).

Tax Allocation District: The Tax Allocation District (TAD) boundaries have been adopted by local elected officials as the areas were incremental increases in tax revenues due to increases in property values can be collected to invest in improvements in said area. See Figure 2.7 (page 25) for the boundaries of the BeltLine TAD, which represents 6,545 acres of the City of Atlanta.

Health: For the purpose of the BeltLine HIA, health has been defined as "a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity" and ability of an individual or group "to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment."

Health Impact Assessment: A Health Impact Assessment (HIA) is "a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population" (WHO, Gothenburg Consensus, 1999). HIAs explicitly consider social and environmental justice issues, adopt a multidisciplinary and participatory process, and use both qualitative and quantitative evidence as well as transparency in the process.

Readers may find it useful to understand the numerous actors that play a role in the development of the BeltLine. A list, with descriptions, is available on page 29.

Executive Summary

The Atlanta BeltLine project is one of the largest redevelopment projects currently underway in the United States. It includes the transformation of a 22-mile loop of freight rail to parks, trails, transit, and residential and commercial developments. It leverages public funds to attract private investment in the redevelopment of this corridor encircling the city's core. The project has been viewed as a springboard for a new vision for the City of Atlanta, one of greenspace, walkability, high-quality infill development, transit, and healthy communities.

With funding from the Robert Wood Johnson Foundation, Georgia Tech's Center for Quality Growth and Regional Development (CQGRD), with technical assistance from the Centers for Disease Control and Prevention (CDC), began an Health Impact Assessment (HIA) of the BeltLine in 2005. The goal of the BeltLine HIA is to make health a part of the decision-making process related to the BeltLine by predicting health consequences, informing decision makers and the public about health impacts, and providing realistic recommendations to prevent or mitigate negative health outcomes. To undertake this task, the HIA team included researchers and practitioners with expertise in public health, city planning, and transportation planning. This report contains numerous recommendations concerning public policy, implementation, design, maintenance, and operations of the BeltLine. These recommendations are intended to give decision makers, community members, designers, and project implementers strategies that can be utilized to support positive health outcomes for all of the populations affected by the BeltLine.

While the assessment is limited to the BeltLine and its immediate surroundings, many of the findings and recommendations are relevant to the City of Atlanta and the larger Atlanta metropolitan region. HIAs enable communities to make the goal of positive health outcomes for all people a primary element in deciding the course of future project and policies.

The BeltLine Vision

The Atlanta BeltLine is a transit, trails, parks, and redevelopment project that uses a 22-mile loop of largely abandoned freight rail line that lies between two and four miles from the city center. It will affect approximately 45 neighborhoods, touching all council districts in the City of Atlanta. The BeltLine will result in improvements to 700 acres of existing parks and the addition of 1,300 acres of new greenspace and parks. The BeltLine vision includes 33 miles of new multi-use trails connecting 40 parks and a 22-mile loop of rail transit service, with an anticipated daily ridership of over 73,000.

The 6,545 acres of redevelopment (approximately seven percent of the city's land area) will create over 29,000 housing units, of which approximately 5,600 units will be set aside for lower-income individuals and families; 30,000 new jobs; and almost 12 million square feet of new construction, to include 5.3 million square feet of office space, over 1.3 million square feet of retail space; 5.2 million square feet of industrial; and 407,000 square feet of public or private institutional space. In addition, there will be sidewalk, streetscape, road, and intersection improvements planned throughout the BeltLine area to link the parks, trails, transit, and redevelopment of the BeltLine to existing neighborhoods. Taken together, the BeltLine components are intended to create a continuous loop of urban regeneration around the core of the city. Linked by transit and greenspace, the BeltLine will connect people with places and with each other.

The BeltLine vision is made possible by a funding strategy called a Tax Allocation District (TAD) [1], which required the approval of the City of Atlanta, Fulton County, and the Atlanta Public Schools. The TAD, a clearly defined area of the City of Atlanta, uses the incremental increase in taxes due to increased property values in the district to repay TAD bonds used to fund capital improvements for the BeltLine. The TAD is expected to raise approximately $1.7 billion over a 25-year period; therefore, the publicly funded improvements, like park development, new infrastructure, brownfield cleanup, and workforce housing, will take place over time. Ultimately, the BeltLine is expected to result in an approximately $20 billion increase in the tax base over 25 years.

Health and the Built Environment

The World Health Organization defines health as "a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity." The 1986 Ottawa Charter for Health Promotion expands this definition to include the ability of an individual or group "to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment." These definitions are important in their recognition that numerous causes influence the ability to be healthy. Known as health determinants, these factors include biological, social and economic, environmental, lifestyle, services, and policy. Many external factors—the environment where we live, work, and go to school; and the social and economic factors, policies, and services that shape the environment—affect the ability to be healthy. It is these health determinants which the BeltLine has the greatest ability to shape through specific policies and interventions.

To reflect on the role the BeltLine can play in health, it is necessary to explore the relationship between the built environment and health. The built environment is the manmade surroundings that provide the setting for human activity. It is composed of land use patterns, transportation systems, and urban design. Land use patterns establish the proximity of different activity centers and spatially determine where we do things—work, school, shop, and other activities. Transportation connects the activities that have been organized into the land use patterns; the transportation system informs the options people have for getting to these different places. Urban design is reflected in the land use patterns and the transportation infrastructure. Design determines how far a building is from the street, the width of a sidewalk, and the placement of street trees and benches. Design instructs the character of the buildings and sets the overall aesthetic qualities of the constructed environment.

In recent years research has suggested a linkage between the characteristics of the built environment and human health outcomes, such as respiratory and cardiovascular health, fatal and non-fatal injuries, physical fitness, obesity, mental health, and social capital. Although causality is not conclusively proven, there is sufficient evidence linking elements of the built environment and health to warrant inclusion of health considerations in project and policy decisions. As such, there is reason to believe that the BeltLine, which will directly affect over 6,500 acres of the city, will play a role in the future health of the people who live, work, play, and go to school near it. A well-designed BeltLine project can encourage healthy behaviors by providing people with the infrastructure and urban design to encourage walking, biking, and transit as viable transportation options; by providing parks and trails for physical activity and social interaction; and by locating jobs and services, such as grocery stores and health care centers, closer to where people live. Furthermore, the lessons learned in the development of the BeltLine can inform new development and redevelopment throughout the city and region.

A Health Impact Assessment

An Health Impact Assessment (HIA) is "a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population, and the

[1] Atlanta's Tax Allocation Districts operate on the same principles as tax increment financing.

distribution of those effects within the population." Four values are integral to the HIA: democracy, equity, sustainable development, and the ethical use of evidence that emphasizes a rigorous structured analysis based on scientific disciplines and methodologies. HIAs explicitly consider social and environmental justice issues, adopt a multidisciplinary and participatory process, and use both qualitative and quantitative evidence as well as transparency in the process. An HIA is intended to make health considerations part of the decision-making process. Furthermore, HIAs seek to link these impacts to a given segment of the population (for example, children, older adults, people living in poverty, or residents of a particular neighborhood). The final product of an HIA is a set of evidence-based recommendations intended to inform decision-makers and the general public about the health-related issues associated with the project. The recommendations provide practical solutions that seek to magnify positive health outcomes and minimize negative impacts.

The steps of an HIA include: **screening**, which determines whether or not there exists the potential for significant health impacts as the result of a policy, program, or project; **scoping**, which establishes the study area boundaries, identifies possible consequences, and determines a management approach for the HIA; **appraisal**, which considers the nature and magnitude of health impacts and the affected populations; **dissemination**, which circulates the results of the HIA to decision makers, individuals implementing the plan/policy, and community stakeholders; and **monitoring and evaluation**, which reviews the effectiveness of the HIA process and evaluates the actual health outcomes as a result of the project or policy.

Potential Health Impacts of the BeltLine

The BeltLine HIA resulted in the identification of several critical overarching issues and five primary areas of potential health impacts related to the BeltLine, including access to health promoting amenities and goods, opportunities for physical activity, safety, social capital, and environmental issues like air quality, water resources, noise, and brownfields. The key findings are summarized below.[2]

Overarching Issues

There are several issues related to the BeltLine that are not limited to specific health impacts, but are more generally related to overall quality of life issues or numerous health concerns. These include the timing of the BeltLine, integration of the BeltLine, mobility priorities, designing for all users, and involving all stakeholders in the decision-making process.

Timing of the BeltLine: The BeltLine faces the challenge of implementing a unifying revitalization and redevelopment plan, but with a combination of public- and private-sector investment. The difficulty arises because private entities operate within a much different process and timeframe than public entities. The result of the differences in public and private progress is a temporal mismatch, where the publicly funded parks and transportation improvements necessary to make the new development livable for both new and existing residents and businesses lag behind private development. While some delay is inevitable, too great a disparity between the work of the two sectors can have health and more broadly quality of life implications.

A Well Integrated BeltLine: The rail corridor that will become the multi use BeltLine has historically divided people and places. The new vision for this corridor has the opportunity to reintegrate many neighborhoods. If such an environment is created several health benefits can be realized, including increases in physical activity, improved social capital, and improved access to health promoting goods, services, and amenities. A well integrated BeltLine means two things: (1) its components—trails and parks, transit, and redevelopment—work well together, and (2) the entirety of the BeltLine becomes woven into the fabric of the city and region.

[2] Please refer to the complete report for references and evidence of specific health impacts.

People-oriented Priorities: Three of the fundamental components of the BeltLine—transit, trails, and redevelopment—are intended to emphasize the mobility of people, not automobiles. This people orientation means that streets are no longer simply conveyors of automobiles, but must serve the needs of multiple modes of travel…becoming "complete streets." A complete street is one that works for motorists, transit riders, bicyclists, and pedestrians, including people with disabilities.

Designing for all Users: BeltLine users will represent a diverse population that will vary in age, income, culture, and ability. Users will include older adults, children, people with disabilities, non-English speakers, and others whose mobility can be affected by short- or long-term limitation in ability. In particular, the population aged 65 and older is expected to increase dramatically in the next 20 years. Considering the fact that almost 80 percent of people over age 65 have at least one chronic health condition, and 50 percent have at least two chronic health conditions, which often lead to disability, the number of people living with functional limitations and disabilities will also increase.

Involving all Stakeholders: Within the BeltLine HIA Study Area there are more than 200,000 residents, 230,000 employees, and numerous businesses and institutions that will be directly affected by the BeltLine, and there will be additional people living and working in the study area as the project progresses. The larger city and region will also be affected by the BeltLine's influence over regional traffic patterns and environmental impacts. Combined, these stakeholders represent a diversity of interests, preferences, and needs. To reflect the uniqueness of the population and the project, three principles regarding the involvement of all stakeholders are important to the implementation of the BeltLine: continuous public involvement, appropriate public involvement, and convenient access to information.

Access and Social Equity

Accessibility is a crucial element for achieving a healthy city. Access refers to an individual's or group's ability to get to health-promoting places, goods, services, and amenities, with reasonable ease, cost, and time. It is concerned with proximity as well as the infrastructure that enables people to travel to these destinations. Numerous studies have linked several critical needs to support good health including transportation, greenspace, housing, and food. Specific health conditions associated with access or the lack of access include obesity, diabetes, heart disease, mental and social health, and poor physical condition.

For decades the largely underutilized rail corridor circling the City of Atlanta, created a divide that severed communities from goods, services, and opportunities. The BeltLine, as a new vision for this corridor, is in large part an accessibility enhancing project intended to link destinations and people either by putting places and people in closer proximity through redevelopment of underutilized land or by providing a more varied transportation system.

The BeltLine HIA evaluates the degree to which access to parks, trails, transit, and redevelopment meet the needs of the existing and future population, and whether improved access, and the resulting health benefits, is equitably distributed geographically and demographically.

Access to Parks and Trails: The assessment of parks reveals that 187,000 of the 213,000 residents in the study area currently have park access (defined as living within 0.5 miles of a park). The BeltLine will create new access to parks for approximately 11,000 people (based on 2000 population), constituting about five percent of the study area population. However, after the BeltLine is created, an estimated 15,370 residents will still be without access to park space. The assessment also finds that although the BeltLine will improve Atlanta's ratio of park acres to residents, the addition of new park acres will be offset by an increase in population. If the City does not create additional park space beyond that for the BeltLine, the citywide ratio of park acres to residents is estimated to decrease between 2000 and 2030. It was also determined that the Southwest Planning Area, may receive slightly less than its fair share of

parks. By 2030, the Southwest Planning Area, which has a high concentration of minorities and poorer residents, will have the lowest ratio of park acres as compared to residents of all five BeltLine Planning Areas.

Approximately 88,800 residents, or 41 percent of the study area population, will have access to the trail system. This population has a slightly higher proportion of whites and is somewhat wealthier than either the City or the study area.

Access to Transit: Access to transit can provide positive health benefits to communities by enabling a higher labor participation rate and providing users with increased opportunities for physical activity and better access to essential services, such as healthcare. Approximately 77,000, or 36 percent, of the residents in the study area will have access to the proposed transit system. The Southwest and Westside Planning Areas, although having the lowest population and employment density of all the planning areas, has the highest transit usage rates and the highest rates of carless households, which suggests that residents in the Southwest and Westside Planning Areas are the most transit dependent of any area.

Access to Housing: Health is related to housing both in terms of the housing unit and the neighborhood. A healthy housing unit is characterized as being in good condition, safe, and designed and maintained to reduce injury. A healthy neighborhood provides the setting for physical activity; provides access to healthy foods, goods, and services; buffers inhabitants from unhealthful things, whether social, economic, or environmental; and provides affordable and appropriate housing choices for residents in all stages of life.

In terms of the BeltLine, the issue of healthy housing takes two forms: the first, the provision of a diverse range, in size and price, of new housing units; and the second, the impact of increasing property values on existing residents. Over the next 25 years, the BeltLine is expected to result in the construction of approximately 28,000 housing units in the Tax Allocation District (TAD); of these, roughly 20 percent will be affordable housing, according to BeltLine, Inc. An additional 110,000+ housing units[3] are anticipated to be constructed in the remaining study area. Together, these factors can create a supply of new healthy housing that provides housing for people of varying incomes, household sizes, ages, and physical abilities.

The BeltLine investment is anticipated to increase property values in and around the TAD, potentially forcing residents to make unhealthy housing choices or leave/locate outside the study area. Left unchecked, the process of neighborhood change can force residents to spend a disproportionate share of their income on housing, leaving less money to acquire healthful products and services; can make residents live in substandard or overcrowded housing units, which increases the risk of negative health outcomes; and causes people to move away, which disrupts people's social networks and access to services and can increase travel times for work and school. Populations at-risk of displacement include renters and households whose median income is below the area median income. Although rental units are scattered rather evenly around the study area, areas with the lowest median income are located in the Westside, Southwest, and Southeast planning areas, where incomes are 30 to 60 percent of the Area Median Income.

Access to Healthy Food: Access also refers to the convenient availability of affordable healthy foods. A healthy diet includes fruits, vegetables, and whole grains and is low in fat, added sugar, and salt. Healthy diets are recommended for prevention of cardiovascular disease and the prevention of such chronic

[3] The estimate of 110,000 housing units is based upon the Atlanta Regional Commission (ARC) 2030 population projection for the study area of approximately 315,000 divided by the average household size reported in ARC's 2006 Housing Report.

diseases as diabetes, hypertension, stroke, and certain types of cancer. Access to food stores and food service places, particularly supermarkets, differs by socioeconomic status with supermarkets locating, more typically and in greater numbers, in wealthier neighborhoods. An assessment of the location of chain grocery stores within the BeltLine study area reveals that grocery stores in the study area tend to be located in neighborhoods that are majority white and of a higher socioeconomic class than the rest of the study area population. The northeast segment of the study area is relatively well serviced by grocery stores while the southeast segment of the study area is underserved. The BeltLine redevelopment can encourage grocery store development in needed areas.

Physical Activity

The link between lack of physical activity and chronic disease is undeniable. Sixty percent of the U.S. adult population is at risk for chronic disease because they do not meet the recommended 30 minutes of daily physical activity. Physical activity can be achieved through exercise or via daily utilitarian activities, such as walking or biking to work or transit. Therefore, the BeltLine's parks, trails, and transit can play an important role in increasing opportunities for daily physical activity.

The Southeast, Southwest, and Westside study areas have higher mortality rates for chronic diseases that have been linked to a lack of physical activity, among other factors. The BeltLine would offer opportunities for a healthy and active lifestyle that could potentially increase physical activity in the most vulnerable populations, but only if the parks, trails, and transit are accessible to these populations. As the assessment of park access showed, the Southwest study area will remain underserved. This indicates a potential at risk group for chronic health concerns exacerbated by a lack of physical activity.

The ability and likelihood of an individual walking to a transit station and utilizing parks and trails have been shown to be affected by factors such as distance, density, connectivity and continuity, quality of the environment and facility conditions, size, amenity set, safety, time, cost, and individual characteristics (gender, race, ethnicity, age, income, and education). Thus the research supports the concept that the Beltline has the opportunity to either facilitate (by connecting people to recreational facilities and facilitating active travel) or reduce (by creating unsafe environments for physical activity by failing to provide adequate infrastructure) the opportunities for physical activity. Greater land-use mixes, population and employment density, street connectivity and continuity of the bike and pedestrian network, are all believed to increase physical activity and contribute to positive health outcomes, as are the presence of recreational facilities and parks.

Just as the BeltLine is envisioned to knit together neighborhoods within the City, transit stops, parks, and trails should be planned for and designed in ways that allow for and encourages biking and walking to, from, and between them. The BeltLine presents an opportunity to increase physical activity within the urban core by making it a way of life..

Safety: Injury and Crime

For the purposes of this HIA, "safety" is defined as the protection from harm, physical or psychological, caused by, crime or accidental injury as it relates to the component parts of the BeltLine: parks, trails, transit, and redevelopment. Public safety both in terms of crime and injury will be an issue for the BeltLine, both directly and indirectly. Users might avoid the BeltLine if it is perceived as being "unsafe," thereby reducing the positive effects of parks and trails promoting physical activity. Injury on the other hand can include problems such as strains and sprains from increased physical activity or the more serious risks of injury or fatality from crashes associated with bicycles, cars, pedestrians, and transit. For the BeltLine to have the greatest impact and success, maintaining the safety of its users, both in terms of injury and crime risk, must be a high priority.

Social Capital

Social capital can be defined as the collective value of a network whose purpose is to inspire trust in and provide support for other members of that community. It is the degree to which people feel that they live in and

belong to a socially cohesive group, and the range of activities and resources that emerge as a consequence of those ties. Research has shown that social capital is a contributor to health in many ways: by serving as a source for information and goods, identifying norms of healthy behavior; creating social ties and emotional support; and contributing to collective efficacy or the ability to problem solve to achieve group gain. Individual involvement in public decision making processes has also been shown to increase social capital. Individuals with high social capital tend to live longer, and are mentally and physically healthier.

The BeltLine can improve social capital by preserving existing neighborhoods, creating places for formal and informal social interactions, and, most directly, by embracing an inclusive public participation process. Success in this endeavor could lead to greater civic pride and involvement. If residents feel excluded from the process, the project could suffer from opposition and criticism, which may put residents at an increased risk for negative health outcomes. Because the demographics of the BeltLine communities vary, an effort must be made to get adequate participation from every neighborhood. Extra expenditure of time and resources may be required for this purpose, and this should be an ongoing component of the development process for the duration of the project.

Environment

The primary environmental impacts related to the BeltLine will include impacts on air quality, water resources, noise, and brownfields. All of these can positively or negatively affect the environment and health.

Air Quality: Air quality is linked to health in many ways. The negative health effects of pollutants include reduced lung function, respiratory illness, cancer, and premature death. Children and the elderly are at greater risk from the effects of air pollution than the general population. Air pollutants are introduced into the environment directly from mobile sources, stationary sources, or indoor sources. The Atlanta Regional Commission projects that there will be a 36 percent increase in traffic volume per day in the Atlanta region if the BeltLine is completed versus a 40 percent increase if the BeltLine project components are not completed. While there will be a marginal improvement in the total amount of air pollutants in the Atlanta region, it is not anticipated to have a significant impact on regional health related to air quality. Localized air quality issues may arise from the possibility that new residential units will be constructed in areas with relatively high concentrations of particulate matter (PM) 2.5 resulting from their proximity to high volume roadways. The research suggests that residential units, schools, and senior centers should be located at least 600 feet from high volume road segments to reduce the risk of negative health impacts associated with PM.

Water Resources: Stormwater management is a critical water quality issue in urban area. In a natural system, when it rains, the stormwater soaks into the soil or runs into streams, rivers, and lakes. In urban environments the natural system is disrupted by paved roads, driveways, and parking lots, and the construction of buildings, which create a large amount of impervious surfaces (areas where stormwater cannot soak into the soil). These impervious surfaces increase the quantity and flow of stormwater and increase pollutants. Stormwater runoff can carry contaminants, both microbial and chemical, into storm sewers and streams affecting water quality and potentially result in outbreaks of waterborne diseases. According to researchers, the reduction of urban stormwater runoff and associated nonpoint source pollution can provide a low-cost complement to water treatment infrastructure and health care interventions. Without detailed development plans it is impossible to determine if the BeltLine will increase or decrease the net amount of impervious surfaces in the study area, but with proper planning and design the project can have a positive impact on the quantity and quality of stormwater runoff. The application of best management practices that reduce the volume and improve the quality of stormwater runoff in the BeltLine can have important health consequences.

Noise and Vibration: The levels of noise and vibration should be assessed and planned for because at higher decibel levels and over longer periods of times they can have adverse health effects. It is

anticipated that the following will be sources of noise and to a lesser degree, vibration, for the BeltLine: transit operations (both the system itself and storage and maintenance facilities), cars, trucks, construction equipment, redevelopment, and people. Noise and vibration can be expected to occur both in the short- and long-term, with short-term levels related to construction and build-out and long-term levels stemming from the operation of the component parts of the BeltLine.

Brownfields: The presence of a brownfield in a community has been shown to have negative health impacts on the residents of the community. The magnitude and type of impacts vary due to the size, characteristics, and location of the brownfield. A general strategy of redeveloping brownfields will likely lead to a mitigation of the negative health impacts. In general, brownfields tend to be located in minority and poorer neighborhoods. For the BeltLine study area, this tendency for brownfields to be located in minority and poorer neighborhoods is continued. The population that lives within 500 feet of brownfields in the study area is 70 percent non-white and has a per capita income of approximately $20,000, which is a slightly higher proportion of non-whites and lower per capita income than the study area population.

The BeltLine HIA Methodology

The BeltLine HIA provides an opportunity to examine the potential health impacts of the largest redevelopment opportunity for Atlanta since the 1996 Olympics. The HIA recognizes the health impacts of the BeltLine on all affected populations, especially disadvantaged and vulnerable groups. It provides a comprehensive public health analysis of the project to inform decision makers. Lastly, this HIA creates a body of work that can be used to inform public health and transportation practitioners and academics, citizens, developers, and elected officials throughout the country.

A team of researchers with expertise in public health and planning was assembled to conduct the HIA of the Atlanta BeltLine. The purpose of the multidisciplinary team was to convene a panel with expertise on issues relating to city planning, including transportation, land use, economic development, environmental management, and public policy, as well as public health, including epidemiology and environmental health. The team was assisted by an advisory committee to provide overall project direction, component specific guidance, and analytical expertise. This international committee was comprised of individuals who have expertise in HIAs, physical activity and public health, transportation planning, city and regional planning, health psychology, architecture, community design, and computation and analysis.

The Plan: To conduct the HIA, the team had to establish an understanding of the composition of the BeltLine and its boundaries, which have been evolving for several years. The Team utilized the Atlanta Development Authority's *BeltLine Redevelopment Plan* (November 2005) as the basis for the HIA. The *Redevelopment Plan* provides a framework for the parks, trails, transit, and redevelopment components of the BeltLine. It specifies the boundaries where TAD funding can be collected and bond money spent, describes the vision of the project, establishes the area's current tax base and projects the increase in the tax base after redevelopment, defines the types of costs that will be covered by bond funding, and meets the requirements of the Georgia Redevelopment Powers Law to establish the TAD.

The Study Area: The project team recognized that the boundaries set by the TAD represented only a portion of the city that will be directly impacted by the BeltLine. The team decided on a 0.5 mile buffer around the BeltLine TAD. This larger study area reflects the fact that BeltLine amenities will be available to the surrounding communities and changes within the TAD will not only impact the immediate area, but will also be a catalyst for change outside the TAD boundary. While the TAD consists of 6,545 acres, the study area equals about 30,500 acres, more than 35 percent of the city's land area.

Affected and Vulnerable Populations: As of 2000, more than 213,000 people lived in the BeltLine study area, which is predominantly non-white, largely of working age, with a per capita income of nearly $24,000. Nearly 23 percent of the population lives below the poverty level and almost 25 percent of the households do not own a vehicle. An additional 101,000 people are projected to live in the area by 2030; it is not possible to predict accurately the composition of this future population. Examining the five segments of the BeltLine, described as planning areas, one finds that the populations residing in the Northside and Northeast planning areas are mostly white, with approximately 80 percent working age, no more than 14 percent living in poverty, and 16 percent of the households being carless. In comparison, the populations of the Southeast, Southwest, and Westside planning areas are predominately non-white, with roughly 65 percent of working age, at least 27 percent of the population living below poverty, and a carless household rate of 33 percent or more.

To characterize the health status of the population currently living within the BeltLine study area, mortality data were examined for heart disease, cancer, stroke, diabetes, homicide, motor vehicle accidents, suicide, HIV, and influenza and pneumonia. Overall mortality rates vary tremendously across the segments of the BeltLine Study Area, indicating significant health disparities. Mortality rates for heart disease, cancer, homicide, diabetes, motor vehicle accidents, and asthma were higher in the Southeast, Southwest, and Westside, where the majority of the population is black and the per capita income is comparatively low, than in the Northside or Northeast planning areas, where the majority of the population is white and with a high per capita income.

While the HIA is intended to look at impacts of the BeltLine on all populations, it emphasizes the assessment of potential health impacts upon the most vulnerable members of the study area population, particularly those who are of low economic status, children, older adults, people with disabilities, renters, and the carless. These groups are identified as vulnerable because of potential existing health issues, a history of being disenfranchised, and a lack of choice, mobility options, and resources.

Critical Health Issues: The team used a multifaceted approach to identify the key issues associated with the BeltLine that have the potential to impact public health. The purpose of this approach was to ascertain issues of public concern, issues with the greatest impact, based on impact severity or the number of people affected, and issues that may affect the most vulnerable populations. Using content analysis of over three years of newspaper articles, a public survey, literature review, and professional expertise the research team identified several critical issues that have the potential to impact the health of the study area population. These include access to amenities, goods, and services; opportunities for physical activity; social capital; safety; and environmental issues such as air quality, water management, noise, and brownfields. The team researched and conducted analyses on these topics.

Priority BeltLine Recommendations

The goal of the BeltLine was to identify potential health impacts and to make recommendations that can increase positive health outcomes and decrease or mitigate negative health outcomes. Section 10 provides a comprehensive list of all recommendations. Following are the more critical recommendations:

- Appoint a health official to the BeltLine Inc. Board.
- Make health protection and promotion a consideration in public funding priorities and timing by developing a mechanism to consider health impacts throughout the process. Such a tool could be applied by the BeltLine Tax Allocation District (TAD) Advisory Board.
- Many city departments including planning, public works, and others will need to work together successfully to ensure the components of the BeltLine compliment each other. Shared performance measures should be established in order for the departments to effectively collaborate.

- Connect the BeltLine to existing schools in the area through the Safe Routes to Schools (SRTS) program. Through a partnership with the Atlanta Public Schools, the Fulton and DeKalb County Health Departments, BeltLine Inc., the City of Atlanta, the Georgia Department of Transportation and others, SRTS would encourage children to be physically active and reduce school-related traffic congestion.
- Establish a coordinated fare and schedule system that ensures that existing and new services work together as part of an integrated local and regional transit system. Partners may include MARTA, the Transit Planning Board, BeltLine Inc., City of Atlanta, the Georgia Regional Transportation Authority, and the Georgia Department of Transportation.
- Include bicycle and pedestrian advocates on the BeltLine advisory committees.
- Develop a 25-year public involvement process that applies strategies to involve representatives of all stakeholder groups. Because of the extended timeframe of the BeltLine it is important that the public involvement process include those people who currently live, work or go to school in the area, and the next generation of citizens.
- Establish a single hub of information about the vision and implementation of the BeltLine prominently on all of the City of Atlanta communications tools. Resources such as print and electronic newsletters and the web site allow stakeholders to stay abreast of involvement opportunities and progress.
- Create additional park acres throughout Atlanta to meet the City's target of 10 acres per 1,000 people. New and existing parks should be designed and retrofitted to optimize use and access.
- Where feasible, provide trail access points every ¼ mile.
- Create trail spurs to increase access to the BeltLine loop from nearby, and especially underserved, neighborhoods.
- Development of trail design standards and operational guidelines should ensure that the BeltLine trails can be used for recreation, exercise, and transportation. This will require additional lighting to allow bicyclists and pedestrians to use the trails in the evening.
- Critically review development plans located within ½ mile of transit stations to ensure safe and convenient walking and biking opportunities. Encourage the creation of transportation infrastructure (including streets, sidewalks, and bike lanes) that is well connected to new and existing transit stops and major destinations.
- Establish policies and programs to prevent displacement in areas surrounding the BeltLine TAD. Property tax freezes, assistance for housing improvements and other programs can reduce displacement of residents from neighborhoods where property values are rapidly increasing. The BeltLine should form partnerships with organizations such as the Atlanta Neighborhood Development partnership, the Atlanta Housing Authority, and others.
- Seek innovative solutions to provide access to healthy foods in the Southeast planning area. Suggested strategies include permitting street vendors of fresh fruits and vegetables near transit stations, establishing a weekly farmer's market, developing community gardens, or providing grocers with incentives like land assembly to create desirable sites for food stores.
- Create a variety of park types, including passive and active parks. Install facilities such as sports fields and courts, and walking circuits that accommodate the needs of all park users, with consideration given to the unique needs of children, seniors, and people with disabilities.
- Implement educational campaigns in the parks, along the trails, and in the broader Atlanta community to encourage physical activity. The City Parks and Recreation department can partner with the Fulton County Department of Health and Wellbeing.
- To mitigate the harmful effects of air pollution locate residential units, schools, senior centers, day care centers, and hospitals away from high volume road segments.

Overall, the BeltLine is expected to have a largely positive impact of the health of Atlantans. The HIA has identified numerous potential positive health impacts and several negative health impacts. Although, it is important to recognize that this HIA has provided recommendations to overcome or mitigate some of the potentially negative outcomes. The BeltLine HIA has also reinforced the link between public decisions and public health consequences and promoted a continuing dialogue between decision makers, city planners, and public health experts on strategies to create a healthy city.

Section 1: Introduction

In fall 2005, the City of Atlanta Council, the Fulton County Board of Commissioners, and the Atlanta Public School System voted to adopt a new vision for the city. It took the form of a massive public and private investment in parks, trails, transit, and redevelopment. Named the BeltLine, the project is intended to reknit the urban fabric and to set in motion a different trend in development in the city, one that would result in quality urban environments linked by transit and green infrastructure. To make this vision a reality, these elected bodies set aside $1.7 billion in funding that will be leveraged to encourage matching private investment.

Such a bold public project carries the potential for both positive and negative health consequences. The question of health benefits is particularly important given that the BeltLine is located in the heart of the City of Atlanta. Therefore, with funding from the Robert Wood Johnson Foundation, Georgia Tech's Center for Quality Growth and Regional Development (CQGRD), with technical assistance from the Centers for Disease Control and Prevention (CDC), began an Health Impact Assessment (HIA) of the BeltLine in 2005. CQGRD's team is led by Catherine L. Ross, director of the Center, with assistance from Andrew Dannenberg, Associate Director for Science, Division of Emergency and Environmental Health Services in the National Center for Environmental Health at CDC. The team includes public health researchers and practitioners as well as city planning researchers with expertise in urban design and land use, environmental, and transportation planning. The team also drew on the breadth of expertise available in the Atlanta metropolitan area.

While HIAs have been conducted for years in other countries, they have only recently been introduced to the United States. All HIAs aim to use data and analysis accurately to promote equitable policies and projects. The purpose of the BeltLine HIA, in particular, is to make health consequences part of the policy and design decisions related to the BeltLine by predicting health consequences, informing decision-makers and the public about health impacts, and providing realistic recommendations. This report includes an assessment of potential positive and negative health impacts and identifies populations, both geographically and by socioeconomic group, who can expect to experience the costs and benefits of the project.

The report also contains numerous recommendations concerning public policy, implementation, design, maintenance, and operations of the BeltLine. The recommendations vary from the very specific (for example, locating residential units at least 600 feet away from high-volume roadways) to the broad and conceptual (prioritizing the mobility needs of pedestrians, cyclists, and transit users). They are also sometimes linked to a single component of the BeltLine (e.g. trails), and at other times address the holistic and interrelated nature of the project. Overall, these recommendations are intended to give decision-makers, communities, designers, and project implementers strategies that can be implemented to support positive health outcomes for the greatest number of people.

Finally, while the assessment is limited to the BeltLine and its immediate surroundings, many of the findings and recommendations are relevant to the City of Atlanta and even the larger Atlanta metropolitan region. Furthermore, like the BeltLine, this HIA tool is unique and potentially path-altering. Throughout this

process, the HIA team has been struck by the unifying influence of health in community decision making. Across all segments of the population, there is general agreement that good health is a desirable goal. Therefore, it is quite possibly one of the most influential points from which consensus and collaboration can be achieved. This HIA could enable the greater Atlanta community, and the communities it contains, to make the goal of positive health outcomes for all people a core element in deciding the course of future projects and policies.

Section 2:
The BeltLine and Health

This section describes the BeltLine, its history, and the major actors in creating it. It also provides a broad definition of health, describes the Health Impact Assessment (HIA) methodology, and examines the impetus for conducting an HIA of the BeltLine.

2.1 The BeltLine

The BetlLine is one of the largest public undertakings in the City of Atlanta's history. It include the creation of parks and trail, transit, and redevelopment to set a new course for urban change in the city. This new direction seeks to create a built environment that balances urban settings and greenspace, links places with several transportation options, and knits together neighborhoods.

2.1.1 Components

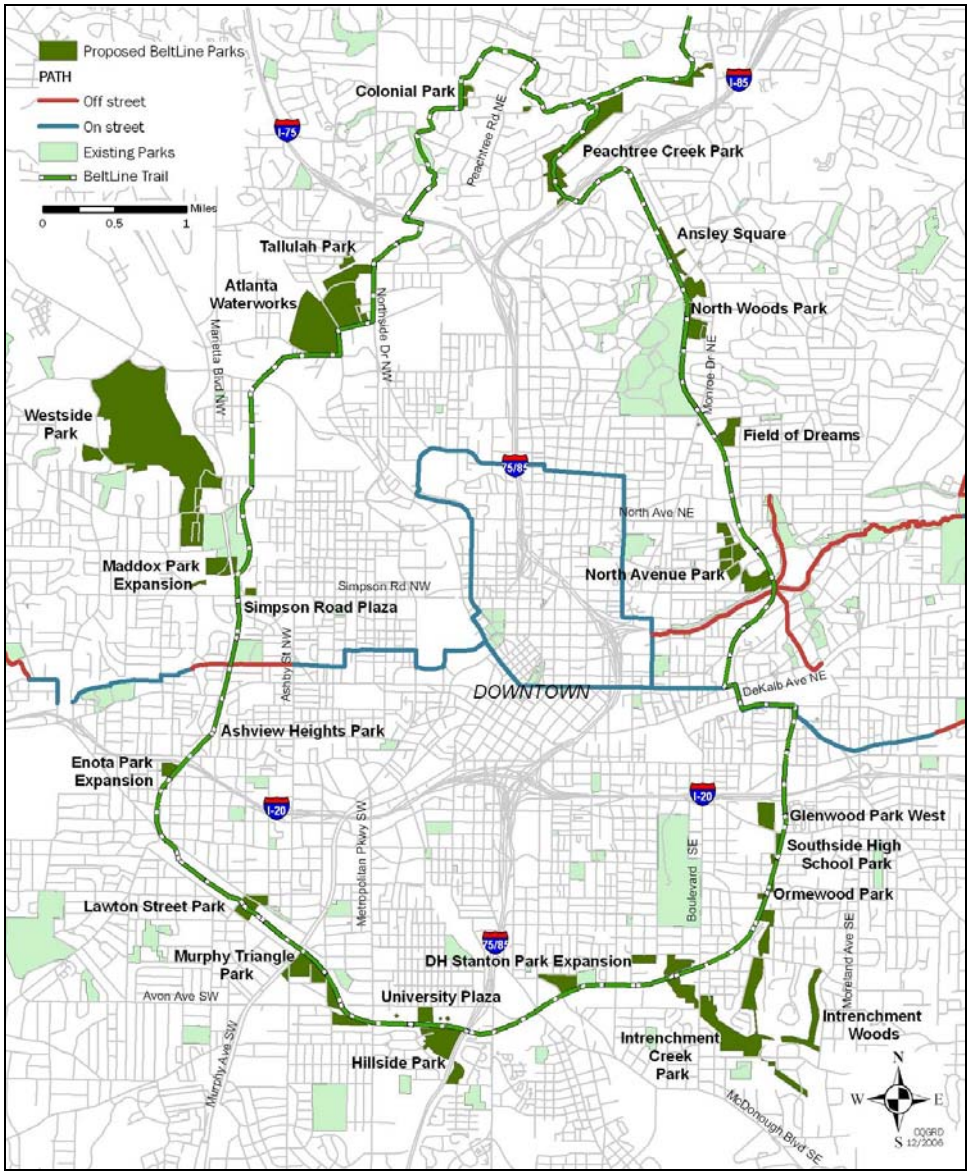
The Atlanta BeltLine is a transit, trails, parks, and redevelopment project that uses a 22-mile loop of largely abandoned freight rail line that at any point is between two and four miles of the city center. The project will affect approximately 45 neighborhoods, 19 neighborhood planning units (NPUs),[4] and 12 council districts in the City of Atlanta. The BeltLine has multiple objectives, including expanded transportation options, the addition of park acres and trail miles, and redevelopment of underutilized land within the city. Specifically, the *BeltLine Redevelopment Plan* (ADA, 2005a) calls for:

Parks: The BeltLine will result in improvements to 700 acres of existing parks and additions of 1,300 acres of new greenspace and parks (see Figure 2.1). Currently, the City of Atlanta operates over 3,500 acres of parks and open space in the City, ranging in size from a fraction of an acre to over 200 acres (City of Atlanta Parks and Recreation Department).

Trails: The BeltLine vision includes 33 miles of new multi-use trails connecting 40 parks (see Figure 2.1). Currently the PATH Foundation and the City of Atlanta have developed several miles of multi-use trails in the City, which connects to a larger regional network that is planned to include over 124 miles of trails (PATH Foundation, www.pathfoundation.org/).

[4] The City of Atlanta is divided into 24 NPUs which are advisory councils made up of citizens. These councils make non-binding zoning, land use, and development recommendations to the Mayor and City Council.

Figure 2.1 Existing and Proposed Parks and Trails in the City of Atlanta

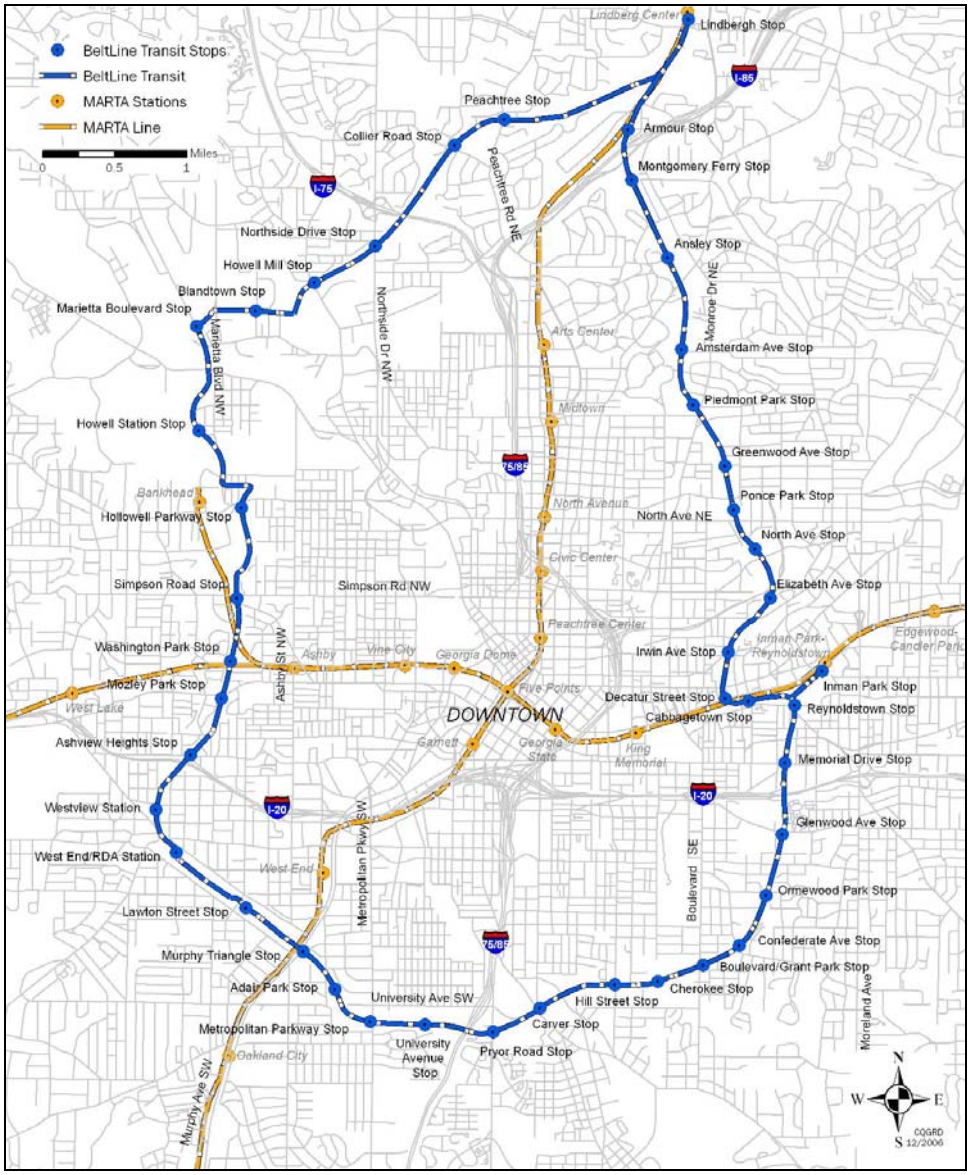


Transit: A component of the BeltLine is an approximately 22-mile loop of rail transit service. In early 2007 the board of the Metropolitan Atlanta Rapid Transit Agency (MARTA) adopted a locally preferred alternative that identified rail transit, either streetcar or light rail, as the transit technology. The analysis for that report anticipated annual ridership of over 26.4 million (MARTA, 2007), or approximately 72,000 riders per day.

Atlanta's current transit network is supplied by MARTA. MARTA is the nation's ninth largest rail/bus system, averaging 500,000 passengers daily. The rail system, which is composed primarily of a North-South and East-West line, operates on over 47 miles of track, with 38 stations. The bus system includes nearly 700 buses on 125 routes that cover over 1,100 route miles every day[5]. Figure 2.2 shows the existing and proposed rail systems.

[5] MARTA, http://www.itsmarta.com/newsroom/martafacts.htm.

Figure 2.2 Existing MARTA Rail Service and Proposed BeltLine Alignment



Redevelopment: The BeltLine Tax Allocation District (TAD) encompasses 6,545 acres (representing approximately seven percent of the city's land area), of which BeltLine, Inc. projects only 2,500 acres will be redeveloped during the TAD period. During this first 25-year period, BeltLine, Inc. anticipates the construction of 28,000 housing units, of which 20 percent will be affordable housing; 30,000 new jobs; and over 13 million square feet of other new construction, to include 7 million square feet of office space, over 5 million square feet of retail space, 1 million square feet of light industrial space, and 407,000 square feet of public or private institutional space.[6]

It is important to put these redevelopment plans in the larger context of the City of Atlanta. The city is composed of more than 200 distinct neighborhoods. In 2006 there were just over 214,000 housing units,

[6] Redevelopment figures are derived from the 2005 *BeltLine Redevelopment Plan*. When numbers were not available in the *Redevelopment Plan* the HIA used estimates from the *Atlanta BeltLine Supporting Documents, Section 3. Circulation Plan*, August 31, 2005, by Grice and Associates. It should be noted that the *Circulation Plan* sometimes used different numbers than appear in the *Redevelopment Plan* for its analysis·

with 47.1 percent single family units and 52.5 percent multi-family units (Atlanta Regional Commission. 2006). Between 2000 and 2006, 60 multi-family units were built for each 100 new residents in the City of Atlanta. Employment is largely centered in three neighborhoods, Downtown, Midtown, and Buckhead. In 2005 there were over 400,606 jobs in the city (Atlanta Regional Commission website, www.atlantaregional.com, accessed 3.20.07).

As Table 2.1 shows, population and housing growth in Atlanta is expected to be most concentrated in the BeltLine TAD, while job growth is anticipated to occur outside of the BeltLine TAD. The projected number of housing units to be constructed in the BeltLine TAD by 2030 is 28,000, while the estimate for housing unit growth in the entire city ranges from 53,900 to 162,700 units. The lower end of the range is calculated using the projected 2030 population divided by the ARC's 2006 average household size of 2.25, while the higher number is calculated by using BeltLine, Inc.'s average household size of 1.6. (this estimate is calculated by dividing the 2030 population by 2.25 (s based on the ARC's 2006 average person calculation for the entire City of Atlanta using ARC population is just over 48,000 housing units.

Table 2.1 Population and Housing Growth in Atlanta and the BeltLine

	City of Atlanta, 2006 (jobs are from 2005)	2030 Forecast	Overall change, 2005/6-2030	Percent change overall, 2005/6-2030	Anticipated BeltLine TAD additions by 2030	Total Potential BeltLine TAD additions	Percent change resulting from BeltLine alone, 2005/2006-2030
Population	451,600	602,783	151,183	33.5%	44,800*-63,000**	80,000*-112,500**	27.5%*-116.9%**
Housing units	214,004	267,000*-376,700**	53,900*-162,700**	25.2%*-76.0%**	28,000	50,000	17.2%*-51.9%**
Jobs	400,606	534,073	133,467	33.3%	30,000	30,000	7.5%

* calculated based on the BeltLine, Inc. projection of an average of 1.6 persons per household
** calculated based on the ARC estimate of an average of 2.25 persons per household (2006)

SOURCES: City of Atlanta population estimates and forecasts are from the Atlanta Regional Commission and BeltLine TAD estimates are from BeltLine, Inc. unless otherwise noted.

Figures 2.3 through 2.6 illustrate the existing housing units and employment density in 2000 and projected densities in 2030. These maps have been created using Census data and projections from the Atlanta Regional Commission, which take into account the presence of the BeltLine. As these maps show, the greatest changes in residential and employment density are anticipated in the northern portions of the study area.

Figure 2.3 Housing Unit Density, 2000

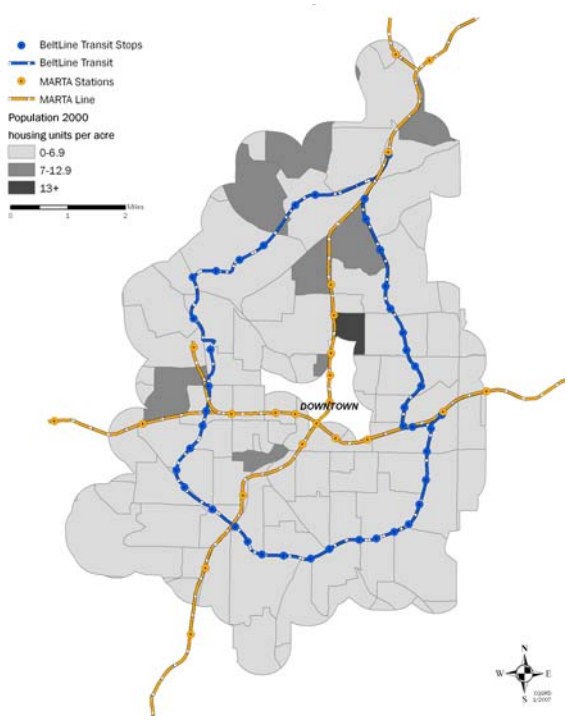


Figure 2.4 Housing Unit Density, 2030

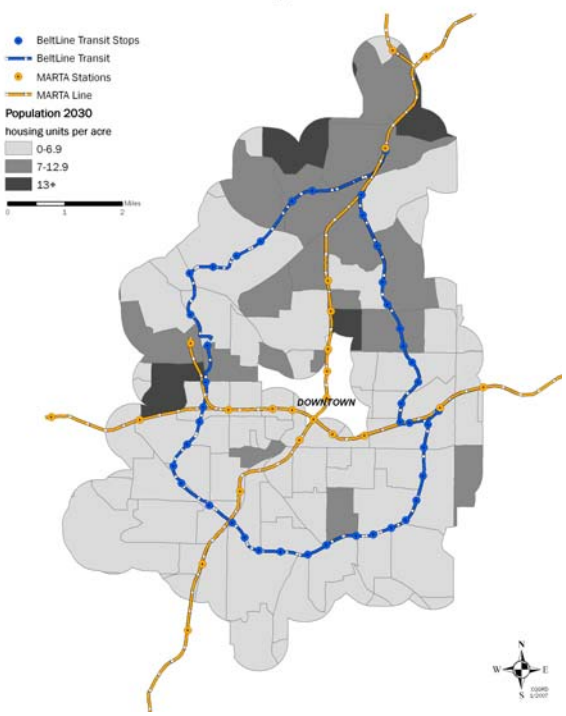


Figure 2.5 Employment Density, 2000

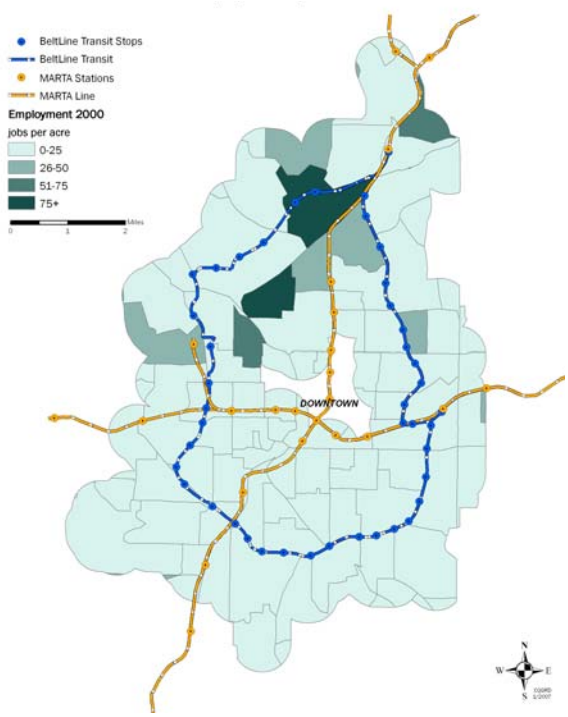
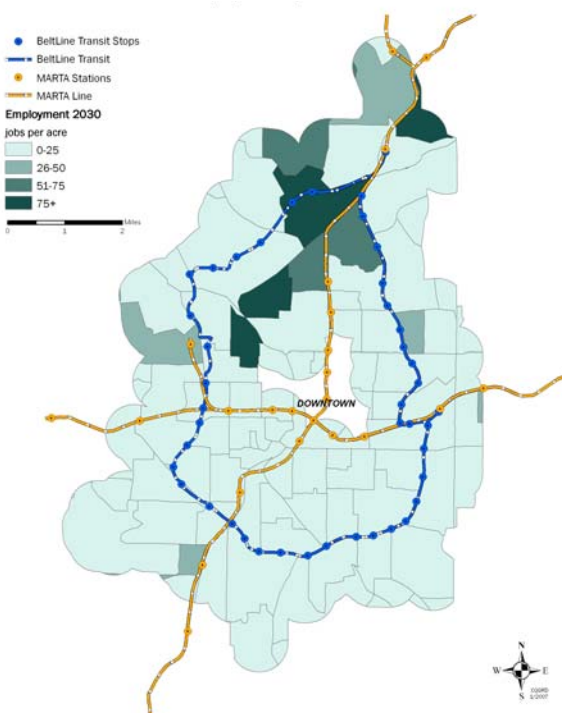


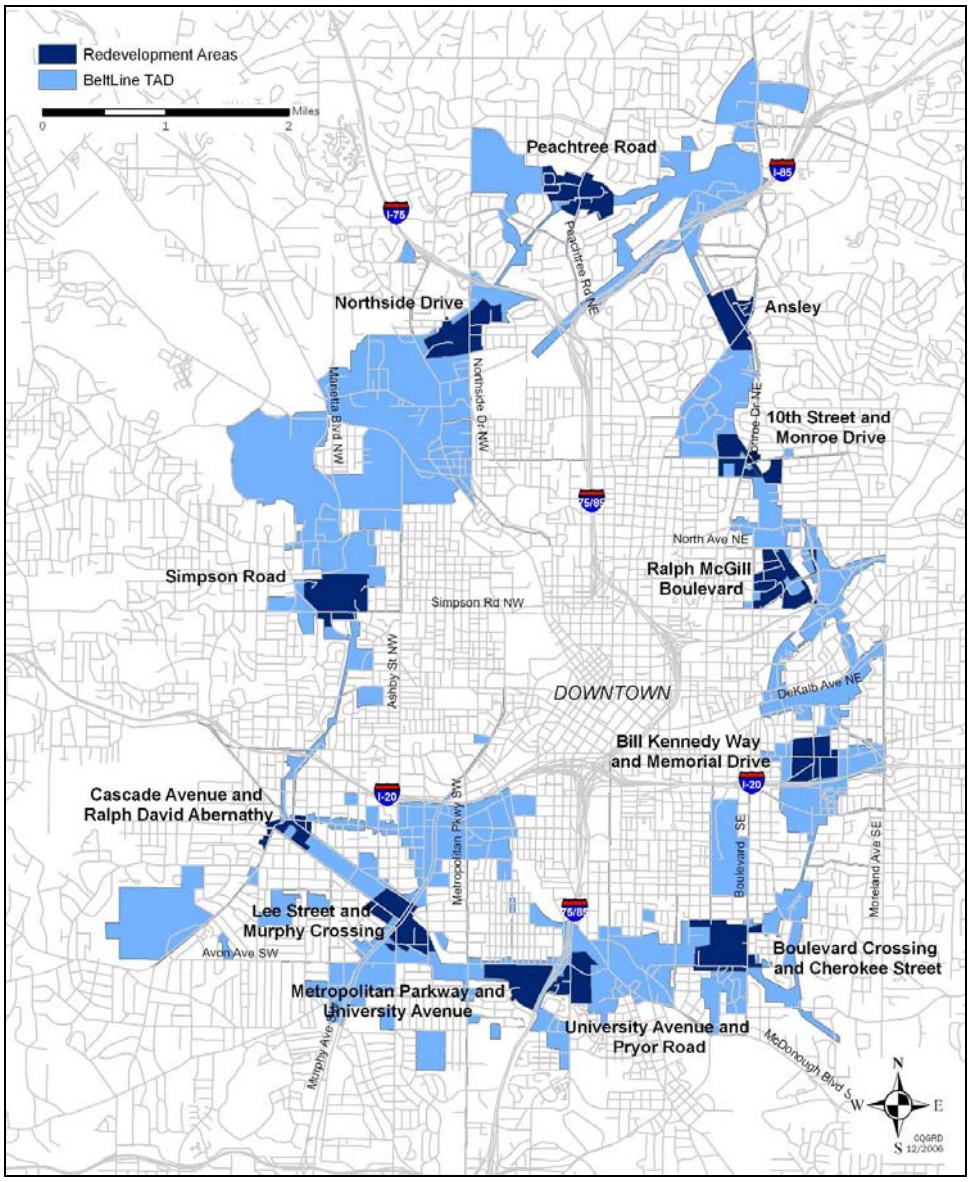
Figure 2.6 Employment Density, 2030



Source: Atlanta Regional Commission, CQGRD calculations

Figure 2.7 shows the boundaries of the Tax Allocation District (TAD) and the designation of the 10 primary redevelopment areas as described in the *BeltLine Redevelopment Plan* (ADA, 2005a).

Figure 2.7 BeltLine TAD and Primary Redevelopment Areas



Other improvements: Sidewalk, streetscape, road, and intersection improvements are planned throughout the BeltLine area to link the parks, trails, transit, and redevelopment of the BeltLine to the existing neighborhoods.

Taken together, the BeltLine components are intended to create a continuous loop of urban regeneration around the core of the city. Linked by transit and greenspace, the BeltLine will connect people with places and with each other.

2.1.2 History

The BeltLine concept first emerged in the early 1990s, when city planners discussed converting the rail lines that circled the core of the city into a cultural loop. While the idea was dismissed at that time, it resurfaced in 1999 in a master's thesis by Ryan Gravel, a graduate student at the Georgia Institute of Technology. This idea sparked the interest of then-Councilperson Cathy Woolard, who became a vocal supporter and a critical part of a grassroots effort to implement this new vision for parks, transit, and development.

In December 2004, the Trust for Public Land, which is a national non-profit organization dedicated to the conservation of land for public use, released the *BeltLine Emerald Necklace* study. This study addressed the opportunities, limitations, and feasibility of the BeltLine park system. In conjunction with this study, the Atlanta Development Authority (ADA) coordinated the *BeltLine Feasibility Study*, which addressed the feasibility of using a Tax Allocation District (TAD) to fund the BeltLine project. The feasibility study was released in March 2005. These two reports included highly favorable findings and added momentum to the BeltLine vision.

The Metropolitan Atlanta Regional Transit Authority (MARTA) completed the Inner Core Feasibility Wrap-Up Report in March 2005. In 2003 MARTA initiated this feasibility study to explore the operational potential of transit concepts proposed within the inner core of the Metropolitan Atlanta area. The study team concluded that a transit investment in the Inner Core is feasible. Through the evaluation process four concepts were identified to transition into the next phase of the study process, the Alternatives Analysis (AA).

In November 2005, ADA released the *BeltLine Redevelopment Plan*, which laid the groundwork for an initial vision of what the BeltLine will become. This plan provided the foundation for a proposed Tax Allocation District (TAD).[7] Soon after, the City of Atlanta, Fulton County, and the Atlanta Public Schools approved the TAD as the primary source of funding for the BeltLine. The TAD, a clearly defined area of the City of Atlanta, includes 6,545 acres (see Figure 3). Taxes that will accrue due to increased property values in the district will repay TAD bonds used to fund capital improvements for the BeltLine. Because the TAD generates funding annually over 25 years, improvements will take place incrementally. The TAD is expected to raise approximately $1.7 billion over its lifetime. These funds will be used as they become available to purchase land, provide infrastructure, clean up brownfields, and develop workforce housing. During the project's 25-year lifespan, the City of Atlanta, Fulton County, and the Atlanta Public Schools will continue to receive 2005-level taxes from the property in the district. At the end of the TAD, these entities will receive their full portion of the new tax base. The BeltLine is expected to result in an approximately $20 billion increase in the tax base over 25 years.

In June 2006, ADA released a draft work plan, a 5-year strategic budget document intended to guide early implementation of the BeltLine using TAD bonds and other funding sources. The work plan allocates $427 million, or 15 percent of the total project funding. Priorities for the first five years include acquiring and developing portions of Westside Park, securing and developing as much Right-of-Way as possible, conducting environmental and planning studies, pursuing federal and/or state funding, and investing in development incentives, affordable workforce housing, preservation, public art, and transportation improvements to drive economic development. The work plan was adopted by the City Council in July 2006.

In 2007 MARTA released a report entitled *Detailed Screening Results and Selection of Locally Preferred Alternative*. This report contained the results of the Alternatives Analysis (AA), conducted to identify and evaluate transit improvements within the Beltline corridor in an effort to improve local and regional mobility, accessibility and connectivity, and to support the City of Atlanta's redevelopment plans. The purpose of this study was to explore transit alternatives based on projected costs, technology, anticipated ridership, and environmental impact. This study concluded that a continuous loop would be the best performing option. The technical results also found that the best performing technology (considering capital and operating costs and environmental impacts, was Bus Rapid Transit. The BRT option was strongly opposed during the public

[7] Atlanta's Tax Allocation Districts operate on the same principles as tax increment financing.

outreach process, therefore, MARTA staff recommended a continuous loop of transit as the preferred alignment with the rail technology to be determined in the next phase of analysis (MARTA, 2007).

In January 2007, MARTA's board voted unanimously in support of a continuous loop of rail-technology transit for the BeltLine. Additional environmental and engineering studies will follow to identify specific technologies and operations characteristics for the system. Still, questions remain regarding the operating agency and source of funding for the transit component of the BeltLine. At an anticipated cost of over $800 million, it has been assumed that several sources of funding will be needed to complete the transit component (MARTA, 2007).

Besides the reports and studies mentioned here, there are numerous other reports on various aspects of the BeltLine.[8] Figure 2.8 illustrates a timeline of BeltLine activities.

[8] Atlanta Development Authority Work Plan: July 2006; Atlanta Development Authority Development Guidelines: November 2005; BeltLine Fiscal Impact Report: October 2005; Transit Feasibility White Paper: September 2005; Tax Allocation District Feasibility Study: March 2005; MARTA Inner Core Transit Feasibility Study: March 2005; Trust for Public Land Emerald Necklace Study: December 2004; Rails to Trails Atlanta Rail Corridors Assessment: April 2004.

Figure 2.8. BeltLine Timeline

* projected dates based on the plans and reports

Early 1990s – City of Atlanta proposes converting the rail to a cultural loop of tourist-oriented transportation, but the concept is not pursued

1999 – Georgia Tech student Ryan Gravel outlines the current BeltLine vision in his master's thesis

2001 – Then-City Councilperson Cathy Woolard becomes a vocal supporter of the BeltLine concept and, with Gravel, helps create Friends of the BeltLine

Dec 2004 – Trust for Public Land releases Emerald Necklace Study, outlining grand vision for the parks and trails

2004-05 – Atlanta Development Authority (ADA) Tax Allocation District Feasibility Study confirms that concept is feasible

2005 – MARTA concludes Inner Core Feasibility Study and begins Alternatives Analysis

2005 – Mayor Shirley Franklin creates BeltLine Partnership

Nov 2005 – ADA releases BeltLine Redevelopment Plan

Nov/Dec 2005 – Atlanta City Council, Fulton County Board of Commissioners, and Atlanta Public Schools Board of Education approve Tax Allocation District

Fall 2005 – Georgia Tech's CQGRD receives funding from Robert Wood Johnson Foundation to study the potential health impacts of the BeltLine

2006 – Land acquisition begins

June 2006 – ADA releases 5-year draft Work Plan

June 2006 – Bellwood Quarry, which will become the largest park in Atlanta, is purchased

July 2006 – BeltLine, Inc. created

July 2006 – Work Plan approved by City Council

Fall 2006 – MARTA releases preliminary results of BeltLine Alternatives Analysis

Nov 2006 – Moratorium issued by City on all development along the BeltLine before updated zoning requirements are enacted

2006-2010* – According to Work Plan:

Parks & Trails: park land acquisition & negotiations; master planning and conceptual design of new parks; design and engineer trails, spurs; construct trails and parks

Transit: acquire Right-of-Way; Environmental Impact Study, preliminary engineering; determine transit and trail alignment; determine governance and operating model for transit

Planning & Development: conduct planning activities; secure matching dollars for transportation; designate historic structures; develop brownfield remediation plans; promote projects in economic development focus areas

Jan 2007 – MARTA Board unanimously supports continuous loop of rail transit for the BeltLine

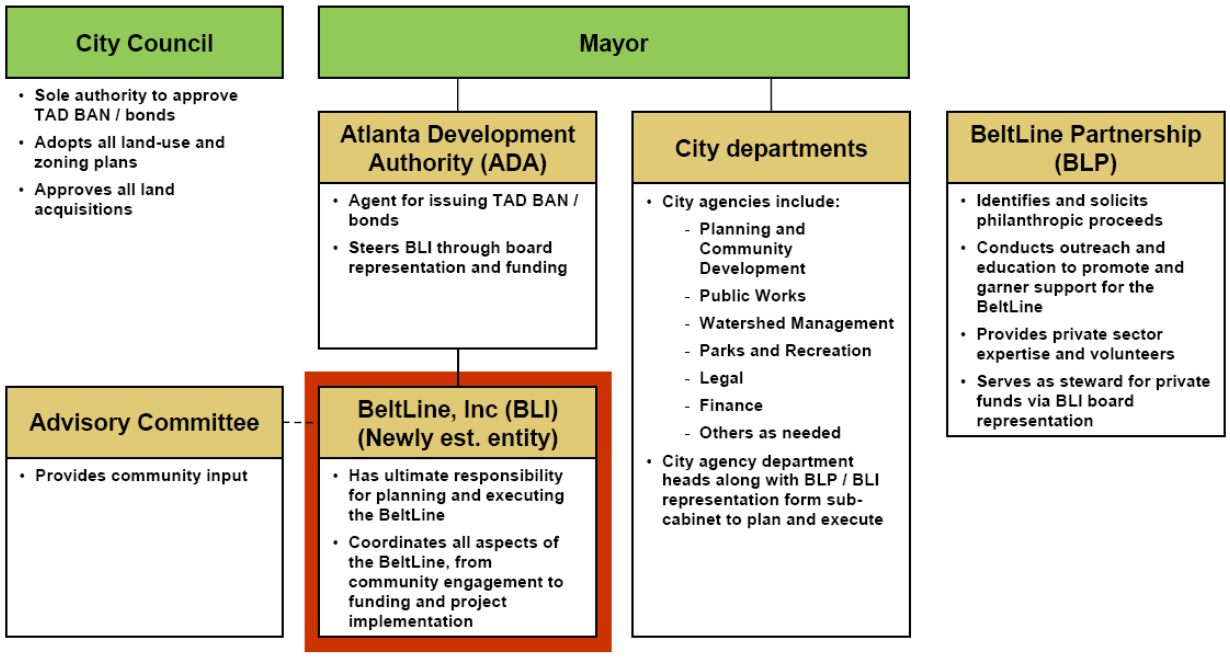
Feb 2007 – BeltLine zoning overlay district approved by City Council

2030* – BeltLine Completed

2.1.3 Actors

Moving the BeltLine forward has been a choreographed ensemble of many entities with a variety of roles. The critical decision-makers with control over some funding sources and regulatory and policy decision are the City of Atlanta City Council, the Fulton County Board of Commissioners, and the Atlanta Public School Board. Figure 2.9 illustrates the organizational relationship of many of the BeltLine actors.

Figure 2.9 Atlanta BeltLine Organizational Chart



SOURCE: Atlanta Development Authority, BeltLine Public Budgetary Work Plan, 7.5.06

The following describes several key partners and their involvement:

Atlanta BeltLine, Inc.: The non-profit group created by the Atlanta Development Authority (ADA) as a subsidiary to oversee planning and implementation of the BeltLine project. Together with the City of Atlanta, Atlanta BeltLine, Inc. will directly manage a number of key implementation activities. Its focus will include land acquisition; expenditures of TAD funding; generation of additional federal funding support; engineering; design and construction; and promotion of affordable housing opportunities. Atlanta BeltLine, Inc.'s board includes Mayor Shirley Franklin and Ray Weeks, chairperson of the BeltLine Partnership, as well as representatives from the Atlanta Public Schools Board of Education and the Fulton County Board of Commissioners.

Atlanta Development Authority: Created by the City of Atlanta to promote quality growth through comprehensive and centralized planning, ADA is a catalyst for residential and commercial economic development in Atlanta. ADA led the development of the *BeltLine Redevelopment Plan*, and the associated public involvement process.

BeltLine Partnership: Friends of the BeltLine, an early grassroots organization that was formed to promote that BeltLine vision, has been folded into this entity. A nonprofit organization created by Mayor Shirley Franklin that is the umbrella entity to build consensus and coordinate actions among the multiple organizations. BeltLine Partnership represents the interests of the community, including neighborhoods,

special-interest organizations, and the business community. The Partnership plays a lead role in fundraising, advocacy, and communications related to the project.

MARTA: The Metropolitan Atlanta Rapid Transit Authority (MARTA) provides public transportation via bus and rail transit. MARTA serves on average one-half million people each day. MARTA conducted a feasibility and locally preferred alterative study of the BeltLine. Although it is the largest transit provider in the region, no decision has been made in regard to who will develop or operate the BeltLine transit component.

Park Pride: Park Pride is a not-for-profit organization dedicated to involving the community in enhancing quality of life through the protection and improvement of parks and greenspace. Through community outreach, Park Pride is actively engaging citizens in creating a park system appropriate for a great city. Park Pride will work with communities to set the vision and design for BeltLine parks.

PATH Foundation: Founded in 1991, the PATH Foundation is a not-for-profit organization dedicated to developing a metro-wide trail system for Atlanta. PATH will be involved in the implementation of BeltLine trails.

Trust for Public Land: The Trust for Public Land (TPL) is a national, not-for-profit, conservation organization that conserves land for parks, community gardens, historic sites, rural lands and other natural places. TPL is currently purchasing lands for BeltLine parks. TPL will sell them to the city at cost as funds become available.

City of Atlanta Departments: Numerous City of Atlanta departments are involved in the development of the BeltLine, including the departments of Planning and Community Development, Public Works, Watershed Management, Parks, Recreation and Cultural Affairs, and others.

2.2 What is health?

Many people define health simply as the absence of disease—that living without cardiovascular or respiratory disease is to be healthy. Such a definition relegates health to the medical professions charged with protecting good health and overcoming or managing poor health. Unfortunately, such a narrow definition fails to recognize the multidimensional factors that influence health.

In 1941, American Public Health Association President C.E.A. Winslow recognized this distinction, writing:

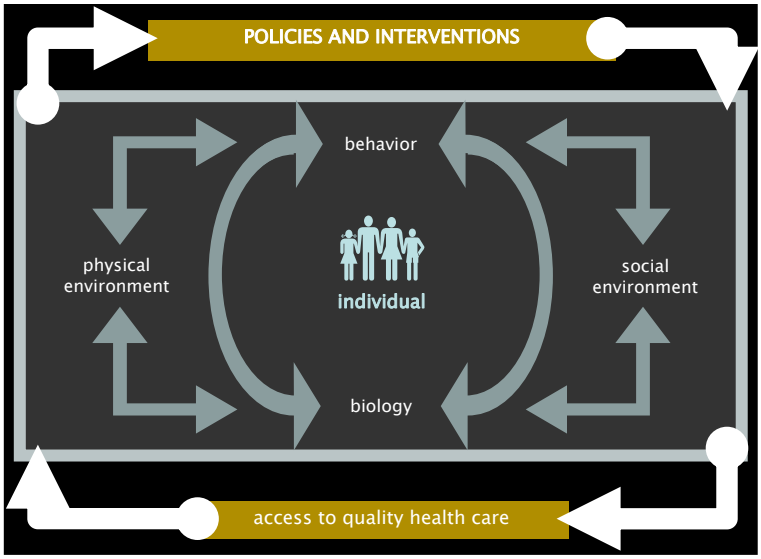
> Thirty years ago, our major emphasis was transferred from the physical environment to the individual. Today, we must shift our gaze from the individual back to the environment, but in a broader sense…to the whole social and economic environment in which the individual lives and moves and has his being (as quoted in Krieger and Higgins, 2002).

This broader context of health was repeated in the 1948 World Health Organization Constitution (WHO), which defines health as "a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity." This definition was further expanded in the 1986 Ottawa Charter for Health Promotion to include the ability of an individual or group "to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment."

Although these definitions of health have been criticized as "utopian" (Fehr, 1999), they are important in their recognition that numerous factors influence the ability to be healthy. Known as health determinants, these factors include biological, social and economic, environmental, lifestyle, services, and policy (see Figure 2.10

for a description of the components of each of these factors) (Ison, 2000). Science has shown that the most significant determinants of health are very personal, based on genes, sex, and age (the biological factors) and behavior, like diet, activity levels, sexual behavior, and the consumption of drugs and alcohol. Yet many external factors—the environment where we live, work, and go to school, and those social and economic factors, policies, and services shaping the environment—affect the second half of the definition of health, the ability "to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment." It is these health determinants which the BeltLine has the greatest ability to shape through specific policies and interventions.

Figure 2.10 Determinants of Health



Source: concept developed by Healthy People 2010, www.healthypeople.gov; visualization by CQGRD

2.3 How might the BeltLine impact health?

To examine the role the BeltLine can play in health it is necessary to explore the relationship between the built environment and health. The WHO definition presents a broad understanding of health, well beyond the typical domain of health services or health care. In doing so it argues for an equally broad understanding of the built environment. According to city planning and transportation expert Susan Handy and others, the built environment is the man-made surroundings that provide the setting for human activity, composed of land use patterns, transportation systems, and urban design (Handy, et al, 2002).

Land use patterns refer to the proximity and mixing of different land uses. In some cases the land use patterns are characterized by separated land uses. In other cases it is the mixing of these uses, like housing, schools, shopping areas, and offices. Land use patterns determine the proximity of different activity centers and spatially determine where we do things—work, school, shopping, and other activities.

The built environment is also composed of transportation infrastructure and services, including highways, streets, railroads, sidewalks, transit services, bike lanes, and multi-use trails. Transportation connects the activities that have been organized in the land use patterns. The transportation system informs the options people have for getting to different places.

Urban design, the third element of the built environment, is reflected in the land use patterns and the transportation infrastructure. Design determines how far a building is from the street and the height of that building. It dictates the size of a sidewalk and the placement of street trees and benches. Design instructs the character of the buildings and sets the overall aesthetic qualities of the constructed environment. Design also creates the interface between land use and transportation.

With this understanding of health and the built environment, it is logical to ask the question: How are they linked? To forge this link it is important to address both historic and contemporary issues.

The potential influence of the built environment on health was first recognized in the 19th century when growing cities were characterized by crowded, poorly designed and maintained housing (often in the form of tenement housing); chaotic public space;, and deficient sanitary systems. These circumstances facilitated the spread of infectious disease. The sanitary reform movement was in response to this public health crisis. The first tenement law was enacted in 1867. It set minimum plumbing standards and required improved ventilation. However, it was not until the New York City Tenement House Act of 1901 that housing conditions saw significant improvement. This law prohibited construction of new tenements on 25-foot wide lots, required improved sanitary conditions and access to light, and mandated changes in pre-existing tenements. The 1916 Zoning Resolution of New York City continued the use of regulations to create healthier living conditions by establishing building height and setback controls to improve access to natural light and ventilation. Most importantly, the 1916 Resolution called for the separation of what were seen as incompatible land uses (Hoch, et al, 2000). The separation of industrial and commercial centers from housing was based on studies that showed that the noise, odor, dust, and traffic generated by businesses were not supportive of public health and safety (Hoch, et al, 2000).

As evidence, in part, of the success of these interventions and improvements in technology, infectious disease was replaced by chronic disease as the leading cause of death in the United States in 2000 (Schilling, et al, 2005). Chronic diseases, such as cardiovascular disease, asthma, and diabetes, are more closely associated with lifestyle or environmental factors as opposed to infection. Chronic disease accounts for 7 of every 10 deaths and affects the quality of life of 90 million Americans (CDC, nd). Although chronic diseases are among the most common and costly health problems today, they are also among the most preventable. Adopting healthy behaviors such as eating nutritious foods, being physically active, and avoiding tobacco use can prevent or control the effects of these diseases.

This change in health issues—from infectious disease to chronic disease—necessitates a more nuanced understanding of the relationship between health and the built environment. Instead of simply identifying concrete environmental exposures, we must also understand how built environments affect behavior. Of course, the built environment is not the only thing that affects behavior and lifestyle. Culture, socioeconomic status, and personal preference are important factors in shaping lifestyle choices. Furthermore, urban environments are extremely complex, making it difficult to identify the specific determinants of health in a quantitative fashion.

In recent years research has suggested further linkages between the characteristics of the built environment and human health (Booth et al, 2005; Ewing and Kreutzer, 2006; Frank, 2004; Frank et al, 2004; Frank et al, 2003; Hinde and Dixon, 2005). This research has received national attention from both the public health and planning communities as well as from the popular media. It has associated the built environment with respiratory and cardiovascular health, fatal and non-fatal injuries, physical fitness, and mental health. While most research has not been able to show causality between elements of the built environment and chronic disease, it is evident that a relationship exists and is significant enough to warrant health consideration in projects and policy decisions.

Clearly, the BeltLine represents a significant change in Atlanta's built environment. It will directly affect over 6,500 acres of land, with indirect impacts reaching well beyond its boundaries. Therefore, the BeltLine has a role to play in the future health of the people who live, work, and go to school near it. A well-executed BeltLine can provide the stage for healthy living by providing people with the infrastructure and urban design to make walking, biking, and transit a viable transportation option; by providing parks and trails for physical activity and social interaction; by locating health promoting jobs and services, like grocery stores and health care centers, closer to where people live. Furthermore, the lessons learned in the development of the BeltLine can inform new development and redevelopment throughout the city and region.

2.4 What is a Health Impact Assessment?

While causal links between chronic health conditions and the built environment are still evolving, there is evidence that a relationship exists. Therefore, a need exists for tools and methodology to understand how changes in the built environment might affect public health. One such tool is a Health Impact Assessment, or HIA. Widely used in other countries and recently rising in use in the US, an HIA is often defined as "a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population" (WHO, Gothenburg Consensus, 1999).

Four values are integral to the HIA: democracy, equity, sustainable development, and the ethical use of evidence that emphasizes a rigorous structured analysis based on different scientific disciplines and methodologies (WHO, Gothenburg Consensus, 1999). HIAs explicitly consider social and environmental justice issues, adopt a multidisciplinary and participatory process, and use both qualitative and quantitative evidence as well as transparency in the process.

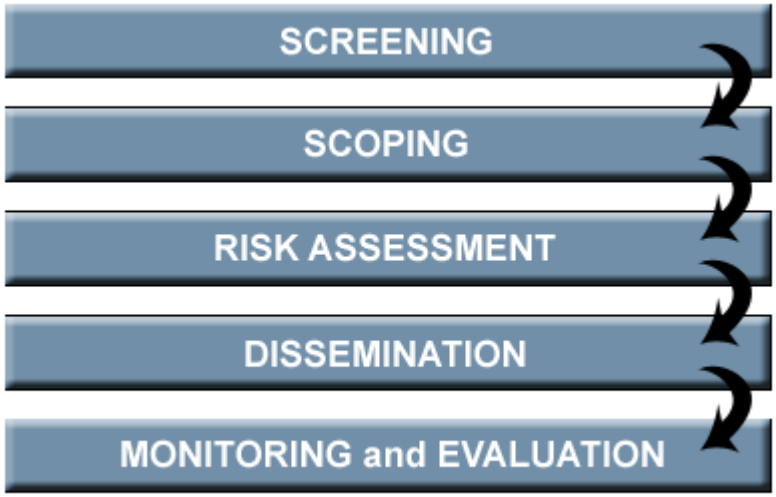
The HIA methodology is based on the social model of health accepted by various national and international agencies. There are three main types of HIAs. Prospective HIAs are conducted before a policy or project is implemented; retrospective HIAs take place after; and concurrent HIAs are simultaneous and are more common in project or policies that are implemented over an extended period of time. There is also a differentiation in HIAs based on the amount of time and effort, leading to distinctions between rapid, intermediate, and comprehensive assessments (Ison, 2000). Regardless of type, an HIA is intended to make health considerations part of the decision-making process. Furthermore, HIAs seek to link these impacts to a given segment of the population (for example, children, older adults, people living in poverty, or residents of a particular neighborhood).

The final product of an HIA is a set of evidence-based recommendations intended to inform decision-makers and the general public about the health-related issues associated with the project. The recommendations provide practical solutions that seek to magnify positive health impacts, and remove or minimize negative impacts.

While there are several different methodologies for conducting an HIA, they all share several critical steps which are illustrated in Figure 2.11. The steps include: screening, which determines whether or not there exists the potential for significant and unknown health impacts as the result of a policy, program, or project; scoping, which establishes the study area boundaries, identifies possible consequences, and determines a management approach for the HIA; appraisal, which considers the nature and magnitude of health impacts and the affected population; dissemination, which circulates the results of the HIA to decision-makers, individuals implementing the plan/policy, and community stakeholders; and monitoring and evaluation, which reviews the effectiveness of the HIA process and evaluates the actual health outcomes as a result of

the project or policy. Section 3 of this report enumerates the ways in which this methodology was applied for the BeltLine HIA.[9]

Figure 2.11 Steps in the HIA Process



Source: CQGRD

2.5 Why conduct the BeltLine HIA?

The BeltLine represents the most significant redevelopment opportunity for Atlanta since the 1996 Olympics. Furthermore, due to its scale and nature, this project will impact the lives of everyone living, working, and going to school near it. By applying the broad definition of health and using the methodology and analysis tools of the public health and city planning professions, the HIA provides an opportunity to undertake a holistic accounting of the potential health impacts of the BeltLine.

The HIA enables due recognition of the health impacts of the BeltLine on the affected population, especially disadvantaged and vulnerable groups. It provides a comprehensive public health analysis of the project to inform decision-makers. Usually, for such large projects, an Environmental Impact Statement (EIS) is the sole analysis that is used as a decision informing tool. An EIS does not explicitly consider negative health impacts, nor does it consider health promoting effects of a project, which may be considerable enough to tip the balance in a cost to benefit analysis. In addition, this HIA will create a body of work that can be used to inform public health and transportation practitioners and academics, citizens, developers, and elected officials throughout the country.

This HIA presents a broader understanding of the health consequences and benefits associated with policy and project development. The objectives of this research are to:

- Ensure the explicit consideration of the human health impacts of the proposed Atlanta BeltLine so that health costs are not unevenly distributed and all health promoting impacts are considered.
- Provide the basis for the consideration of health impacts in environmental and economic decision-making regarding the BeltLine.
- Provide guidance to improving the health status of communities surrounding the Beltline, thus reducing the burden on the health sector.

[9] For a thorough overview of health impacts assessments: Kemm, John, Jayne Parry, Stephen Palmer. 2004. *Health Impact Assessment: Concepts, theory, techniques, and applications*. Oxford University Press.

- Promote inter-sectoral research (planning, public health, medicine) as per the basic principles of an HIA.
- Create a body of data and information as well as structured performance measures that may inform future HIAs.
- Inform the level of public dialogue and policy development to be considered by elected officials, making clear, through better identification and description of the issues, the trade-offs to be made and consequences of decisions.
- Inform decision-makers about health outcomes so these outcomes are considered in broad-based policy decisions that require strategic thinking.
- Disseminate information through peer-reviewed journals, manuscripts, the Internet, magazines, and presentations at professional conferences.

The BeltLine HIA provides the opportunity to explicitly introduce health issues into the planning and decision-making process. Because the BeltLine is a large, highly publicized, and multifaceted project, this HIA has the potential to initiate a broader public discourse on ways that the built environment can influence health and quality of life.

Section 3: BeltLine Health Impact Assessment Methodology

The BeltLine Health Impact Assessment (HIA) adheres to the critical steps of any form of HIA. These include screening, scoping, appraisal, decision making, and monitoring and evaluation, as previously described. This section of the report provides an overview of each of these steps in relation to the BeltLine HIA.

3.1 HIA Project Team

To conduct an HIA of the Atlanta BeltLine, a team of researchers with expertise in public health and planning was assembled. The purpose of this multidisciplinary team was to have a better understanding of issues of city planning, including transportation, land use, economic development, environmental management, and public policy, as well as public health, including epidemiology and environmental health. Such a team was necessary to conduct an assessment of such a complex and large project. This team was responsible for the scoping and appraisal steps on the HIA.

3.2 Advisory Committee

An advisory committee was recruited to provide overall project direction, component-specific guidance, and analytical expertise. The committee was comprised of individuals that have expertise in one or more of the following areas:

- Health Impact Assessment
- Physical Activity and Public Health
- Transportation Planning
- City and Regional Planning
- Health Psychology
- Architecture and Community Design
- Computation and Analysis
- Quality of Life

The committee included:

- Adjo Amekudzi , Ph.D., associate professor, Georgia Tech, School of Civil and Environmental Engineering;
- Rajiv Bhatia, MD, MPH, director, Occupational and Environmental Health Section and Health Inequities Research Unit, San Francisco Department of Public Health;

- Susan Handy, Ph.D., associate professor, University of California at Davis, Department of Environmental Science and the Institute of Transportation Studies;
- Michael D. Meyer, Ph.D., professor, Georgia Tech, Department of Civil and Environmental Engineering;
- Jenny Mindell, Ph.D., clinical senior lecturer, University College London, Department of Epidemiology and Public Health;
- Anne Vernez Moudon, Ph.D., professor University of Washington, Seattle, Department of Architecture, Landscape Architecture, and Urban Design and Planning

See Appendix 1 for biographies of each committee member.

The advisory committee participated in two sessions; the first conducted by phone on July 6, 2006. During this session we discussed the project scope and approach and solicited recommendations on data sources and participation strategies. On September 7 and 8, 2006, members of the committee came to Atlanta to meet with the project team. During this meeting, team members presented preliminary results and sought constructive criticism of methodology and presentation of results.

3.3 Screening

Screening was conducted during the development of the grant proposal to Robert Wood Johnson requesting funding for a HIA. The process brought together members of the project team and other public health and planning researchers and students to apply their knowledge and experience to quickly assess whether the BeltLine had the potential to impact health and, if the answer was yes, then to decide if those impacts were well known.

Through a series of meetings, the group determined that the BeltLine did have the potential to impact health through noise, injury, physical activity, air quality, social capital, crime, accessibility, and gentrification. The group also decided that without further investigation it was impossible to understand the direction and magnitude of the impacts and which populations would bear the benefits and burdens. Finally, it was believed that the consideration of potential health effects could make the BeltLine a better project. Beyond the typical screening steps, the team recognized that the BeltLine represents the largest civic undertaking in the City of Atlanta since the construction of the MARTA rail system in the 1970s. For these reasons, the group recommended conducting an HIA.

3.4 Scoping

Scoping calls for a broad outline of the possible negative consequences and benefits and identifies the boundaries for appraisal, as well the steps for management. For the BeltLine HIA, the team used the scoping phase to identify the parameters of the assessment, the affected and most vulnerable populations, and potential key health impacts. Each of these elements is described below.

3.4.1 Parameters of the Assessment

To conduct the HIA, the team had to establish an understanding of the BeltLine, a project which has been evolving for several years, and boundaries for the project. This required the identification of the most coherent, descriptive, and publicly accepted vision of the BeltLine; determination of study area boundaries; and consideration of the temporal component of the project.

The Vision of the BeltLine: Since the BeltLine is such a large and complex project that will be constructed over a 30-year period, it was necessary to identify a document that best described the project and was largely accepted by decision-makers and the public. The Team identified the Atlanta Development Authority's *BeltLine Redevelopment Plan* (November 2005), which provides a framework for the parks, trails, transit, and redevelopment of the BeltLine area, as the basis for the HIA. The document was selected because it is the only conceptualization of the BeltLine that has been approved by local elected officials. In late 2005, the City of Atlanta Council, Fulton County Board of Commissioners, and Atlanta Public Schools Board each voted to adopt the *Redevelopment Plan* as the framework for a Tax Allocation District (TAD). The TAD is the source of public funding for the BeltLine, as described in section 2.1.2 of this report.

The *Redevelopment Plan*, as required by the Georgia Redevelopment Powers Law (Chapter 44, Title 36), specifies the boundaries of where funding can be collected and bond money spent (see Figure 2.7), provides evidence that the area meets the statutory requirements for the creation of a TAD, explains the proposed vision, establishes the area's current tax base and project the increase in the tax base after redevelopment, defines the types of costs that will be covered by TAD funding, and fulfills requirements of the Redevelopment Powers Law.

The Study Area: The project team recognized that the boundaries set by the TAD represent only a portion of the city that will be directly impacted by the BeltLine. Even though such a large project will likely affect people living both near and far, there is a critical group of people who will be most directly affected by the positive and negative effects of the BeltLine. Therefore, the team set about deciding an appropriate study area from which to conduct appraisals of potential health impacts.

The team decided to use a 0.5-mile buffer around the BeltLine TAD to create the BeltLine HIA study area. This study area was selected to reflect the fact that changes within the TAD will not only impact the surrounding communities, but will also be a catalyst for change outside the TAD. Furthermore, this buffer is consistent with the outer range of the generally accepted distance people will walk to access transit and parks (Talen, 1998). The use of this distance is also supported by a recent Atlanta-area study of park users that found that people walk approximately 0.5 miles to access parks.[10]

The study area is almost entirely within the boundary of the City of Atlanta. Less than 1 percent, or approximately 270 acres, is outside of the city (in unincorporated DeKalb County and the City of East Point). Due to the relatively small portion of the study area outside of the City of Atlanta, the team decided that the assessments would use only City of Atlanta data. It should be noted that the city, and the study area, is part of two counties, Fulton and DeKalb.

While the TAD consists of 6,545 acres, or approximately seven percent of the City of Atlanta, the HIA study area equals about 30,800 acres, thus including over 35 percent of the city's land area. Approximately 11,000 acres (or 35.8 percent) of the study area are used for residential purposes (see Table 3.1). According to the 2000 Census, there were approximately 88,250 housing units in the study area. There are approximately 232,500 jobs in the study area according to 2000 figures from the Atlanta Regional Commission.

Table 3.1 Study Area Land Use Characteristics

Land Use	Acreage	Percent of Total
Residential	11,045	35.8%
Commercial	3,609	11.7%
Industrial	2,138	6.9%
Institutional	5,460	17.7%

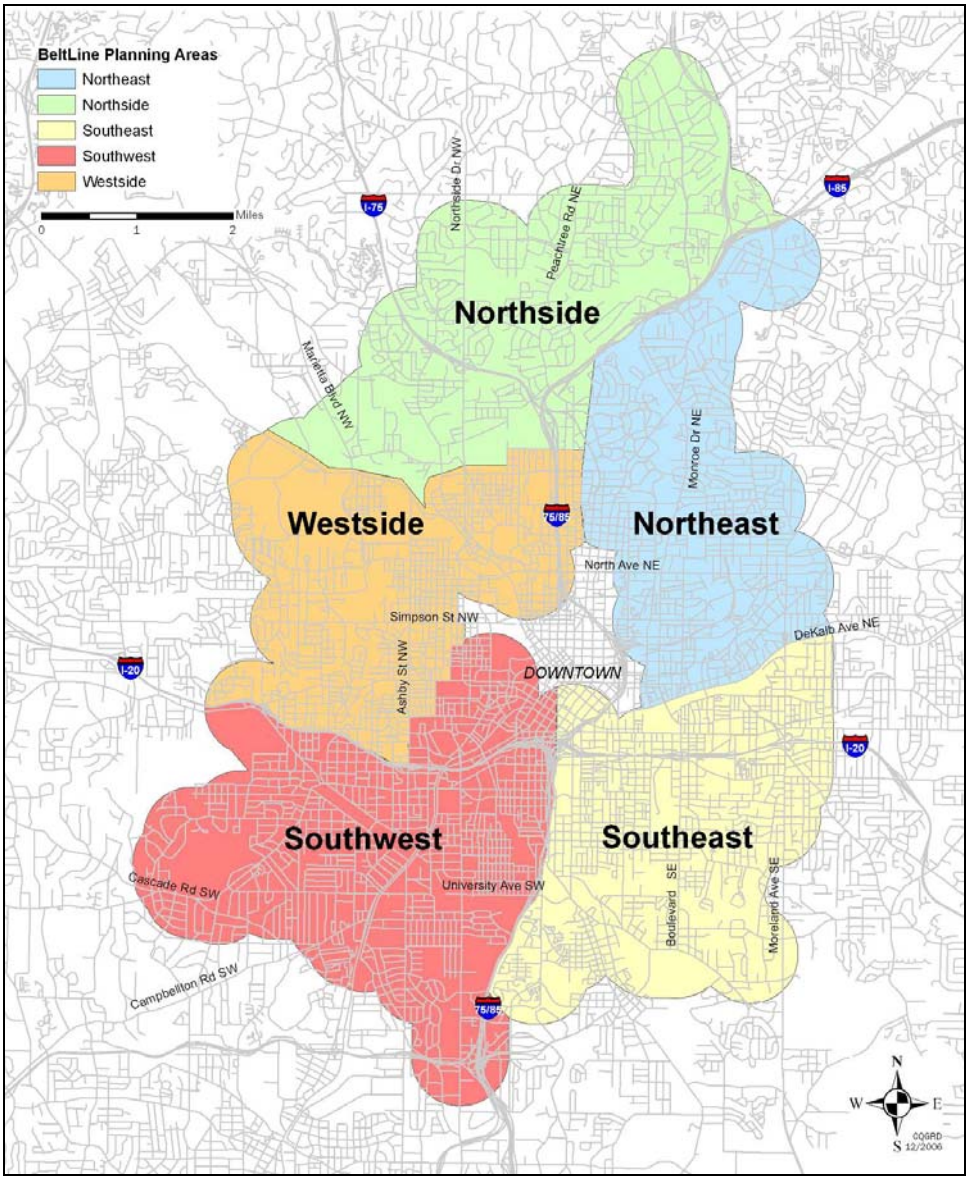
[10] An ongoing study entitled Neighborhood Parks and Active Living (NPAL) led by Emory University's Dr. Karen Mumford and colleagues and funded by the Robert Wood Johnson Foundation.

Utility	679	2.2%
Unknown	1,789	5.8%
ROW/Other	6,107	19.8%
TOTAL	30,826	100.0%

Source: Fulton and DeKalb County Tax Parcels, 2005

To accurately study the different segments of the BeltLine, the team used an approximation of the Planning Areas defined by the City of Atlanta Planning Bureau, including the Northside, Northeast, Southeast, Southwest, and Westside. These planning areas are representative of existing neighborhood boundaries and are thus useful for understanding the potential health implications of historically defined areas. Figure 3.1 illustrates the BeltLine HIA study area divided by the Planning Areas being used by the city.

Figure 3.1 BeltLine HIA Study Area and Planning Area Boundaries



3.4.2 Affected and Most Vulnerable Populations

As of 2000, more than 213,000 people lived in the BeltLine Study Area (U.S. Census, 2000). As Table 3.2 shows, the study area population is predominantly non-white, largely of working age, with a per capita income of nearly $24,000. Nearly 23 percent of the population lives below the poverty level and almost 25 percent of the housing units do not have a vehicle available. An additional 101,000 people are projected to be living in the area by 2030 (ARC, 2006). The team did not attempt to predict the composition of the future population.

Table 3.2 City of Atlanta and Study Area Population Profile

	City of Atlanta	Study Area
Total Population	416,474	213,920
White	138,352 (33.2%)	80,865 (37.8%)
Non-white	278,122 (66.8%)	133,055 (62.2%)
Aged 0-5	26,666 (6.4%)	13,535 (6.3%)
Aged 6-17	66,338 (15.9%)	29,828 (13.9%)
Aged 18-64	282,935 (67.9%)	152,591 (71.3%)
Aged 65+	40,535 (9.7%)	17,966 (8.4%)
Below Poverty Level	95,743 (23.0%)	48,904 (22.9%)
Rate of Carless Housing Units	21.2%	24.6%
Per Capita Income	$25,772	$23,925.38

SOURCE: U.S. Census Bureau, 2000 Census, SF1 and SF3

A more precise examination of the affected population is possible by assessing the differences between the five planning areas defined above. As Table 3.3 shows, the North and Northeast planning areas have similar populations, while the Southeast, Southwest, and West planning areas share many of the same characteristics. The populations of the North and Northeast planning areas are mostly white, with approximately 80 percent of the population of working age and no more than 13.6 percent poverty and 16.1 percent carless housing units. In comparison, the population of the Southeast, Southwest, and West planning areas are predominately non-white, with roughly 65 percent of working age and at least 26.8 percent of the population living below poverty, and a carless housing unit rate of 32.6 percent or more.

Table 3.3 Population Profile by BeltLine Planning Areas

	Northside	Northeast	Southeast	Southwest	Westside
Total Population	36,872	43,149	39,711	51,080	43,057
White	28,686 (77.8%)	30,137 (69.8%)	10,713 (27.0%)	1,989 (3.9%)	9,325 (21.7%)
Non-white	8,186 (22.2%)	13,012 (30.2%)	28,998 (73.0%)	49,091 (96.1%)	33,733 (78.3%)
Aged 0-5	1,857 (5.0%)	1,806 (4.2%)	3,527 (8.9%)	3,830 (7.5%)	2,513 (5.8%)
Aged 6-17	2,390 (6.5%)	2,719 (6.3%)	7,177(18.1%)	10,558 (20.7%)	6,979 (16.2%)
Aged 18-64	29,243 (79.3%)	35,642 (82.6%)	26,103 (65.7%)	32,081 (62.8%)	29,479 (68.5%)
Aged 65+	3,381 (9.2%)	2,982 (6.9%)	2,904 (7.3%)	4,611 (9.0%)	4,086 (9.5%)
Below Poverty Level	4,200 (11.4%)	5,879 (13.6%)	12,153 (30.6%)	15,109 (29.6%)	11,548 (26.8%)
Rate of Carless Housing Units	12.0%	16.1%	32.6%	34.5%	38.4%
Per Capita Income[11]	$47,055	$39,527	$15,009	$12,218	$10,604

SOURCE: U.S. Census Bureau, 2000 Census, SF1 and SF3

[11] Per capita income was calculated using the following method: The total population for each block group was adjusted to reflect the percentage of the block group that was in the area. This adjusted population was then multiplied by the reported per capita income to get an aggregate income for that block group. All aggregate incomes for all block groups were then summed and divided by the total adjusted population for the area in question. This yields per capita income.

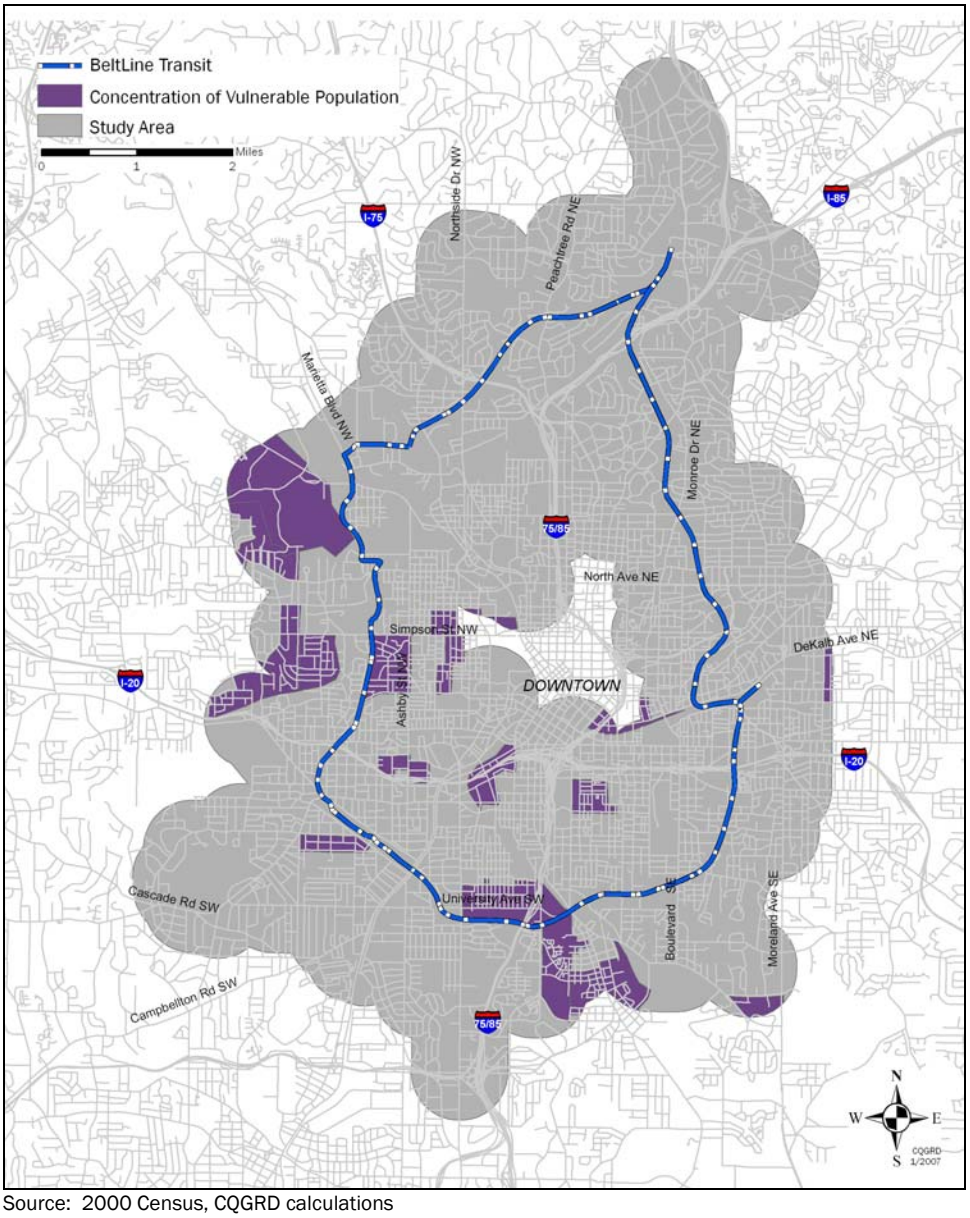
A priority of the BeltLine HIA is the assessment of potential health impacts upon the most vulnerable members of the study area population. For the purposes of the HIA, the potentially vulnerable populations have been defined as individuals in one or more of the following categories:

- Low economic status
- Children
- Older adults
- Renters
- Carless

The focus on these groups reflects research that has shown that underserved populations tend to be minority and/or of lower economic status (Gordon-Larsen, et al, 2006; Huston, et al, 2003; Parks, et al, 2003 ; Taylor, et al, 2006; Wilson, et al, 2004). Furthermore, the health of younger and older populations are more sensitive to environmental conditions. Renters can also be particularly vulnerable in areas of intense redevelopment, where increases in property values can encourage landlords to sell properties, significantly raise rents, or convert apartment into condominiums. The result of which can be displacement of existing residents. The pool of renters may be composed of a variety of types of households, from low-income families to young professionals just getting started to older adults on fixed incomes. Finally, access to a motor vehicle, especially in an auto-oriented city like Atlanta, can create hardships by preventing reasonably convenient and safe access to necessary goods, services, and employment opportunities.

For the BeltLine HIA, areas with the highest concentration of vulnerable populations were identified using six indicators: non-white population, population in poverty, population under 18 years old, population 65 or older, number of carless housing units, and number of rental housing units. Each of these indicators were converted to a percent and then multiplied together. This yielded a vulnerability score of between 1 (most vulnerable) and 0 (least vulnerable). The top 10 percent of these census tracts were then identified as locations of the most vulnerable populations in the study area. Figure 3.2 shows the census tracts with the highest vulnerability scores.

Figure 3.2 Census Tracts with Most Vulnerable Populations



Source: 2000 Census, CQGRD calculations

To serve as a benchmark of existing health conditions for the HIA study and future research the team utilized two data sources, mortality data and the Behavioral Risk Factor Surveillance System, to characterize the health status of the population currently living within the BeltLine Study Area. The purpose of this effort was to compare the health status of the populations living in planning areas of the BeltLine and the study area against the population of the City of Atlanta, Fulton County, the state, and the nation to identify potential disparities. The results of this analysis follow.

Mortality data:[12] The team identified the following conditions and causes of death as potentially influenced by the BeltLine:

- Heart disease

[12] Mortality data was compiled and analyzed by Sheryl Lyss, M.D., MPH, Fulton County Department of Health and Wellness.

- Malignant neoplasm (cancer)
- Cerebrovascular disease (stroke)
- Diabetes mellitus
- Homicide
- Motor vehicle accidents
- Suicide

We also included data on HIV, influenza and pneumonia[13] as reference points.

We obtained mortality data at the state, county, and census tract level for the years 2000–04 to determine the mean mortality rate for the 5-year period. Vital statistics data were accessed through OASIS, a standardized health data repository of the Georgia Department of Human Resources, Division of Public Health. Mortality rates (per 100,000 population) at the state and county level were obtained for each year and then averaged to obtain a mean mortality rate for the 5-year period.[14] The results are shown in Table 3.4

Table 3.4 Crude Death Rate (per 100,000 Population) from Selected Causes of Death

Cause of Death	BeltLine Study Area, 2000–04	City of Atlanta, 2000–04	Fulton County, 2000–04	State of Georgia, 2000–04	United States, 2002*
Heart disease	186.6	206.5	174.1	203.3	241.7
Malignant neoplasms	145.0	170.6	149.3	163.2	193.2
Cerebrovascular disease	44.4	51.3	42.1	50.3	56.4
HIV	43.5	39.8	25.3	8.3	4.9
Homicide	21.7	23.0	16.4	7.9	6.1
Diabetes mellitus	19.6	23.8	17.1	18.4	25.4
Influenza and pneumonia	18.3	21.1	18.3	18.6	22.8
Motor vehicle accidents	11.3	11.8	11.5	16.8	15.7
Suicide	11.1	9.6	9.3	10.7	11.0
Asthma	3.2	2.5	1.9	1.4	1.5

* Kochanek KD, Murphy SL, Anderson RN, Scott C. Deaths: Final Data for 2002. National Vital Statistics Reports, 53(5), October 2004.

Source: OASIS, a standardized health data repository of the Georgia Department of Human Resources, Division of Public Health; HIA Team calculations

[13] For mortality data, influenza and pneumonia are often analyzed as a single, combined category.

[14] The City of Atlanta was defined using the census tracts that closely resemble the official city boundaries. For the purposes of these health status analyses, the BeltLine Study Area and its component planning areas was defined as comprising those census tracts whose geographic center was within the boundaries of the respective study area. Mortality rates for the City of Atlanta, the BeltLine Study Area, and the geographic subdivisions of the BeltLine Study Area were derived as follows:

(1) The number of deaths within each geographic area from each selected cause between 2000 and 2004 was obtained from OASIS. The mean number of deaths per year was determined by summing the yearly deaths and dividing the total deaths by 5 years.

(2) The population for the geographic areas was obtained from the 2000 Census and the Atlanta Regional Commission population estimates for the intercensal years. Because tract-level population data were not available for the years 2001 and 2002, we calculated the mean population size as follows:

> Mean population (2000–04) = [2 * (year 2000 population) + 2 * (year 2003 population) + year 2004 population] / 5

(3) Mean mortality rates were then calculated by dividing the mean number of deaths over 5 years by the mean population size.

As Table 3.4 shows, the mortality rates due to HIV and homicide are much higher for the BeltLine Study Area and the City of Atlanta than for Fulton County, the State of Georgia, or the United States overall. Similarly, the mortality rate due to asthma is much higher for the study area and the City of Atlanta than for the county, state, or country overall. Mortality rates from motor vehicle accidents for the study area, city, and county were less than for the state and country overall. Study area mortality rates for heart disease, malignant neoplasms, cerebrovascular disease, and diabetes did not differ dramatically from the county or state-wide rates; however, all were less than the respective national averages.

Table 3.5 shows that mortality rates vary tremendously across planning areas of the BeltLine Study Area, indicating significant health disparities. Mortality rates for heart disease, cancer, homicide, diabetes, motor vehicle accidents, and asthma were higher for the Southeast, Southwest, and Westside than for the Northside or Northeast; rates for many causes of death were greatest in the Southwest. Of note, the black population constitutes the majority of residents in the Southeast (73.0 percent non-white), Southwest (96.1 percent non-white), and Westside (78.3 percent non-white); whereas whites are the majority of residents in the Northside (77.8 percent white) and Northeast (69.8 percent white). Nationally, mortality rates are higher among blacks than whites for HIV, homicide, diabetes, and asthma, but not for heart disease, cancer, or motor vehicle accidents (Kochanek, et al, 2004).

Table 3.5 Crude Death Rate (per 100,000 Population) from Selected Causes of Death, Planning Areas of the BeltLine Study Area, 2000–04

Cause of Death	Northside	Northeast	Southeast	Southwest	Westside
Heart disease	159.1	131.6	178.8	236.5	209.8
Malignant neoplasms	115.1	96.9	154.4	183.9	163.2
Cerebrovascular disease	41.7	32.2	34.8	58.7	48.9
HIV	10.6	48.7	45.3	52.6	50.7
Homicide	10.6	6.3	25.5	30.8	32.3
Diabetes mellitus	11.7	11.0	21.5	27.2	24.0
Influenza and pneumonia	22.3	17.4	13.4	20.8	17.1
Motor vehicle accidents	6.5	9.3	15.7	12.5	12.0
Suicide	11.7	16.5	12.2	8.6	6.9
Asthma	*	*	5.2	4.7	4.6

* Number of deaths in the planning areas was too small to be reported.

Source: OASIS, a standardized health data repository of the Georgia Department of Human Resources, Division of Public Health; HIA Team calculations

We were unable to derive mortality rates for the various demographic subgroups of the BeltLine Study Area because estimates of the population sizes for sex, race, and ethnicity subgroups of census tracts were not available for intercensal years. This is due to the fact that the City of Atlanta has experienced pockets of significant population change over the 2000–04 time period, making the use of the proportions from the year 2000 census inappropriate for later years.

We could not compare study area, county, or state mortality rates with national mortality rates over the same time period because the National Center for Health Statistics does not conduct analyses of mean death rates over this 5-year period; thus we have compared rates within Georgia to the national mortality rates for 2002, the middle year of the time period. Importantly, reported rates are crude mortality rates that have not been adjusted for age or for other demographic factors; therefore, differences in mortality rates across areas may be due in part to differing age distributions. For this reason, the project team did not assess statistical significance of theses differences. Finally, we have estimated both the number of deaths and the population size by defining the study area and its planning areas for this analysis according to census tracts whose centroid was within the defined boundaries; nonetheless, we believe that the planning areas as defined are fairly representative of the true geographic subareas.

Behavioral Risk Factor Surveillance System (BRFSS) data: The Behavioral Risk Factor Surveillance System (BRFSS) is a telephone health survey conducted by health departments in all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. Information on health risk behaviors, health practices, and health care access and use is collected through telephone surveys on persons aged 18 years and older. In Georgia, BRFSS data are available at the county level, but not at the census tract or other sub-county level.

The HIA team identified the following measures as potentially influenced by the BeltLine development:

- Obesity
- High blood pressure
- Coronary heart disease
- Diabetes
- Asthma
- Physical inactivity
- Low fruit and vegetable consumption
- Mental distress
- Binge drinking

For these measures, we obtained estimates of the population proportion for the county and for the state, stratified by race, from the Georgia Department of Human Resources, Division of Public Health (Bryan, et al, 2005). In order to help contextualize the data, we also obtained estimates of the proportion of the population without any health insurance.

Table 3.6 Proportion of Population Reporting Selected Health Characteristics*, Georgia Behavioral Risk Factor Surveillance System, 2000–05**

	Fulton			Georgia		
	Overall	White	Black	Overall	White	Black
Obesity	20.3	13.4	29.7	24.1	21.5	31.4
High blood pressure	21.6	19.0	26.5	27.3	26.7	31.5
Coronary heart disease	2.7	3.5	2.3	3.8	4.5	2.5
Diabetes	4.8	3.0	7.5	7.4	6.6	9.6
Asthma	7.1	4.9	10.4	7.1	6.9	7.7
Physical inactivity	22.0	15.6	29.5	26.5	24.0	31.8
Low fruit and vegetable consumption	74.8	72.8	76.6	77.2	76.7	79.1
Mental distress	17.7	13.4	22.5	17.9	17.3	19.6
Binge drinking	14.9	17.9	11.2	12.3	12.9	10.7
No health insurance	15.5	6.3	24.6	15.8	12.2	21.2

* Definitions of measures:

- Obesity: adults with a body mass index (BMI, as determined by reported height and weight) of 30 or higher
- High blood pressure: adults who have ever been told by a doctor, nurse, or other health professional that they have high blood pressure
- Coronary heart disease: adults who have ever been told by a doctor, nurse, or other health professional that they have angina or coronary heart disease
- Diabetes: adults who have ever been told by a doctor that they have diabetes
- Asthma: adults who have ever been told by a doctor, nurse, or other health professional that they have asthma and still have asthma
- Physical inactivity: adults who did not participate in any physical activities or exercise during leisure time in the past 30 days
- Fruit and vegetable consumption: adults who consume <5 servings of fruits or vegetables per day
- Mental distress: adults who self-report that they have been under stress, have been depressed or have had problems with emotions for 14 days or more within the past 30 days
- Binge drinking: adults who have had 5 drinks or more on a single occasion during the past 30 days
- No health insurance: adults who report no health insurance

** Some measures were not collected in all five years.

As these data show, there are tremendous disparities in health status between the black and white populations of the state and particularly of the county. On most of these measures, adults in Fulton County fare better than their counterparts in the other 17 health districts of the state. However, for three measures, the county overall ranked in the lower half of the health districts: asthma (11 of 18), binge drinking (17 of 18), and lack of health insurance (10 of 18). Compared to whites in other districts, whites in Fulton County fared particularly poorly only with regard to binge drinking (17 of 18). However, blacks in Fulton County fared worse than blacks in most other districts on 4 measures: asthma (17 of 17 districts reporting statistics for blacks), mental distress (12 of 14), binge drinking (13 of 16), and lack of health insurance (16 of 17). Health disparities in the district are further evidenced by the finding that for three of these four measures (asthma, mental distress, and lack of health insurance) whites in Fulton County ranked better than whites in any other health district in the state.

A few limitations of the use of BRFSS data to describe the health status of the BeltLine Study Area population are noteworthy. First, BRFSS county-level data may not be representative of the BeltLine study population. Fulton County includes urban, suburban, and rural areas and only approximately one-quarter of the county population lives within the BeltLine Study area. Furthermore, BRFSS data do not provide estimates of health behaviors or health status of children or of households without telephones or households that use cellular telephones only. Second, these data are based on self-reporting. Third, the high proportion of blacks in the county without health insurance may mean that many have poor access to health care. Since many of the measures of health status are based on having been told of a condition by a health care professional (e.g., high blood pressure, coronary heart disease, diabetes, asthma), these estimates of such measures may particularly underestimate the true prevalence of these conditions.

3.4.3 Identification of Key Issues

The team used a multifaceted approach to identify the key issues and conditions that may result from the BeltLine that have the potential to impact public health. The purpose of this approach was to ascertain: (1) those issues that concern the public most, (2) those issues that will have the greatest impact, based on either the severity of impacts or the number of people impacted, and (3) those issues that may affect the most vulnerable populations. This approach involved a content analysis of newspaper coverage, the development of logic frameworks, and several strategies to promote public education and involvement in the process. These elements are outlined below.

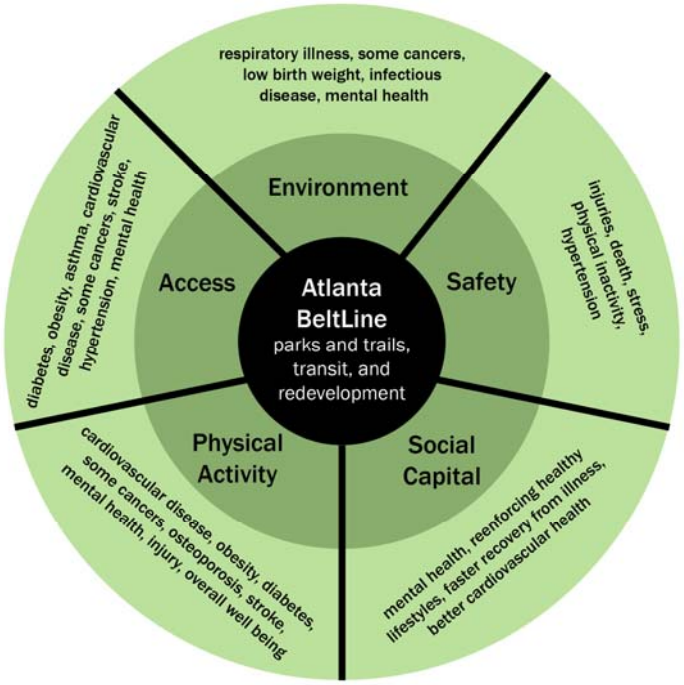
Content analysis of newspaper coverage: To collect information on the public's and elected officials' perceptions and issues regarding the BeltLine, the team conducted a content analysis of the *Atlanta Journal-Constitution, the Atlanta Business Chronicle, Creative Loafing,* and *The Story* between April 2002 and October 2005. The analysis showed that the overall reaction to the BeltLine is very positive. Furthermore, the articles made several references that linked greenspace and transit to improved health. A notable absence in the reporting were concerns about social equity and residential displacement. See Appendix 2 for a summary of newspaper coverage.[15]

Development of a logic framework: At the early stages of the project the team developed a table of potential health impacts associated with various elements of the BeltLine and a logic framework. The purpose of these tools is to identify assumptions, indicators, and possible correlation between the BeltLine vision, intermediary effects, and potential health outcomes. Over the course of the project these tools were adapted to reflect new information and deeper understanding of

[15] A similar analysis of meeting minutes of the City of Atlanta City Council, MARTA, Atlanta Development Authority, City of Atlanta Neighborhood Planning Units, and Sierra Club was initiated, but difficulties in accessing minutes made the task cumbersome and time-consuming. A preliminary assessment indicated results similar to the newspaper analysis; therefore, the meeting minutes analysis was discontinued to make better use of the team's limited resources.

relationships between the BeltLine and health. Figure 3.3 illustrates the conceptual paths that products of the BeltLine to more specific societal, environmental, and individual impacts, ultimately to potential health outcomes. The arrows reflect only potential correlation between elements that the BeltLine will influence (e.g. urban form, population and economic growth, transportation systems, property values, public commitment, and private investment) to potential health outcomes.

Figure 3.3 Logic Model Framework



As the diagram shows, the products of the BeltLine include more than parks, trails, transit, and redevelopment, and the potential impacts of the BeltLine are numerous and complex. The team recognized that decisions about parks and trails affected transit, transit affected redevelopment, redevelopment affected greenspace, and so on. This realization brought the team to the conclusion that to assess the project it would be necessary to study the project as a whole and not its component parts individually Therefore, the potential health impacts that are included in section 4 examine impacts, like physical activity, across all components of the project.

Public involvement and education: A critical part of scoping is public involvement, outreach, and education. For the BeltLine HIA, the goals of outreach were to (1) announce the project, (2) educate on HIA and health, (3) identify potential health impacts, (4) get information (data, deadlines, decision points, work plans, etc), and (5) identify recommendations.[16] Four primary groups were identified, including decision-makers, implementers and experts (public agencies and private developers who will be designing and building the BeltLine), study area residents and businesses, and academics and practitioners. The goals were accomplished through presentations to elected officials and community members, Web pages, e-mail notices, newspaper articles, and a survey. More information about the public involvement and education strategy is available in Appendix 4.

Survey: CQGRD also conducted a survey of people who live, work, and/or go to school near the BeltLine. The purpose of the survey was to ensure that the health concerns of those that will be most affected by the BeltLine were considered within the scope of the BeltLine HIA. The survey consisted of 23 questions, both open- and closed-ended, to gauge respondents' opinions on the current state of health and the built environment and their perceived potential health effects of the BeltLine project. The survey was administered through a website, while over 1,000 paper copies of the survey were distributed through the neighborhood planning units of the affected neighborhoods. Four hundred forty-six respondents completed the survey online, while 43 completed and returned paper copies.

[16] Subsequent to the release of this report, CQGRD will continue the public involvement and education phase to provide information to stakeholders and decision-makers and to share lessons with academics and practitioners.

Preliminary results find that of the nearly 500 respondents, over 70 percent believe that the BeltLine will have a positive effect on their health. Those who identified potential positive health impacts (382 respondents) mentioned more space for walking, jogging, and biking (49 percent); more pedestrian activity and less car dependency (29 percent); and better air quality (22 percent) as potentially having a positive impact on their health. Those who identified potential negative health impacts (77 respondents) attributed them to increases in congestion (42 percent), density (36 percent), air pollution (32 percent), and noise (18 percent). Additionally, 74 percent (out of 463 respondents) either disagree or strongly disagree that their community currently has good air quality and 63 percent (out of 455 respondents) either agree or strongly agree that the BeltLine will improve air quality in their community. Initial project scoping had focused on the noise, traffic, and density impacts, but had not placed as much emphasis on the issue of air quality. The importance of that issue on the survey led to a deeper study of the health effects of the BeltLine with respect to air quality. One impact that was not noted by survey respondents, but was included in the initial project scoping, was the health effects of any potential gentrification, or more specifically residential displacement, that might occur due to the construction of the BeltLine.

While the survey respondents were not fully representative of the population mix of the BeltLine Study Area, the survey results did provide an additional avenue through which public perception of the potential health effects of the BeltLine could be measured and integrated into the overall health impact assessment. The survey questionnaire results can be found in Appendix 4.

Through this process the HIA Team identified several critical issues that have potential to impact the health of the study area population. These include:

- Access and Social Equity
- Physical Activity
- Safety
- Social Capital
- Environment (including Air Quality, Noise, and Water Management)

The team researched and conducted analysis on these topics. The results and recommendations appear in Section 4 and 5.

3.5 Appraisal of Health Impacts

Appraisal requires characterizing the nature and magnitude of both harmful and beneficial impacts of the project and determines if they are distributed disproportionately over the affected population. Appraisal consists of profiling the affected communities, analysis, identifying and characterizing potential health impacts, and reporting on the results. Because the appraisal phase explores numerous issues, a detailed outline of methodologies is outlined in Sections 4 and 5.

3.6 Next steps

It is recommended that continuous monitoring of the Beltline Project be conducted to gauge the accuracy and the appropriateness of the impact measures used in HIA. This is not currently in the scope of the BeltLine HIA due to funding limitation, but will be addressed again at the culmination of the project.

Section 4: Overarching Issues

The BeltLine has the ability to propel significant change in the City of Atlanta. As such, there are several issues that transcend the specific health impacts that are addressed in detail in subsequent sections and, instead, address the overarching goal of well being, quality of life, and urban sustainability. Many of these issues are in response to the challenges of implementing a large and multi-faceted project, including:

- timing of the various components of the BeltLine,
- integration of the BeltLine,
- prioritization of people,
- design that accommodates all users, and
- processes that substantively involve all stakeholders and coordinate efforts.

This section examines these issues and provides recommendations. Several specific health impacts are discussed in this section with references to subsequent sections for more detailed information.[17]

4.1 Timing of the BeltLine

The BeltLine faces the challenge of implementing a unifying revitalization and redevelopment plan, but with a combination of public- and private-sector investment. The difficulty arises because private entities operate within a much different process and timeframe than public entities. In part, this disconnect is exacerbated by the use of the Tax Allocation District (TAD), which incrementally raises money over the 25-year bond period, and results in incremental public improvements.[18] Private interests are not restricted by such a long-term funding mechanism.

The result of the differences in public and private progress is a temporal mismatch, where the publicly funded parks and transportation improvements necessary to make the new development livable for both new and existing residents and businesses lag behind private development. For example, while the City of Atlanta, BeltLine, Inc., BeltLine Partnership, and partners have all undertaken tremendous efforts toward the realization of the BeltLine, including the public workshops and the purchase of land for the largest BeltLine park (Westside Park), little on-the-ground change initiated by the public has occurred. In contrast, at the time of publication, approximately $1.6 billion in private investment has been directed to 50 projects according to BeltLine, Inc.[19] In fact, the fast pace of development resulted in the city enacting a short-term development

[17] Care was taken to closely follow the BeltLine progress, but the complexity and constantly evolving nature of the BeltLine mean that some commentary and analysis may not reflect the most current conditions. Therefore, actions may have already been taken on some issues and recommendations that are not reflected in this report.

[18] While other sources of funding are being acquired for the project—philanthropic donations, opportunity bonds, and federal funds—the TAD represents the overwhelming majority of funding for the BeltLine.

[19] As reported by BeltLine, Inc. staff at BeltLine Quarterly Meeting, 3.20.07.

moratorium (from November 2006 to February 2007) to give the city time to develop and adopt BeltLine Overlay District Regulations for land development within the BeltLine Planning Area.[20]

While some delay is inevitable, too great a disparity between the work of the two sectors can have health and more broadly quality of life implications. For example, with the existing population, the City of Atlanta already has a shortage of park space. With rapid private development quickly increasing the number of residential units, this deficiency may be exacerbated (see Sections 5 and 6 for details on park allocations and specific health impacts of opportunities for physical activity). Furthermore, new residential development is planned to occur in areas that were previously industrial sites that did not require extensive neighborhood infrastructure systems (sidewalks, parks, and other public facilities). Although developers are responsible for construction of segments of such systems, the result is often a disjointed system of sidewalks that will require public intervention to function as an integrated network. Furthermore, the roads servicing these areas are typically designed to support industrial land uses, instead of multimodal and multipurpose transportation needs. Improvements will be needed to make travelways convenient and safe for a more diverse group of users.

Recommendation

- **Make health protection and promotion a consideration in public funding priorities and timing.** Direct initial public "bricks-and-mortar" BeltLine investments to projects, like trails, parks and transportation improvements that link the BeltLine TAD to existing parks, transit, and goods and services. Such improvements can better utilize existing facilities until additional, and more costly, projects are developed over a longer timeframe. Focus on transportation improvements that support alternative travel modes (including links to MARTA) and improve safety for pedestrians in rapidly growing areas.

4.2 A Well Integrated BeltLine

The rail corridor that will become the multi use BeltLine has historically divided people and places. The new vision for this corridor has the opportunity to reintegrate many neighborhoods. If such an environment is created several health benefits can be realized, including increases in physical activity (Section 6), improved social capital (Section 8), and improved access to health promoting goods, services, and amenities (Section 5). To create an integrated BeltLine, attention will need to be directed at the points of intersection from design, implementation, operations, and policy perspectives. A well integrated BeltLine means two things:

(1) its components—trails and parks, transit, and redevelopment—work well together and

(2) the entirety of the BeltLine becomes woven into the fabric of the city and region.

Integrated BeltLine Components: The internal BeltLine intersections include places where components of the BeltLine meet. For example, where transit interacts with development, where trails and transit meet, and where parks intersect with redevelopment. Close working relationships among the many entities, both public and private, charged with developing the BeltLine are necessary to create an integrated BeltLine environment. To accomplish this, transportation, land use, parks and recreation, public works, and real estate development planners must work together. For example, developers and private land owners need to know the principles and guidelines by which new residential and commercial buildings and sites should interface with parks, trails, and transit, even though the final form of these components is not yet determined. Such information would be more detailed and conceptual than the BeltLine Overlay District Regulations, but would clearly articulate to the private section the vision and goals of the city and communities. In so doing, new development happening now can promote, instead of inhibit accessibility created by future public investment in recreation and transportation infrastructure.

[20] The BeltLine Overlay District Regulations are available at www.atlantaga.gov/government/planning/beltline.aspx.

Buildings, greenspace, streets, and transit services must be designed to enable fluid movement across spaces (see Figure 4.1). To accomplish this, careful consideration of several elements of design are paramount, including:

- The design of buildings and blocks to allow for access from the street side and trail/transit side,
- The location of crosswalks to create convenient and safe access to parks, trails, and transit, and
- The technology and design of the transit system to eliminate or decrease severance conditions between neighborhoods. Accomplished, for example, by running the BeltLine at-grade with the street as opposed to elevating it.

Figure 4.1 A permeable space: conceptualization of flows between components of the BeltLine

SOURCE: *BeltLine Redevelopment Plan*, CQGRD enhancements

Integration also requires a multimodal strategy for transportation. Such a strategy allows people to choose to walk, bicycle, use transit, or drive according to the type of trip they wish to make. As Georgia Tech Professor Michael Meyer, Ph.D., describes it, a multimodal transportation system uses more than one mode and is connected, coordinated, customer-oriented, and community serving. More specifically, the system must include efficient intermodal connections that make changing modes convenient; complementary facilities and services, such as bike storage at transit stations, bus shelters, and connected sidewalks; coordinated schedules, frequency of service, fare systems, and information strategies; and supporting policies and regulations regarding land use, parking programs, ridesharing, and pricing. To create a multimodal system requires consideration of infrastructure type and design, system operations, customer education, and matched land use policies.

As Figure 4.2 shows, rail transit technologies, like streetcar, can be designed to share space with other modes of transportation, including automobiles, buses, bikes, and pedestrians. These images show transit systems in Portland, Oregon and Seattle, WA, where a layering of urban functions (like transit, auto, and pedestrian activities) creates a compact environment where pedestrian and bicycle modes of travel can serve more trip types because infrastructure is available and land uses are in closer proximity to each other.

Figure 4.2 Transit systems in Portland, Oregon and Seattle, Washington

SOURCE: *BeltLine Redevelopment Plan*, CQGRD enhancements

Integration of elements within the BeltLine can also improve the function and aesthetics of places. For example, as Figure 4.3 shows, a public restroom, combined with wayfinding maps, lighting, and an emergency call box can create a unified image and a synergy of function. Individually these items have specific health benefits—public restrooms allow people to engage in longer intervals of physical activity, pedestrian wayfinding tools increase comfort levels and encourage people to walk or bike to more destinations, and lighting and emergency call boxes improve feelings of safety. Designed as a collective amenity they reduce visual clutter and can serve as activity nodes along the trail.

Figure 4.3 Accessible public restrooms with call boxes and maps are needed along the trails.

SOURCE: *BeltLine Redevelopment Plan*, CQGRD enhancements

To achieve integration, many city departments will need to work together. For example, the departments responsible for watershed management, sewer and water infrastructure, and parks and recreation, along with transit and utility providers must be able to work together to create synergies that enable the BeltLine to serve multiple purposes in one space. As Atlanta continues to develop its unused and underutilized land, it will become increasingly necessary to build efficiencies among functions. This approach requires a layering and connectivity of services and infrastructure. For instance, parks, if properly designed, can serve recreational and stormwater management purposes, thereby creating the multiple benefits of increased opportunities for physical activity and reduced likelihood of flooding. To accomplish such projects, city department procedures and goals must allow for collaboration.

Integrated with the City and Region: Historically, the freight rail corridor that is being redeveloped as the BeltLine created barriers that limited connectivity between what lay outside the loop and what was inside the loop. The BeltLine, if designed and built with the intention of connecting the opposing sides of the railroad tracks, can remove these obstacles and serve as a permeable space.

To achieve the desired web like connectivity, a concerted effort is needed to allow the BeltLine to contribute to a walkable and well-connected urban fabric. Figure 4.4 shows an enhancement of an illustration appearing in *Atlanta BeltLine Development Guidelines* (ADA, 2005b). In this graphic, the green nodes of parks space create the hubs from which the spokes of transit and trails (orange) and development (blue) radiate. It must be the job of these spokes to link the BeltLine to existing destinations within the city. These destinations include jobs centers, health care services, cultural institutions, and regional sports and entertainment venues.

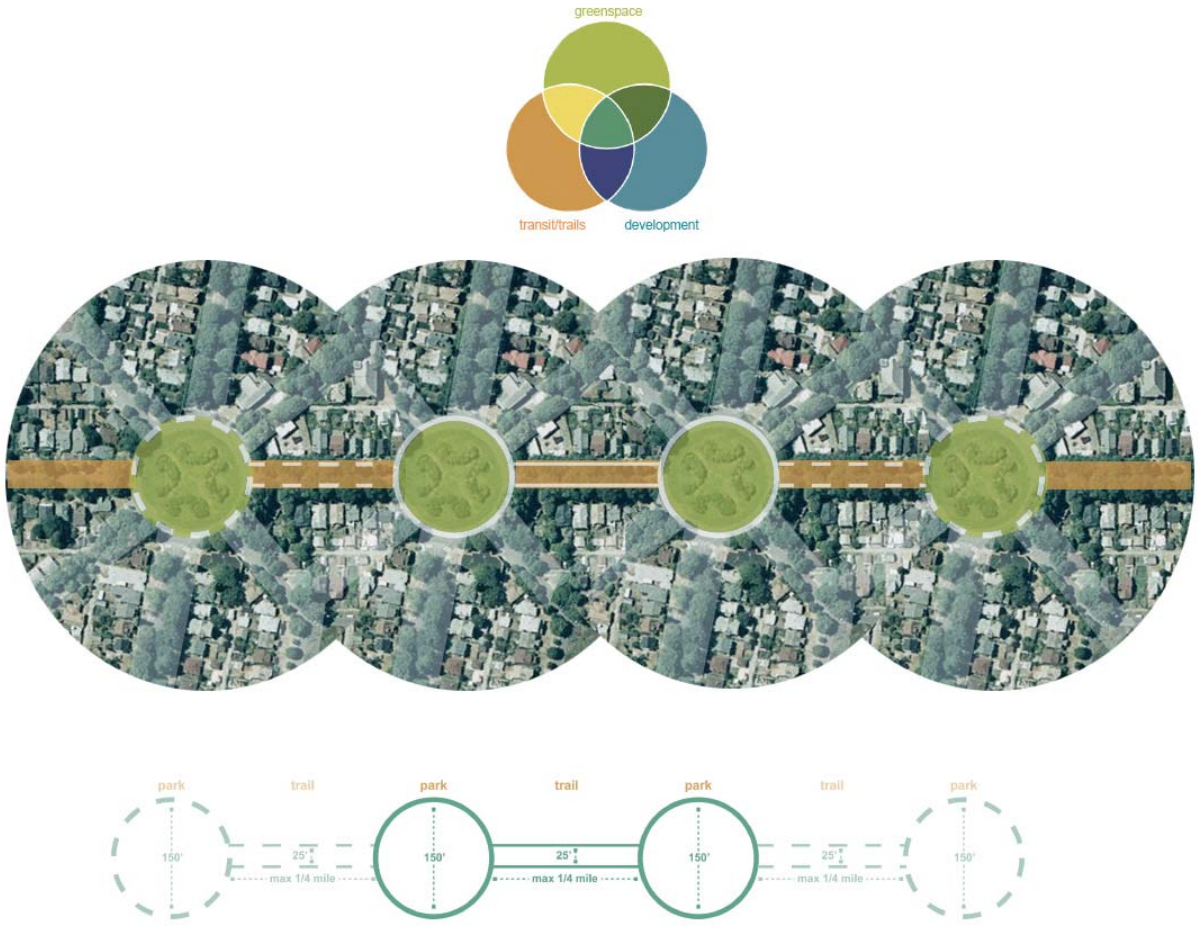
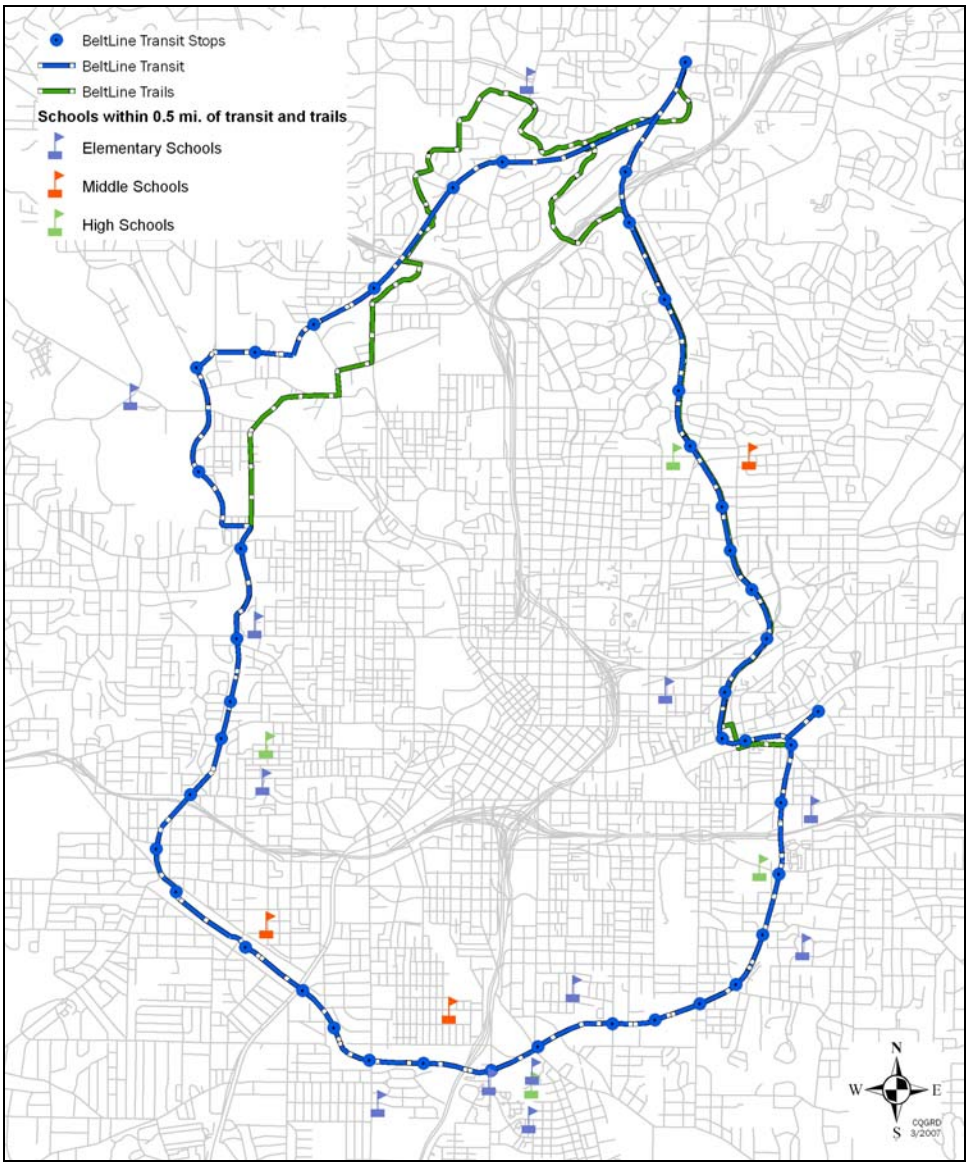


Figure 4.4 Using the BeltLine to create a web of connectivity throughout the city
SOURCE: *BeltLine Redevelopment Plan*, CQGRD enhancements

The spokes can enhance integration within the city and region in many forms. For one, BeltLine block structures and street and sidewalk networks can grow out of the surrounding urban fabric to increase connectivity. Greenspaces can be connected to each other to improve natural environmental functions and extend recreation opportunities. Wayfinding tools can be developed to help people navigate between existing and new amenities. New trails can be linked to existing multi-use trails and on-road bike lanes to provide long-distance mobility, recreation, and exercise opportunities.

The BeltLine can also be connected to existing neighborhood institutions to promote increased physical activity and social capital. One example is to leverage BeltLine investment to create Safe Routes to Schools (SRTS) programs to link the BeltLine to nearby schools. At present, 19 schools, including 12 elementary schools, three middle schools, and five high schools, are within 0.5 miles of the BeltLine transit and trails (as shown in Figure 4.5). Infrastructure improvements, combined with education and enforcement can create an environment where students can safely walk and bike to school. BeltLine communities can apply for SRTS funding, which can complement BeltLine investments. Between 2007 and 2009, the State of Georgia is projected to receive more than $13 million in federal funding for SRTS programs.[21]

Figure 4.5 Public Schools with 0.5 miles of BeltLine Transit and Trails



Finally, transit system connectivity will be important to the success of the BetlLine and overall transit development in Atlanta. Effective transit options can have significant health implications. As research shows, 29 percent of transit users achieve the recommended level of 30 minutes of daily physical activity (Besser and

[21] For more information about SRTS in Georgia visit http://www.dot.state.ga.us/srts/index.shtml.

Dannenberg, 2005). An effective transit system is one that embraces the multimodal definition described earlier.

The BeltLine suffers from several challenges regarding transit connectivity. First, decisions must be made regarding how the BeltLine will interface with several MARTA stations, including West End, Inman Park/Reynoldstown, Ashby, and Lindbergh. Site restrictions (space and elevation constraints) make the retrofit of existing stations difficult. Since much of the BeltLine TAD and surrounding areas have relatively low concentrations of housing and jobs it will be vital to the success of the BeltLine system that it be connected to existing concentrations of jobs in Downtown, Midtown, and Buckhead (Ross et al, 2005).

Recommendations

- **Establish shared measures of success between multiple city departments for BeltLine projects.** Create procedures and communication lines that enable city departments to work together.
- **Create Safe Routes to Schools programs using the BeltLine improvements to enable children to walk and bike to school safely.** At present there are 19 schools (11 elementary, 3 middle, and 5 high schools) within one-half mile of the BeltLine transit and a total of 47 schools in the BeltLine Study Area.
- **Establish a coordinated fare and schedule system for existing transit and BeltLine and other new transit systems.**

4.3 People-oriented Priorities

Three of the fundamental components of the BeltLine—transit, trails, and redevelopment—are intended to emphasize the mobility of people, not automobiles. This people orientation means that streets are no longer simply conveyors of automobiles, but must serve the needs of multiple modes of travel…becoming "complete streets." A complete street is one that works for motorists, transit riders, bicyclists, and pedestrians, including people with disabilities. But the complete street philosophy extends beyond a single street. It is intended to serve as a jurisdiction-wide policy that supports a diversity of travel on all streets while recognizing that some streets must have a greater auto orientation and others can emphasize non-motorized transportation. Many cities have embraced complete streets principles, including the cities of Seattle, WA, Charlotte, NC, Louisville, KY, and Sacramento, CA.

According to the Complete the Street Coalition[22], a good complete street policy:

- Specifies that 'all users' includes pedestrians, bicyclists, transit vehicles and users, and motorists, of all ages and abilities.
- Aims to create a comprehensive, integrated, connected network.
- Recognizes the need for flexibility: that all streets are different and user needs will be balanced.
- Is adoptable by all agencies to cover all roads.
- Applies to both new and retrofit projects, including design, planning, maintenance, and operations, for the entire right of way.
- Makes any exceptions specific and sets a clear procedure that requires high-level approval of exceptions.

[22] More information on the Complete the Streets Coalition is available at www.completestreets.org.

- Directs the use of the latest and best design standards.
- Directs that complete streets solutions fit in with context of the community.
- Establishes performance standards with measurable outcomes.

The complete street philosophy corresponds to the goals of the BeltLine. Specifically, the *BeltLine Redevelopment Plan* calls for a "high-quality, pedestrian friendly, public realm." This is certainly an appropriate aspiration for the BeltLine Study Area, where almost one quarter of all housing units is carless (based on data from the 2000 Census). Such a goal can result in less auto congestion, improve mobility for people who do not drive, and reduce traffic noise. It can also have several health-related consequences, including increased physical activity, greater social connections, and fewer pedestrian-related auto crashes (see Sections 6, 7, and 8).

The BeltLine TAD presents a unique opportunity to create a people-oriented environment because it requires the creation of a nearly wholly new urban fabric. The 6,500-acre district is largely composed of industrial (23 percent of the total TAD) and right-of-way (25 percent) land uses (ADA *Redevelopment Plan*, 2005). As is commonly the case, these land uses require large parcels and only a limited travelway network. To redesign these areas into the complex urban environment envisioned in the *Redevelopment Plan* will require the creation of a new system of lots, blocks, and streets. Students from Georgia Tech's College of Architecture studied several BeltLine areas to suggest a reorganization of parcel to create a more diverse and human-scaled environment (Figures 4.6 and 4.7).

Figure 4.6 Block and parcel arrangement along BeltLine

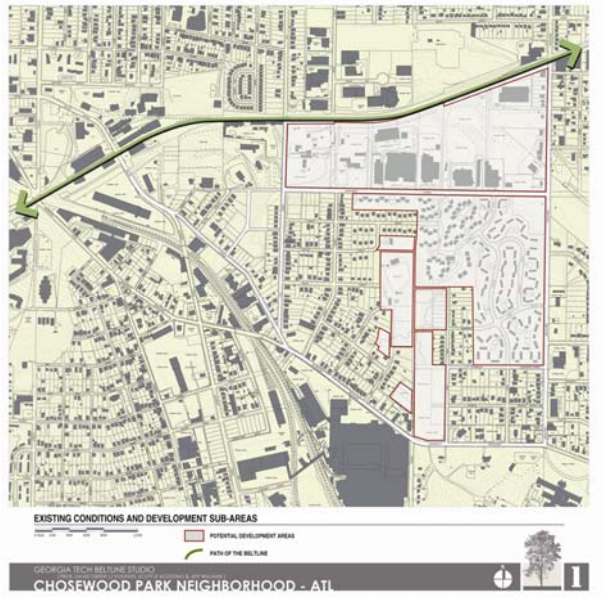


Figure 4.7 Subdivision of blocks and lots to knit into the existing fabric and create a walkable neighborhood

Source: Georgia Tech BeltLine Studio, Professor David Green, Students Scott D'Agostino and Jeff Williams

Recommendations

- **Adopt land use regulations that prioritize the needs of pedestrians, bikers, and transit users.** For example, zoning regulations can require wider sidewalks, reduce parking requirements, require pedestrian lighting, or prohibit drive thru options (e.g. for fast food, pharmacies, banks). Such strategies encourage non-motorized travel, while discouraging types of auto use that can create inconvenient and potentially unsafe environments for pedestrians and bicyclists.

- **Adopt complete streets principles and roadway design standards that create walkable and bikeable street networks.**

4.4 Designing for all Users

BeltLine users will represent a diverse population that will vary in age, income, culture, and ability. Users will include older adults, children, people with disabilities, non-English speakers, and others whose mobility can be affected by short- or long-term limitation in ability. In particular, the population aged 65 and older is expected to increase dramatically in the next 20 years (McKenzie, 2004). Considering the fact that almost 80 percent of people over age 65 have at least one chronic health condition, and 50 percent have at least two chronic health conditions, which often lead to disability (National Institute on Aging, 2006), the number of people living with functional limitations and disabilities will also increase.

Older adults, children, and people with long- and short-term disabilities have specific needs in order to effectively function within the community. Historically, specialized design for each of these groups has often resulted in segregation and stigmatization of these populations and increased the costs. A better solution can be found in the principles of Universal Design, which is design of "products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Mace et al, 1991). Such a design philosophy can enable the BeltLine to accommodate all people with different age and ability levels by the same design to become as inclusive as possible. Seven principles of Universal Design advocate equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use (see Appendix 5 for more information on Universal Design and visualizations of environments that are supportive of varying levels of ability) (CUD, 1997).

The BeltLine, as one of the largest and most comprehensive planning and urban design projects in Atlanta, aspires to the creation of mixed use, walkable communities connected by transit and trails. Currently, the *Development Guidelines* address the full spectrum of physical features and design configurations that promote safe pedestrian access between the proposed development sites, parks, transit, and trails. However, "accessibility" seems to be designed for able-bodied users, without a comprehensive understanding of the needs of users with limited abilities, such as the elderly and people with disabilities. By embracing an inclusive vision for the BeltLine using the principles of Universal Design it is possible to create a welcoming environment that can serve as a model for other redevelopment projects throughout the country.

Recommendations

- **Educate city staff involved in the BeltLine on the principles and execution of Universal Design.**
- **Provide Universal Design Implementation booklets to the developers for private and public areas.**

4.5 Involving all Stakeholders

Within the BeltLine HIA Study Area there are more than 200,000 residents, 230,000 employees, and numerous businesses and institutions that will be directly affected by the BeltLine. The larger city and region will also be affected by the BeltLine's influence over regional traffic patterns and environmental impacts. Combined, these stakeholders represent a diversity of interests, preferences, and needs. To reflect the uniqueness of the population and the project, three principles regarding the involvement of all stakeholders

are important to the implementation of the BeltLine: continuous public involvement, appropriate public involvement, and convenient access to information.

Continuous public involvement recognizes that the long-term nature of the TAD to fund the public improvements will require an equally long-term commitment to public involvement. Due to the long timeframe, 25-years, an involvement strategy is necessary to respect stakeholders' time, while providing effective opportunities to voice opinions.

Appropriate public involvement means that involvement strategies are adapted to meet the conditions of different communities and are part of a transparent process. To promote equal participation from all BeltLine Planning Areas it will be necessary to recognize that each area is unique in its social, cultural, and communications structures and its historic degree of efficacy. Effective stakeholder involvement strategies may require varied approaches and resources. The result of such a customized approach is that local needs and preferences can be reflected in the type and design of parks and redevelopment, which can lead to greater use and hence increased levels of physical activity (see Section 6). Furthermore, providing communities with an effective voice in the public decision making process can lead to greater social capital (see Section 8).

Convenient access to information is an important step towards successful stakeholder involvement. Since its inception the BeltLine vision has had many voices. It began with Friends of the BeltLine, a grassroots organization that advocated for the BeltLine; then the Atlanta Development Authority ushered through the *BeltLine Redevelopment Plan* along with the BeltLine Partnership, which took on public involvement efforts. More recently Atlanta BeltLine, Inc. (a non-profit group created by the Atlanta Development Authority to oversee planning and implementation of the BeltLine project) has been created to lead the implementation of the BeltLine. There are also neighborhood groups, like BeltLine Neighbors Coalition[23], that have organized in response to the project. This is not to mention the numerous city departments and other public entities involved in the BeltLine (see Section 2.1). Stakeholders need a single source of information to provide convenient access to information.

Recommendations

- **Develop a 25-year public involvement plan.** Public participation should be a critical component throughout the project, which could mean up to 25 years of participation of varying degrees and forms to correspond to the timeframe of the TAD. The plan should identify appropriate strategies to involve all stakeholders.
- **Establish a single information hub.** To improve stakeholder involvement and convey a consistent BeltLine message and vision it will be important to have a single hub of information and announcements. Meetings announcements and minutes, reports, official actions, timelines, and progress updates should be accessible from one entity. This hub of information should be available online and in print and by phone. Serving as the hub does not require the entity to be in charge of all actors, but to serve as a coordinated source of all information related to the BeltLine.

[23] Information on the BeltLine Neighbors Coalition is available at http://bncatlanta.org/.

Section 5:
Access and Social Equity

Accessibility is a crucial element to achieve a healthy city. Access refers to an individual's or group's ability to get to health-promoting goods, services, amenities, and opportunities at reasonable cost, in reasonable time, and with reasonable ease (SEU, 2003). It is concerned with both the proximity of such things, as well as the infrastructure and services that enable people to travel to these destinations. Numerous studies have linked several critical needs to support good health including transportation, housing, food, and greenspace. Specific health conditions associated with access or the lack of access include obesity, diabetes, heart disease, mental and social health and poor physical condition.

5.1 Access, Social Equity and Health

Access refers to the opportunity for people to be able to get to critical needs. And health, according to the 1948 World Health Organization Constitution and the 1986 Ottawa Charter for Health Promotion, is "a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity." Furthermore, health is the ability of an individual or group "to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment." This second part of the definition is where health and access intersect. The concept of access takes on many meanings in relation to the BeltLine, including:

- Access to Parks and Trails
- Access to Transportation
- Access to Healthy Housing
- Access to Healthy Foods

Historically underserved populations, and hence the populations discussed regarding social equity, include poor people and people of color. Furthermore, these populations suffer from disproportionate prevalence of disease. For example, in households earning less than $15,000 obesity rates are higher, physical inactivity is more likely, and the risks of health problems associated with a sedentary lifestyle are greater compared to households with incomes above $50,000 (Emerine and Feldman, 2005). Other studies have found that people of color are less likely to get the recommended levels of physical activity and more likely to experience the chronic disease associated with a sedentary lifestyle compared to the total population. There is evidence that less than one-third of adults aged 65 to 74 take part in regular physical activity (U.S. Department of Health and Human Services, 2000); women, especially minority women, have higher rates of physical inactivity than men (Crespo, 2000); the rate of prevalence of being overweight in children has nearly tripled (U.S. Department of Health and Human Services, 2001); and certain ethnic minority populations and children in low-income households have been found to have higher rates of obesity than the population at large (Institute of Medicine, 2004).

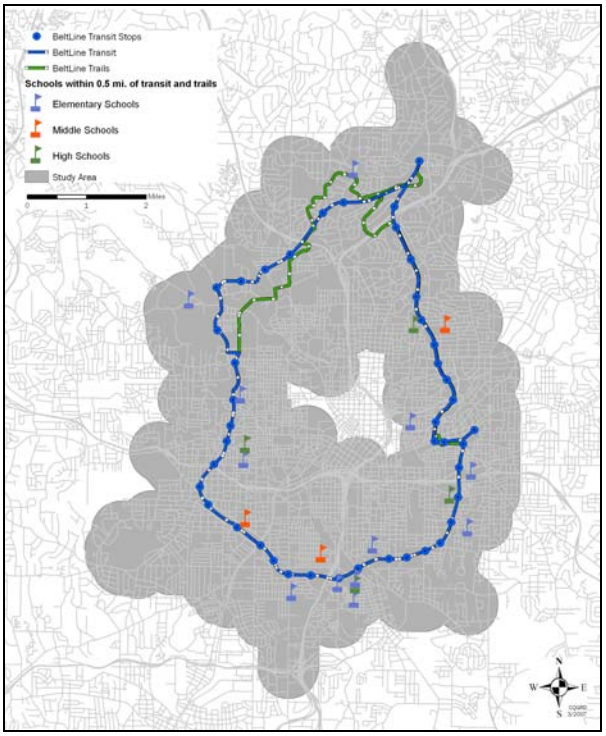
More recent studies have added children and older adults to populations of concern. For instance, specific types of air pollution have been identified as having an adverse effect on the lung development of adolescents, which can lead to lifelong lung deficiency (Gauderman et al, 2000; Gauderman et al, 2004). Research has also shown that cardiovascular hospital emissions are associated with certain air pollutants (Barnet el al, 2006). A

combination of greater vulnerabilities to unhealthy environments and often less ability to influence decisions about living arrangement (due to youthfulness and a fixed income) making children and older adults a particularly at risk population.

5.2 Access, Social Equity and the BeltLine

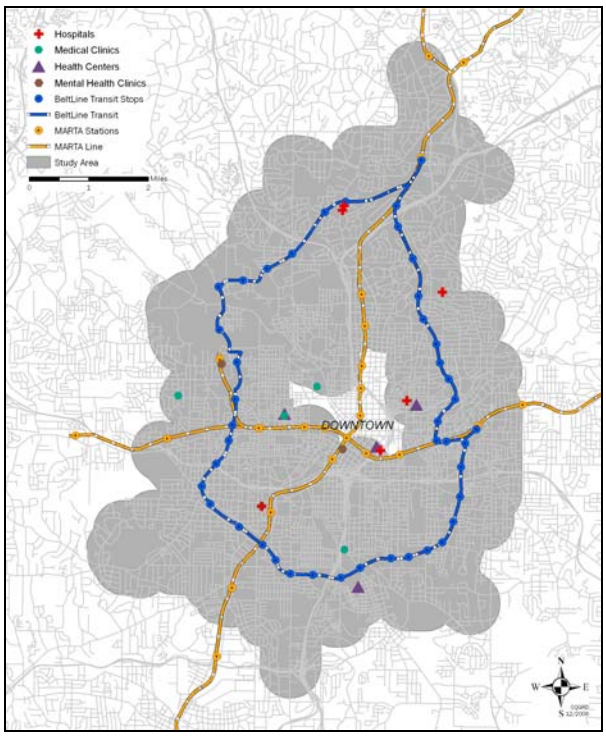
For decades a largely underutilized corridor has circled the City of Atlanta, creating a divide that severs communities from each other and people from goods, services, and opportunities. Furthermore, Atlanta's relatively low-density and auto-oriented urban development patterns have resulted in longer trip distances and fewer travel options to accesses basic needs. The BeltLine, as a new vision for this corridor, is in large part an accessibility enhancing project. In vision and plan it is intended to link destinations and people either by putting places and people in closer proximity through redevelopment of underutilized land or by providing a more varied transportation system that includes additional transit, trails, and sidewalk networks to link people to existing parts of the city. Within the BeltLine Study Area there are 47 schools (20 within one-half mile of the transit and trails), six hospitals, five medical centers, four health centers, and two mental health clinics (Figures 5. 1 and 5. 2). Through a concerted and coordinated effort, the BeltLine has the potential to improve access to these much needed services for the 213,000 people currently living in the study area.

Figure 5.1 Public Schools near BeltLine



Credit: Georgia Tech GIS Center

Figure 5.2 Health Care Facilities near BeltLine



Credit: data compiled by Fulton County Department of Health and Wellness

According to the BeltLine HIA survey, 73 percent (346 of 472 respondents) of respondents believe that the BeltLine will have a positive impact on their health. In questions related to access, 40 percent (188) disagree that they currently have enough places for recreation; 35 percent (162) disagree that they have enough places to walk, jog, or run; 37 percent (171) disagree that they have enough places to bike; and 43 percent (202) strongly disagree that they have enough transportation options. On the other hand, 30 percent (138) agree that they have enough places to shop and 36 percent (169) neither agree nor disagree that there are enough jobs in their communities. For all of these measures, respondents overwhelmingly agreed that having access to

these resources and amenities can have a very positive effect on personal health. As the results show, survey respondents believe that access is an important contributor to positive health outcomes.

5.3 Assessment

To assess equity and access regarding the BeltLine, the BeltLine HIA evaluates the degree to which access to parks, trails, transit, and redevelopment meet the needs of the existing and future population, and evaluates whether improved access, and the resulting health benefits, is equitably distributed geographically and demographically. Access is measured by the quantity and proximity of amenities and services and the level of equity is measured using a variety of indicators, such as race, income, and age, which have been used to gauge inequalities or a lack of equity. In essence, if the population that has access to the components of the BeltLine closely resembles the population of the study area and the City of Atlanta as a whole, then it can be asserted that an equitable distribution of access exists, and the resulting health benefits are open to all residents along the BeltLine.

This review examines the land use plans and regulations, and transportation network of the BeltLine in relation to their potential health impacts. Using readily available data (Census data, local population estimates, public health permitting data, tax records, and project data), this research examines how the BeltLine can potentially impact health. Specifically, the analysis identifies changes in access to parks, trails, transit, employment, housing, nutritious foods, and other services to identify unmet needs based on the spatial organization of the city and the location of vulnerable populations.

5.3.1 Parks

The BeltLine HIA focuses on two aspects of park access—supply and location. The following analysis describes the results of existing and proposed parks in the City of Atlanta and especially the HIA study area in regard to these two characteristics.

Park Supply

Parks provide opportunities for physical and social activity and can provide stress relief (see Sections 6 and 8 for health impact reviews on these topics). As such, parks are an important component of urban areas, where smaller residential lots and greater densities increase the need for places for recreation, public gatherings, and exercise.[24] The BeltLine is envisioned to add approximately 1,300 acres of parks and improve 700 acres of park in the city and this assessment examines access to existing and proposed parks in the study area and the city. In terms of parks, access is concerned with not only proximity, but also the amount of park space.

The City of Atlanta has proposed a goal of 10.5 park acres per 1,000 persons (henceforth referred to as "park acres per capita").[25] At present within the BeltLine Study Area existing parks provide 5.4 acres per capita, which is below the citywide parks acres per capita of 6.4. Upon closer examination it is evident that the park acres are not equally distributed around the five BeltLine Planning Areas. As the table 5.1 shows, the Northeast currently has the highest number of existing park acres per capita at 8.7, and the Westside the lowest at 3.4. Overall, the BeltLine will add 1,300 acres of parks. Analyzing the distribution of parks among the planning areas it is clear that the Westside is receiving the most park acres per capita (9.8), while the Northeast (1.9) and Southwest (2.1) are receiving the least.

[24] While this study limits the scope to the analysis of parks, it is important to note that parks are just one element of a larger greenspace system. Atlanta's Project Greenspace initiative defines greenspace as "a system of parks, natural areas, open spaces, outdoor gathering places, and streetscape and greenway connections that perform vital environmental, economic, and social functions essential to Atlanta's quality of life and community health."
[25] Atlanta's Project Greenspace, Preliminary Implementation Framework, 2.26.07.

Table 5.1 Existing and BeltLine Park Acres/1,000 People (2000 population)

	Northside	Northeast	Southeast	Southwest	Westside	Study Area	Citywide
2000 Population	36,872	43,149	39,711	51,080	43,057	213,869	416,474
Existing Park Acres	133	375	210	281	146	1,145	2,678
Existing Park Acres/1000 People	3.6	8.7	5.3	5.5	3.4	5.4	6.4
Proposed BeltLine Park Acres	210	83	201	106	422	1,022	N/A
Proposed Park Acres/1000 People	5.7	1.9	5.1	2.1	9.8	4.8	N/A

Source: U.S. Census Bureau, 2000; BeltLine Redevelopment Plan

The next step in the analysis is to combine existing and proposed park acres to determine if the total acres will meet the city's goal of 10.5 acres per capita. By combining existing and proposed parks, the acres per capita in the study area increases to 9.5 and to 8.6 citywide, still short of the city's proposed target. Using 2000 population, the Northside (9.0), Northeast (10.7), and Southeast (9.6) park acres per capita are all relatively close to that of the study area as a whole, while the Westside (11.4) is considerably above and the Southwest (7.5) is considerably below (Table 5.2).

Table 5.2. Combined Park Acres/1,000 People (2000 population)

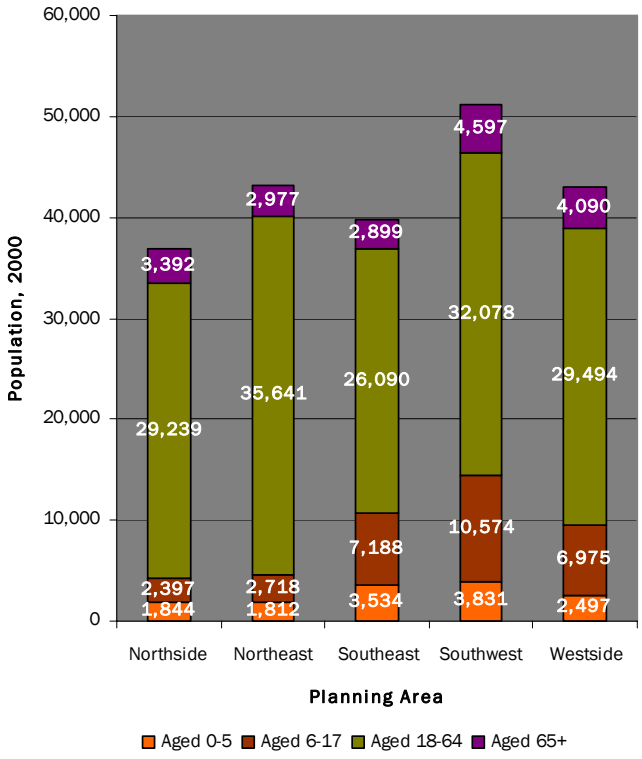
	Northside	Northeast	Southeast	Southwest	Westside	Study Area	Citywide*
2000 Population	36,872	43,149	39,711	51,080	43,057	213,869	416,474
Existing and BeltLine Park Acres	331	461	380	381	489	2,042	3,575
Total Park Acres/1000 People	9.0	10.7	9.6	7.5	11.4	9.5	8.6

* Atlanta's Project Greenspace is developing a citywide park plan that will set goals for additional park acres. At time of the BeltLine HIA this information was not available.

Source: U.S. Census Bureau, 2000; BeltLine Redevelopment Plan

The shortage of park acres in the Southwest planning area is notable, particularly given that the area has a relatively large vulnerable population compared to the other planning areas (see Section 3.4.2 for details regarding vulnerable populations in the study area). The Southwest planning area has the largest minority population, as well as the largest number of children under age 18 and adults 65 and older (see Figure 5.3). Young and old populations often have the greatest restrictions in mobility, therefore nearby parks are of critical importance. Additionally, minority populations tend to have greater prevalence of diseases related to physical inactivity. Furthermore, the Southwest planning area has the highest rates of death in the study area for heart disease, malignant neoplasms, cerebrovascular disease, and diabetes, all diseases which studies show can be prevented and/or managed by appropriate levels of physical activity (see Section 3.4.2 for details on health status in the planning areas). However, the Westside area, with the lowest per capita income and second highest minority concentration, will go from the most underserved to the best served section in the study area.

Figure 5.3. Age composition by planning area



Source: U.S. Census Bureau, 2000

It is important to note that while the BeltLine will considerably increase the number of park acres in the study area, it is also projected to appreciably increase the population in the study area. By the time the BeltLine is fully built out in 25 years (year 2030) the Atlanta Regional Commission projects that the city's population will increase from 416,000 to over 600,000 (ARC, 2006). Of that population increase, approximately 100,000 people are expected to move into the BeltLine Study Area. Even with the additional BeltLine park acres, the citywide per capita park acres will drop from the 6.4 (today's per capita park acres) to 5.9 due to population growth (Table 5.3) assuming no additional park space is added. Within the study area, the ratio will change from 9.5 (using 2000 population) to 6.5 (using 2030 projected population) (Tables 5.2 and 5.3). While the BeltLine as proposed will add a substantial number of park acres, the city must continue to add parks to keep pace with population growth. To meet the proposed target of 10.5 park acres per 1,000 persons in 2030, the city would have to develop an additional 2,700 park acres in addition to the BeltLine parks.

Table 5.3 Combined Park Acres/1,000 People (2030 projected population)

	Northside	Northeast	Southeast	Southwest	Westside	Study Area	Citywide*
2030 Population	49,561	66,189	58,875	70,472	70,541	315,638	602,783
Existing and BeltLine Park Acres	331	461	380	381	489	2,042	3,575
2030 Park Acres/1000 People	6.7	7.0	6.5	5.4	6.9	6.5	5.9

* Atlanta's Project Greenspace is developing a citywide park plan that will set goals for additional park acres. At time of the BeltLine HIA this information was not available.

Source: Atlanta Regional Commission; BeltLine Redevelopment Plan

It may be argued that 10.5 park acres per 1,000 population is an unrealistic goal when considering population growth, but as Table 5.4 shows other larger cities have been able to exceed this goal. On a citywide level, Atlanta is performing moderately well when compared to other cities, however as the population of Atlanta continues to grow, it will be necessary to continue to add park acres.

Table 5.4 Comparing Atlanta to other Major Cities

	Park Acres	Population (2000)	Park Acres/1,000 People
Dallas	21,670	1,188,580	18.2
Washington, DC	7,576	572,059	13.2
Houston	21,252	1,953,631	10.9
Boston	5,451	589,141	9.3
Los Angeles	30,134	3,694,820	8.2
Atlanta	**3,235***	**416,474**	**7.8**
San Francisco	5,916	776,733	7.6
Philadelphia	10,621	1,517,550	7.0
New York	36,646	8,008,278	4.6
Chicago	11,676	2,896,016	4.0

*Differs from BeltLine HIA total park acres number. BeltLine HIA counts only parks designated as parks, playgrounds, recreation centers, and nature preserves. This number includes areas such as traffic medians.

Source: Alex Garvin and Associates, Inc. 2004. *The BeltLine Emerald Necklace: Atlanta's New Public Realm*; U.S. Census

Park Location

The analysis of park location determines how many people within the study area would have access to park space after the BeltLine is completed who do not currently have access to a park. More simply put, the HIA analysis determined the number of "potential new users" to the Atlanta park system. This population is important to capture because this is the population that will go from no access to access, and is where the greatest potential for positive health impacts are likely to occur.

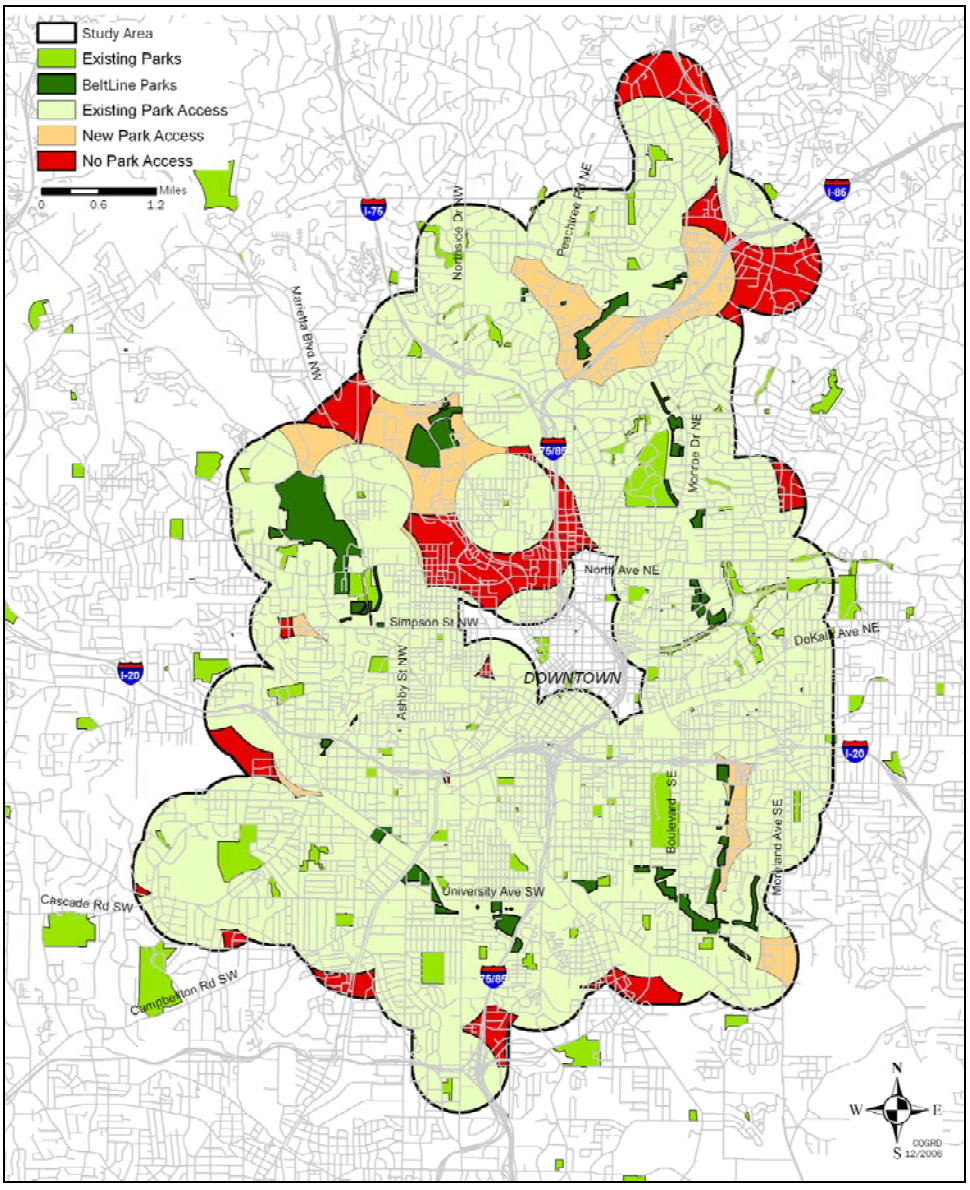
After a review of the literature, a methodology was created to measure access to the proposed BeltLine parks. This method uses a Geographic Information System (GIS) to determine levels of park access. For this study, people with park access are those that reside within a 0.5 mile radius of the edge of a park. This half mile radius reflects the reasonable distance people are willing to travel to access a park by foot (Talen, 1998; Nicholls, 2001).[26] This analysis uses a relatively coarse-grain approach for assessing access to the proposed BeltLine parks due to limited information about their design, entry points, and any changes to the surrounding environment. If such information were available, a more accurate and most likely lower estimate of population access to proposed parks could be conducted using network buffers rather than edge buffers. Since our analysis combines existing (for which data are available) and proposed parks (for which data are not available),

[26] An ongoing study entitled Neighborhood Parks and Active Living (NPAL) led by Emory University's Dr. Karen Mumford and colleagues and funded by the Robert Wood Johnson Foundation also supports the 0.5 distance.

the team decided to use the same rougher grained approach for the analysis of access to existing parks to have comparable measure of access.[27]

Using the 0.5 mile standard, more than 187,000 people, or over 87 percent, within the study area currently have access to existing parks (which are located both inside and outside the study area), leaving over 26,000 people without park access. With the addition of the BeltLine parks, an estimated 11,000 people will gain access to a park (based on 2000 population). Figure 5.4 shows the location of populations that will gain park access as a result of the BeltLine and those that will still lack access. As the map shows, the largest areas without park access (shown in red) are located in the Westside, Northside, and Northeast Planning Areas.

Figure 5.4 Park Access in the Study Area



[27] For more information about a study assessing access to existing parks in the City of Atlanta, contact Dee Merriam at the City of Atlanta Planning Department.

Next, the analysis focused on describing the populations that will and will not gain access to park facilities within the study area and the City of Atlanta as a whole to assess the distribution of park access in spatial and demographic terms. The demographic description of the study area described in Section 3.4.2 highlights the uneven social and economic characteristics of the five planning areas around the BeltLine. There are several studies that demonstrate the tendency for park access to be unequal across socioeconomic groups, contributing to negative health impacts on the underserved populations. Particularly, research has shown that these underserved populations tend to be minority and/or of lower economic status (Gordon-Larsen, 2006; Huston et al., 2003; Parks et al., 2003; Taylor et al., 2006).

To begin the analysis, a demographic profile was generated for those who currently have access to the existing Atlanta park system and those who will have access to parks after the BeltLine is completed on a city-wide scale. Once again, the 0.5 mile radius around parks was used as a measure of access for this study. Table 5.5 compares the population that has access to the existing Atlanta park system both before and after the BeltLine with those that will not have access. These data suggest that over 321,000 of the city's residents, or approximately 77 percent, have access to park space and those that have access are a slightly lower proportion white and of lower economic status when compared to the city. After the BeltLine is completed, an estimated 332,560 people, or 80 percent of the city's population, will have access to parks in Atlanta. The proportion of whites who will have access increases slightly with the construction of the BeltLine, as does economic status of the population living in proximity to the parks. The characteristics of the population without access to parks are similar to the city-wide population composition, but a notable exception is that the population under 18 years of age will be better served in the city as a result of the BeltLine and those without access have a higher per capita income.

Table 5.5 Citywide Park Access before and after the BeltLine

	City of Atlanta	Access to Parks before BeltLine	Access to Parks after BeltLine	No Access to Parks after the BeltLine
Total Population	416,474	321,559	332,560	83,914
White	138,352 (33.2%)	101,440 (31.5%)	107,855 (32.4%)	30,497 (36.3%)
Non-white	278,122 (66.8%)	220,119 (68.5%)	224,705 (67.6%)	53,417 (63.7%)
Under Poverty	95,743 (23.0%)	78,374 (24.4%)	80,149 (24.1%)	15,594 (18.6%)
Aged 0-17	93,004 (22.3%)	77,536 (24.1%)	78,952 (23.7%)	14,052 (16.8%)
Aged 65+	40,535 (9.7%)	30,802 (9.6%)	31,579 (9.5%)	8,956 (10.7%)
Rate of Carless Housing Units	21.2%	25.0%	24.4%	15.3%
Per Capita Income	$25,772	$23,932	$24,140	$32,242

Data Sources: U.S. Census Bureau, 2000; BeltLine Redevelopment Plan; CQGRD calculations

A similar analysis was conducted on the study area alone to compare the characteristics of the populations with park access against those that will still not be serviced by nearby parks after the BeltLine is completed. As this analysis shows, the population with access to parks after the BeltLine is completed is similar to the entire study area population, and therefore shows a reasonably equitable distribution of parks (see Table 5.6). A notable disparity is evident in the characteristics of the study area population that will not gain park access. This population is considerably more white and has a lower per capita income compared to the study area overall. Based on this analysis, additional park acres may be warranted in these lower income areas.

Table 5.6 Study Area Park Access Before and After BeltLine

	Study Area	Access before BeltLine	Access after BeltLine	No Access after BeltLine
Total Population	213,920	187,549	198,550	15,370
White	80,865 (37.8%)	66,665 (35.5%)	73,081 (36.8%)	7,784 (50.6%)
Non-white	133,055 (62.2%)	120,884 (64.5%)	125,469 (63.2%)	7,586 (49.4%)
Under Poverty	48,904 (22.9%)	44,483 (23.7%)	46,257 (23.3%)	2,646 (17.2%)
Aged 0-17	43,363 (20.3%)	39,333 (21.0%)	40,750 (20.5%)	2,614 (17.0%)
Aged 65+	17,966 (8.4%)	16,240 (8.7%)	17,017 (8.6%)	949 (6.2%)
Rate of Carless Housing Units	24.6%	25.0%	24.5%	26.3%
Per Capita Income	$23,925	$24,024	$24,233	$18,222

Data Sources: U.S. Census Bureau, 2000; BeltLine Redevelopment Plan; CQGRD calculations

Finally, a demographic profile of each proposed BeltLine park was constructed to identify the diversity of populations surrounding each park (Table 5.7). These parks will serve anywhere from 2,500 to 13,700 individuals, based on 2000 census, with expectations of significant population increase in the next 25 years. Depending on the park, the number of potential users living in poverty will range from less than 1 in 10 to nearly 4 in 10. Age breakdowns vary considerably across each park, with some parks having large concentrations of children and others with large concentrations of elderly. The populations that have access to each park will also have varying access to automobiles. Per capita incomes across all park populations differ widely, ranging from a high of over $53,000, to a low of barely over $10,000.

This analysis indicates that each park will be different because each park will serve a different population. While neighborhood change will alter the population composition of these areas, this snapshot in time gives an indication of the diversity of potential park users. Great care needs to be taken to ensure that all parks are designed with the population they are serving in mind, yet also designed with the flexibility to respond to future demographic changes. Failure to do so could lead to an underutilization of park space, thus reducing the potential positive health impacts for the populations they are intended to serve.

Table 5.7. Demographic Profile of Potential Users at BeltLine Parks

Name	BeltLine Area	Total Access Population	White	Other	Under Poverty	Aged 0-17	Aged 18-64	Aged 65+	Rate of Carless Housing Units	Per Capita Income
Field of Dreams	NE	6,875	82.1%	17.9%	9.3%	9.80%	85.5%	4.7%	8.4%	$45,496
North Woods Park	NE	5,840	86.5%	13.5%	7.6%	11.40%	82.5%	6.1%	6.8%	$53,426
North Avenue Park	NE	9,041	52.9%	47.1%	19.6%	13.50%	79.9%	6.6%	21.6%	$29,177
Piedmont Park Greenway	NE	6,642	81.4%	18.6%	8.9%	8.60%	85.2%	6.2%	9.2%	$48,879
Ansley Square	NE	4,637	83.7%	16.3%	9.0%	10.30%	84.1%	5.6%	7.0%	$52,335
Colonial Park	N	6,657	84.5%	15.5%	11.7%	11.50%	79.6%	8.9%	14.4%	$45,102
Tallulah Park	N	2,425	73.0%	27.0%	16.3%	8.40%	87.5%	4.2%	4.8%	$35,960
Atlanta Waterworks	N	5,789	58.4%	41.6%	16.3%	6.20%	91.0%	2.9%	6.6%	$23,524
Peachtree Creek Park	N	11,585	73.9%	26.1%	10.4%	9.80%	82.9%	7.4%	14.4%	$42,110
Southside High School Park	SE	4,063	55.2%	44.8%	15.5%	17.00%	74.1%	8.9%	13.3%	$23,006
Glenwood Park West	SE	4,087	53.9%	46.1%	17.0%	15.80%	74.2%	10.0%	16.1%	$22,054
Intrenchment Creek Park	SE	13,709	30.7%	69.3%	29.9%	29.60%	65.4%	5.1%	24.6%	$14,148
DH Stanton Park Expansion	SE	4,701	7.7%	92.3%	39.9%	34.80%	55.4%	9.9%	49.0%	$10,191
Intrenchment Woods	SE	4,405	37.0%	63.0%	23.7%	30.10%	65.4%	4.6%	15.8%	$16,319
Ormewood Park	SE	4,100	55.0%	45.0%	16.0%	20.00%	73.2%	6.8%	10.5%	$23,330
Enota Park Expansion	SW	5,979	0.8%	99.2%	27.7%	26.70%	57.4%	15.9%	27.5%	$12,936
Hillside Park	SW	4,348	4.4%	95.6%	37.4%	32.70%	55.6%	11.8%	33.5%	$12,009
Murphy Triangle Park	SW	7,042	5.7%	94.3%	29.3%	29.80%	61.3%	9.0%	28.7%	$13,668
Lawton Street Park	SW	5,081	1.8%	98.2%	31.4%	26.50%	62.1%	11.3%	40.7%	$14,655
University Plaza	SW	4,324	4.2%	95.8%	34.4%	31.40%	57.2%	11.4%	33.4%	$11,885
Ashview Heights Park	W	5,559	0.2%	99.8%	33.7%	26.80%	56.5%	16.7%	34.5%	$12,375
Maddox Park Expansion	W	9,588	3.1%	97.0%	32.3%	27.10%	62.8%	10.1%	41.6%	$10,748
Westside Park	W	9,904	6.4%	93.6%	28.0%	25.60%	65.7%	8.8%	36.7%	$11,106
Simpson Road Plaza	W	5,320	0.4%	99.6%	36.9%	28.90%	59.4%	11.7%	45.0%	$11,204

Data Sources: U.S. Census Bureau, 2000; BeltLine Redevelopment Plan; CQGRD calculations

5.3.2 Trails

The BeltLine proposes to add 33 miles of multiuse trails. At present, the city has a limited supply of trails made possible in part by the PATH Foundation.[28] Therefore, the BeltLine represents a significant expansion of the Atlanta trails system.

The trails access assessment is similar to that done for parks. Like parks, people with trail access are those residing within a one-half mile distance of the trail. Unfortunately at this time there is little or no data available as to the entrance points and design of the BeltLine trail system. Therefore, for the purpose of this HIA, this method assumes equal access at all points along the BeltLine trail. In nearly all cases of trail construction, there are designated entry points that allow access to the trail. Therefore trail design and the location of entry points will have a significant impact on access to the proposed BeltLine trail and will significantly affect the number of people with access.

The assessment of trail access is presented in two parts. First, access to the entire system is analyzed to determine if any differences exist between the population who has access to the trail system and the population of the study area and City. Second, the system is divided into the five designated BeltLine Planning Areas to determine if there are any differences between the populations who have access in each area.

The first part of the assessment of trail access compares the population that has access to the proposed BeltLine trail system with the study area and City of Atlanta populations. This is illustrated in Figure 5.5, which shows the BeltLine trail and the areas surrounding the trail that will have access to the trail. The results of this part of the assessment are shown in Table 5.8. Of the approximately 213,000 individuals who live in the study area, approximately 88,800, or 41 percent, will have access to the trail system. This population has a moderately higher proportion of whites (42.0 percent) than both the study area (37.8 percent) and city (33.2 percent) populations. The trail access population is somewhat wealthier than the study area and city populations, with a higher per capita income and lower proportion under the poverty line.

[28] The PATH Foundation is a nonprofit organization founded in 1991 with a mission to develop a system of interlinking greenway trails through metro Atlanta for commuting and recreating (www.pathfoundation.org).

Figure 5.5 Areas with BeltLine Trail Access

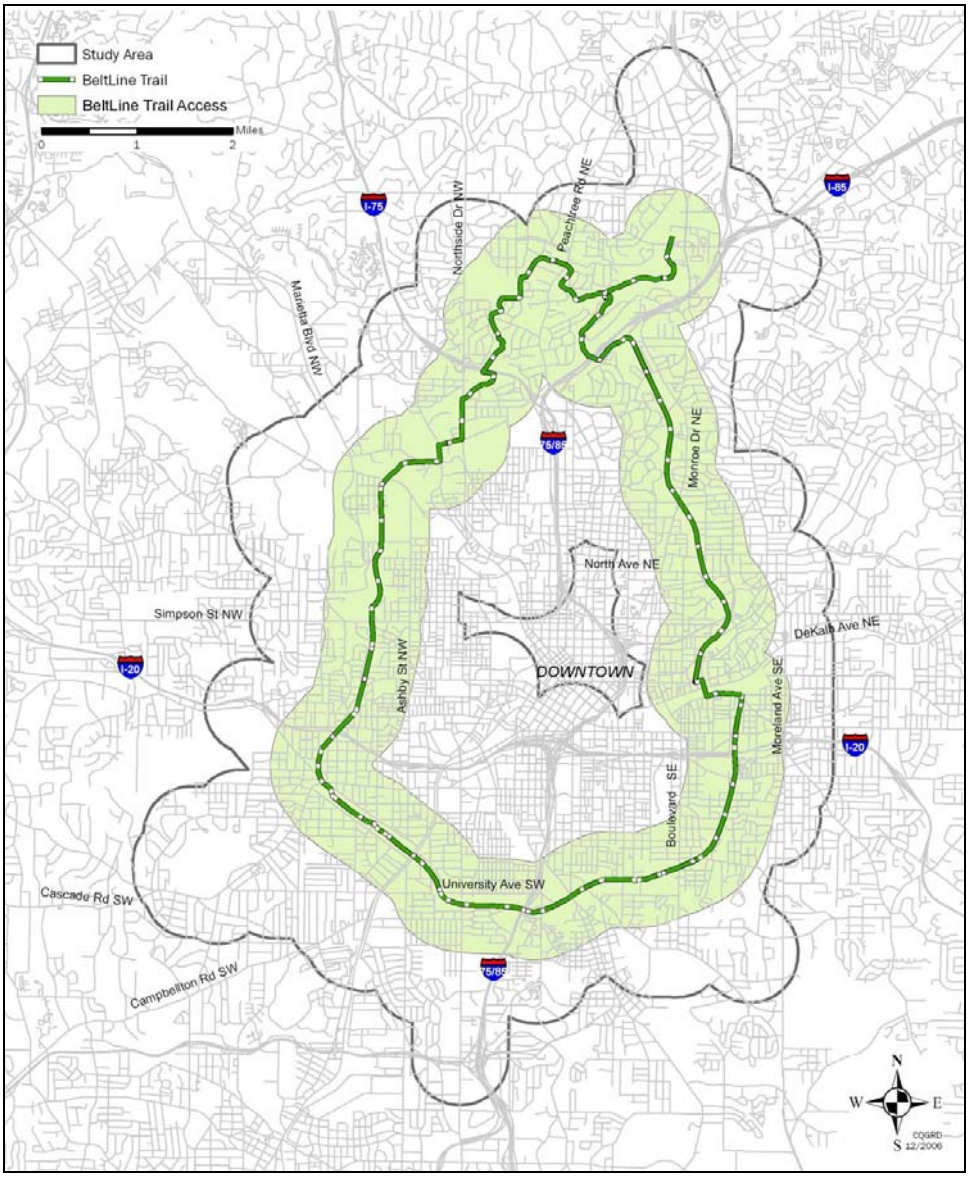


Table 5.8 Access to BeltLine Trail System as Compared to City and Study Area

	City of Atlanta	Study Area	Access to Trail System
Total Population	416,474	213,920	88,752
White	138,352 (33.2%)	80,865 (37.8%)	37,285 (42.0%)
Non-white	278,122 (66.8%)	133,055 (62.2%)	51,467 (58.0%)
Under Poverty	95,743 (23.0%)	48,904 (22.9%)	18,396 (20.7%)
Aged 0-17	93,004 (22.3%)	43,363 (20.3%)	16,499 (18.5%)
Aged 65+	40,535 (9.7%)	17,966 (8.4%)	7,645 (8.6%)
Rate of Carless Housing Units	21.2%	24.6%	20.7%
Per Capita Income	$25,772	$23,925	$27,130

Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

While there appear to be slight differences between the population that has access to the BeltLine trail system and the study area and the City, these differences are much more noticeable when the BeltLine is broken down into the five planning areas for part two of this assessment. The results, shown in Table 5.9, illustrate that the populations that will have access to the BeltLine trail in the Northside and Northeast Planning Areas have a considerably higher proportion of whites and a much higher per capita income. Conversely, the populations that will have access to the BeltLine trail in the Southwest and Westside Planning Areas have a considerably higher proportion of non-whites and a much lower per capita income. The only area that appears to closely resemble the city and study area in terms of demographics is the Southeast planning area.

Additionally, there appear to be disparities in the number of people in each planning area that have access to the BeltLine trail. For example, 58 percent of the residents of the Northside have access to the trail, while less than 29 percent of the Southwest has access to the trail. Part of this difference is due to the sheer size of the Southwest planning area, which extends well beyond the designated access distance of one-half-mile from the BeltLine trail. This difference is also a reflection of the existing land uses near the proposed trail. At present, segments of the BeltLine corridor are surrounded by acres of industrial land uses and unused properties. In other parts of the corridor, residential areas are immediately adjacent. Furthermore, residential densities vary along the corridor. Regardless, it is notable that the Southwest planning area has the largest number of residents yet the fewest number of residents who will have access to the trail.

Table 5.9 Access to Trail System by BeltLine Planning Area

	Northside	Northeast	Southeast	Southwest	Westside
Total Population	36,872	43,149	39,711	51,080	43,057
Population with Access	21,445	20,379	15,773	14,661	16,451
% of Area Population with Access	58.2%	47.2%	39.7%	28.7%	38.2%

Characteristics of the Population with Access to Trails

	Northside	Northeast	Southeast	Southwest	Westside
White	16,474 (76.8%)	13,825 (67.8%)	5,198 (33.0%)	477 (3.3%)	1,283 (7.8%)
Non-white	4,971 (23.2%)	6,554 (32.2%)	10,575 (67.0%)	14,185 (96.7%)	15,168 (92.2%)
Under Poverty	2,437 (11.4%)	2,739 (13.4%)	4,488 (28.5%)	4,264 (29.1%)	4,463 (27.1%)
Aged 0-17	2,317 (10.8%)	2,258 (11.1%)	4,113 (26.1%)	4,252 (29.0%)	3,501 (21.3%)
Aged 65+	1,527 (7.1%)	1,418 (7.0%)	1,299 (8.2%)	1,492 (10.2%)	1,901 (11.6%)
Rate of Carless Housing Units	11.7%	14.1%	27.5%	31.6%	36.7%
Per Capita Income	$ 43,814	$ 39,937	$ 16,693	$ 13,696	$ 11,350

Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

5.3.3 Transit

Access to transit has an indirect relationship with health. Many people rely on public transportation in order to participate in essential activities, such as going to work or accessing adequate healthcare (Joint Center for Political and Economic Studies and Policy Link, 2004; Chappelle, 2001). One study in Atlanta found that labor participation rates increased in areas that had access to public transit (Sanchez, 1999; Adler, 2002). For many reasons, such as having a steady income and access to healthcare benefits, the employed generally have better health than the unemployed (Adler, 2002). Additionally, some studies have found that commuters who take transit to work are more physically active than those who do not as a result of increased walking to and from transit (Wener, 2007; Fenton, 2005).

There are significant health benefits for individuals who have access to transit, however the literature shows those benefits have the potential to be unevenly distributed across socioeconomic groups. There are numerous reports asserting that transit plays a major role in equity. Particularly, many of these reports stress the marginalization of minorities and lower income individuals, who are more likely to be transit dependent, through a prioritization of highway funding over public transit funding (Garrett, 1997; Sanchez et al., 2003; Hess, 2005).

To assess the level of equity of the proposed BeltLine transit system, a methodology similar to that utilized in the park and trail equity sections is used. A 0.5 mile buffer was created around each of the 43 proposed BeltLine transit stops to represent the area of reasonable walking distance to the stop. This buffer was then intersected with Census data to obtain a demographic profile of the population within walking distance of the transit system.

The first part of the assessment examines access to the system as a whole (Figure 5.6). As Table 5.10 shows, approximately 77,000 people, or 36 percent, within the study area will have access to the proposed transit system (using 2000 population). The demographic profile of the transit access population is similar to that of the study area and the city as a whole, meaning that the population that will have access to the BeltLine transit is not markedly different than the city or study area. Therefore, on a system-wide basis, access to the BeltLine transit system is equitably distributed based on race, age, income, and transit dependence.

Figure 5.6 Areas that have Access to the BeltLine Transit system

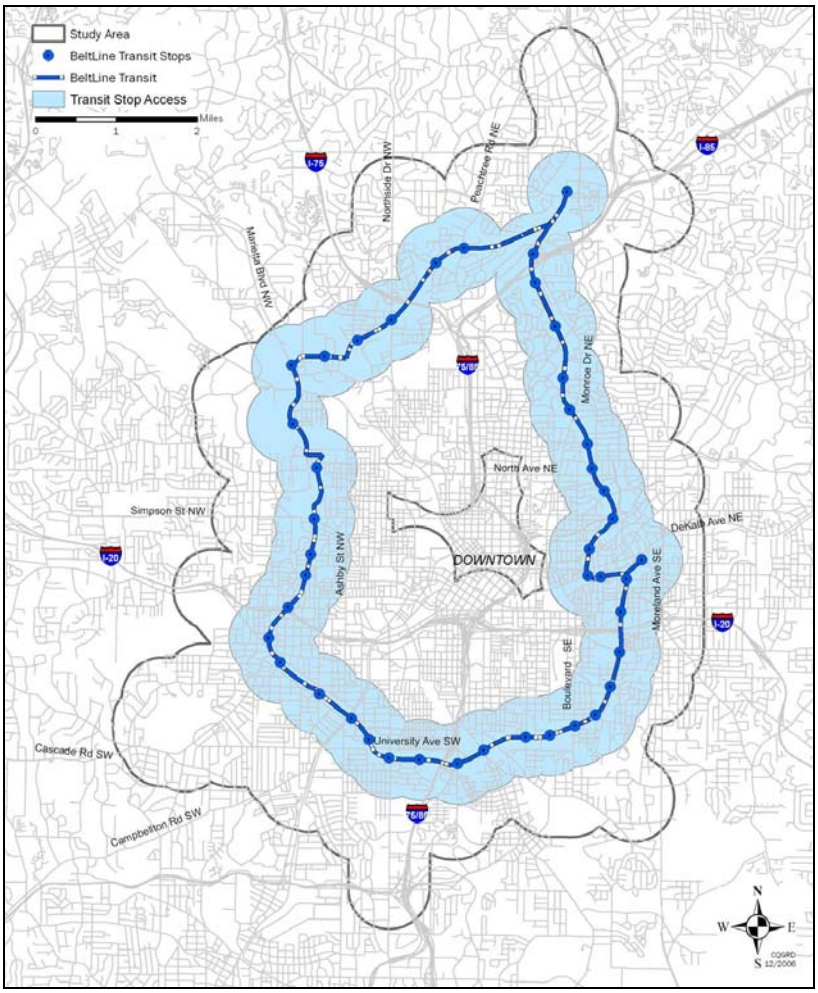


Table 5.10 Access Population Profile for BeltLine Transit as Compared to the City and Study Area

	City of Atlanta	Study Area	Access to BeltLine Transit System
Total Population	416,474	213,920	77,397
White	138,352 (33.2%)	80,865 (37.8%)	30,246 (39.1%)
Non-white	278,122 (66.8%)	133,055 (62.2%)	47,152 (60.9%)
Under Poverty	95,743 (23.0%)	48,904 (22.9%)	16,782 (21.7%)
Aged 0-17	93,004 (22.3%)	43,363 (20.3%)	14,965 (19.3%)
Aged 65+	40,535 (9.7%)	17,966 (8.4%)	6,815 (8.8%)
Rate of Carless Housing Units	21.2%	24.6%	21.6%
Per Capita Income	$25,772	$23,925	$25,587
Currently Taking Transit to Work	40,535 (9.7%)	14,737 (6.9%)	5,793 (7.5%)

Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

The second part of the assessment divides the BeltLine transit system into five planning areas. Table 5.11 displays a demographic profile of the transit access population for each planning area, which again illustrates the differences among the five areas.

Table 5.11 Demographic Profile of BeltLine Transit Stop Access Population by Planning Area

	Northside	Northeast	Southeast	Southwest	Westside
Total Population	36,872	43,149	39,711	51,080	43,057
Population with Access (2000)	15,486	19,007	15,851	13,787	13,249
% of Area Population with Access	42.0%	44.0%	39.9%	27.0%	30.8%

Characteristics of Population with BeltLine Transit Access

	Northside	Northeast	Southeast	Southwest	Westside
White	11,342 (73.2%)	12,765 (67.2%)	5,234 (33.0%)	452 (3.3%)	452 (3.4%)
Non-white	4,415 (26.8%)	6,242 (32.8%)	10,617 (67.0%)	13,334 (96.7%)	12,796 (96.6%)
Under Poverty	1,956 (12.6%)	2,593 (13.6%)	4,426 (27.9%)	4,020 (29.2%)	3,783 (28.6%)
Aged 0-17	1,593 (10.3%)	2,134 (11.2%)	4,098 (25.9%)	4,002 (29.0%)	3,137 (23.7%)
Aged 65+	1,036 (6.7%)	1,313 (6.9%)	1,312 (8.3%)	1,408 (10.2%)	1,744 (13.2%)
% Taking Transit to Work	1,274 (8.2%)	1,044 (5.5%)	1,075 (6.8%)	1,329 (9.6%)	1,071 (8.1%)
Rate of Carless Housing Units	12.9%	14.2%	27.4%	31.6%	36.4%
Per Capita Income	$39,604	$ 39,575	$ 16,912	$ 13,716	$ 11,891

Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

Table 5.12 compares 2000 population and employment to 2030 projected population and employment (calculated by the Atlanta Regional Commission) among the five planning areas.[29] This data shows the greatest population growth occurring in the Northeast planning area. By 2030, over 115,000 people are expected to live within 0.5 miles of BeltLine transit stops. BeltLine transit stops will be within 0.5 miles of over 67,000 jobs (using 2000 employment), but by 2030 a projected 82,000 will be within walking distance of a stop. The Westside and Northside Planning Areas will see the largest percentage increases in employment.

To be able to support transit, population and employment density must be sufficiently high. The Southwest and Westside Planning Areas appear to have the least potential for transit use with the lowest populations and lowest employments in 2030. However, these planning areas currently have the highest transit usage rates and the highest rates of carless housing units (shown in Table 5.11), which suggests that residents in the Southwest and Westside Planning Areas are the most transit dependent of any area. Although transit may be more feasible in the Northeast and Northside areas from a conventional transit planning perspective that identifies residential and employment density as the primary measures of feasibility, the carless rates and existing transit usage of residents in the Southwest and Westside areas indicate greater need and potentially greater ridership.

Table 5.12 Population Growth in BeltLine Transit Access Areas by Planning Area

	Northside	Northeast	Southeast	Southwest	Westside	TOTAL
2000 Population with Transit Access	15,486	19,007	15,851	13,787	13,249	77,379
2030 Population with Transit Access	20,847	30,500	24,061	18,998	20,840	115,247
% Population Change	35%	60%	52%	38%	57%	49%
2000 Employment with Transit Access	25,432	29,059	6,172	3,484	3,247	67,394
2030 Employment with Transit Access	34,401	32,129	6,602	3,572	5,932	82,636
% Employment Change	35.3%	10.6%	7.0%	2.5%	82.7%	22.6%

Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; ARC, 2030 projection; CQGRD calculations

The final transit access assessment provides a demographic profile for each individual stop along the proposed BeltLine transit system using 2000 population data.[30] Table 5.13 displays a demographic profile of each of the 43 proposed stations along the BeltLine transit system. The transit access populations vary considerably along the BeltLine. The access populations range in size from 788 to 5,543; the rate of workers who use transit is between two percent and 21 percent; and per capita income ranges from $9,723 to $58,319. Clearly, each proposed transit stop will serve a different kind of population, a conclusion similar to that found in the park equity section.

[29] These estimates were generated using a Geographic Information System to estimate the population living near transit stations in each planning area. A 0.5 mile radial buffer was created around each station to select complete and partial Census Tracts contained within the buffer. For partial Tracts, the proportion of land area that is within the buffer was used to determine the portion of the population within the 0.5 miles. This technique will result in overestimations in some cases and underestimations in others because of variations in residential patterns that cannot be account for in this broad-brush technique, but since it is being applied throughout the 22-mile loop of transit stations it should result in a relatively accurate estimation.

[30] These estimates were generated using the same technique used to create the previous table, except that it was applied to Census Block Groups.

Table 5.13 Demographic Profile of BeltLine Transit Stop Access Population

Name	Area	Total Population	White	Non-white	Under Poverty	Aged 0-17	Aged 18-64	Aged 65+	Transit to Work	Rate of Car-less Housing Units	Per Capita Income
Armour	NS	2,751	83.3%	16.7%	6.6%	8.0%	83.2%	8.8%	6.0%	11.2%	$47,629
Blandtown	NS	910	53.2%	46.8%	13.0%	6.9%	88.6%	4.5%	1.9%	5.3%	$30,973
Collier Road	NS	4,104	83.2%	16.8%	12.7%	9.8%	82.6%	7.6%	1.7%	13.2%	$43,181
Howell Mill	NS	1,469	71.1%	28.9%	17.4%	7.3%	88.9%	3.8%	3.5%	4.7%	$35,676
Lindbergh	NS	4,208	58.2%	41.8%	13.0%	12.9%	81.6%	5.4%	20.9%	18.5%	$33,297
Marietta Boulevard	NS	788	36.1%	63.9%	15.2%	11.4%	80.9%	7.7%	3.8%	14.7%	$20,790
Northside Drive	NS	2,241	74.1%	25.9%	15.1%	8.8%	87.2%	4.0%	3.1%	4.6%	$37,433
Peachtree	NS	4,385	82.2%	17.8%	13.6%	9.3%	81.7%	9.0%	3.4%	15.9%	$42,230
Amsterdam Ave	NE	3,114	86.3%	13.7%	7.9%	10.6%	81.4%	7.9%	3.7%	7.2%	$58,319
Ansley	NE	3,269	81.1%	18.9%	11.1%	9.9%	85.0%	5.0%	6.5%	8.2%	$51,808
Decatur Street	NE	3,642	43.9%	56.1%	20.4%	13.0%	76.2%	10.8%	8.1%	23.4%	$22,294
Elizabeth Ave	NE	3,164	58.9%	41.1%	14.1%	14.1%	79.3%	6.6%	5.0%	18.9%	$28,821
Greenwood Ave	NE	5,543	74.7%	25.3%	12.0%	9.3%	86.8%	3.9%	4.5%	10.3%	$40,276
Irwin Ave	NE	3,586	40.4%	59.6%	19.1%	13.4%	75.9%	10.6%	7.8%	23.3%	$23,830
Montgomery Ferry	NE	2,067	83.5%	16.5%	6.6%	9.4%	81.5%	9.0%	5.0%	8.1%	$51,793
North Ave	NE	4,189	53.6%	46.4%	20.1%	13.6%	79.6%	6.8%	5.0%	23.1%	$28,957
Piedmont Park	NE	3,971	82.7%	17.3%	9.0%	9.5%	83.5%	7.0%	3.1%	8.9%	$49,868
Ponce Park	NE	5,328	58.1%	41.9%	19.5%	12.7%	82.0%	5.4%	5.2%	19.2%	$32,207
Boulevard/ Grant Park	SE	2,915	35.5%	64.5%	31.0%	28.7%	65.7%	5.7%	4.7%	21.7%	$16,644
Cabbagetown	SE	3,482	49.8%	50.2%	17.9%	14.4%	76.6%	9.0%	7.0%	20.4%	$23,945
Carver	SE	2,740	5.3%	94.7%	39.7%	34.4%	54.0%	11.6%	8.7%	52.6%	$9,723
Cherokee	SE	3,411	22.8%	77.2%	41.7%	34.8%	59.2%	6.0%	5.9%	35.1%	$11,902
Confederate Ave	SE	2,929	46.0%	54.0%	21.5%	25.4%	69.5%	5.2%	4.2%	13.3%	$20,722
Glenwood Ave	SE	2,889	54.4%	45.6%	15.6%	16.0%	74.1%	9.9%	5.8%	15.1%	$22,474
Hill Street	SE	3,589	14.9%	85.1%	41.7%	36.7%	56.6%	6.7%	7.1%	42.5%	$10,814
Inman Park	SE	3,355	49.7%	50.3%	13.7%	18.7%	74.7%	6.6%	9.1%	19.7%	$27,000

Name	Area	Total Population	White	Non-white	Under Poverty	Aged 0-17	Aged 18-64	Aged 65+	Transit to Work	Rate of Car-less Housing Units	Per Capita Income
Memorial Drive	SE	3,028	43.5%	56.5%	18.7%	17.1%	72.7%	10.2%	5.8%	21.4%	$19,503
Ormewood Park	SE	3,336	55.7%	44.3%	16.0%	20.6%	73.1%	6.3%	4.4%	9.6%	$23,645
Pryor Road	SE	2,201	3.6%	96.4%	42.4%	32.7%	53.5%	13.7%	8.6%	44.2%	$10,296
Reynoldstown	SE	3,366	47.6%	52.4%	15.8%	18.2%	74.7%	7.2%	6.9%	20.5%	$24,168
Adair Park	SW	3,083	7.4%	92.6%	29.8%	29.8%	61.4%	8.8%	8.8%	27.6%	$13,179
Lawton Street	SW	3,482	1.2%	98.8%	31.1%	26.9%	61.9%	11.1%	10.8%	40.3%	$14,854
Metropolitan Parkway	SW	3,104	6.4%	93.6%	28.3%	30.9%	60.3%	8.9%	9.2%	24.8%	$13,594
Murphy Triangle	SW	3,083	5.6%	94.4%	30.2%	27.5%	62.7%	9.9%	9.0%	32.6%	$13,721
University Ave	SW	2,507	4.0%	96.0%	34.4%	31.5%	56.0%	12.6%	8.8%	31.5%	$12,310
West End/RDA	SW	4,640	1.7%	98.3%	26.5%	28.9%	62.0%	9.2%	10.3%	32.1%	$15,133
Westview	SW	4,548	1.4%	98.6%	27.0%	28.6%	60.4%	11.0%	9.1%	28.0%	$13,179
Ashview Heights	WS	4,667	0.3%	99.7%	30.9%	26.9%	56.5%	16.6%	9.0%	31.5%	$12,444
Hollowell Parkway	WS	3,697	6.5%	93.5%	23.1%	24.2%	69.2%	6.6%	8.4%	39.2%	$10,766
Howell Station	WS	2,191	12.1%	87.9%	10.8%	13.1%	81.3%	5.6%	5.5%	26.6%	$10,638
Mozley Park	WS	4,279	0.0%	100.0%	31.6%	23.9%	55.9%	20.2%	8.4%	32.6%	$13,329
Simpson Road	WS	4,500	0.3%	99.7%	37.7%	29.4%	58.3%	12.3%	8.7%	43.4%	$11,367
Washington Park	WS	3,750	0.0%	100.0%	31.0%	22.9%	57.2%	19.9%	7.9%	31.2%	$13,321

Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

Table 5.14 shows future access population and employment in 2030 around each transit stop using ARC estimates.[31] Again, each stop is different in the level of population and employment growth over the 30 year period. With the exception of two stops (Howell Mill and Northside Drive), the access populations are estimated to increase over the next 25 years for every stop, even doubling in some locations. The employment figures are much less robust with 16 of the 43 stops expected to see employment decreases over the next 25 years, with most of those stops located in the Southeast and Southwest Planning Areas. Most areas north of Interstate 20 (primarily the Westside, Northside, and Northeast Planning Areas) are expected to see strong job growth over the next 25 years.

[31] As was done with the 2000 Census data, these profiles were generated using a Geographic Information System to estimate the population living around each station in 2030. A 0.5 mile radial buffer was created around each station to select complete and partial Census Tracts contained within the buffer. For partial tracts, the proportion of land area that is within the buffer was used to determine the portion of the population within the 0.5 miles. This technique will result in overestimations in some cases and underestimations in others because of variations in residential patterns that cannot be account for in this broad-brush technique, but since it is being applied throughout the 22-mile loop of transit stations it should result in a relatively accurate estimation.

Table 5.14 Estimated Population and Employment Growth of BeltLine Transit Stop Access Areas

Name	Area	2000 Pop.	2030 Pop.	% Pop. Change	2000 Employ.	2030 Employ.	% Emp. Change
Armour	NS	2,751	4,885	78%	5,145	5,877	14%
Blandtown	NS	910	1,575	73%	3,741	3,066	-18%
Collier Road	NS	4,104	5,479	34%	6,484	8,224	27%
Howell Mill	NS	1,469	1,441	-2%	3,897	3,134	-20%
Lindbergh	NS	4,208	5,705	36%	4,081	11,123	173%
Marietta Boulevard	NS	788	1,770	125%	2,557	2,281	-11%
Northside Drive	NS	2,241	1,738	-22%	3,349	2,864	-14%
Peachtree	NS	4,385	6,023	37%	7,693	9,656	26%
Amsterdam Ave	NE	3,114	4,338	39%	11,572	12,051	4%
Ansley	NE	3,269	4,691	44%	4,310	4,939	15%
Decatur Street	NE	3,642	7,643	110%	4,342	4,480	3%
Elizabeth Ave	NE	3,164	5,902	87%	4,295	4,499	5%
Greenwood Ave	NE	5,543	7,152	29%	3,491	5,144	47%
Irwin Ave	NE	3,586	7,983	123%	5,110	4,900	-4%
Montgomery Ferry	NE	2,067	4,874	136%	4,798	5,321	11%
North Ave	NE	4,189	6,384	52%	4,969	6,030	21%
Piedmont Park	NE	3,971	5,684	43%	8,422	9,498	13%
Ponce Park	NE	5,328	7,033	32%	4,410	5,944	35%
Boulevard/Grant Park	SE	2,915	3,804	31%	1,231	963	-22%
Cabbagetown	SE	3,482	6,586	89%	3,125	3,290	5%
Carver	SE	2,740	5,145	88%	941	860	-9%
Cherokee	SE	3,411	4,737	39%	1,163	869	-25%
Confederate Ave	SE	2,929	3,576	22%	1,164	967	-17%
Glenwood Ave	SE	2,889	4,246	47%	1,332	1,386	4%
Hill Street	SE	3,589	5,430	51%	956	765	-20%
Inman Park	SE	3,355	4,795	43%	1,439	1,664	16%
Memorial Drive	SE	3,028	4,930	63%	1,248	1,662	33%
Ormewood Park	SE	3,336	3,952	18%	1,202	1,151	-4%
Pryor Road	SE	2,201	4,661	112%	931	869	-7%
Reynoldstown	SE	3,366	5,056	50%	1,335	1,603	20%
Adair Park	SW	3,083	4,272	39%	1,110	1,053	-5%
Lawton Street	SW	3,482	5,231	50%	977	1,021	4%
Metropolitan Parkway	SW	3,104	4,180	35%	1,036	996	-4%
Murphy Triangle	SW	3,083	4,593	49%	1,149	1,065	-7%
University Ave	SW	2,507	4,645	85%	943	866	-8%
West End/RDA	SW	4,640	5,461	18%	547	702	28%
Westview	SW	4,548	5,601	23%	516	689	34%
Ashview Heights	WS	4,667	7,108	52%	492	698	42%
Hollowell Parkway	WS	3,697	5,184	40%	1,221	2,950	142%
Howell Station	WS	2,191	3,037	39%	1,266	1,604	27%
Mozley Park	WS	4,279	8,225	92%	535	545	2%
Simpson Road	WS	4,500	6,102	36%	537	1,977	268%
Washington Park	WS	3,750	6,892	84%	531	582	10%

NOTE: Because stops are located in close proximity to each there is an overlap in the service areas for each stop. Therefore, summing all of the station in a planning area will result in a larger service population than exists. For an accurate estimate of services population by planning area see Table X.

SOURCE: U.S. Census, 2000; ARC; BeltLine Redevelopment Plan

5.3.4 Housing

Over the next 25 years, the BeltLine is expected to result in the construction of approximately 28,000 housing units in the Tax Allocation District (TAD); of these, roughly 20 percent will be affordable housing, according to BeltLine, Inc. An additional 110,000+ housing units[32] are anticipated to be constructed in the remaining study area to increase total housing units in the study area to approximately 198,000 by 2030.

Housing and Health

Housing has been identified as one of the main settings that affect human health. Housing not only serves as the place where we spend a large portion of our day, but shapes the context in which we pursue our lives. It can determine where we shop, go to school, play, and work. It provides basic shelter. It can influence who our friends are and the opportunities we have to be an active part of a community. Housing can influence the access we have to healthy foods, health care, and other important services. Clearly, the role of our dwelling unit goes well beyond the front door; instead, it situates people in society. Thus it follows that housing has a significant impact on public health.

Housing not only provides adequate shelter, "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" (WHO).

For the purpose of this report, housing is defined as "the conjunction of the dwelling, the home, the immediate environment and the community" (WHO). This definition means that housing is not simply the residential unit or even the piece of real estate where it is located, but is instead the collective housing units, associated land uses, and social environment that compose a neighborhood. Therefore, for the purpose of the BeltLine, healthy housing is concerned primarily with the housing unit and the neighborhood in which it is situated. A healthy housing unit is characterized as being in good condition, free from pollutants and excesses in noise, temperature, and humidity. It is safe and not overcrowded and designed and maintained to reduce injury. And a healthy neighborhood promotes active living through good design — appropriate density, land use mix, street connectivity, awareness of the human scale, attention paid to aesthetics — and by being safe and perceived as safe. A healthy neighborhood buffers inhabitants from unhealthful things, whether social, economic, or environmental; and provides affordable and appropriate housing choices for residents in all stages of life. Following is a brief overview of studies that address the relationship between the housing unit and neighborhood to health outcomes.

The Housing Unit: Indoor air quality, temperature, humidity, noise, light, crowding, and general safety are all issues related to housing and health. For example, poor ventilation, cheap or old building materials, and inadequately functioning appliances can cause the release of toxic substances, such as carbon monoxide, nitrogen dioxide, asbestos, radon, polyvinyl chloride, pesticide residues, and volatile organic compounds that can contribute to a host of symptoms such as asthma, headaches, acute intoxication, lung cancer, hypertension, and bronchial obstruction (Krieger and Higgins, 2002; Jordan, 2006). Allergens produced by pests such as rats, dust mites, and roaches are associated with increased asthma attacks, particularly in children and the elderly (Krieger and Higgins, 2002).

Temperature and humidity are also factors in health housing. A constant and acceptable range of indoor temperature is important for the health of the household. The potentially fatal consequences of heat exposure are perhaps better known than the increased risk of cardiovascular disease and arthritic problems associated

[32] The estimate of 110,000 housing units is based upon the Atlanta Regional Commission (ARC) 2030 population projection for the study area of approximately 315,000 divided by the average household size reported in ARC's 2006 Housing Report.

with excessively cold indoor temperatures (Krieger and Higgins, 2002). Dampness, which breeds mold and is exacerbated by poor ventilation or the inability to dry out a space using adequate heating and cooling systems, is a contributing factor to a variety of chronic conditions such as asthma, sore throat, skin problems, and headaches. Dampness also attracts rats and mice, mites, roaches, and other pests which produce allergens that are a major contributing cause of asthma attacks (Krieger and Higgins, 2002). In preliminary research, mold growth has also been linked with fatigue, depression, cerebral strokes, heart attacks, and hypertension (Lavin, et al, 2006).

Additionally, noise and light in relation to housing conditions can impact health. Noise can be caused by many factors, from the location of a house near a freeway, airport, or busy industrial complex to crowded living conditions. The health impacts of noise are difficult to quantify, particularly when noise is an annoyance rather than excessive to the point of hearing damage. Research has found that the effects of noise manifest themselves differently among age groups. Symptoms for adults typically include depression and impacts on the respiratory, cardiovascular, and muscular-skeletal systems. Children experience respiratory symptoms, while the elderly have an increased risk of stroke (Lavin, et al, 2006). Exposure to excessive or prolonged noise, such as in multi-family units with poor insulation, can lead to psychological stress and activation of the sympathetic nervous system (Krieger and Higgins, 2002). Lack of light, particularly exposure to daylight, has a negative effect on psychological well-being and can have a detrimental effect on learning and motivation. Lack of light or poor lighting is also a contributing factor for physical injuries caused by falls and can increase feelings of isolation, apprehension, and fear (Krieger and Higgins, 2002; Lavin, et al, 2006).

The 1999 U.S. Census Housing Survey documented 2 million houses that had severe physical problems and an additional 4.8 million homes with moderate problems, both of which contribute to injury risk. This places nearly 7 million households at increased risk of physical injury from burns, falls, and fires (Krieger and Higgins, 2002; Lavin, et al, 2006). A 2002 study noted that 13.5 million non-fatal injuries occurred in or around U.S. homes in one year (Krieger, et al, 2006). Falls are the leading cause of injury-related visits to emergency rooms in the U.S., (Fuller, 2000) and children under the age of five and adults over the age of 65 account for the largest number of emergency department patients (CDC, nda). In 2003 more than 1.8 million seniors over the age of 65 were treated in emergency rooms for fall-related injuries, resulting in an annual cost of approximately $19.2 billion. By 2020, the annual costs of injuries are expected to be $43.8 billion (CDC, nda). The risk of injuries in housing units is exacerbated by the fact that many older homes and housing may not follow the Americans with Disabilities Act (ADA) guidelines for corridor and door width, and may lack accommodations that allow for safe and increased mobility for the elderly and disabled residents. Injury, decreased physical activity, and psychological consequences are of concern ((Krieger, et al, 2006). There is also evidence that people living in dwellings occupied by more than one household are at an increased risk of injury and even death from fire, burns, and scalding (Lavin, et al, 2006).

Crowded living conditions have also been associated with the transmission of respiratory infections, such as tuberculosis, and ear infections in children and have even been linked to mold growth in homes due to increased humidity (Krieger and Higgins, 2002). Crowding also contributes to an increase in noise and can have detrimental effects on the development of children, who cannot study undisturbed. Lack of space for playing contributes to a decrease in physical activity in children and increases the risk of obesity, this may have behavioral manifestations (Lavin, et al, 2006).

And finally, inadequate food storage and disposal facilities and leaking water feed pest infestations and contribute to respiratory ailments and other pest-borne diseases. Lack of safe drinking water, lack of hot water for washing, and poor sewer facilities contribute to the spread of infectious diseases (Krieger and Higgins, 2002).

Housing design has an effect on the health of the inhabitants as it impacts the functionality of the housing unit for people of all ages and ability levels. The impacts can be physical, in terms of injuries sustained, or can be psychological, when the ability to function efficiently and effectively within the house and the neighborhood is

reduced. Some issues with design have been addressed above. In addition, two groups for whom housing design is of utmost importance are older adults and those with disabilities. As people live longer, the number of individuals living with functional limitations and disabilities is on the rise (U.S. Census, 1997). Researchers and designers have developed a practice known as Universal Design, which is defined as the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design (Mace, et al, 1991). The implementation of Universal Design in the construction of houses and the design of neighborhoods can promote livable communities that enable individuals of all ages and ability levels to function over time without segregation, loss of choice, lack of safety, increase in cost burden, or loss of mobility. These in turn have implications for the overall health and well-being of the inhabitants. More information on Universal Design is available in Appendix 6.

The Neighborhood: The neighborhood's role in supporting healthy housing is varied. It provides a setting for and access to opportunities for physical activity (Section 6), it can provide access to healthy foods (Section 5.3.5), and determines exposure to noise (Section 9.3) and poor outdoor air quality (Section 9.1), among other factors. These subjects are discussed in depth in other sections of this report and do not require more detail here, suffice to say that the neighborhood provides the daily context for healthy housing.

Gentrification and Displacement

Gentrification can be defined as a physical or social manifestation of neighborhood change. Using the physical environment as the descriptor, gentrification is the process of increasing land values in traditionally poor areas through redevelopment and renovation. The social expression of this process is the transition from a low-income population to a higher-income population (Kennedy and Leonard, 2001; Atkinson, 2004; Redfern, 2003; CDC, ndb). In effect, existing residents are displaced by the process because gentrifying neighborhoods typical loose their stock of affordable housing units over time. And it is the inadequate availability of affordable housing that "is amongst the most prevalent community health concerns" (Anderson, 2003).

Gentrification and displacement have several types of potential health impacts related to mental health, social capital, access to health promoting goods and services. Left unchecked, the process of neighborhood change can:

- **Force residents to spend too much on housing.** Gentrification causes property values, and hence home prices and rental costs, to rise. According to federal guidelines, a financially healthy household should not spend more than 30 percent of its income on shelter. The high housing costs burden means there is less money to go toward health care, nutritious foods, education, and recreational opportunities among other things, all of which have direct impacts on health, overall quality of life, and the long-term economic success of the household (Lipman, 2006; Haas, et al, 2006; Ellen, et al, 2001).
- **Make residents live in substandard or overcrowded housing.** With reduced housing options, residents may be forced to occupy substandard housing or move in with family and friends, resulting in overcrowding. Such conditions may increase risk of injury, lead poisoning, and respiratory illnesses. The health consequences of substandard and overcrowded housing are enumerated earlier in this section.
- **Move away.** Locating a greater distance from employment results in increased transportation costs that also can burden the physical, mental, and economic health of households. People are paying the penalty in time (spent traveling to and from work), money (spent on transportation costs), and health (stress and less time for health-promoting activities). The penalties become increasingly and disproportionately severe for those families who earn less than $40,000 a year (Bernstein, 2004; Haas, et al, 2006). Living further from jobs and services also results in an increase in vehicle miles traveled, which increases vehicle emissions and crash rates. Emissions negatively impact air quality, causing associated health issues (see Section 9.1). These sprawling conditions have also been

associated with increases in both traffic and pedestrian fatalities (Ewing, et al, 2003). For example, exurban counties have been shown to have higher traffic fatality rates compared to core counties (Lucy, 2003).

Widespread gentrification can also lead to areas of concentrated poverty that typically lack many amenities and facilities and can be stressful environments as people struggle to make ends meet. These conditions make automobiles increasingly important, causing families on tight budgets to extend themselves to purchase a vehicle and isolating non-drivers—including children, older adults, and people who do not own a vehicle (Ellen, et al, 2001). The cost of owning and maintaining a car adds significantly to the cost burden of a household. Direct costs of owning a vehicle are approximately $0.29 per mile or approximately $3,700 per year per vehicle. Households in auto dependent communities, like Atlanta, can spend as much as 20 percent of their annual expenditures on transportation costs. In addition to the direct costs to households, there are also external costs to automobile dependency that can approach an additional $0.40 per vehicle mile. Included in this calculation are environmental, congestion, equity impact, and land opportunity costs to name a few (Victoria Transport Policy Institute, 2006).

Displacement may also result in a loss of social cohesion. Social cohesion refers to connections to the family, neighborhood, identity group, locality, and society. A sense of social cohesion affects human health by providing supportive social networks that provide access to material and emotional support, allowing for social participation through relationships that provide friendship and participation in the workforce, supporting community engagement through participation in organizations that work for the benefit of members and others, and encouraging political engagement through involvement in the democratic process. Social cohesion has mental health and illness outcomes. For example, social networks have been shown to reduce stress, while isolation may aggravate mental illness. Social networks have also been linked to access to employment opportunities (Goetz, 2003), which can provide resources for healthcare services.

Housing and the BeltLine

In the BeltLine Study Area, if the goal of Healthy Housing is to be achieved the following issues should be addressed:

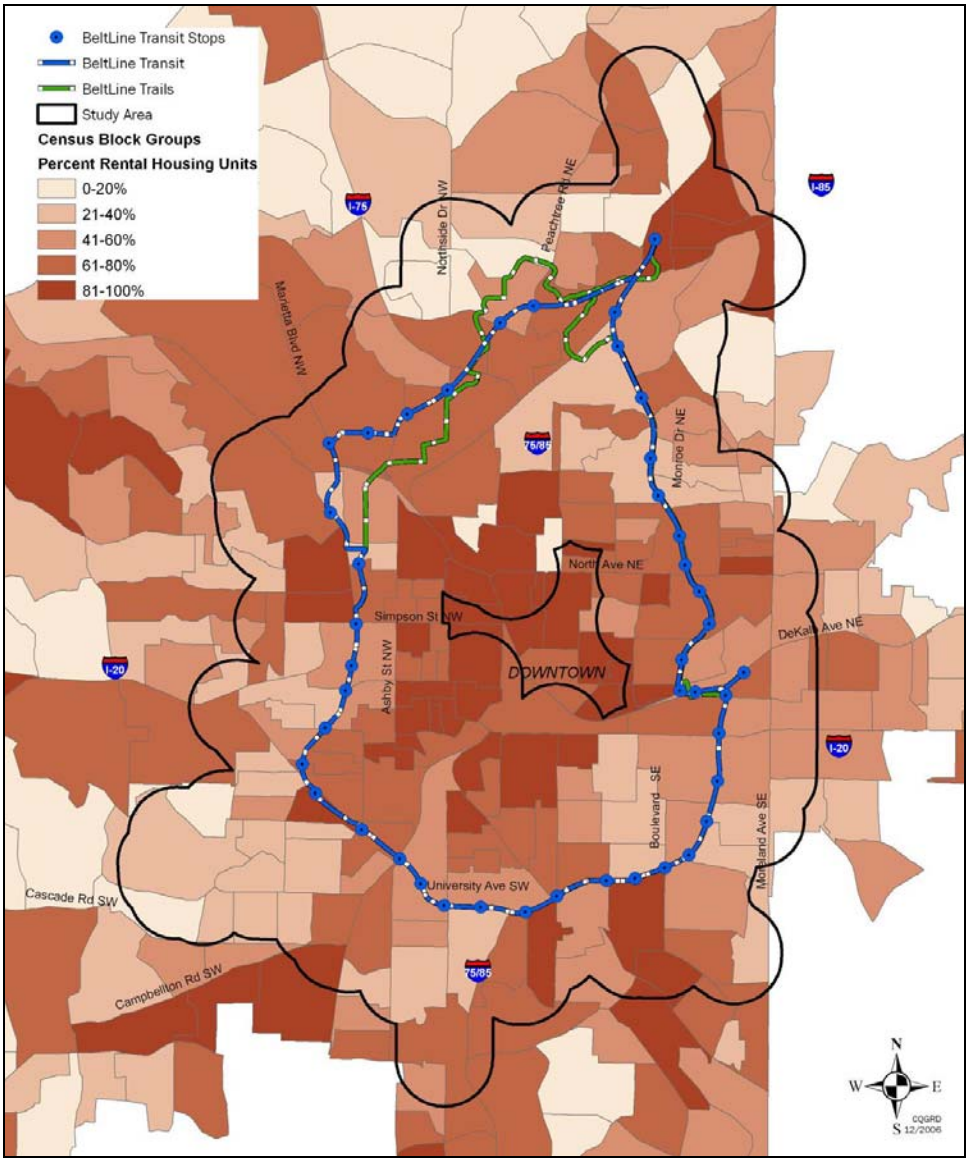
- Construction of new healthy housing largely based on income and age to meet needs of many populations
- Improvements to existing substandard housing
- Potential displacement of vulnerable housing groups, including people with lower incomes and renters

As was previously noted, approximately 138,000 housing units are anticipated to be built in the study area, thus providing the opportunity to increase the stock of healthy housing units. To ensure that these units provide healthy housing, quality construction practices and a diversity of housing types by size, product (townhome, condominium, apartment, single-family attached, single-family detached), and price is necessary. The *Atlanta BeltLine Redevelopment Plan* includes funding and incentives for the construction of 5,600 affordable housing units within the TAD. These units are targeted at households earning between $18,000 and $85,000 (Lee, 2006).

Populations at-risk of displacement include renters and households whose median income is below the area median income. Rental housing provides the one of most affordable housing options in any city. Increasing property values and local revitalization can encourage owners of rental properties to raise rents, convert properties to condominiums, or redevelop the property at a higher intensity. Regardless of the direction the property owners take, tenants are frequently displaced and are often forced to find housing in other neighborhoods, often distant from their employment, services, and social networks. In the BeltLine Study Area, the Block Groups with the highest percentage of rental units circle the downtown (see Figure 5.7). Table 5.15

provides the total number of rental units by planning area, showing that rentals are relatively equally distributed around the study area. As this data shows, 61.9 percent of housing units, or 54,620, in the study area are occupied by renters.

Figure 5.7 Census Block Group by Percentage of Rental Housing Units



Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

Table 5.15 Distribution of Rental Units among the BeltLine Planning Areas

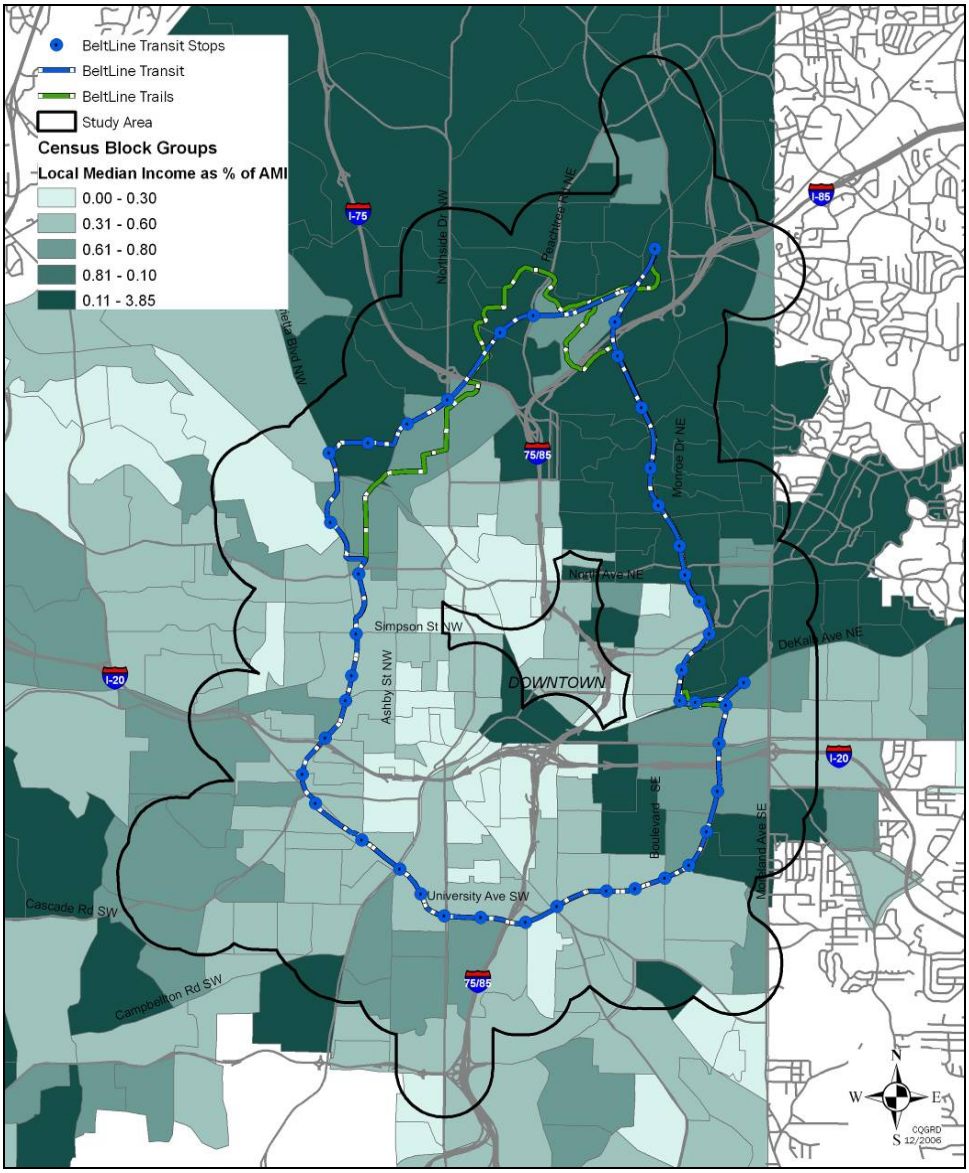
	City of Atlanta	Study Area	Northside	Northeast	Southeast	Southwest	Westside
Total Housing Units	168,147	88,267	19,604	24,635	14,334	17,446	23,636
Renter Occupied	94,674 (56.3%)	54,620 (61.9%)	12,064 (61.5%)	15,561 (63.2%)	8,403 (58.6%)	10,178 (58.3%)	15,948 (67.5%)
Owner Occupied	73,473 (43.7%)	33,646 (38.1%)	7,540 (38.5%)	9,074 (36.8%)	5,931 (41.4%)	7,268 (41.7%)	7,688 (32.5%)

Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

To assess the existing population's affordable housing needs, the HIA project team examined area median income (AMI). U.S. Housing and Urban Development (HUD) uses the median income for families to calculate income limits for eligibility in a variety of housing programs. HUD estimates the median family income for an area in the current year and adjusts that amount for different family sizes so that family incomes may be expressed as a percentage of the area median income. For example, a family's income may equal 80 percent of the area median income, a common maximum income level for participation in HUD programs.

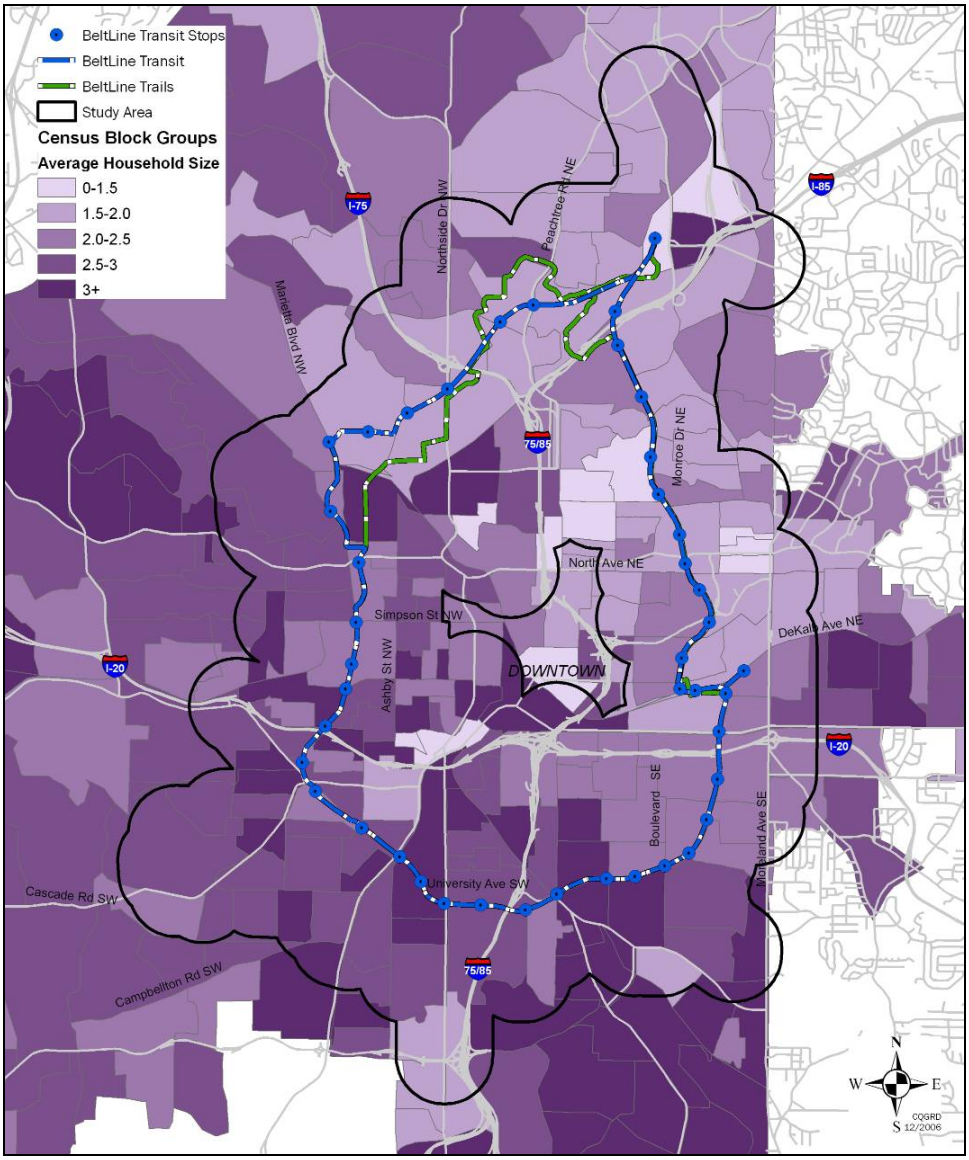
As Figure 5.8 shows, areas with the lowest median income in relation to AMI are located in the Westside, Southwest, and Southeast Planning Areas, where incomes are 30 to 60 percent of the AMI. These lower income areas also have comparatively larger household sizes (see Figure 5.9), meaning that their housing and other costs are greater because of the number of people in the household. As public and private investment takes place in the BeltLine TAD, it is reasonable to expect that surrounding areas will appreciate, making properties unaffordable to the local population and stretching current land owners' resources to pay increasing property taxes. The areas with the lowest AMI are likely to experience the greatest rate of displacement unless policy interventions are adopted.

Figure 5.8 Average Median Household Income in Relation to AMI



Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

Figure 5.9 Average Household Size by Block Group



Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

5.3.5 Healthy Foods

Access also refers to the convenient availability of healthy foods. A healthy diet is one that consists of fruits, vegetables, and whole grains and is low in fat, added sugar, and salt. Healthy diets are recommended for prevention of cardiovascular disease (Morland et al., 2002). Common dietary guidelines warn against unhealthy diets, which contribute to chronic diseases such as diabetes, hypertension, stroke, and certain types of cancer (Jetter and Cassady, 2006). However, studies have shown that unhealthy foods, or "energy-dense" foods with refined grains, added sugars, and added fats, cost less. As a link between healthy food costs and health, lower income and minority groups report higher rates of obesity (Drewnowski, 2004).

Regardless of socioeconomic status, individuals agree on what defines healthy eating, but barriers like cost, transportation, and availability make access to healthy foods an equity issue (Eikenberry and Smith, 2004). Jetter and Cassady (2006) found that in Los Angeles and Sacramento, small grocery stores, which are more prevalent in low-income neighborhoods, do not offer as many "healthy" food items (foods that are lower in fat, higher in fiber than alternatives) as large supermarkets (defined as large, corporate-owned chains) or offer them at higher prices. This means that people without sufficient transportation may never have consistent access to a healthier diet. Furthermore, a family of four would spend an additional 850 to 960 dollars (equivalent to 35 percent to 40 percent of a very low-income family's annual food-at-home budget) each year on a healthier food basket (Jetter and Cassady, 2006).

Access to food stores and food service places, particularly supermarkets, differs by socioeconomic status. Research in Mississippi, North Carolina, Maryland, and Minnesota found that there are over three times as many supermarkets in wealthier neighborhoods compared to lowest-wealth areas, but fewer small grocery stores, convenience stores, and specialty food stores. Furthermore, the same study discovered that supermarkets are four times more common in predominantly white neighborhoods than in predominantly black neighborhoods. Overall, food service places (restaurants, carry-out places, cafeterias), except for bars and taverns, are more prevalent in predominantly white or mixed areas. Lack of access to supermarkets reduces the availability of the most healthy food items at lower prices (Morland et al, 2002).

In Dunkley et al (2004), a study of the City of Atlanta found that individuals usually choose to shop for groceries close to home, which means that competitiveness in price, quality, and service is not as important to consumers as proximity. This condition reduces competition among grocery stores in a market, which means there is less need to lower prices to maintain customer base. Furthermore, this research found that accessibility is improved when more stores (often smaller stores) serve the market. In contrast, large stores (in Atlanta the Kroger, Publix, and Wal-Mart chains dominate the market) are more spaced out and often require driving to shop.

The BeltLine has the potential to improve access to healthy foods by encouraging the location of grocery stores in unserved and underserved areas.[33] To assess the access to healthy foods within the BeltLine Study Area, the Fulton County Department of Health and Wellness assisted the project team by gathering and mapping data on businesses that sell food in the HIA Study Area.[34] This data set includes convenience stores, food stores, independent stores, and chain grocery stores. For the purpose of the HIA, only chain grocery stores were used because it can be assumed that such stores offer the full range of food products, including fresh fruits and vegetables. The other types of stores vary greatly in their offerings, and may provide an adequate array of health foods, but would require on-site visits, which are outside the scope of this HIA, to confirm.

Three levels of access were determined for each store for travel by walking, biking, and driving. Based on a study of Atlanta by Dunkley and colleagues (2004), the reasonable walking distance to a grocery store was set at 0.25 miles, the reasonable biking distance at 0.8 miles, and the reasonable driving distance at 2.0 miles. A radial buffer was extended from each store for each distance to determine the areas with access by mode of transportation. Radial buffers were utilized to be consistent with other assessments in this report. Additionally, the use of network buffers would have required information about the entrance points for stores that was not available to the researchers.

Table 5.16 displays the demographic profile of the populations served at each distance. Approximately eight percent of the study area population lives within walking distance of a grocery store, 53 percent have bike

[33] While the BeltLine Redevelopment Plan and its associated policies and recommendations can directly influence the zoning and local redevelopment plans that can accommodate new grocery stores, it is important to recognize that other efforts can improve access to healthy foods. For example, shuttle services can be used to deliver transit dependent residents to grocery stores or farmer's markets can be started to bring fresh produce and vegetables closer to residents.
[34] The addresses of chain grocery stores were obtained from Fulton and DeKalb Counties and were geocoded using a Geographic Information System. The currency of these data was not independently verified.

access to a store, and 92 percent are within the 2.0-mile driving buffer. In terms of race, the proportion of whites with access increases as the buffer shrinks in size, as does per capita income. Also the percentage of individuals living in poverty and the percentage of children and elderly decrease as the buffer distance decreases. Taken together, these data reveal that grocery stores in the study area tend to be located in neighborhoods that are majority white and of a higher economic class than the rest of the study area population.

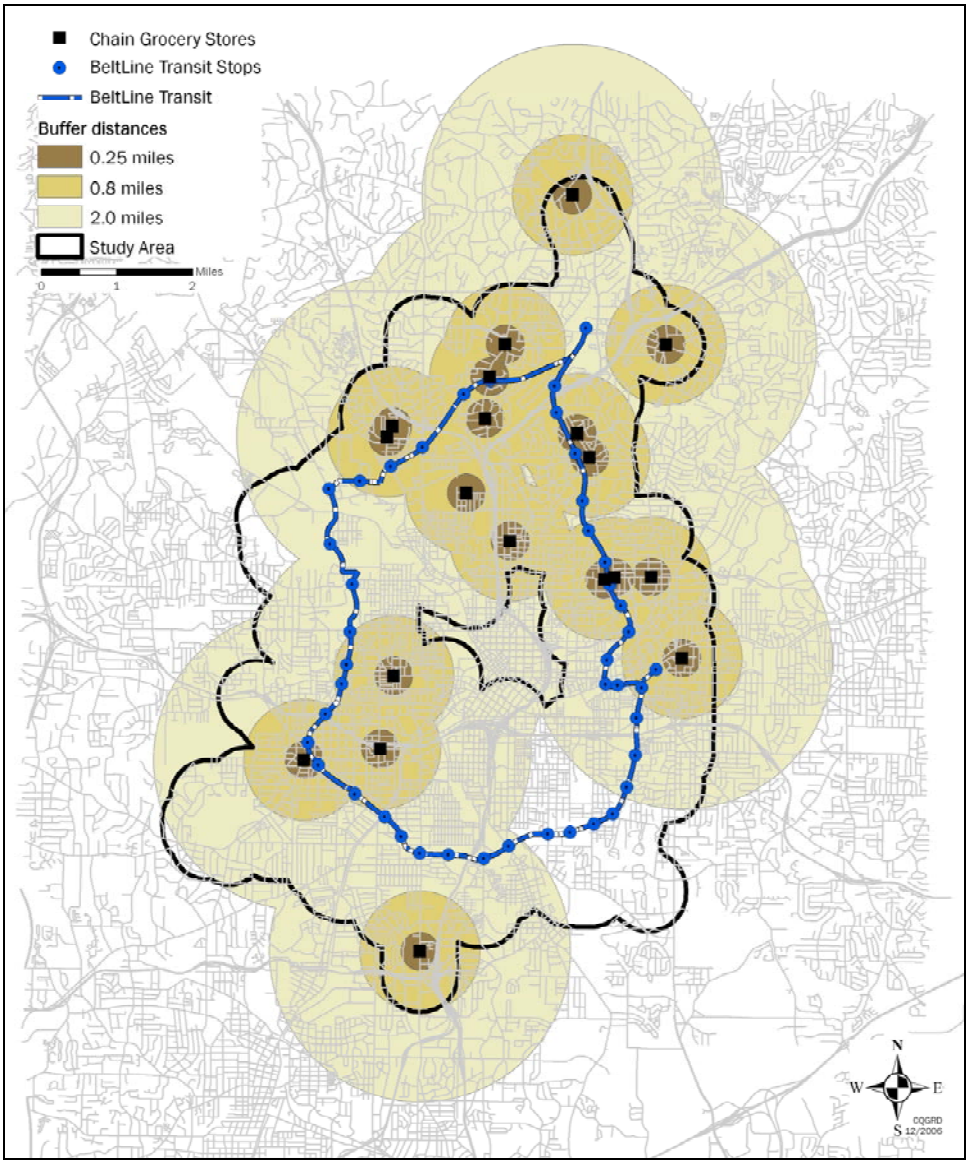
Table 5.16 Chain Grocery Store Access within the BeltLine Study Area

	0.25 mile buffer (access by walking, biking, and driving)	0.8 mile buffer (access by biking or driving)	2 mile buffer (access by driving)	Study Area Characteristics
Total Population	17,325	112,381	196,730	213,920
White	10,469 (60.4%)	56,078 (49.9%)	76,312 (38.8%)	80,865 (37.8%)
Non-white	6,856 (39.6%)	56,303 (50.1%)	120,418 (61.2%)	133,055 (62.2%)
Under Poverty	3,104 (17.9%)	21,249 (18.9%)	43,695 (22.2%)	48,904 (22.9%)
Aged 0-17	2,247 (13.0%)	18,503 (16.5%)	38,401 (19.5%)	43,363 (20.3%)
Aged 65+	1,352 (7.8%)	8,917 (7.9%)	17,098 (8.7%)	17,966 (8.4%)
Rate of Carless Housing Units	19.1%	20.1%	24.3%	24.6%
Per Capita Income	$33,260	$30,183	$24,864	$23,925

Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

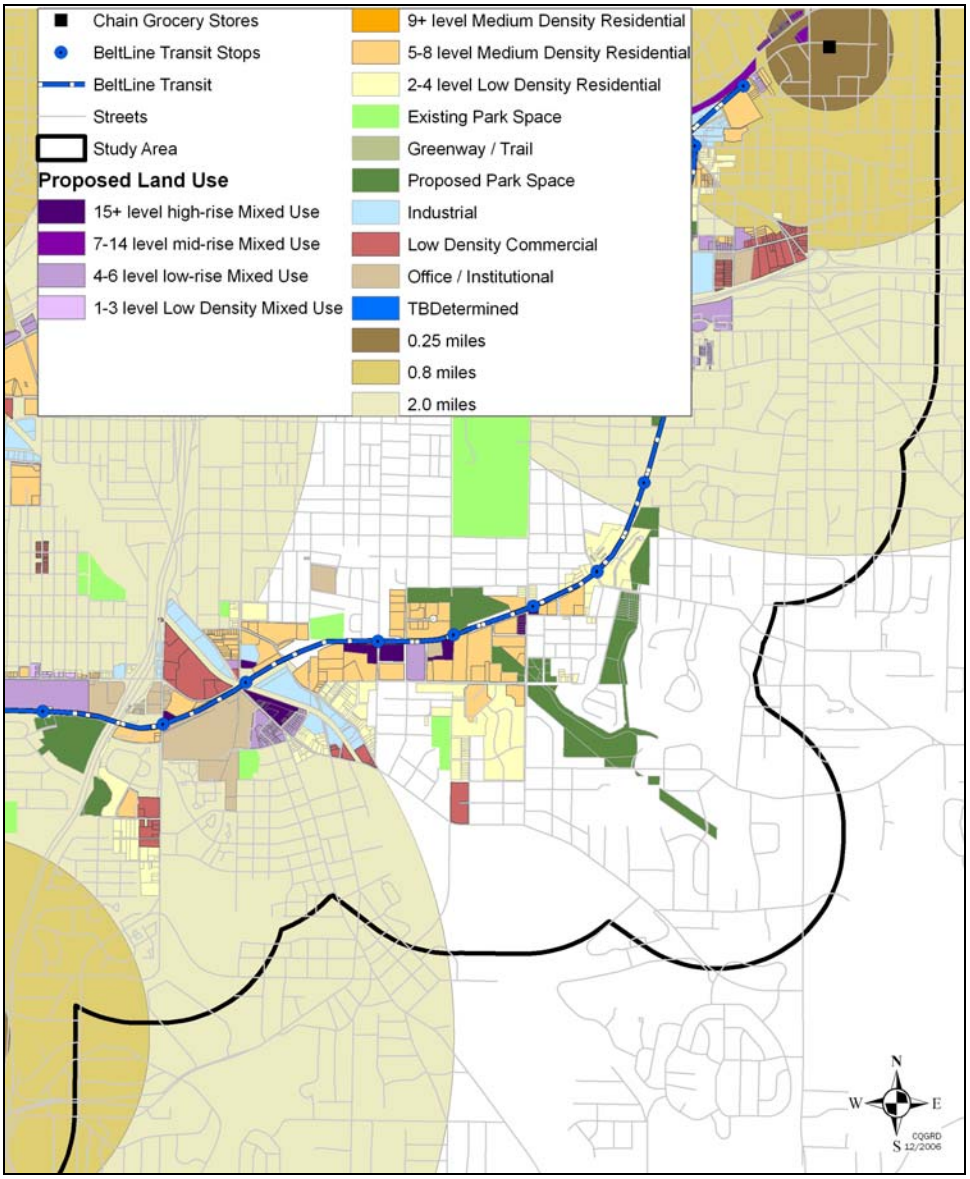
Figure 5.10 shows the three successive access buffers for 19 chain grocery store in the study area. For clarification, the buffer areas are nested, that is, areas within the 0.25 mile buffer are also within the 0.8 mile and 2.0 mile buffer, and areas within the 0.8 mile buffer are also within the 2.0 mile buffer. To determine the populations that have access to chain grocery stores at each distance, a demographic profile was generated using U.S. Census 2000 Block Group data. As the map illustrates, the northern half, and particularly the northeast segment, of the study area is relatively well serviced by grocery stores and one part of the southeast segment of the area lacks service at all three scales.

Figure 5.10 Access to Chain Grocery Stores in the Study Area



Since the southeast segment of the BeltLine HIA study area appears to be unserved by a chain grocery story the HIA study team examined the proposed land use for the BeltLine, as shown in Figure 5.11. New chain grocery stores are often situated as part of a large retail development; therefore, they have large site requirements. Such retail developments can range from seven to 10 acres in urban settings (Policy Link, nd; Porter, et al., 2002). Therefore, parcels identified as mixed use or commercial were inventoried to determine if, under current conditions, a grocery store might be able to locate in the area. There are several high-rise mixed use parcels ranging from 0.2 acres to approximately 4 acres, one low-rise mixed use parcel of about 6.8 acres, and a low density commercial parcel of approximately 7 acres. While these sites fall at the lower end of the typical retail site size, it is possible that a grocery store could locate here.

Figure 5.11 Proposed Land Use Plan for the Southeast Planning Areas of the BeltLine TAD



Source: BeltLine, Inc.

5.4 Recommendations

Parks

- **Continue to add park acres throughout the City.** Although the BeltLine will add considerable park acreage to the city, it will also lead to large population increases. This will leave the number of park acres per capita unchanged over the next 25 years.
- **Create additional park acres in the Southwest planning area.** This traditionally underserved area appears to be receiving less BeltLine park acres than the other planning areas and opportunities for physical activity can have a positive impact on their health status.

Trails

- **Make trail access points as frequent as possible.** The more frequent the access points, the greater the number of people who will be able to utilize the trail system. Large gaps in access points could reduce overall access.
- **Add trail spurs to create increased access to underserved neighborhoods.** Trail spurs are shorter trails (either trail or street based) that feed into a larger trail system. Only 41 percent of the study area will have direct access to the trail system. This figure could be increased with the use of spurs by creating additional opportunities to access the trail system.
- **Connect to other trail systems**. Much work has been done recently in metro Atlanta to create a network of regional trails. The BeltLine should coordinate with other trail systems, both current and planned, to foster regional connectivity among trail systems through route planning, signage, and maps. In doing so it is possible to increase access to BeltLine trails.
- **Integrate trail and transit design**. Create a seamless transition between the trail and transit systems to allow users of one system to easily access the second. One example is to install bike parking near transit stops to allow people to bike on the trail to the transit system.
- **Design and operate trails for recreation, exercise, and transportation**. To incorporate all uses, trails should be designed to allow for all user needs and should be operated to allow for bicycle transportation most times of the day.

Transit

- **Ensure transit to serve all neighborhoods along the BeltLine.** While some areas may appear more feasible for supporting transit, both physically and demographically, it is important that all areas have access to the BeltLine transit system. Many of the most transit dependent residents live in areas with little employment. The BeltLine transit could act as a gateway to employment opportunities in employment-rich neighborhoods. The BeltLine transit could also as a critical amenity for potential employment to locate in neighborhoods that currently lack jobs.
- **Focus new housing and population growth near transit stops**. By focusing development around transit stops, new residents and workers will have the potential to experience many of the health benefits associated with transit usage.

Housing

- **Require a diversity of housing types and prices within the BeltLine TAD**. Housing should be available to suit young, single professionals, families, and older adults. A variety of housing size, styles, and product types (e.g. apartments, townhomes, condominiums, lofts, attached homes, etc.) to suit the needs and preferences of a diverse population. Housing should be mixed income, with units dedicated to households requiring financial assistance.
- **Establish policies and programs to prevent displacement in areas surrounding the BeltLine TAD.** Explore adopting tax assessment policies, such as deferred tax payment plans, to reduce impact of increasing property tax assessment on lower income owner-occupants or tenants; creating rehabilitation funds to improvements to properties in need of maintenance and renovation.
- **Establish programs to support improvements to substandard housing.** Such housing improvement efforts can be undertaken in concert with non-profit and community organizations.

Food

- **Use zoning and parcel assembly to encourage the location of grocery stores near underserved populations.** Ensure that existing zoning requirements do not place undue constraints on grocery store development, especially in the southeast segment of the BeltLine Study Area. The City of Atlanta could target grocery store location through a strategic outreach. In the absence of full-service grocery stores, weekly farmer's markets and shuttles to nearby stores can provide underserve areas with much

needed access to healthy foods. Consider providing assistance in parcel assembly, as needed, to create a desirable site.

Section 6: Physical Activity

Physical activity refers to exercise, recreational activity, and activity that is a result of everyday life (transportation, labor, chores, and so on). Health impacts related to physical activity levels include many chronic diseases, such as obesity, diabetes, cardiovascular disease, and some cancers.

6.1 Physical Activity and Health

Chronic disease has replaced infectious disease as the leading cause of death in all populations, precipitating the need to reconsider the link between health and the built environment. Whereas infectious disease results from contact with viruses and bacteria, chronic disease is largely, although not exclusively, an issue of lifestyle (diet, activity level, tobacco use) and long-term exposure (contact with toxic substances and unhealthful environments). Because research shows that many chronic diseases, such as obesity, diabetes, cardiovascular disease, and some cancers, can be prevented or controlled by engaging in physical activity, physical activity has become an important part of the discussion on health and the built environment.

Physical activity can be defined as "bodily movement produced by the contraction of skeletal muscles that increases energy expenditure above the basal level" (U.S. Department of Health and Human Services, 2001). It is typically categorized by the context in which it occurs, such as transportation, leisure, household, and occupation (TRB, 2005). *Physical fitness* has been defined as the "ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies" (U.S. Department of Health and Human Services, 2001). The term applies both to athletic- and performance-related fitness as well as health-related fitness (TRB, 2005). Finally, *exercise* is considered a subcategory of physical activity and relates to physical activity that is "planned, structured repetitive, and purposive…" with physical fitness as the objective (TRB, 2005). This HIA is interested in physical activity that is both purposeful (exercise) as well as utilitarian (home, work, travel).

Approximately 60 percent of the U.S. adult population is at risk for diseases associated with physical inactivity because they do not achieve the recommended 30 minutes of daily physical activity (National Institute on Aging, 2000), and 25 percent of all adults are completely inactive (National Center for Chronic Disease Prevention and Health Promotion, 1999). Physical inactivity is thought to account for 22 percent of colon cancers, 18 percent of osteoporotic fractures, 12 percent of diabetes, 12 percent of hypertension, and five percent of breast cancer cases (Pratt, Macera et al., 2000). Moreover, an estimated 200,000 deaths per year are attributed to a lack of physical activity (U.S. Department of Health and Human Services, 1996). Studies show that between 32 and 35 percent of deaths in the U.S. due to coronary heart disease, colon cancer, and diabetes could be prevented by regular physical activity (Flegal, Graubard et al., 2005).

Fortunately, even modest increases in physical activity have the potential to produce significant health benefits (Pate, Pratt et al., 1995). For example, a study in Copenhagen, Denmark found that bicycling to work (average cycling time to work was three hours per week) was related to a 38 percent decreased risk of mortality after adjusting for leisure-time physical activity, body mass index (BMI), blood lipid levels, smoking, and blood

pressure (Andersen, Schnohr et al., 2000). Another study in France examined men between the ages of 50 and 59 and found that those who regularly spent more than 10 MET h/week (metabolic equivalent hours per week) in walking or cycling to work had a lower mean BMI (0.3kg/m^2), waist circumference (1 cm) and change in BMI over 5 years (0.06 kg/m2) than those who did not expend energy getting to work (Wagner, Simon et al. 2001). Research has also shown that walking at least ten blocks per day is adequate to maintain health and reduce the risk of cardiovascular events in older individuals (Sesso, Paffenbarger et al., 1999).

Regular physical activity is beneficial to people of all ages and walks of life, having positive effects on health, longevity, and quality of life (CDC). It has been found to improve self-image, self-esteem, physical and mental wellness, and overall health. The benefits of regular physical activity extend to both older and younger adults (Kaplan et al., 1996; Paffenbarger et al., 1993; Sherman et al., 1994; TRB, 2005). In fact, benefits of physical activity have been seen in all segments of the population including people with disabilities and chronic diseases (TRB, 2005). Participating in regular physical activity starting at an early age appears to have lifelong health benefits in terms of early muscle, bone, and joint development as well as weight control, high blood pressure prevention, and feelings of depression and anxiety (Report to the President, 2000; TRB, 2005). Negative health effects associated with low physical activity include heart disease, certain types of cancers, high blood pressure, stroke, osteoporosis, obesity, diabetes, and higher mortality rates (Flournoy, 2002; U.S. Department of Health and Human Services 1996; World Health Organization 2004; World Health Organization 2005).

U.S. physical activity prevalence data reveal differences across socioeconomic groups. The detailed physical activity prevalence data by race, education, and age are included in Figures 6.1, 6.2, and 6.3 (CDC, 2005). Women, for example, tend to be less physically active than men and minority women are typically the least physically active (ICMA, 2005). According to the 2005 Behavioral Risk Factor Surveillance System (BRFSS), African Americans and Hispanics engaged in less physical activity compared to whites. As Figure 6.1 shows, the African-American population is less likely, compared to Hispanic, multiracial, white, or other groups, to take part in at least 30 minutes of moderate physical activity five or more days per week or vigorous physical activity for 20 or more minutes three or more days per week. In addition, the data suggest a dose-response relationship between education attainment and levels of physical activity, with higher levels of education being related to higher levels of physical activity. For example, the population with less than a high school degree is 15 percent less likely to get the recommended amount of physical activity (see Figure 6.2). Differences in physical activity levels were also apparent by age; those aged 65 years or more engaged in the least amount of physical activity compared to all other age groups (see Figure 6.3).

Figure 6.1 Physical Activity Levels of Adults by Race

Percentage of adults with 30 or more minutes of moderate physical activity five or more days per week, or vigorous physical activity for 20 or more minutes three or more days per week, by race, (CDC, 2005)

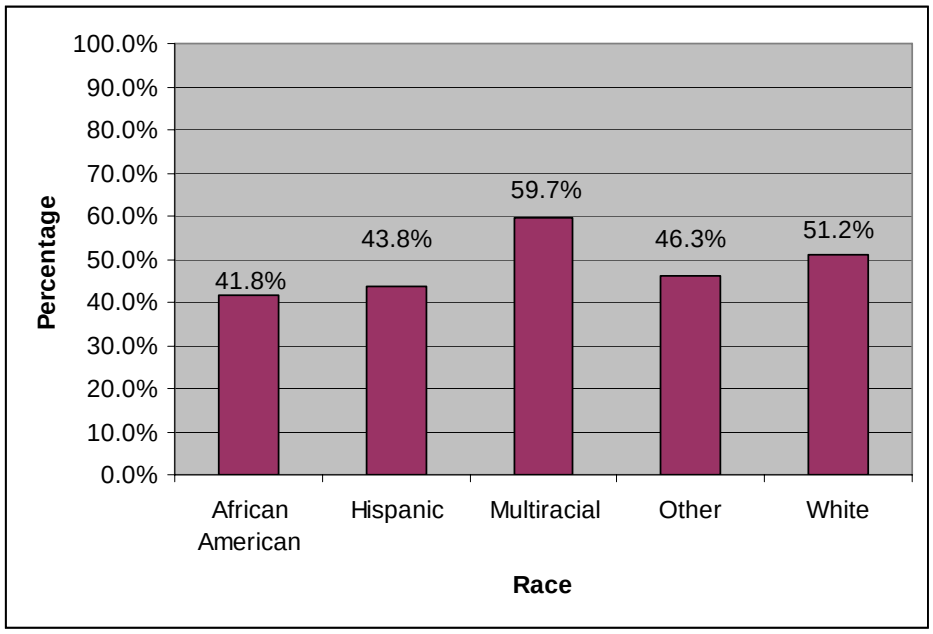


Figure 6.2 Physical Activity Levels of Adults by Education

Percentage of adults with 30 or more minutes of moderate physical activity five or more days per week, or vigorous physical activity for 20 or more minutes three or more days per week, by education level (CDC, 2005)

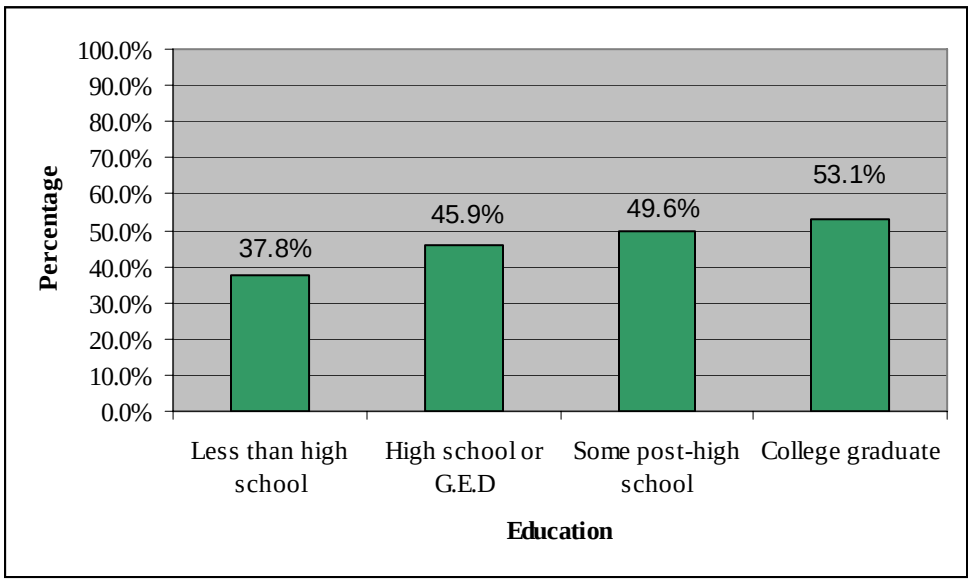
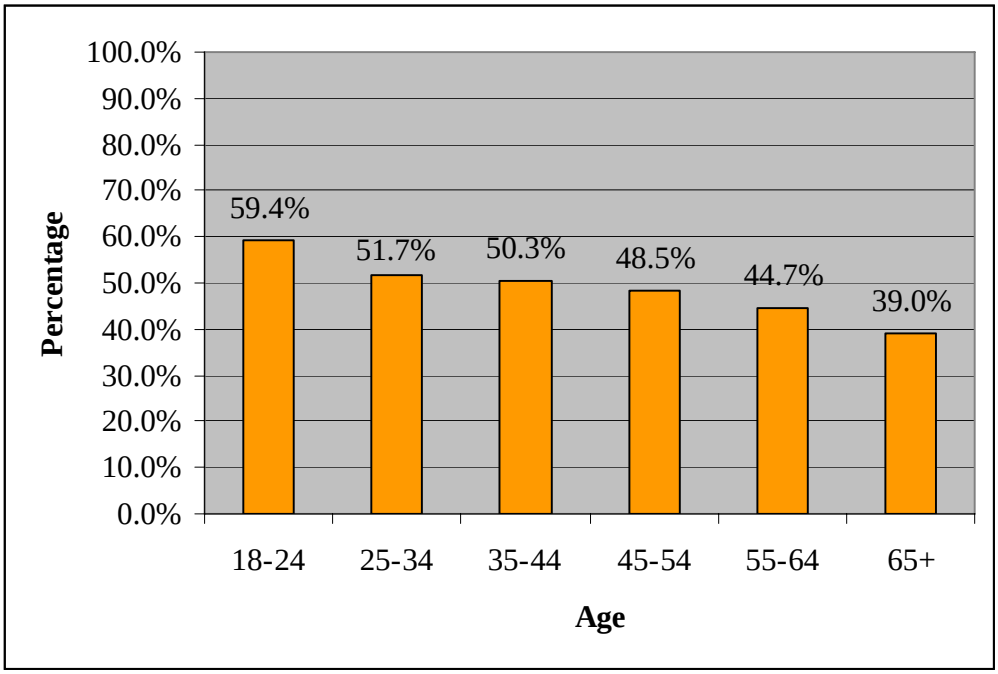


Figure 6.3 Physical Activity Levels of Adults by Age

Percentage of adults with 30 or more minutes of moderate physical activity five or more days per week, or vigorous physical activity for 20 or more minutes three or more days per week, by age (CDC, 2005)



Two approaches are being used to change patterns of physical inactivity: interventions and alterations to the built environment. First, the field of public health has attempted to increase physical activity through interventions that are used to prevent rather than treat a disease through surveillance and the promotion of healthy living habits and behaviors. Much research has been completed on the success of interventions with the goal of increasing physical activity. Systematic reviews of population-based interventions to promote health and prevent disease have provided strong evidence that public health efforts can successfully increase physical activity (Truman, Smith-Akin et al., 2000; Kahn, Ramsey et al., 2002). Sallis and Owen (1996) hypothesized that when physical activity interventions are unsuccessful, it is because environmental factors which influence sedentary behavior remained in place during (and after) the intervention had ended.

The second approach to increasing physical activity is via alterations to the built environment. Researchers have begun to examine the impact of societal and environmental variables on both sedentary and physical activity behavior (Green and Kreuter, 1991; Dishman and Sallis, 1994; King, Jeffery et al., 1997; Owen, Leslie et al., 2000). The variables that encourage physical activity include street lighting, stair accessibility, walking/bicycling paths, parks, and athletic clubs/gyms (King, Jeffery et al., 1997; Swinburn, Egger et al., 1999). In a review of 19 environmental studies, Humpel, Owen, and Leslie (2002) reported that greater physical activity was related to accessibility of a cycle path, access to exercise facilities, having exercise facilities on a frequently traveled route, having a park or shops within walking distance, safe footpaths, and living in a friendly, pleasant, and attractive neighborhood with enjoyable scenery.

Environmental and societal barriers to activity can include lack of access to infrastructure and services, economic limitations, and built environments that are unsafe and prohibit healthy activities. Health promoting attributes of the built environment can be associated with the socioeconomic composition of the neighborhood. For example, one study found that “moving from a community with a 1 percent poverty rate to a 10 percent poverty rate is associated with a decreased prevalence of bike paths from 57 percent to 9 percent

respectively" (Powell et al., 2004). Low income and minority individuals also typically lack access to healthy foods which contributes to the overweight and obesity problems (ICMA, 2005).

For many communities, lack of access to transit has a relationship to physical activity levels. Despite the fact that most low-income and minority neighborhoods have low car-ownership rates, these communities are more likely to rely on cars for their primary mode of transportation reducing opportunities for physical activity (ICMA, 2005). Finally, traffic, pedestrian, and personal safety are issues that directly affect physical activity levels. Neighborhoods with high traffic volume and speeds, lack of pedestrian or bike amenities like sidewalks and paths, and issues related to crime or incivilities (litter and graffiti) do not encourage or support physical activity (ICMA, 2005).

For older adults, the design of the built environment is crucial to their ability to remain mobile and engage in physical activity. Walking is the primary mode of transportation and exercise for older adults (ICMA, 2005). The design and condition of the built environment, if poor, can render the elderly housebound (ICMA, 2005). This issue is becoming increasing relevant as the older adult population grows.

6.2 Physical Activity and the BeltLine

The BeltLine is projected to add roughly 33 miles of multi-use trails, 22 miles of transit, 1,300 acres of new parks, and 6,500 acres of redevelopment. These four components of the BeltLine provide increased opportunities for purposeful and utilitarian physical activity. The BeltLine HIA survey results reflect the public's expectation that the BeltLine will provide opportunities for physical activity. The majority of respondents either "agreed" or "strongly agreed" that the BeltLine will provide them more places for recreation/sports, walking, running, cycling, and more transportation and shopping choices. As these six items each play a role in providing opportunities for engaging in physical activity, it appears Atlanta residents believe that the BeltLine has the potential to increase the likelihood that people will become more physically active.

Studies and data show that minorities, people in lower income brackets, older adults, and people with lower educational attainment are less likely to get the recommended levels of daily physical activity and therefore are more likely to suffer from the chronic diseases associated with physical inactivity (ICMA, 2005). Recognizing the need to encourage physical activity in these vulnerable groups, the BeltLine is an especially important project because within the study area 66.8 percent of the population is non-white and almost 10 percent of the population is over the age of 65.[35]

The health data presented in Section 3.4.2 also show that mortality rates vary tremendously across the planning areas of the BeltLine Study Area. In particular, the Southwest and Westside planning areas have higher death rates for heart disease, malignant neoplasms (cancer), and diabetes, compared to the other study areas. As discussed earlier in this report, these diseases have been related to physical inactivity. Because the presence of parks, trails, and transit positively affects one's opportunity to exercise, the BeltLine's creation of an environment that creates opportunities for a healthy and active lifestyle can potentially to increase physical activity in these most vulnerable populations.

6.2.1 Parks and Physical Activity

The physical activity literature suggests that a considerable amount of physical activity takes place in parks in many forms and by a variety of users. Numerous factors determine if people will patronize parks and what activities they engage in while at the park. Individual characteristics (ethnicity, age, sex), location and access to

[35] U.S. Census Bureau, SF1, 2000 Census.

parks (distance from home, transportation system, proximity of land uses), and the characteristics of the park itself (size, amenities, safety) all influence an individual's decision to use a particular park as well as the activities he or she engages in while at the park (Hutchinson 1987; Dwyer and Gobster 1997; Tinsley, Tinsley et al., 2002). The following literature review on parks outlines some of the studies that look at park characteristics and issues of age, race, gender, and access, as they relate to park use and physical activity.

Parks are a popular place to engage in physical activity; 29.6 percent of physically active individuals from a national sample reported that they exercised in parks (Brownson, Baker et al., 2001). Hoehner and colleagues studied how park use was related to meeting the Centers for Disease Control and Prevention/ American College of Sports Medicine (CDC/ACSM) recommendations for physical activity. They found that compared to non-users, those that used the park 1-5 days per month were 1.2 times more likely to meet the recommended levels of physical activity, those that used the park 6-10 days per month were 2.1 times more likely, and those that used it more than 10 times per month were 4.3 times more likely to meet recommended levels (Hoehner, Brennan Ramirez et al. 2005).

Proximity to parks is often cited as a determining factor in the frequency of park visits and is related to physical activity levels. In 2006, RAND surveyed park users as well as households living within a 2 mile radius of 12 urban parks in Los Angeles. They performed systematic observation in parks in addition to surveying park users and households near the parks. The parks were matched on neighborhood demographics, economic indicators, and physical features. The RAND study found that 81 percent of park users lived within one mile of the park. Those living within one mile were four times more likely to visit the park at least once a week and had 38 percent more exercise sessions per week than those living more than one mile from the park. Of residents living within 0.25 mile of the park, 65 percent went to the park at least once a week. Half of the park users reported that they walked to the park, followed by driving (37 percent), multiple modes (10 percent), biking (2 percent), and bus (1 percent) (Cohen, Sehgal et al., 2006).

Park accessibility and attractiveness/safety as they relate to physical activity levels are frequently discussed in the park and physical activity literature. Park accessibility is influenced by a variety of factors including proximity, travel time, number of parks, cost, and available modes of travel among others. In addition to having access to the park, individuals must also view it as attractive and safe. Some aspects of parks will have a more universal appeal such as cleanliness and regular maintenance, while other aspects such as a playground or a dog park may be viewed as attractive by some individuals but less attractive or even unattractive by others. A study in Savannah, Georgia and St Louis, Missouri found that residents were more likely to engage in recreational physical activity if they perceived themselves as having access to recreational facilities and if those recreational facilities had been given objective ratings of high attractiveness (Hoehner, Brennan Ramirez et al., 2005).

In a study in Australia, Corti (1998) found that walking as recommended decreased by half for people who had limited access to attractive public open space. Moreover, in a national study of adolescents Gordon-Larsen et al. (2006) found that those living in low socioeconomic status neighborhoods had significantly less access to attractive recreation areas. There may have been the same number of facilities in the community but those facilities were rated as much less attractive, safe and accessible. In a study by Babey, Brown, et al. (2005) access to a safe park was related to regular physical activity in teenagers (71.8 percent) compared to teenagers that did not have access (67.3 percent). Teens with no access were also more likely to engage in no physical activity (10.3 percent). Lee, Booth et al. (2005) also found that while the number of facilities (parks, greenspace, gyms, community centers) were roughly equal between communities, the physical activity resources near public housing had a much greater number of 'incivilities:" more litter, graffiti, unattended dogs, and unsafe traffic conditions, which were frequently reported as discouraging physical activity. Thus, in addition to measuring access to facilities it is also important for researchers and practitioners to examine the type and quality of facilities since they may act as important determinants of use.

In addition, different amenities attract different types of park users. Dwyer and Gobster (1997) found that African Americans were more likely to use urban parks with recreation facilities, while whites were more likely to use non-urban parks for camping and hiking. A study of Lincoln Park in Chicago found that Asians, Latinos, and whites valued the natural environment, while African Americans favored cultural facilities. In this same study, whites participated at higher rates in active individual pursuits such as biking, walking, and jogging in the park while African American, Latino, and Asian park users participated at higher rates in passive activities such as sitting and relaxing (Gobster 2002). Such differences may be cultural, but may also reflect different recreation desires based on differing work environments (high stress, desk job, manual labor) (Day, 2005). These findings demonstrate the importance of designing a variety of parks with differing amenities so as to appeal to the broadest spectrum of potential park users (Giles-Corti and Donovan 2002a).

Age is also a significant factor in park use. Older adults are less likely to use parks than younger adults (Payne, Mowen et al., 2002), though historically, older adults have been observed to use parks regularly (Godbey, Caldwell et al., 2005). Park use for 2,041 adults in South Carolina was related to employment status, African-American ethnicity, male gender, and ages between 18 and 34. Park use was also positively related to knowing about two or more walking/biking routes, a perception that the community was safe, and the belief that physical activity was important (Paxton and Sharpe 2005). Another study found that socioeconomic factors were more important then spatial factors in explaining overall trip frequency and travel for particular purposes although spatial factors still exerted an important influence (Hanson and Huff 1986).

Park size has also been studied in relation to park use and physical activity. A recent Australian study found that individuals living in Perth with very good access to large attractive open public spaces were 50 percent more likely to walk six sessions a week (more than 180 minutes) than those with poor access (Giles-Corti, Broomhall et al., 2005). The 2006 RAND study of Los Angeles park usage found that the size of the park was less important than access to the park (Cohen, Sehgal et al., 2006). Programming was also an important factor influencing park usage (Cohen, Sehgal et al., 2006). The positive associations between park access and physical activity levels are supported by a handful of studies that have used objective measures (Giles-Corti and Donovan 2002a; Giles-Corti and Donovan 2002b; Giles-Corti, Macintyre et al., 2003). Many variables have been suggested as important for influencing both park use and physical activity within parks including, park size, lighting, safety, availability of drinking fountains, restrooms, and accessibility of trails. However, there is little empirical data currently available to support these hypotheses.

The literature suggests that parks not only serve as places for physical activity they also have other health benefits. In Australia a qualitative study showed that the creation of a community park was seen as increasing physical activity, was an environmental and aesthetic benefit, enhanced congeniality, and increased civic pride (Gill and Simeoni, 1995). Positive mental health outcomes can be gained from being outside in the natural environment. Natural environments, such as parks and open greenspace enhance recovery from mental fatigue. Attentional restoration theory (Kaplan, 1995, 1992b; Kaplan and Kaplan, 1989) states that recovery from mental fatigue can be achieved through four avenues. These include a form of involuntary attention requiring effortless interest, a sense of escape from one's usual settings, a sense of being part of a greater system, and compatibility with one's individual needs from that environment.

One study by Bodin and Hartig (2003) found that running in a park fostered more psychological restoration than running in an urban environment. Walking in a natural setting has also been shown to alleviate symptoms of mental fatigue more than walking in an urban environment (Hartig et al.,1991). Similar results have also been reported in the classroom and workplace. Attentional capacity was measured in university students with differing views from dormitory windows ranging from a lake and trees to streets and buildings. Those with the natural views performed better on attentional measures than did those with views of buildings (Tennessen and Cimprich, 1995). Having natural views of trees and flowers in the workplace is related to lower levels of perceived job stress and higher levels of job satisfaction as well as fewer illnesses at work, such as headaches (Kaplan and Kaplan, 1989). A ten-year study of patients recovering from surgery showed that patients with a view of trees had shorter hospitalizations (8.0 days compared 8.7), needed less pain medication, and had

fewer negative comments in nurses' notes than did patients with window views of a brick wall (Ulrich, 1984). Greenspace has also been linked to mortality in elderly individuals. Five-year survival rates for senior citizens improved when there was space for taking a stroll or parks and tree lined streets near their home (Takano, et al., 2002).

Having natural environments nearby has been shown to enhance children's psychological health. Wells and Evans (2003) suggest that the presence of nearby nature in the window view and in the surrounding outdoor yard buffers the impact of life stress on rural children and enhances self-worth. The attenuation of attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD) symptoms has also been shown after contact with nature. In one study, parents were asked to rate aftereffects of several green outdoor, built outdoor, and indoor activities (e.g. reading) for children with physician-diagnosed ADHD. Ratings showed that green outdoor activities reduced symptoms significantly more than built outdoor or indoor activities after controlling for activity type (Kuo and Taylor, 2004).

Regular physical activity reduces depression, improves mood, and enhances cognitive functioning (U.S. Department of Health and Human Services, 1996; World Health Organization, 2000); therefore, an increase in physical activity in the parks holds potential for mental health benefits. With Atlantans near the BeltLine being physically active in the parks and choosing active forms of transport such as bicycling and walking, there is the potential for positive mental health impacts. Although no quantitative predictions on mental health can be made, the increase in greenspace and conservation of existing greenspace will likely affect the individuals who live along the BeltLine as well as those who travel to the new parks for recreation. It is expected that there will be an increase in individuals living within one-quarter or one-half mile from the BeltLine and it would be expected that these individuals as well as those that drive to the parks and trails would experience increased attentional restoration and possibly decreased mortality (for elderly individuals), less anxiety, and attenuated symptoms of ADD and ADHD in children.

6.2.2 Trails and Physical Activity

Like parks, trails are also important places where physical activity occurs. In a national U.S. sample, people responded that they engaged in physical activity on walking/jogging trails 24.8 percent of the time (Brownson, Baker et al. 2001). The literature also indicates a relationship between parks and trails and meeting the CDC/ACSM recommendations for physical activity. A study by Huston, Evenson, et al. (2003) and colleagues found that trails were associated with a 51 percent increased chance of meeting the CDC/ACSM recommendations for physical activity, controlling for individual level factors. In addition, Brownson (1999) found a 55 percent increased chance of individuals meeting the recommendations if people had access to a walking/biking trail after controlling for demographic variables.

Trail use is often related to trail accessibility and other aspects such as connectivity, continuity, length of routes, presence of bike lanes, and signage. Connectivity of bikeways is an important factor that influences their use. In Eugene, Oregon bike trip volume increased 76 percent where bikeways were connected (U.S. Department of Transportation, 1994). Each mile of bikeway across 18 US cities was associated with a .075 increase in commuters using bikes (Nelson and Allen 1997). Additional evidence of the link between access to trails and increased use comes from the transportation literature. The Federal Highway Administration (FHWA, 1994) reported that cities with higher levels of bicycle commuting had 70 percent more bikeways per roadway mile, six times more bike lanes per arterial mile, and tended to be laid out in grids.

In addition to the determinants of use based on the design of the built environment, presence of trails, and issues of access, there are determinants of use based upon the individual user. In Arlington, MA, Troped , Saunders, et al. (2001) found that higher education and living in a mixed residential or commercial neighborhood were related to increased use of a local bike path. In addition, older individuals and women were less likely to use the bikeway. Another study in rural Missouri found that after walking paths were introduced

55.2 percent of trail users increased the time they spent walking (Brownson, Housemann et al., 2000; Brownson, Baker et al., 2004). Many people who were not previously walking for exercise reported they were now doing so and that others who were already active increased their amount of activity because of the trail. Interestingly, the study also found that groups which are often considered 'hard to reach' were using the trails: women and individuals with less than a high school education increased their walking the most. In addition to regular walkers, women, people earning more than $35,000 per year, people from 'midsized' communities (5,500 to 10,000 people), and people with more education were more likely to use the new trails (Brownson, Housemann et al. 2000).

A Chicago study examined objective physical activity along a 1.2 mile trail in an urban area and found that 9 percent of trail users were engaging in vigorous physical activity (fast walking, running, roller skating), 65 percent were moderately active (walking, bicycling), and 26 percent were engaging in low levels of physical activity (standing, sitting). Individuals engaging in high levels of physical activity were more likely to be men between the ages of 18 and 34. They were also more likely to use the trails during the morning, on weekdays, and during bad weather. The only other group who used the trail despite bad weather was moderately active individuals walking dogs.

Trail users in the Chicago study were also asked why they used the trails: 44 percent of users reported that pleasure or recreation was the most important reason, followed by 32 percent who said that it was health or physical training. Less than 10 percent of users reported social interaction, safety, scenery, or commuting as the reason for use. Respondents who reported health or physical training as the most important reason for using the trail used the trails more often and went alone. Along with commuters, they used the trail for a shorter length of time, were less likely to drive to the trail, and tended to use the same trail. Health-motivated users reported safety as a major barrier, although this may have been due to using the trail in the early morning. People who used the trail for pleasure were more likely to travel more than 20 miles to use the trail (Gobster 2005).

Barriers to trail usage can be analyzed to ascertain some of the determinants of use. Built environment barriers were noted in several studies. Troped, Saunders, et al. (2001) found that increases in self-reported and actual distance was related to decreased use of bikeway. There is an inverse relationship between perceived distance from the trail and the likelihood that trail was used—the greater the distance, the less likely the use of the trail. Not having to cross a busy street and not having to cross a steep hill (greater than 10 percent change in slope over 100 meters) were related to increased use of the Minuteman Bikeway in Boston.

Another potential barrier to use is lack of knowledge regarding the existence of trails. A study by Reed, Ainsworth, et al. (2004) in a rural southeastern community found that that there was very low agreement (Kappa = 0.07) between presence of trails and people's awareness of them. Thirty-three percent of people who knew about the trails reported using them. However, there is evidence that knowledge about the benefits of trails is widespread. One study found that 90 percent of adults in the U.S. were in favor of using local government funds for installing jogging/bicycle trails and recreational facilities (Brownson, Baker et al. 2001).

Safety and fear of crime are often mentioned as barriers to trail installation and trail use. A study by the Rails-to-Trails Conservancy (1998) examined both minor and more serious incidents on urban, suburban, and rural trails. They found that there were no burglaries in homes adjacent to the trails in urban areas and the rate was 0.01 percent for suburban rail-trails. While minor infractions (graffiti, littering, and damage to property) occur more frequently along urban trails than suburban or rural trails, severe crimes do not occur at high rates, making trails safer than other public spaces.

A number of interventions focused on access have been used to reduce some of the barriers to trail use. For example, Minnesota's Comprehensive State Bicycle Plan attempts to increase pedestrian travel by building bikeways, offering education and safety programs, and hiring a full-time bike coordinator. A survey found that adults in Minnesota bike twice the national average, with biking for transportation accounting for half of all of

these miles (Barnes 2004). Other examples of enhanced access interventions do not include the construction of additional trails. In Germany, bicycle share of urban trips increased 50 percent from 1972 to 1995 with this increase largely due to public policies that increased the safety, speed, and convenience of cycling. This was accomplished by, in most cases, giving precedence to cyclists over cars. In addition amenities were added for bikers such as bike racks at transit stations, bike rental facilities, and an integrated signage system. Outreach activities included safety training for children as well as planning festivals and giving awards. Policies were implemented that made automobile use more expensive and inconvenient such as reducing speed limits for cars, eliminating all free parking in the city core and decreasing the number of parking spaces, and making some streets one-way for cars and two-way for cyclists (Pucher 1997).

The importance of encouraging trail usage is not only to promote awareness of alternative transportation methods to access work, play, or errands, but also to promote the health benefits of trail usage in terms of increased opportunities for physical activity. Research has been conducted to ascertain potential health benefits related to trail use. Vuori, Oja, et al. (1994) evaluated a trail use intervention in Finland. At the end of the 10-week intervention they found that physically active commuting to work (average of 1 hour per day for 10 weeks) increased VO2 max (maximum volume of oxygen consumed per kilogram of body weight per minute) by 4.5 percent. VO2 max is the maximum amount of oxygen in milliliters, one can use in one minute per kilogram of body weight. Those who are more fit have higher VO2 maximums and are able to exercise more intensely. Maximum treadmill times were increased by 10.3 percent, and HDL cholesterol (good cholesterol) by 5 percent (Vuori, Oja et al., 1994).

In addition to the evidence to suggest that the availability of trails and their promotion is related to increased physical activity and improved cardiovascular function, there is evidence of additional benefits. A study of trails users found that only a small minority (4 percent) of users were using the trail solely for exercise most users reported additional benefits including social, spiritual, physical, and time spent in nature (Bichis-Lupas and Moisey 2001). The Oregon Department of Transportation (1995) stated that some of the benefits to cycling were economic, such as increased tourism from cyclists while others were more intangible such as increased quality of life, feelings of safety, sense of community, social interactions, and enhanced access for children and the elderly.

While trails provide places for people to be physically active, it is important to ask the question: is this new physical activity that is occurring because the trail exists or are people simply using the trail instead of being active at another location? If the trail simply provides another location (i.e. no net increase in physical activity) then the trail cannot be said to affect an individual's physical activity levels and subsequent health outcomes. Conversely, if the person was engaging in physical activity on the trail as opposed to being sedentary elsewhere, then the physical activity performed on the trail is additional physical activity and the health outcomes can be attributed to the existence and promotion of the trail. From the handful of studies that have explicitly examined substitution of physical activity as well as all of the information available about trail use and physical activity, one can conclude that trails and their promotion do lead to a net increase in physical activity for a percentage of users. While the exact percentage is uncertain it is likely that 25 percent to 50 percent of the activity performed on trails can be attributed to the existence of the trail.

6.2.3 Transit and Physical Activity

Prior to health officials becoming interested in the physical environment, transportation planning researchers had studied the relationship between the built environment and travel behavior. Given the primacy of the automobile for transportation in the U.S., most travel behavior research has traditionally focused on automobile travel, not bicycle or pedestrian modes. Census data indicate that fewer people are walking and biking to and from work: trips made by walking and biking dropped from seven percent in 1980 to only four percent in 1990 (U.S. Census Bureau 1980; U.S. Census Bureau 1990). The growing dependence on automobile travel versus other modes of travel may have considerable implications for physical activity and

health. A 2004 study in Atlanta, Georgia, found that each additional hour spent in the car was associated with a 6 percent increase in the odds of being obese and every kilometer walked per day was associated with a 4.8 percent reduction in those same odds (Frank, Andresen et al. 2004).

Recent declines in walking and biking for work transportation are not necessarily indicative of a growing preference for automobile travel. Several polls have shown that between 13 percent and 20 percent of people state that walking and biking are their preferred modes of travel. Of those that had ridden a bike in the previous year, 46 percent said they would commute to work by bike if bike lanes were available, and 53 percent would commute by bike if there were dedicated paths (Rodale Press 1992; Oregon Department of Transportation 1995). In many studies, the most important factor which determined the decision to walk or bike for transportation was the distance traveled (Cervero 1996; Handy 1996; Loutzenheiser 1997). Given that most walking trips are less than one kilometer, shorter trips tend to encourage pedestrian travel (Antonakos, 1995). Despite this, automobile use often dominates trips of short distance in the U.S. and walking for transportation decreases as the number of automobiles per household increases (U.S. Department of Transportation, Federal Highway Administration et al. 1997).

Several countries other than the U.S. are less dependent on the automobile for transportation needs. Newman and Kenworthy (1991) found that the average percentage of workers who walked or biked to work was 5 percent in the U.S and Australia, 6 percent in Canada, 21 percent in Europe, 24 percent in Russia, and 25 percent in Asia. Across all countries studied, the proportion of workers who walked or biked to work was positively associated with the number of job opportunities in the area, population density, and use of public transportation.

The layout of cities and communities and their transportation infrastructure are important factors in determining whether people walk or drive as a means of transportation (Moudon, Hess et al., 1997; Frank and Engelke 2001). For example, connectivity, density, and land use have all been found to influence the levels of pedestrian travel within cities even after individual variables were controlled for in the analyses (Newman and Kenworthy, 1989; Holtzclaw, 1990; Dunphy and Fisher, 1994; Frank and Pivo, 1994; Holtzclaw, 1994; Kockelman, 1997; Pushkarev and Zupan, 1997).

An important element of a traditional community mobility plan includes mass transit. Transit use is 10-45 percent higher in transit orientated (traditional) neighborhoods than in newer auto-dependent neighborhoods (Messenger and Ewing, 1996). In the San Francisco Bay Area individuals living in transit-orientated neighborhoods made 70 percent more transit trips and 120 percent more pedestrian/biking trips than individuals living in auto-orientated neighborhoods (Cervero and Gorham, 1995). Transit ridership is influenced by both residential and employment density near stations (Cervero, 1993; Cervero, 1994; Holtzclaw, 1994).

A survey of the literature indicates that taking transit is linked to physical activity. Besser and Dannenberg (2005) found that Americans who use transit average 19 minutes of daily walking going to and from transit. Thus increasing access to transit could significantly increase the opportunities to be physically active, as most transit trips incorporate walking to and/or from destinations. The study also found that 29 percent of people walking to and from transit achieve the recommended level of 30 minutes of daily physical activity. In addition, the results of the study indicated that rail users (more so than bus users), minorities, households earning less than $15,000 per year, and people in high-density urban areas were most likely to achieve recommended physical activity levels by walking to transit. These groups are also the most likely to suffer from obesity and overweight. Finally, the study found that 72 percent of single-segment walking trips are less than 10 minutes in duration which is under the Surgeon General's recommendation of accumulating physical activity in periods of 10 minutes or more. However, it was unclear from research whether or not accumulating these shorter periods of activity also has a positive health benefit (Besser and Dannenberg, 2005).

The ability and likelihood of an individual walking to a transit station have been found to be affected by distance to station, density, number of parking spaces, grid pattern, physical quality of the environment, facility conditions, time, cost, and individual level factors, i.e. gender, ethnicity, age, income, and education (Loutzenheiser, 1997). Recent research in New York found that adding a commuter rail stop not only resulted in new riders who previously drove, but meaningful increases in the level of physical activity of existing commuters. They reported increasing their total amount of activity during the week, in many cases enough to move them from the "insufficient" to "meeting recommendations" categories of physical activity (Greenberg and Renne, 2005).

Numerous factors have been found to influence an individual's decision of what mode to take for commuting to work. Cervero (1988) found an association between the percentage of work trips by walking or bicycling and the share of commercial floor space devoted to retail around the workplace. Research showed that bringing additional land uses (e.g., places to shop, eat or play) to a suburban workplace increases the number of non-work trips that can be taken on foot or bike and accessed directly from the work site without the need for a motor vehicle. Among workers at 57 large office developments in the U.S. every 10 percent increase in floor space dedicated to retail/commercial use was related to a three percent increase in transit and ride-sharing commutes (Cervero, 1988). In six large suburban-area centers, having a retail component within an office building cut vehicle trip rates eight percent per employee. Buildings with mixed uses also generated an average three percent more commute trips using transit (Cervero, 1991).

6.2.4 Built Environment and Physical Activity

Two independent panels recently examined the links between the built environment and physical activity: the Task Force on Community Preventive Services (Task Force) and the Transportation Research Board (TRB)/Institute of Medicine (IOM). The TRB/IOM report noted that research is at an "early stage of development" but provides a "growing body of evidence that shows an association between the built environment and physical activity levels." They also concluded that the science is "not sufficiently advanced to support casual connections" or "state unequivocally that certain changes to the built environment would lead to more physical activity or be the most efficient way of increasing such activity" (Transportation Research Board, 2005). In addition, both the Task Force and TRB/IOM noted the difficulty in separating out the different environmental characteristics used to determine which had the strongest association with physical activity (Transportation Research Board, 2005; CDC, 2006b). However, the TRB/IOM report recognized that several factors such as land-use mix, accessibility, and transportation infrastructure had good support, although both panels concluded that the data were insufficient to determine how the built environment affects physical activity across population subgroups (Transportation Research Board, 2005; CDC, 2006b). The Task Force concluded that street-scale and community-scale design interventions were effective at increasing walking and cycling (CDC, 2006b).

The research supports the concept that the design of the physical environment can either facilitate or reduce the opportunities for physical activity. Greater land-use mixes, population and employment density, street connectivity and continuity of the bike and pedestrian network, are all believed to increase physical activity and contribute to positive health outcomes, as are the presence of recreational facilities and parks (Ewing & Kreutzer, 2006). Some studies have found that higher density neighborhoods generally have higher rates of physical activity (Lavin et al., 2006). However, density alone does not determine rates of physical activity; demographic characteristics of households must also be taken into account (Ewing & Kreutzer, 2006). The evidence suggests that density leads to greater physical activity, except in low-income neighborhoods, where other factors such as time, access, and fear of personal safety can result in decreased physical activity. This area of research is still evolving because of the complexity of the built environment and of behavior and lifestyle choices. In fact, some studies have placed socioeconomic factors over the built environment in the determination of physical activity levels (Garrow et al., 2006).

Land-use design—mix of land uses, density, and proximity—can impact physical activity. Street design, architecture, the overall attractiveness of a community, and perceptions of crime and public safety, all affect the willingness of people to physically interact with their surroundings. Street design can facilitate or hinder walking and bicycling. Streets laid out in a traditional grid system have proven to be more conducive to walking than streets designed with long blocks and less connectivity (Lavin et al., 2006). Greater street connectivity and continuity encourage travel by foot (Ewing et al., 2006). The presence of sidewalks, trails, crosswalks, and bicycle lanes has a positive impact on increased physical activity (ICMA, 2005). Building scale and the relation of architecture to the street can either encourage or discourage physical activity by making the pedestrian feel comfortable and safe or exposed and vulnerable. Crime or the perception of crime and personal safety are significant obstacles to physical activity. Safety is often cited as a reason for not walking, visiting parks and recreational centers, or allowing children to play outside or walk to school, all of which reduce opportunities for physical activity and increase the risk of health problems (ICMA, 2005). Neighborhoods with declining or substandard housing stock, boarded-up houses, broken windows, vacant lots, litter, graffiti, and vandalism can affect health if people are afraid to engage in physical activity outdoors (Lavin et al., 2006).

Much has been made of the design differences between traditional urban neighborhoods and their suburban counterparts in particular their effect on travel behavior (Friedman, Gordon et al., 1994; Cervero and Gorham, 1995; McNally and Kulkarni, 1996). Suburban neighborhoods typically possess little land-use mix, connectivity, and residential density and have a transportation system which encourages automobile use and discourages pedestrian and transit travel. Traditional urban neighborhoods, on the other hand, typically have high connectivity, land-use mix, and density, and posses a transit system which is more conducive to pedestrian and public transportation (Friedman, Gordon et al., 1994; McNally and Kulkarni, 1996).

Walking is perhaps more closely linked in the literature with the design of the built environment which determines the "walkability" of a public space. Shriver (1997) found that individuals living in traditional neighborhoods were three times more likely to walk to work and 65 percent more likely to walk on errands. In the San Francisco Bay Area residents of a neo-traditional (New Urbanist style) neighborhood were five times more likely to walk or bike to the store. Walking trips were 22 percent higher for non-work trips of less than one mile. Nineteen percent of shopping trips were by walking or biking, compared to two percent in the suburban neighborhood, and 31 percent of trips to transit were by foot (compared to 13 percent in the suburban community) (Cervero and Radisch, 1996). More recently, Khattic and Rodriguez (2005) found that people in neo-traditional neighborhoods made 17.2 percent of their trips by walking, compared to 7.3 percent in conventional neighborhoods.

Studies have shown that walking has positive effects on the accumulation of physical activity and therefore has positive effects on health. Frank, Sallis et al. (2006) found that a 5 percent increase in walkability was associated with a 32.1 percent increase in time spent engaging in physically active travel, a 0.23 point reduction in BMI, and 6.5 percent fewer vehicle miles traveled in King County, WA. Saelens, Sallis, et al. (2003) found that people who live in walkable neighborhoods averaged an additional 30 minutes of walking for transportation each week and achieved more total physical activity.

One of the reasons for increased pedestrian travel in traditional urban neighborhoods may be the proximity and availability of shopping facilities. Handy (1996) found that a majority of traditional neighborhoods were within walking distance of commercial areas in comparison to only 15 percent of suburban neighborhoods. Having a grocery store or other retail spaces within 300 feet of an individual's residence increases the probability that they will walk or bike to the store after controlling for factors such as residential density and vehicle ownership. When these shops are further than 300 feet but closer than one mile from an individual's residence it encourages travel by automobile (Cervero 1996). Other factors such as feeling safe and not having to walk along or cross a busy street have also been found to be related to walking to local stores (Handy 1996; Shriver 1997).

Individual characteristics such as gender, race, and age have been shown to affect the relationship between physical activity and the built environment. Studies examining how individual variables affect the specific relationship between transportation-related physical activity and urban form are limited. As both the TRB/IOM report and the Task Force indicated in their reviews of the literature, the data were insufficient to determine how the built environment affects physical activity across population subgroups (Transportation Research Board, 2005; CDC, 2006b). A few studies help illustrate the potential influence of individual factors. For example, in a Belgian study, availability of sidewalks was related to walking in men, while land-use mix and ease of walking to public transportation stop was related to walking in women. Land-use mix was also associated with moderate activity in women. No distinction was made between walking for transport and walking for recreation (De Bourdeaudhuij, Sallis et al., 2003).

In addition, the built environment may also encourage or discourage physical activity by age group. Research has found that some age groups, especially children and the elderly are differentially affected by aspects of urban form (Frank, Engelke et al., 2003; Lockett, Willis et al., 2005; de Vries, Bakker et al., 2006). For instance, the immediate environment around the home may prove to be more important for children, adolescents under 16, and for elderly individuals who cannot drive since these groups have more limited mobility. In the Netherlands the number of days youth (6-11 years) met physical activity recommendations increased with increased access to sports facilities, greenspace and residential areas with limited access to traffic while parking spaces, intersections, and heavy bus and truck traffic were associated with less activity (de Vries, Bakker et al., 2006). Traffic speed is the key determinant for pedestrian injury risk for children Jacobson et al., 2000). Traffic safety improvements in California resulted in a 65 percent increase in walking, and a 114 percent increase in biking to school among children (Staunton, Hubsmith et al., 2003).

Since many older adults cannot perform vigorous physical activities they typically walk for exercise (Feskanich, et al., 2002; Tudor-Locke, et al., 2002). In a six-year longitudinal study, older adults who walked a mile at least once a week were significantly less likely to develop functional limitations (Miller, 2000; Feskanich et al., 2002). Walking also improves cardiovascular endurance, balance and flexibility (A. C. King et al., 1998). Walking as a form of regular physical activity is also important for older adults with disabilities as a means to maintain their functional abilities and independence (Miller, 2000; Shephard, 1997; Brach et al., 2003) and to decrease the chance of increasing their disability (DiPietro, 1996; Ettinger et al., 1997; Spirduso and Cronin, 2001; Hillsdon et al., 2005).

A study in Seattle found significant relationships between community form and level of activity among seniors (Frank, Engelke et al. 2003). Seniors in Ottawa, Canada, reported that traffic hazards and fear of falling are barriers to walking. They were specifically afraid of being hit or splashed by a car, not having enough time to cross intersections, speeding traffic, vehicles not stopping for pedestrians, cracked or uneven sidewalks and ramps, sidewalks that ended and did not connect, inaccessible stairs and entrances, poor visibility, and crossings at inconvenient locations. They reported that they would be assisted by convenient routes and destinations, good public transportation, aesthetics, benches, and restrooms (Lockett, Willis et al. 2005). CDC (1999) found that fear of crime in one's neighborhood had a significant impact on physical activity levels of older adults (Weinstein, Feigley et al. 1999). Other environmental features which impact walking include congested paths and trails; litter; blocked curb cuts; narrow sidewalks; poor street furniture placement; lack of signage; seating, ramps or curb cuts; steep inclines; noise; poor lighting; landscaping and weather conditions (Matthews & Vujakovic, 1995). Barriers to walking for people with mobility impairments include uneven paving surfaces due to pavement type or condition; presence of grass, mud, or ice; bumping sensations; wheels getting stuck; and the concern of tipping over wheelchairs (Matthews & Vujakovic, 1995).

The concepts of Universal Design (UD) and active living (AL) are two of the more well-known efforts to integrate physical activity into daily life. Universal design is defined as the design of "products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Mace et al., 1991). Therefore UD is an architectural and urban design intervention that creates spaces to encourage and enable physical activity in people of all walks of life, ages, and ability levels. Active living,

meanwhile, can be described as a way of life that integrates physical activity into daily routines. An active living community is designed to be pedestrian-friendly and provides opportunities and encouragement for people to incorporate physical activity into their daily activities (ICMA, 2005). Both of these concepts can be integrated into the design of the BeltLine.

Both the IOM/TRB and Task Force reports noted several additional side effects that the built environment may have on health irrespective of affecting physical activity levels. The Task Force noted that street-scale and community-scale urban design interventions may also lead to improved air quality and greenspace, increased sense of community and decreased social isolation, increased consumer choice for places to live, reduced stress, crime, and either increases or decreases in pedestrian injury (CDC, 2006a). The TRB/IOM report concluded that changes to make the built environment more activity conducive are desirable "even in the absence of the goal of increasing physical activity because of their positive social effects on neighborhood safety, sense of community, and quality of life" (Transportation Research Board, 2005).

Physical activity should be considered in the design of the built environment and the ways in which natural environments are accessed and used. Building a trail without planning for and designing points of access or ensuring connectivity and continuity will result in a trail that is only accessed and used by a few for limited purposes rather than serving as a viable transportation alternative. This issue is particularly important when there is interest in encouraging the use of bicycles for work and other non-recreational trip purposes. Likewise designing parks that are inaccessible or designed primarily for relaxation purposes or passive uses will not encourage physical activity. Just as the BeltLine is envisioned to knit together neighborhoods within the City, transit stops should be planned for and designed in ways that allow for and encourage biking and walking to, from, and between the stations. Finally, the BeltLine is anticipated to spur significant redevelopment. Density can discourage physical activity if the needs of pedestrians and bicyclists are not considered in the design and planning process. Physical activity can be encouraged via street connectivity and continuity, access to the component parts of the BeltLine (transit, trails, and parks), architecture, and street design. The BeltLine presents an opportunity to increase physical activity within the urban core making it a way of life not a luxury.

6.3 Recommendations

- **Provide a variety of park types** (active and passive) with a diversity of amenities (ball fields, skateboard parks, dog parks, picnic facilities, etc.) with varying levels of challenges (e.g. trails of different difficulties, surface materials, and slope), and a variety of programming to meet the physical activity needs of the diverse residents of the city. Consider including par courses, or fitness stations, to encourage physical activity.
- **Implement educational intervention** both onsite, in parks and along trails, and in the broader Atlanta community.
    - Install educational and motivational signage along trails and in parks to encourage physical activity (see www.pacesavannah.org for examples of posters).
    - Install distance markers along trails to encourage people to walk or bike further. Have signs that show points of interest and the time it would take to walk or bike there.
- **Install amenities that both encourage and accommodate the needs of all parks, trails, and transit users** and **apply Universal Design principles in the design of parks and trails** to enable and encourage the elderly, people with disabilities, children, and people with functional limitations to use the facilities.
    - Install restrooms and water fountains in the parks, along longer stretches of trails, and in transit facilities.
    - Install benches and places to rest at consistent intervals along trails and within parks.

    - Install bike racks near transit stops to encourage people to ride to transit.
    - When designing and landscaping parks and trails provide areas of shade from the summer sun.
    - One Universal Design standard for trail width is the distance that allows at least two wheelchairs to travel side-by-side or to pass one another.
    - Place street furniture, lighting, signage, trash receptacles, and other amenities so as not to block or narrow sidewalks, trails, and paths. This is particularly important for the visually impaired, older adults, people pushing strollers, and individuals with disabilities.
    - The incorporation of steps and steep slopes should be avoided or complimented with ramps to enable equal opportunities for access.
- Bearing in mind studies that show that transit users are typically more physically active than their auto-dependent peers, **design transit stops along the BeltLine that are accessible via the trail and/or a well-connected sidewalk system** to enable transit riders to gain their 30 minutes of daily physical activity in the recommended 10 minute spurts of walking.
- **Provide adequate lighting** along the trails, within parks, around transit stops, and along sidewalks and walkways that access these features of the BeltLine. **Install police or 911 call boxes** at periodic intervals to boost people's sense of personal safety.
- **Collect data on physical activity levels before and after the implementation of the Beltline** in order to illustrate the health-related results of public investment in infrastructure and to further the field of environmental determinants of physical activity. Such information will ensure that future design of parks and trails encourages physical activity.

Section 7:
Safety: injury and crime

For the purposes of this HIA, "safety" is defined as the protection from harm, physical or psychological, caused by, in this case, crime or accidental injury as it relates to the component parts of the BeltLine project: parks, trails, transit, and redevelopment. In this section we will consider the types of injury and crime that could occur in relation to the BeltLine and the health impacts that might result.

Ninety two percent of respondents to the BeltLine HIA survey said that low crime rates have a positive or very positive effect on their health, yet only 26 percent said that their community currently has low crime rates. And while more than 73 percent of respondents thought the BeltLine will have an overall positive impact on their health, it would appear that they do not link that to crime. When asked whether the BeltLine will reduce crime rates, 58 percent said that they neither agree nor disagree, implying that they believe the BeltLine will not change current crime levels. In response to the open-ended question regarding potential negative health effects of the BeltLine, both injury (7 out of 77 answers) and crime (13 out of 77 answers) were listed as concerns although response rates indicate that these are not the top health concerns for most people.

Public safety both in terms of crime and injury will be an issue for the BeltLine, both directly and indirectly. Users might avoid the BeltLine if it is perceived as being "unsafe" or conducive of criminal activity, thereby reducing the positive effects of parks and trails promoting physical activity. Injury on the other hand can include physical problems such as strains and sprains from increased physical activity or the more serious risks of injury or fatality from crashes associated with bicycles, cars, pedestrians, and transit. For the BeltLine to have the greatest impact on how Atlantans and visitors travel, exercise, shop, work, and think about the city, maintaining the safety of its users must be a high priority.

7.1 Injury and Health

In relation to the BeltLine, injury is primarily concerned with three specific types: pedestrian and bicycle injury, light-rail transit injury, and sports-recreation injury. Crashes are also another important type of injury to motor vehicle occupants, but the *BeltLine Redevelopment Plan* is not explicit about road system changes and improvements that may affect motor vehicle-motor vehicle crashes; therefore, such injuries have not been addressed in the HIA.

Pedestrians and Bicyclists Injury

Motor vehicle crashes are the leading cause of death among persons aged 5-34 years in the U.S. (CDC, 2006a) (NOTE: This data was corrected on 11.30.07. We apologize for the error). In 2004, 42,636 people were killed and almost 2.8 million were injured on public roadways (NHTSA, 2005). In addition to the burden on the population, these injuries represent a tremendous cost burden. Motor vehicle crashes accounted for 18 percent of the $117 billion spent on injury-attributable medical expenditures in 2000 (Finkelstein, Fiebelkorn, Corso, Binder, 2004).

Because motor vehicle occupants represent the largest proportion of road users in the U.S., they are the most frequent victims of crashes. However, pedestrians and cyclists who represent a smaller proportion of road users are also vulnerable groups. In the U.S., these non-motorists represent almost 13 percent of all motor

vehicle crash (MVC) deaths (NHTSA, 2005), although walk/bicycle trips represent only 9.5 percent of all trips and comprise shorter distances traveled than motorized travel modes (Pucher and Renne, 2003). A study by Pucher and Dijkstra used distance traveled to calculate fatality rates in the U.S. and found that pedestrians and cyclists in the U.S. were 23 times and 12 times, respectively, more likely to be killed than car occupants (Pucher and Dijkstra, 2003).

Several studies have concluded that increased pedestrian and bicycle volume may reduce the risk of pedestrian or bicycle crashes (Jacobsen, 2003; Robinson, 2005; Garder, Leden, Pulkkinen, 1998). However, it is important to note that, while a given individual's risk of crash injury may be reduced, the absolute number of injured pedestrians or cyclists may increase due to an increase in the number of these road users who are exposed to the traffic environment.

In 2004, a total of 4,641 pedestrians were killed and 68,000 were injured in the U.S (NHTSA, 2005). The pedestrian fatality rate is higher for males than for females and generally increases with age (NHTSA, 2005; CDC, 1999; Harruff et al., 1998). In contrast, the nonfatal pedestrian injury rate is highest among 10-15 year-olds (43 per 100,000) and begins to decrease with increasing age (NHTSA, 2005). The high fatality rate among older pedestrians is due in part to a higher case-fatality rate. Studies in metropolitan Atlanta and Seattle indicate that blacks and Hispanics have higher pedestrian fatality rates than whites or non-Hispanics (CDC, 1999; Harruff et al., 1998).

Almost half of all nonfatal pedestrian injuries occur at intersections, while only 21 percent of fatal injuries occur at intersections. Two-thirds of pedestrian deaths occur between 6 pm and 6 am and more than 80 percent of weekend deaths occur in the evening. Although the proportion of all alcohol-related crash fatalities has declined from 60 percent in 1982 to 39 percent in 2004, the proportion of pedestrians (14+ years) killed with a blood alcohol concentration (BAC) of 0.08+ has not declined in the last 20 years. In 2004, 36 percent of pedestrians (14+ years) killed had a BAC of 0.08+ (NHTSA, 2005).

In 2004, a total of 725 bicyclists were killed and an estimated 41,000 cyclists were injured in the U.S. (NHTSA, 2005). The bicyclist fatality rate is higher among males than females (0.44 versus 0.06 per 100,000, respectively). The fatality rate is highest among 10-15 year olds, then drops among young adults, and increases again for the 35 to 74 year age group. The nonfatal injury rate is highest among 10 to 15 year olds and decreases steadily with age. A survey of 2,335 American children found that for children between the ages 5 and 9 or the ages 10 and 13, rates of nonfatal injury due to bicycling or skating were greater than rates of motor-vehicle injury, though the motor-vehicle injuries were far more likely to be fatal (Scheidt *et al*., 1995). Two-thirds of the fatalities occurred at non-intersection locations, while almost two-thirds of the nonfatal injuries occurred at intersections. Most (69 percent) weekday bicycle fatalities occur between 6 am and 6 pm), while most (62 percent) weekend fatalities occur during the evening hours (NHTSA, 2005).

Light-Rail Transit Injury

Transit-related injuries are reported by the Federal Transit Administration. Almost 32 percent of public transportation trips are on rail transit, yet rail transit accounts for only 6 percent of public transportation accidents. There were 209 accidents (collisions, derailments, and fires) in 2003 for all transit types (heavy, light, and other rail). Seventeen percent of these were caused by pedestrians and 47 percent were caused by other vehicles. These statistics exclude suicides, suicide-attempts, and trespassing-related injuries (FTA, 2004).

Light rail transit injury rates are low (see Table 7.1). The light rail fatality rates for collisions, derailments, and fires averaged 0.43, 0.00, and 0.00 per 10 million trips annually from 1999-2003, respectively (FTA, 2004). Most nonfatal light rail injuries in the U.S. are a result of "other" causes (i.e., slips/trips/falls in station, escalators/stairwells, boarding/deboarding train, door injuries, assaults, suicide attempts, trespassing, or other). These causes were responsible for 231 injuries in 2003, while collisions caused 209 injuries,

derailments caused zero injuries, and fires caused zero injuries. On the other hand, most fatal injuries are a result of collisions (9 fatalities in 2003). Suicides represented the second highest number (n=7) of fatal injuries associated with light rail in 2003 (FTA, 2004).

Table 7.1 Light Rail Collision, Fatal and Nonfatal Annualized Injuries and Rates, US, 1999-2003

	Fatal Injuries			Nonfatal Injuries		
Incident Type	Avg. # per Year	Annualized Rate per 10 Million Passenger Trips	Annualized Rate per 100,000 Population	Avg. # per Year	Annualized Rate per 10 Million Passenger Trips	Annualized Rate per 100,000 Population
Collisions	13	0.4300	0.0050	149	4.9200	0.0530
Derailments	0	0.0000	0.0000	12	0.4000	0.0040
Fire	0	0.0000	0.0000	2	0.0500	0.0000
Other*	1	0.0300	0.0003	209	6.8500	0.0741

* Other, Fatal Injuries: excludes suicides and trespassing-related. Other, Nonfatal Injuries: Does not exclude suicide attempts and trespassing-related.

Note: 44% (7/16) of ALL light rail fatalities in 2003 were suicides.

Source: FTA, *State Safety Oversight Program Annual Report for 2003*; Census data to calculate population-based rates obtained from DOT's *Annual Traffic Safety Reports*

Light rail transit more commonly operates on city streets, in mixed traffic, and in pedestrian malls, requiring roadway-light rail grade crossings. In 2003, there were 111 light rail accidents at rail grade crossings, resulting in 9 fatalities and 103 nonfatal injuries. Per passenger trip, the accident, fatality, and injury rates at rail grade crossings appear to be increasing slightly over the last 3 years (FTA, 2004).

The Rails-to-Trails Conservancy and the National Park Service have monitored safety issues related to the trails, including the interaction of pedestrians and cyclists with trains. A *Rails-with-Trails* (2000) report analyzed 61 rails-with-trails representing 523 total miles of multi-use trails, 239 miles of which were adjacent to active rail lines.[36] The train service varied by type of train (industrial, commuter, transit, etc.), frequency of trains, and speed of trains. Only one train-trail user crash occurred. This case involved a cyclist at an at-grade crossing. The cyclist ignored the warning bells, flashing lights, and lowered crossing gate and was struck by the train (injury severity unknown).

Research suggests that alcohol (Lerer and Matzopoulos, 1996; Cina et al., 1994; Glasgow et al., 1999) and male gender (Cina et al., 1994; Goldberg et al., 1998; Agalar et al., 2000; Glasgow et al., 1999) are significant factors in train-pedestrian fatalities. A study of rail trespassers in Georgia found that 11% of those injured or killed were children (<18 years old) (Glasgow et al., 1999). A separate study of children injured by trains in a U.S. metropolitan area found that 17 children were injured in a 10-year period. The majority of children were playing on or near the tracks (including trying to jump onto or off of a moving train) at the time of the incident, which suggests a need to limit access to the rails (Blazar et al., 1997).

[36] Reporting period for this study is not given in the report; presumably persons reported incidents that had ever occurred along the trails.

Sports-Recreational Injury

The promotion of physical activity is a public health priority because of the potential to reduce the risk of cardiovascular disease and other health problems. However, physical activity can also be associated with injuries, which may have significant consequences, such as health care costs and disabilities. This review focuses primarily on those activities (e.g., walking, running, cycling) that are likely to occur on a shared-use path such as the proposed Beltline.

Walking is not frequently associated with a significant increase in risk of injury (Bovens and Janssen, 1989; Kimsey, 2000); however, runners and joggers are at risk for musculoskeletal injury (Bovens and Janssen, 1989; Zemper, 1991; Hootman et al., 2002(b); Koplan et al., 1982). Further, walking has been shown to have a lower risk of injury than running (Colbert et al., 2000). Research has found that 27 percent to 70 percent of recreational and competitive runners are injured each year (Hreljac, 2005; Koplan et al., 1982). Musculoskeletal injuries of the knee or lower leg (including foot and ankle) are common. Risk factors for over-use injuries include excessive distance, high intensity, rapid increase in distance, running surface, and footwear (Hreljac, 2005; Hootman et al., 2001). One study concluded that exercising less than 20 miles/week at a pace slower than 15 minutes/mile may be protective of lower extremity injury (Hootman et al., 2002(a)).

Two studies of nonfatal bicycle injuries found that 75 percent of injuries treated in emergency departments (Davidson, 2005) and 93 percent of those treated during a physician or dentist visit (Eliert-Petersson and Schelp, 1997) did not involve collisions with motor vehicles. Approximately six percent to 11 percent involved collisions with other bicyclists. Davidson (2005) found that nine percent of the emergency department treated injuries occurred on bike paths (not on public roads) or shared-use pedestrian-bike paths, and 14 percent of injuries occurred at locations such as playgrounds, parks, and gardens. Tucci and Barone (1988) studies cycling crashes in an urban area and found that 92 percent of crashes occurred on a paved roadway, four percent occurred on the sidewalk, and four percent occurred on some other surface. The most common crash causes were cyclist being struck by a motor vehicle (28 percent), pedestrian or cyclist being struck by a cyclist (28 percent), and fall from bicycle (26 percent). The study did not identify whether the roadway crashes occurred in bike lanes or not, or whether bike lanes were available in this urban setting.

One notable exception to the positive association between physical activity and injury is the literature on falls among older adults. Analyses have concluded that exercise programs for older adults can reduce the risk of falls and hip fractures. Moreover, lack of physical activity is a risk factor for hip fracture (Hoidrum et al., 2001).

Primary prevention of injury is important since people with a history of previous injury are about twice as likely to sustain an injury during physical activity, according to some studies (Hootman et al., 2001; Hootman et al., 2002(a); Lysholm and Wiklander, 1987; Koplan et al., 1985). A study of injuries in high school, cross-country runners found that previous injury was associated with a 20 percent increase in injuries experienced during the high school, cross-country season (Rauh et al. , 2006). Injuries that result in permanent structural and biomechanical malfunction may contribute to the risk of future injury (Mechelen and Hlobil, 1987). Injury and fear of injury can also be barriers to adopting a more active lifestyle (Finch and Owen, 2001).

On a shared-use path where users are separated from the roadway, user-conflict interactions are less likely to occur with motor vehicles (though this may occur if the path intersects with the roadway), but are more likely to occur when users of the path may interact with other users. There is limited literature on injury outcomes due to user conflicts. However, based on current knowledge, it is appropriate to educate the shared-use path users about path "etiquette," including staying to one side of the path, allowing faster moving travelers the ability to maneuver safely, and limiting speed of travel on the path (FHWA, 1994). Other important safety measures include the use of appropriate safety gear, such as helmets and wearing clothing that is visible (i.e., reflective materials), particularly in the early morning and evening.

In summary, existing studies describe the incidence and prevalence of sports- and recreation-related injuries and risk factors associated with injuries. These studies indicate the need for injury prevention messages which could decrease the risk of injury and therefore encourage users of the shared-use path to engage in long-term and consistent use of the facility, thus resulting in increased overall health benefits.

7.2 Injury and the BeltLine

According to the literature review, appropriate design and engineering, policies, signage, and education will be important components to reducing the risk of injury on the BeltLine trails, transit, and urban environment. The following section describes strategies to prevent injuries to pedestrians, cyclists, and transit users.

Prevention Strategies: Pedestrians and Cyclists

Vehicle speeds are associated with injury occurrence and injury severity for all road users. A literature review sponsored by the National Highway Traffic Safety Administration (NHTSA) found that pedestrians have a five percent chance of fatal injury when hit by a car traveling 20 miles per hour (mph) or less. This risk increases to 40 percent at a vehicle speed of 30 mph, 80 percent at 40 mph, and nearly 100 percent at 50 mph or more (Leaf and Preusser, 1999). Anderson et al. (1997) has estimated a 14 percent reduction in collisions and 16 percent reduction in pedestrian fatalities if a 60 kilometer/hour (kph) speed limit were reduced by 10 kilometers (Leaf and Preusser, 1999).[37]

Various types of countermeasures are available that may reduce the likelihood of pedestrian and/or bicyclist injuries. Retting et al. (2003) conducted a literature review of engineering interventions to increase pedestrian safety. Interventions examined can be classified broadly as those that separate pedestrians by time, separate pedestrians by space, increase pedestrian visibility and conspicuity, and reduce motor vehicle speeds. Effective interventions included traffic signals at high-speed intersections, exclusive walk signal phasing, adequate duration of yellow/red signal timing, sidewalks in urban residential and mixed-use areas, refuge islands and raised medians on multi-lane, high traffic volume roads; and increased intensity of roadway lighting to reduce nighttime pedestrian crashes (Retting et al., 2003). A separate review found a consistent protective effect of sidewalks for pedestrians (Campbell et al., 2004).

A comprehensive review of the effect of marked crosswalks at uncontrolled locations (i.e., no traffic signal or stop sign) found no effects or negative effects, depending on the circumstances. Marked crosswalks alone should not be used where the speed limit is >40 miles per hour; the road has $\geq$4 lanes, average daily traffic volume (ADT) of 12,000 or greater, and no raised median or crossing island; or the road has $\geq$4 lanes, ADT of 15,000 or greater, and does have a raised median or crossing island. In these cases, additional improvements will be necessary. Examples include raised medians on multilane roads, traffic signals where warranted, curb extensions and/or raised pedestrian islands, raised crossings, adequate nighttime lighting, and others (Zegeer et al., 2005). Special consideration should be given to crossing environments for pedestrians with disabilities and vision or hearing impairments (Campbell et al., 2004). For these populations, design characteristics can include texturized curb-cuts and audible pedestrian crossing equipment.

The NHTSA found that traffic calming (i.e., engineering measures) was most effective on moderate and low speed roads (Leaf and Preusser, 1999). Speed humps as a traffic calming measure may be effective in reducing vehicle speeds but are recommended only on two-lane residential streets and not on streets with "significant numbers of emergency vehicles, transit, or long wheelbase vehicles" (Campbell et al., 2004). A multi-pronged intervention (combination of educational and engineering components) to reduce child pedestrian injuries in an urban setting reduced these injuries by 45 percent. The overall goal of the intervention was to move children's play from the streets to new and improved playgrounds and parks (Durkin et al., 1999).

[37] 60 kph is approximately 35 mph; and 50 kph is about 30 mph.

A review of studies of pedestrian signal indications concluded that the effects are different depending on the type of signal used and the type of pedestrian crash examined (all pedestrian crashes vs. pedestrian turning crashes). Overall, concurrent signals (i.e., those that allow concurrent pedestrian and traffic flow) had no effect on pedestrian crashes but did reduce pedestrian turning crashes. Exclusive signals (i.e., those that allow pedestrian crossing while traffic is stopped in all directions) reduced all pedestrian crashes and pedestrian turning crashes. These effects were most pronounced on roads with high pedestrian and low traffic volumes (Campbell et al., 2004).

The public health literature on bicycle safety focuses on the benefits of helmet use. Bicycle helmets are effective in preventing head injuries following a crash, whether the crash is a result of a collision with a motor vehicle or some other cause (e.g., falls, striking fixed objects, or collisions with other bicycles) (CDC, 1995a). Other strategies to protect bicyclists include the prevention of crashes. The engineering principles that promote pedestrian safety can be expected to improve bicyclist safety as well (i.e., separation by space, separation by time, increased visibility and conspicuity, and reduced vehicle speeds). Sidewalks are not recommended for cyclists; bicycle lanes are preferred where bicycles must travel alongside the roadway (Pedestrian and Bicycle Information Center, 2002). Bicycle lanes[38] have been shown to reduce bicycle-motor vehicle crashes by 31 percent (Lott and Lott, 1976). Guidance on the design of bicycle lanes can be found in the Federal Highway Administration's *Manual on Uniform Traffic Control Devices* (2004), the American Association of State and Highway Transportation Officials' (AASHTO) *Guide for the Development of Bicycle Facilities* (1999), and the Pedestrian and Bicycle Information Center's *Bike Lane Design Guide* (2002). The AASHTO Guide also includes information about providing cyclists with safe railroad crossings.

The AASHTO Guide (1999) provides guidance about the design of shared-use paths. Paths along former railroad corridors work well because they tend to have few intersections with roadways, minimizing the interactions between non-motorized travelers and motorized vehicles (Pedestrian and Bicycle Information Center, undated). The AASHTO Guide (1999) generally discourages the placement of shared-use paths adjacent to roadways. One issue is that two-way travel is permitted on shared-use paths, while roadway travel normally requires pedestrians to walk against traffic and cyclists to ride with traffic. When users must cross the roadway, pedestrians and cyclists may be at risk because drivers are not expecting them to emerge from this wrong-way direction. Where paths must intersect with roadways, AASHTO (1999) recommends that this crossing be placed as close as possible to existing roadway intersections and the path intersection should be clearly marked for motor vehicle drivers.

Prevention Strategies: Transit

The literature on transit tends to focus on the overall low injury and fatality rates of these transportation systems. Some literature addresses the need for regular maintenance, operational oversight, and security on transit and in rail stations (Zimmerman, 2005; Gershon, Qureshi, Barrera, Erwin, Goldsmith, 2005; Gershon, 2005). Few studies have reported on train-pedestrian crashes, most of which do not involve light rail, urban settings (Lerer and Matzopoulos, 1996; Cina et al., 1994; Goldberg et al., 1998; Agalar et al., 2000; Glasgow et al., 1999; Blazar et al., 1997). However, based on the results of these studies, it may be necessary to provide safe rail crossings for pedestrians where appropriate and barriers to the railroad tracks where crossings and children's play is not desired.

The Rails-with-Trails (2000) report, the American Association of State and Highway Transportation Officials *Guide for the Development of Bicycle Facilities* (1999) and the U.S. Department of Transportation's *Rails-with Trails: Lessons Learned* (Birk et al., 2002) provide recommendations about the safe design and maintenance of shared-use paths and their interaction with railroads. Seventy-one percent of rails-with-trails use a barrier to

[38] Note that bicycle lanes and shared-use paths are different types of facilities. Bicycle lanes are typically on-street, striped facilities, whereas a shared-use path is an off-road facility.

separate the trail and rail (*Rails-with-Trails*, 2000). These barriers vary from the use of vegetation, grade separation, cement walls, ditches and fences (chain link, wire, rail, wrought iron, vinyl, steel pickets). The report suggests using fences when needed to direct trail users to legal crossings or when the trail is "particularly close to a rail line," and posting "no trespassing" signs where appropriate (*Rails-with-Trails*, 2000). The report found an average setback of 33 feet for distance between rails and trails, but found no empirical data regarding setbacks and safety.

Prevention Strategies: Sport and Recreation

Existing public health literature indicates the need for injury prevention messages that could decrease the risk of injury to walkers, runners, and cyclists on the shared-use path. On a shared-use path, user-conflict interactions may result in injuries, although there is limited literature on this subject. Based on current knowledge, it is appropriate to educate shared-use path users about path "etiquette," including staying to one side of the path, allowing faster moving travelers the ability to maneuver safely, and limiting speed of travel on the path (FHWA, 1994). It may also be appropriate to educate users about appropriate safety gear, such as bicycle helmets and, particularly during early morning and evening hours, wearing clothing that is visible (i.e., reflective materials).

7.3 Crime and Health

The second element of safety for the BeltLine is crime. Crime in the United States is typically classified into two categories. The most serious crimes are considered Part I offenses: murder, rape, robbery, aggravated assault, burglary, larceny, motor vehicle theft, and arson. Part II crimes include gambling, driving under the influence, violating curfew, fraud, embezzlement, vandalism, counterfeiting, and buying or selling stolen property. The FBI publishes information on Part I crimes, collected nationally, semi-annually, as well as in the annual *Crime in the United States* publication.

Part I crimes are generally subdivided into "personal" and "property" crimes. Personal crimes, also referred to as violent crimes, are those in which the offense is committed against a person, whereas a property crime involves the taking of money or property but do not involve force or threats of violence against a victim. Thus an act of larceny (such as pickpocketing), in which the perpetrator neither harms nor threatens harm to the victim, is regarded as a property crime, whereas an act of robbery, in which the perpetrator does show intent to harm, is regarded as a personal crime. Personal crimes are regarded, by law enforcement, as more serious than property crimes, and frequently carry stiffer penalties. While property crimes can have negative health impacts, primarily increased stress or fear, personal crimes generally carry greater negative health impacts, such as direct physical injury (bruises, broken bones, wounds).

Assault-related injuries resulted in 1.7 million emergency-room visits in 2004 alone (CDC Advance Data No. 372, 2006). Between 1987 and 1990 the health insurance and disability costs for the victims of assaultive injuries were estimated at $34 billion (Miller et al., 1993).

Young men in urban settings are the most at risk of being the victims of crime (Crime Concern, citing Shepherd and Farrington, 1993). Homeless people, prostitutes, and those from ethnic minority groups are also at increased risk relative to the general population. The majority of victims of crime suffer psychological as well as physical harm (Crime Concern, 1999, citing Lugrigio, 1987). Victims of crime in London reported physical aftereffects such as insomnia, skin rashes, panic attacks, headaches, asthma, and nausea, and psychological health impacts such as obsessive behavior, anger, fear, depression, and loss of confidence (Crime Concern, 1999). A study of 150 victims of violent or attempted violent crime found that 19 percent met the criteria for a DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, used by psychologists) diagnosis of acute stress disorder within one month after the crime, and 20 percent met the criteria for a DSM-III-R diagnosis of post-traumatic stress disorder six months after the crime (Brewin et al., 1999).

The fear of crime also has negative health impacts. Fear of crime can lead to increased stress and anxiety, and increased isolation. A link has been drawn between neighborhoods characterized as disorderly, including those with higher crime levels, and higher levels of depression (Ross, 2000). A threatening environment may stimulate stress hormones, such as cortisone and cortisol; excess cortisone and cortisol can produce hypertension, hyperglycemia, and obesity (Ross and Mirowsky, 2001).

Fear of being attacked while walking or exercising can act as a disincentive to engage in those activities, leading to higher risks of obesity and the negative health impacts associated with inactivity. In one survey, 21.9 percent of women and 19 percent of men surveyed named high crime as a barrier to physical activity. Among lower-income participants in the survey, the numbers were even higher: 27.5 percent of lower-income women and 25.2 percent of lower-income men perceived crime as a barrier to physical activity (Brownson et al., 2001). Other research has suggested that lower-income residents are more likely to feel less safe in their own neighborhoods (Loukaitou-Sideris, 2006). Higher levels of neighborhood safety have been associated with higher levels of physical activity (Weinstein, 1999). Fear of crime can also decrease the likelihood that children and older adults will walk (Loukaitou-Sideris, 2006).

7.4 Crime and the BeltLine

According to the most recent data reported by the FBI, in 2005 there were 1.39 million violent crimes reported nationwide, at a rate of 469.2 violent offenses for every 100,000 people. Property crimes occurred more frequently than personal crimes with 10.2 million property crimes reported or approximately 3,430 crimes per 100,000 people.[39] In Atlanta, by contrast, with a population of 430,666, there were 7,213 violent crimes and 31,397 property crimes, or 1,675 violent crimes and 7,290 property crimes per 100,000 people. This is a drop from 2000, when 10,808 violent crimes and 41,515 property crimes, or 2,534 violent crimes and 9,734 property crimes per 100,000 people, were reported. Table 7.2 shows all cities with populations between 300,000 and 500,000 (organized from least to greatest population) in the FBI's 2005 "Crime in the United States" report, with their count of personal and violent crimes. As these data show, Atlanta's rates of personal and property crimes are higher than the average for a city of its size.

[39] Federal Bureau of Investigations Web site, http://www.fbi.gov/ucr/05cius/about/crime_summary.html

Table 7.2 Property and Violent Crime Rates for Cities of 300,000 to 500,000 population in 2005

City	State	Population	Violent crime	Property crime	Violent crime per 100,000 population*	Property crime per 100,000 population*
Toledo	OH	305,107	3,725	23,630	1,221	7,745
Cincinnati	OH	314,292	3,723	22,411	1,185	7,131
Tampa	FL	329,035	4,707	20,271	1,431	6,161
Pittsburgh	PA	330,780	3,385	15,628	1,023	4,725
Raleigh	NC	332,084	2,051	12,528	618	3,773
Anaheim	CA	335,992	1,616	9,512	481	2,831
Santa Ana	CA	344,991	1,845	10,292	535	2,983
St. Louis	MO	346,005	8,323	38,245	2,405	11,053
Arlington	TX	365,380	2,369	20,403	648	5,584
Colorado Springs	CO	374,482	1,792	19,619	479	5,239
Minneapolis	MN	376,277	5,472	22,417	1,454	5,958
Tulsa	OK	386,414	4,995	25,169	1,293	6,513
Miami	FL	388,295	6,134	23,321	1,580	6,006
Oakland	CA	400,619	5,692	23,027	1,421	5,748
Omaha	NE	412,128	2,327	22,056	565	5,352
Atlanta	**GA**	**430,666**	**7,213**	**31,397**	**1,675**	**7,290**
Virginia Beach	VA	446,448	1,140	13,342	255	2,988
Kansas City	MO	447,915	6,536	34,822	1,459	7,774
Mesa	AZ	452,340	2,280	24,071	504	5,321
Sacramento	CA	457,347	5,265	26,083	1,151	5,703
Cleveland	OH	458,885	6,416	28,543	1,398	6,220
Fresno	CA	460,758	3,897	25,546	846	5,544
Long Beach	CA	479,729	3,399	13,506	709	2,815
Albuquerque	NM	490,631	4,670	30,243	952	6,164
Average		**394,442**	**4,124**	**22,337**	**1,045**	**5,663**

Source: FBI, *Crime in the United States* 2005, http://www.fbi.gov/ucr/05cius/. *CQGRD calculations

It is difficult to predict how much impact the BeltLine will have on future crime levels. One reason is that while the built environment does have an influence on crime, so do many other variables, including the local economy, the number of police, and even such elements as the weather—burglary rates have been shown to fall during cold weather, for example (Giles, 2003). Therefore, the remainder of this section focuses on the parks and trails, transit, and overall redevelopment components of the BeltLine and provides data and results of various studies to suggest strategies to reduce the risk of crime.

Crime and the Built Environment

There are two schools of thought to explain where, how, and why crime occurs: the "compositional" school, which concentrates on the offender, and the "ecological" school, which focuses on the context in which the crime takes place. Compositional theorists look at socioeconomic characteristics, while ecological theorists

concentrate on where and when the criminal has an opportunity to strike with a relatively low risk of getting caught (Loukaitou-Sideris, Liggett, & Iseki, 2002).

Crime tends to be concentrated at "hot spots," where the risk of victimization is higher than average. A hot spot can be as small as a block or as large as a region (Eck et al., 2005). Advances in GIS and mapping technology have made pinpointing hot spots easier. Although the literature has yet to isolate a particular cause of hot spots, it is thought that neighborhoods with obvious signs of disorder are more likely to attract crime. The "broken windows" theory (Kelling & Wilson, 1982) posits that obvious signs of disorder, such as broken windows, vandalism, and litter, suggest to would-be criminals that law enforcement and residents are not paying attention or do not care and that the location is prime for criminal activity. The broken windows theory is descended from Jane Jacobs's original proposal that more attractive neighborhoods had more "eyes on the street"—more people who could observe others' behavior—and thus were less attractive to criminals.

In several cases, cities have tried to temporarily clean up a particular hot spot by focusing police resources on that spot. The 1999 "Blitz to Bloom" campaign in Richmond, Virginia, saw crime levels drop by 92 percent in the target area during the month-long police blitz, and, six months later, remained 35 percent lower than before the blitz (Smith, 2001). But this effort required 4,812 additional man-hours spent on a 5-by-10-square-block area (Smith, 2001) and was thus not fiscally sustainable long-term.

Another approach, requiring less police overtime, is to strike preemptively at crime by changing the built environment. Efforts towards "situational crime prevention" involve making changes to the surrounding environment to make it un-conducive to criminal activity. Often these changes involve "opportunity blocking," or using environmental cues to make committing a crime less attractive to the potential offender (Eck, 1996). Examples of such environmental cues include gates on closed shops, windows that face the street to increase informal surveillance ("eyes on the street"), bright lighting, or emergency phones. The idea of using visual and environmental cues to reduce the likelihood of criminal activity has been championed since the 1970s, in the form of CPTED (Crime Prevention Through Environmental Design). The tactics advocated by CPTED followers can be summarized as five basic principles (Saville, 1998), presented in Table 7.3.

Table 7.3 Principles of Crime Prevention Through Environmental Design

Principle of CPTED	Reasoning	Implications for the Built Environment
Territorial reinforcement	If people know that a place is "their own," they will be more active in protecting and maintaining it. "Semi-public" realms, where ownership is unclear, are more likely to be neglected and create an unsafe space where crime is more likely to occur.	Make clear subdivisions between public and private space through landscape and architectural cues. This is especially true in cases where private residences are close to shared spaces—apartment complexes, or houses on a busy street.
Access control	Easy entrance and exit of a potential crime scene is important to a would-be criminal; thus, making it harder to enter and leave an area unnoticed reduces the attractiveness of the area as a place in which to commit crimes.	Monitor entryways and exits into buildings, parks, parking lots, and neighborhoods. Make sure entrances and exits are well-lit, not hidden.
Natural surveillance	The more "eyes on the street," the more potential witnesses to a crime, and thus the more dangerous it is for a potential criminal to act.	When building, pay attention to sightlines; keep streets relatively free of obstructions and allow informal surveillance from windows and porches.
Neighborhood image and maintenance	A more dilapidated neighborhood suggests a lack of formal concern and thus a greater likelihood that a crime committed there will not be detected or prosecuted.	Budget for regular maintenance of the built environment: replacing light bulbs, street-cleaning, removing graffiti and broken windows, keeping vacant buildings locked.
Proper land use	Different public groups may all have legitimate uses for the same space, but those uses may conflict with each other (i.e. bicyclists and cars). Conflict can reduce the ability of all groups to use the public land safely.	Design public spaces (such as parks, trails, or streets) with different potential uses in mind, allowing all users to share the space safely.

Source: adapted from Saville, 1998

CPTED has been criticized in the past for creating displacement effects— lowering crime in one area, only to have it rise in another—and for concentrating too narrowly on the built environment at the expense of the broader context of a place and people (Saville, 1998). While using CPTED techniques do not guarantee a reduction in crime, it has been shown to reduce crime and the fear of crime, and the attendant negative health impacts.

Furthermore, greenery in and of itself can reduce crime and the fear of crime and have positive health impacts. In a public housing development in Chicago, 145 residents were randomly assigned to architecturally identical apartment buildings and those that lived in buildings with more vegetation outside felt safer and had higher rates of attentional restoration (Kuo & Sullivan, 2001). Residents living in areas with more greenspace also reported less overall aggression, psychological aggression, mild violence, severe violence and used fewer aggressive tactics against their partners and children (Kuo & Sullivan, 2001).

Crime and Public Transit

MARTA collects crime data on personal crimes committed at its stations. Table 7.4 shows the average number of personal crimes recorded each year at all MARTA train stations and the average number of crimes per station for the last five fiscal years. As these data show, crime appears to be declining at MARTA stations.

Table 7.4 Personal Crimes at MARTA Train Stations, 2002-2006

	FY02	FY03	FY04	FY05	FY06
Number of Crimes at all MARTA Train Stations	614	595	509	476	470
Average number of crimes per station	16.5	16.1	13.8	13.2	12.7

There is little evidence to support the assumption that transit spreads crime by increasing criminals' access to potential sites they would not have been able to reach otherwise. A study of crime levels around the Kensington and Indian Creek MARTA stations before and after their openings in 1993, found that the presence of the MARTA stations had a marginal impact, at most, on local crime rates (Poister, 1996). Similarly, the opening of the Green Line, a light-rail line in Los Angeles, did not have significant impacts on crime in the stations' neighborhoods; suburban areas continued to have higher levels of safety than average even after the introduction of light-rail service (Loukaitou-Sideris, Liggett, & Iseki, 2003). In general, transit crime is often highly correlated with the existing crime rates in the neighborhood in which the station is located (Loukaitou-Sideris, Liggett, & Iseki, 2002).Thus the environment in which the public transit is located is more indicative of crime levels than the presence or absence of transit itself.

A study of bus stop "hot spots" in Los Angeles found several potential environmental contributors to crime: nearby bad neighbors, like vacant buildings, liquor stores, and pawn shops; a lack of opportunities for informal public surveillance, such as a bus stop surrounded by surface parking lots; narrow sidewalks, which aggravate crowding and make purse-snatching easier; multiple escape routes; and inadequate lighting and general upkeep (Loukaitou-Sideris, 1999). Half the bus riders polled at six of these high-crime bus stops reported feeling unsafe at the stop, while only a quarter felt unsafe on the bus (Loukaitou-Sideris, 1999).

Similar considerations of the built environment and the potential for crime can be taken into account when designing and building light-rail stations. Washington's Metro, one of the safest light-rail systems in a major American city, was built with CPTED principles in mind. Each station has at least eight closed-circuit television cameras and a uniformed station attendant. Long escalators were designed to avoid lengthy, curved passageways in which potential criminals could linger un-seen. Metro also has a policy to clean graffiti and repair vandalism damages within 24 hours of the occurrence. Researchers found that Metro's crime rate was significantly lower than MARTA's, even though Metro had, at the time of the study, 500,000 riders per day compared to MARTA's 219,000 (La Vigne, 1997).

Crime and Parks

Fear of crime in parks can reduce the likelihood of park use, leading to decreased opportunities for physical activity, fresh air, and relaxation. Several studies suggest that creating urban parks and greenways do not increase crime levels. A study of Boston's Southwest Corridor, a linear greenway, tabulated calls to police and found no evidence that the corridor increased crime for those houses abutting it (Crewe, 2001). A study of Providence, Rhode Island's parks found that none of the parks qualified as hot spots (Pfisterer, 2002).

It should be acknowledged that parks can be a setting for criminal activity. One Stockholm park, Vasaparken, became the setting for drug-dealing interactions. The police and park authorities responded by making changes to the park environment, such as trimming hedges in order to increase visibility of the area where the drug users tended to congregate (Knutson, nd).

A study of the creation of regional urban greenways in the greater Toronto metropolitan area (Luymes and Tamminga, 1995) resulted in several recommendations for using design to improve safety in parks:

- If a pathway is meant to be used at night, lighting should be provided to a level that will allow a user to recognize another person's face at a distance of 25 meters (82 feet). Lighting levels should be consistent, instead of creating contrasts between pools of bright light and pools of shadow.
- Signs should be simple and clear, readable from 20 meters (66 feet) away, and in multiple languages if appropriate for the community. Signs and maps should communicate the location of key landmarks in relation to the user, and give information on how to get help if needed.
- On pathways, vegetation should be controlled to allow clear sightlines. Vegetation that creates shadow pools and potential hiding places should be appropriately pruned or located.
- Isolated natural areas should include signs that tell the user that the area will be low-use and unlit, and suggest alternative routes, with maps.

Crime and Trails

The Rails-to-Trails Conservancy found in a 1998 survey of 372 trails that "converting an abandoned rail corridor to a trail actually tends to reduce crime by cleaning up the landscape and attracting people who use the trail for recreation and transportation" (Tracy & Morris, 1998). In their survey, less than four percent of urban trails and less than two percent of suburban trails reported a mugging in 1996; less than eight percent of urban trails and less than four percent of suburban trails reported an assault that same year. Table 7.5 shows the reported incidence rate of major crimes, whereas Table 7.6 shows the percentage of trails reporting less serious crimes (both Tracy & Morris, 1998).

Table 7.5 Rates per 100,000 Population of Reported Violent Crimes in the US and Along Selected Rails-to-Trails, 1995

Type of crime	Urban		Suburban		Rural	
	Per 100,000 people, 1995, nationally	Per 100,000 people, 1995, on urban rail-trails	Per 100,000 people, 1995, nationally	Per 100,000 people, 1995, on suburban rail-trails	Per 100,000 people, 1995, nationally	Per 100,000 people, 1995, on rural rail-trails
Mugging	335	0.53	102	0.00	19	0.00
Assault	531	0.58	293	0.02	203	0.01
Forcible rape	43	0.04	29	0.00	26	0.01
Murder	11	0.04	4	0.01	5	0.01

Source: Tracy & Morris, 1998

Table 7.6 Percentages of Selected Rails-to-Trails Reporting Damage

Type of damage/crime	Percentage of urban trails reporting damage	Percentage of suburban trails reporting damage	Percentage of rural trails reporting damage
Burglary	0.00	0.01	0.01
Trespassing	5	3	4
Graffiti	26	17	12
Littering	24	24	25
Sign damage	22	22	23
Unauthorized motorized use	18	14	23

Source: Tracy & Morris, 1998

The trails surveyed reported a variety of crime-prevention measures. More than three-fifths reported some sort of regular patrol, usually by bike, car, or truck. Eight percent had installed phones throughout the trail. Trail

design can also contribute to a feeling of safety. One of the entrances to the James River Heritage Trail in Lynchburg, Virginia, has been cited as using CPTED measures to encourage informal surveillance, which can in turn decrease the attractiveness of the location as a site for crime. Visitors entering the trail can be seen by visitors and volunteers at the nearby Awareness Garden, who in turn can be seen from the parking lot (McCormick, 2006).

7.5 Recommendations

Pedestrian/Bicyclist Injuries

- **Provide appropriate infrastructure for biking.** Sidewalks are not recommended for cyclists. Bicycle lanes are preferred where bicycles must travel alongside the roadway. See the Federal Highway Administration, the American Association of State and Highway Transportation Officials, and the Pedestrian and Bicycle Information Center for design guidelines.
- **Place pedestrian and cyclist crossings to increase visibility.** Where paths for pedestrians and cyclists must intersect with roadways, crossings should be placed as close as possible to existing roadway intersections and the path intersection should be clearly marked for motor vehicle drivers. In addition, pedestrians and cyclists should be given priority at such intersections.
- **Implement interventions for pedestrian and cyclist safety.** Interventions for pedestrian and cyclist safety focus on separation by time and space, increasing pedestrian/cyclist visibility, and reducing motor vehicle speeds. Effective interventions include: traffic signals at high-speed intersections; exclusive walk signal phasing; adequate duration of yellow/red signal timing; sidewalks; bicycle lanes; refuge islands and raised medians on multi-lane, high traffic volume roads; and increased intensity of roadway lighting to reduce nighttime pedestrian crashes.
- **Design crossings for all users.** Special consideration should be given to the design of crossing environments for pedestrians with disabilities and vision or hearing impairments. Here is an opportunity to go beyond American with Disabilities Act (ADA) standards to become best in class in design and execution.

Light Rail Transit Injuries

- **Institute regular maintenance, operational oversight, and security on transit and in rail stations to help prevent injuries to transit users.**
- **Provide safe rail crossings.** The likelihood of train-pedestrian crashes may be reduced by providing safe rail crossings for pedestrians where appropriate and by providing barriers to the railroad tracks where crossings and children's play is not desired. See the Rails-with-Trails (2000) report, the American Association of State and Highway Transportation Officials *Guide for the Development of Bicycle Facilities* (1999) and the U.S. Department of Transportation's *Rails-with Trails: Lessons Learned* for specific recommendations about the safe design and maintenance of shared-use paths and their interaction with railroads, including guidance for providing safe crossings and installing barriers. Whenever possible the light rail tracks should not act as a barrier but rather should allow people to move safely and freely across the tracks. Fencing, grade separation, cement walls, ditches, and vegetation are all viable safety mechanisms but should be employed only where necessary rather than as standard practice. Employing such separation barriers can sever neighborhoods. Look to other examples of light rail and pedestrian integration at grade for best practices. Examples include Portland, OR, San Jose, CA, and Amsterdam, The Netherlands.

Sports-Recreation Injuries

- **Incorporate injury prevention messages to decrease risk of injury.** Existing public health literature indicates the need for injury prevention messages that could decrease the risk of injury to walkers, runners, and cyclists on the shared-use path. On a shared-use path, user-conflict interactions may result in injuries, although there is limited literature on this subject. Based on current knowledge, it is appropriate to educate shared-use path users about path "etiquette", including staying to one side of the path, allowing faster moving travelers the ability to maneuver safely, and limiting speed of travel on the path (FHWA, 1994). It may also be appropriate to educate users about appropriate safety gear, such as bicycle helmets and, particularly during early morning and evening hours, wearing clothing that is visible (i.e., reflective materials).

Crime Prevention

- **Design parks, trails, and transit to promote 24-hour surveillance and increase feelings of personal safety.** This can be accomplished by maximizing visibility, increasing informal surveillance, and decreasing the possibility of hiding criminal behavior. These facilities should be constructed with Crime Prevention through Environmental Design (CPTED) principles in mind, incorporating such environmental cues as lighting, call boxes, and police patrols. Such elements should be part of the design and budgeting process.
- **As the BeltLine develops, regular maintenance of parks and park facilities, trails, and the transit system including transit cars, should be scheduled and included in the budget.** The BeltLine authorities should follow the example of Washington's Metro, which provides for speedy graffiti removal and vandalism cleanup. Several studies have suggested that routine maintenance of the urban environment will aid in reducing crime (Cozens et al., 2005).
- **Consider creating a BeltLine patrol or police force.** Because of the size of the BeltLine and the variety of its component parts, it may be necessary to create a BeltLine police force. This could be an expansion of the MARTA police force, or a separate group created along similar lines. Such a force would ensure familiarity with the parks, trails, and transit facilities; would not further tax the Atlanta Police Department; and would ensure continuous patrolling of the 22-mile system.
- **Educate users about ways to maintain personal safety.** Information and advice on maintaining personal safety in public spaces, such as trails, parks, and public transit, should be made publicly available, via such media as brochures that can be picked up when entering the trail, signs, or via the World Wide Web. Community organizations could also be contracted to provide lessons on personal safety.

Section 8: Social Capital

Social capital can be defined as the collective value of a network—social, political, and economic—whose purpose is to inspire trust in and provide support for other members of that community (Dannenberg et. al, 2003). Social capital is built both formally, through participation in group activities, and informally, through casual association and encounters. It is the degree to which people feel that they live in and belong to a socially cohesive local environment, and the range of activities and resources that emerge as a consequence of those ties. Overall, a decline of participation in various civic associations and of socialization with neighbors has been recorded in the United States (Putnam, 1995).

8.1 Social Capital and Health

Individuals who are not well integrated into the social, political and economic networks, those with low social capital, are reportedly at increased risk for poor physical and mental health (Kawachi, 1999; Hawe et al., 2000). In contrast, people socially engaged in their communities live longer and are healthier both physically and psychologically (Kaplan et al., 1998; House, et al., 1988; Berkman, 1979; Seeman et al., 1987; Kawachi, 1999; Berkman et al., 2000; Kawachi & Berkman, 2001; Brummett et al., 2001).

Some researchers have argued that social capital plays a role in health in several ways: by serving as a source for information and goods and identifying norms of healthy behavior; creating social ties and emotional support; and contributing to collective efficacy or the ability to problem solve to achieve group gain (UCBHIG, 2007). When the information shared among members of a socially cohesive group regards health care or health-related services, such sharing directly impacts the health of those involved. Identifying norms of healthy behavior can be used to reinforce healthy living habits, such as not smoking, physical activity, prenatal care, and healthy eating habits. Social ties are based on mutual trust and the desire for individuals to look out for one another. Such ties can have profound affects both on the mental and physical health of individuals by reducing feelings of isolation and contributing to overall feelings of self-esteem and self-worth. Finally, social capital can lead to collective efficacy in which the information, resources, and talents of the group are pooled to achieve a desired positive outcome for health and well-being (UCBHIG, 2007).

In the last decade, a number of studies have established a link between social capital and a variety of health outcomes. Individuals with high social capital tend to live longer and are physically and mentally healthier (Leyden, 2003). Studies have shown that isolation is a major cause of illness, and that once ill, socially isolated individuals are two to five times more likely to die than those with strong social networks (Berkman & Glass, 2000). Thus social capital has been linked to prolonged life expectancy. Social capital has also been linked to better overall health including fewer colds, better cardiovascular health with reduced risk of stroke and heart attack, reduced risk of cancer, faster recovery from illnesses, and improved mental health (better self-esteem, self-image, and greater self-worth) (Putnam, 2000; Ewing & Kreutzer, 2006). Social capital, with its components of networking, information-sharing, and social norms, has been found to have an effect on prenatal care and infant mortality rates (Harpham et al., 2002). In addition, there are conceptual links between support provided by social

networks and improved mental health, particularly in times of stress (Harpham et al., 2002). Social capital has even been shown to reduce incidents of violent crime and increase physical activity, as residents of safer environments tend to spend more time thereby partaking in more activities, including active travel, and providing informal surveillance to decrease crime (Ewing & Kreutzer, 2006; Adler & Newman, 2002).

Social capital is built through positive social interactions, group activities, political and civic engagement, and membership in clubs and organizations, among other means. In today's society, people acquire social networks beyond their neighborhoods through their jobs, clubs, or houses of worship in what can be called communities of interest (Glynn, 1986; McMillan & Chavis, 1986; Lyon, 1987; Cochran, 1994; Nasar & Julian, 1995). However, people also become involved in their immediate environment or their community in place, which is important for the creation of social capital within the neighborhood (Glynn, 1986; McMillan & Chavis, 1986; Cochran, 1994; Nasar & Julian, 1995).

Robert Putnam, whose book *Bowling Alone,* examined the concept of social capital, describes two types of social capital: bonding and bridging. Bonding social capital ties people together through inclusion, but with exclusion as a by-product. Bridging social capital expands the social network outwards beyond the insularity of the group fostering a larger scale sharing of information and sense of well being and inclusion (Putnam, 2000; Ewing & Kreutzer, 2006 (citing numerous studies)). Public participation is affected by social capital in that low social capital results in decreased public participation. However, public participation also creates social capital by encouraging group visioning and consensus building.

Evidence shows that social capital is affected not only by public participation and community involvement, but also by the built environment. Much of the research that has examined the relationship between the built environment and social capital has focused on the differences between traditional, urban neighborhoods and suburban neighborhoods. The results indicate that social capital tends to be higher in traditional neighborhoods. As the BeltLine is an urban project, it is unnecessary to discuss the suburban context in great detail. Instead it is important to look at those features of a built urban environment that have an influence on social capital, and by extension physical and mental health.

Research suggests that walkability, automobile dependence, mix of land uses, density, size of place, traffic volume, homogeneity, and presence of public spaces all impact social capital through their ability to create or support opportunities for formal and informal interaction. Walkability, which refers not only to the design of a public space or a neighborhood but also to feelings of personal safety, is positively correlated to social capital. Walkable neighborhoods are typically defined as those that have: a grid-street pattern, narrow streets, small lots, mix of uses, density, traffic calming, sidewalks and crosswalks, and the presence of parks, trails, and other public spaces (Ewing & Kreutzer, 2006). A study by Hollie Lund from California State Polytechnic University, set in Portland, Oregon, found that having an interest in walking, opportunities for social interaction, and feeling safe while walking were all positive predictors of a sense of community. In addition, the study found that sense of community was more strongly correlated with recreational walking trips rather than destination trips (Ewing & Kreutzer, 2006).

Mixed uses and density as independent variables in research have proven to be inconclusive in their relationship to social capital. Although there is evidence to suggest that mixing uses in close proximity tends to increase the number of walking destinations and thereby social capital, the evidence in relation to density is less clear (Ewing & Kreutzer, 2006). The size of place, like a residential development, neighborhood, or city, also correlates with social capital, with larger places typically having less social capital (Putnam, 2000).

Automobile dependence, in particular for commuting long distances, has been correlated with decreased social capital (Ewing & Kreutzer, 2006). Robert Putnam found that each 10 minutes spent commuting translates directly into a 10 percent decrease in community involvement (Putnam, 2000).

Traffic volume has been shown to affect people's sense of community; as traffic volumes increase, people's social capital decreases. Similarly, research suggests that people residing on streets with light traffic volumes have larger social networks than those on streets with heavy volume (Lavin et al.,2006). The link between high traffic volume/speed and low social capital stems primarily from three causes: fear for personal safety, which limits walking and children playing outside; not wanting to walk in an unpleasant environment; the physical divide caused by the amount of traffic, its speed, and the width of the road (Lavin et al., 2006).

The decline of social capital has been attributed in part to a loss of public spaces. These public spaces, including sidewalks, parks, plazas, dog parks, community gardens, playgrounds, and even cafes, bookstores, and hair salons provide spaces in which people can interact intentionally or accidentally, formally or informally. These moments of interaction, whether for the exchange of pleasantries or information, create and strengthen the social networking bonds of social capital and can have real and substantial positive health outcomes (Ewing & Kreutzer, 2006; Baum & Palmer, 2002; Bedimo-Rung et al., 2005; Leyden, 2003). In addition, these opportunities for socializing in public spaces or neutral territories can help reduce feelings of prejudice and increase understanding of other cultures and races by enabling interaction amongst people of differing races, economic status, education levels, and ethnicities thereby building feelings of social capital (Lewis, 1996). Homogeneity in communities, particularly in terms of income and age, has been shown to reduce social capital, in particular political participation, which can have detrimental impacts on the well-being of that community (Ewing & Kreutzer, 2006).

The design of the built environment in terms of architecture can also have an effect on social capital. The placement of entrances to residential units that are adjacent to or facing one another, or that are directly connected to pedestrian paths or active common spaces, increases the likelihood of social interaction. The inclusion of certain architectural features such as stoops, porches, and communal gathering spaces also increases social interaction, improving one's sense of emotional well-being. Views of and access to nature have also been shown to have positive health impacts resulting in increased recovery times for hospital patients, decreased mortality in seniors, lower blood pressure and decreased anxiety, and higher levels of attention in school age children (Lavin et al., 2006).

Declining social capital can also be blamed on the condition and deterioration of the built environment and the accompanying social ills that affect perceptions of personal safety, well-being, and overall quality of life. High crime rates, vandalism, litter, and graffiti, have been shown to decrease the willingness of people to be involved in their community. For example, fear for personal safety is an often cited reason for not engaging in physical activity out of doors, thereby reducing the possibilities of informal interactions with neighbors. There is mounting evidence to support the assumption that poorer people have poorer health because they live in places that are unhealthy, although the relationship is complex (Baum & Palmer, 2002). One study indicated that residents of high poverty neighborhoods live on average eight years less than non-poverty neighborhoods (Bhatia et al., 2006).

In addition, involuntary displacement and gentrification also diminish social capital by removing people from their established social networks and support systems, which has physical and mental health implications (Bhatia et al., 2006). Neighborhood change, whether in terms of gentrification and displacement or increasing crime and deterioration, can be stressful for long-time residents who feel unable to control the events surrounding them which can have negative mental and physical health repercussions (Baum & Palmer, 2002). Displacement is covered in greater detail earlier in this HIA in Section 5 (Access and Social Equity).

8.2 Social Capital and the BeltLine

A content analysis of the BeltLine HIA survey found that 23 respondents (5 percent) mentioned that the BeltLine would improve their sense of community or community well-being. This is a very low response rate compared to higher percentages of users who predicted positive impacts on more concrete aspects of the BeltLine, such as transportation (70 percent), parks and greenspace (52 percent), and trails (39 percent). In addition, only nine percent of respondents thought that a sense of community would have a positive effect on their health. Still, considering the results of the research linking the built environment and social capital to health, such survey results do not negate the issue or the need to examine it in the context of the BeltLine.

Social capital is affected by both tangible and intangible elements. The tangible elements are those that make up the built environment. These include mixed land uses, density, size, transit options, public spaces, and architecture. The intangible elements are those that are a bit harder to quantify: neighborhood condition, homogeneity of the neighborhood, displacement, public involvement, and walkability. Each element, whether physical or intuitive, plays a role in the creation and perpetuation of social capital and will be impacted by the BeltLine.

The BeltLine and its component parts, the tangible elements, offer opportunities to build, improve, and create social capital. Parks create public spaces that encourage interaction and depending upon size and programming, create opportunities for large and diverse groups to come together for a common purpose. Trails also function as public spaces albeit with more limited purposes, primarily exercise and transportation. The transit component gets people out of their cars and moving around together. Finally, redevelopment will bring new housing, businesses, and people to neighborhoods and the city. This redevelopment can have both positive and negative consequences. In a positive light, redevelopment can connect neighborhoods long separated by the freight rail corridor to each other. A negative impact of redevelopment may be increased property taxes and rent that lead to displacement of long-time residents and businesses.

Examining the intangible elements of the BeltLine brings attention to the process by which the BeltLine is implemented. This process has the ability to diminish, weaken, or destroy social capital if executed poorly, but it may also enhance social capital and lead to greater civic pride, buy-in, and involvement along with the potential for positive health outcomes. A critical component of the BeltLine process is public participation. Thus if the BeltLine process involves an inclusive public participation process that is transparent it can result in the creation of social capital. On the other hand, if residents do not feel heard or are marginalized by the process, not only can the project suffer from criticism and opposition but also residents who may suffer the negative health impacts—from stress, for example. It will be critical to promote equal participation from all BeltLine Planning Areas. Since these areas and their representative neighborhoods are unique in their social structures and historic degree of efficacy, strategies for effective public involvement may require varied approaches and resources depending on the planning area.

8.3 Recommendations

- **Continue and enhance effective public participation and transparency.** Public participation and transparency in decision-making should be policy as it relates to the BeltLine process. Citizens, either individually or through neighborhood and community organizations, should be engaged in the decision making process to ensure the creation and maintenance of healthy social capital. Care must be taken to ensure that all BeltLine neighborhoods participate in the process.

- **Continue public participation throughout the project.** Public participation should be a critical component throughout the project, which could mean up to 25 years of participation of varying degrees and forms to correspond to the timeframe of the TAD.
- **Design environments that promote formal and informal social interaction.** While the design elements of the built environment that encourage social capital (mixed-use, grided-streets, connectivity, density, walkability, etc) are familiar within the New Urbanist vocabulary and have become somewhat standard design in the City of Atlanta, it is important to recognize the value they bring to the creation of social capital and the potential health consequences of these design decisions.
- **Embrace an expanded definition of public space.** Public spaces, including sidewalks, parks, plazas, community gardens, dog parks, and seating areas, should be planned for and encouraged within parks, along trails, and within redevelopment areas to enable opportunities for public interaction.
- **Provide diversity in park types.** Variety in the types of parks (active and passive) as well as the types of facilities and amenities in the parks is important for the ability to create social capital by providing opportunities for formal and informal interaction. Some examples include outdoor sport areas (soccer fields, basketball and tennis courts, swimming pools, shuffleboard and bocce ball courts, skateboard parks), community gardens, picnic areas, seating furniture, pet parks, and wide open areas for festivals and events.
- **Preserve neighborhoods.** Redevelopment can have both positive and negative impacts on neighborhoods and their residents. Policies need to be created and put in place that require public input on the design of developments, help long-time residents stay in their homes, help qualified homeowners with financial needs make repairs to their homes, and execute programs that help clean-up neighborhoods. Such measures will help create and maintain social capital.

Section 9: Environment

Primary environmental impacts related to the BeltLine include issues related to air quality, water resources, brownfields, and noise. Air quality includes the regional and localized context. Water resources primarily refers to stormwater and impervious surfaces. Brownfields is concerned with redevelopment of contaminated sites. Finally, noise issues are concerned with potential disturbances from construction and operation of the BeltLine.

9.1 Air Quality

Air quality is a topic that has become pervasive in recent decades. The various impacts of air quality on health, the environment, and quality of life in general have led to interventions such as the Clean Air Act of 1970, which was introduced to minimize the impacts of poor air quality by setting limits on the total amount of pollutants that can be released into the air in the United States. Air pollutants are introduced into the environment directly from mobile sources (automobiles, trucks, trains), stationary sources (factories, power plants), or indoor sources (building materials). Some pollutants, such as ozone, are the result of a chemical reaction of other pollutants.

Air quality regulations established by the Clean Air Act are built around National Ambient Air Quality Standards (NAAQS) for each of six types of ambient air pollutants: ozone, lead, nitrogen dioxide, particulate matter, carbon monoxide, and sulfur dioxide. All of these pollutants with the exception of particulate matter are gaseous substances. Particulate matter (PM) refers to solid particles and liquid droplets suspended in the air and is generally measured in PM 10, particulates with a diameter of 10 micrometers or less and more recently PM 2.5 (also referred to as fine particulate matter), particulates with a diameter of 2.5 micrometers or less.

9.1.1 Air Quality and Health

Air quality is linked to health in a variety of ways. The health effects of these pollutants include reduced lung function, asthma and other respiratory illnesses, cancer, irritation of breathing passages, premature death, with children and the elderly being at a higher risk than the general population (EPA, 2006).

Short- and long-term exposure to air pollutants can have health effects at both a regional and local scale. Increased rates of mortality and morbidity from cardiovascular and respiratory diseases have been associated with various indices of air pollution, including gaseous pollutants generated by the burning of fossil fuels, but have been most strongly associated with air pollution that contains fine particulate matter (Health Effects Institute, 1999; Dockery et al. 1993; Lippman et al., 2002). Hospital admissions for cardiovascular and respiratory diseases in Europe and North America have been observed to be associated with PM and gaseous pollutants such as ozone, CO and NO_2 (Health Effects Institute, 1999).

The effects of gaseous and particulate pollutants on health have been found in both short- (acute exposure) and long-term studies (chronic exposure) with effects being seen at very low levels of exposure. However

research is ambiguous on whether or not there is a threshold concentration below which no effect on health will occur (Brunekreef & Holgate, 2002). Both short- and long-term exposure to particulate matter (PM) have been associated with increased rates of cardio-respiratory morbidity and mortality. This includes increased lung cancer risk, along with short- and long-term non-cancer health effects such as bronchitis, asthma, and reduced lung function (Bhatia et al. 2006). Additionally, PM 2.5 is seen to have an adverse effect on lung development in adolescents that can lead to lifelong lung deficiency (Gauderman et al., 2000; Gauderman et al., 2004). The elderly are also at increased risk for negative health effects stemming from exposure to PM. Research has shown that common emission sources for PM have significant associations with elderly cardiovascular hospital emissions and that modest amounts of air pollutants are associated with small changes in cardiac function in the elderly (Barnet et al., 2006; Mar et al., 2005).

Studies by Houston et al. (2006) and Fischer, et al. (2000), have examined particulate matter's impact on human health. PM 2.5 is generally seen to have a greater negative effect on health, since the particles are small enough to be absorbed through lung tissue into the bloodstream, but both PM 2.5 and PM 10 can have a negative effect on health (Health Effects Institute, 1999; Health Effects Institute, 2001). Studies have indicated that vehicle-related fine particulate matter becomes highly concentrated in areas immediately adjacent (200 meters) to major roadways. Outdoor particulate matter concentrations (PM2.5 and PM10) are an estimated 15 to 20 percent higher at homes located in high traffic intensity streets compared to low traffic homes. Vehicle-related pollutants have been associated with increased respiratory illness, impaired lung development and function, and increased infant mortality. Also, pregnant women living within 200 to 300 meters of high-volume roads face a 10 to 20 percent higher risk of early birth and of low-birth-weight babies. In addition to general vehicle exhaust, exposure to fine particulates from diesel exhaust has a negative effect on those that live near roadways or areas such as rail yards or inter-modal yards with high diesel emissions. People living in immediate proximities (200 meters) of major diesel thoroughfares are more likely to suffer from respiratory ailments, childhood cancer, brain cancer, leukemia, and higher mortality rates than those who live further away. Research shows that particulate concentrations approach normal background levels at distances greater than 200 meters (Houston, et al. 2006; Fischer, et al., 2000).

9.1.2 Air Quality and the BeltLine

One of the principal concerns of the BeltLine HIA survey respondents was the effect of air quality on their health. Ninety-one percent of survey respondents felt that having good air quality has a very positive effect on their health. Sixty-three percent of survey respondents either agree or strongly agree that the BeltLine, when fully built out, will help improve the region's air quality.

For the past decade or more, concerns surrounding air quality have been an important topic for the Atlanta public, state and local government officials and the region's metropolitan planning organization (MPO), the Atlanta Regional Commission (ARC). The Atlanta region is considered in non-attainment, having levels exceeding NAAQS, for ground level ozone and fine particulate matter.

The ARC, as the Atlanta region's MPO, is the agency responsible for managing the long-range transportation planning process to ensure that "regional transportation projects do not cause or contribute to worsened air quality." The BeltLine project components are part of the most recent Mobility 2030 Regional Transportation Plan (ARC, 2006). The inclusion of the BeltLine project components shows that region-wide, the BeltLine components will not have a net negative effect on the region's air quality.

The BeltLine represents a massive 25-year construction project, including the creation of parks, trails, transit, 50,000 housing units, and 13 million square feet of other new construction. Construction projects can contribute to a type of PM emissions called "fugitive dust." Fugitive dust accounts for 88 percent of total PM_{10} and 66 percent of $PM_{2.5}$ emissions (EPA, 1998). In urban areas, the most common cause of fugitive dust is vehicular movement on paved roads, unpaved roads, parking lots, and construction sites. The amount of dust

emissions is closely related to vehicle shape, speed, weight, and number of wheels (Nicholson et al., 1989). Usually, dust emissions from paved surfaces are due to dust being tracked out from construction sites and other unpaved areas or spilled from construction vehicles (Chow and Watson, 1992). In addition, standard construction activities such as digging, scraping, and storing or moving materials create dust reservoirs that are targets for wind erosion (Watson and Chow, 2000).

9.1.3 Air Quality Assessment

According to numbers provided by the Atlanta Regional Commission (ARC), completion of the BeltLine project will have a moderately positive effect on the Atlanta region's air quality by 2030. This comes both from the addition of the transit component of the BeltLine and the mixed-used infill development as part of the TAD redevelopment plan. Current (2005) traffic volumes for the 13-county metro Atlanta region are approximately 130 million vehicle miles traveled (VMT) per day. ARC projects that there will be a 36 percent increase in traffic volume, to 178 million vehicle miles traveled (VMT) per day in the Atlanta region, if the BeltLine is completed versus a 40 percent increase to (184 million VMT per day) if the BeltLine project components are not completed.[40] This reduction in projected daily VMT is not expected to have any major effects on health within the region, but the higher levels forecast with no BeltLine project component completion could exacerbate health concerns in children and those with existing respiratory ailments. To measure the potential air quality ramifications of the build and no-build options, the projected VMTs for each of the options were used to estimate the total daily emissions for the Atlanta region under each scenario. 2004 per-mile emission factors were obtained from the Georgia Environmental Protection Division (EPD) and were combined with the VMTs for each scenario to obtain a total emission calculation for each scenario (see Table 9.1.1 in the results section).

While there will be a marginal improvement in the total amount of air pollutants in the Atlanta region, there is the possibility that new residential units will be constructed in areas with relatively high concentrations of PM 2.5. Given the land-use changes associated with the TAD redevelopment plan for the BeltLine area, there are areas where residential units will be zoned for construction within 200m of high traffic corridors or large truck and rail yards with high quantities of diesel exhaust. These locations proximate to high traffic areas and thus higher levels of fine particulate matter could pose potential health risks to residents, especially those in the high risk groups of the elderly and children.

To analyze the potential health impacts of placing residential units in close proximity to high traffic areas, a GIS was used to map the residential construction planned with the TAD and their location relative to high traffic areas. Projected traffic volumes for the year 2030 were obtained from the ARC and mapped. Using standards established by the California Environmental Protection Agency (CEPA), buffers of 200 meters were created around road segments with average daily traffic volumes of 100,000 vehicles per day (VPD) and around large rail yards (CEPA, 2005). Figures 9.1, 9.2 and 9.3 show the high volume road segments with 200m buffers.

It should be noted that under the no-build scenario for the BeltLine there will be more transportation corridors that will reach the high volume designation of 100,000 VPD. However, without a TAD or similar redevelopment plan to direct future residential development, there is no definitive way to predict where that residential development will occur such as there is with the BeltLine TAD redevelopment plan. Regardless, the no-build option will create more areas that are at high risk for proximal exposure to PM 2.5 and other vehicular air pollutants.

[40] These totals were calculated by CQGRD using the Atlanta Regional Commission's (ARC) 2030 travel demand numbers for a BeltLine and no BeltLine scenario. These data were obtained from the ARC in August 2006.

Figure 9.1 2005 High Volume Road Segments

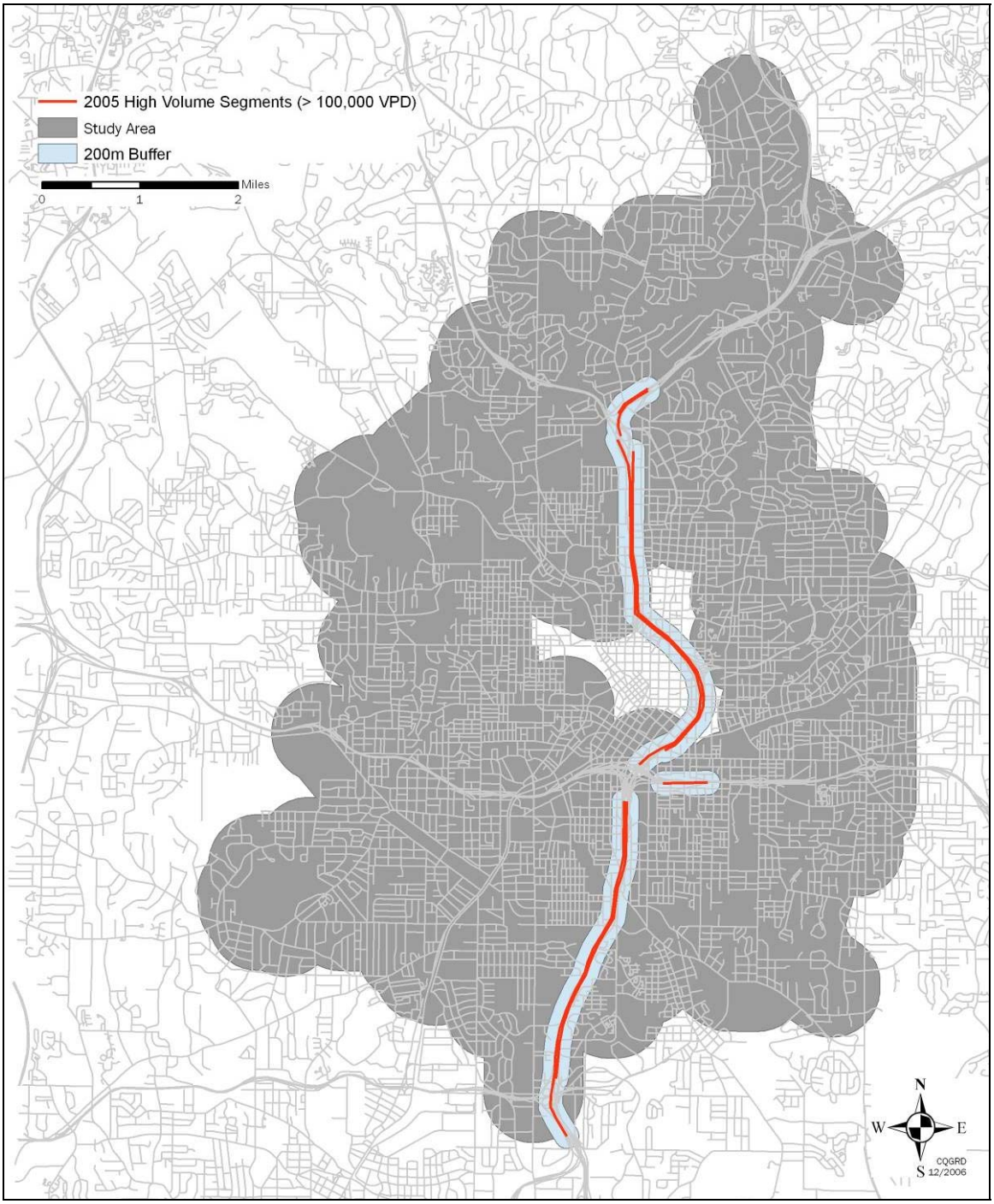


Figure 9.2 2030 High Volume Road Segments with the BeltLine

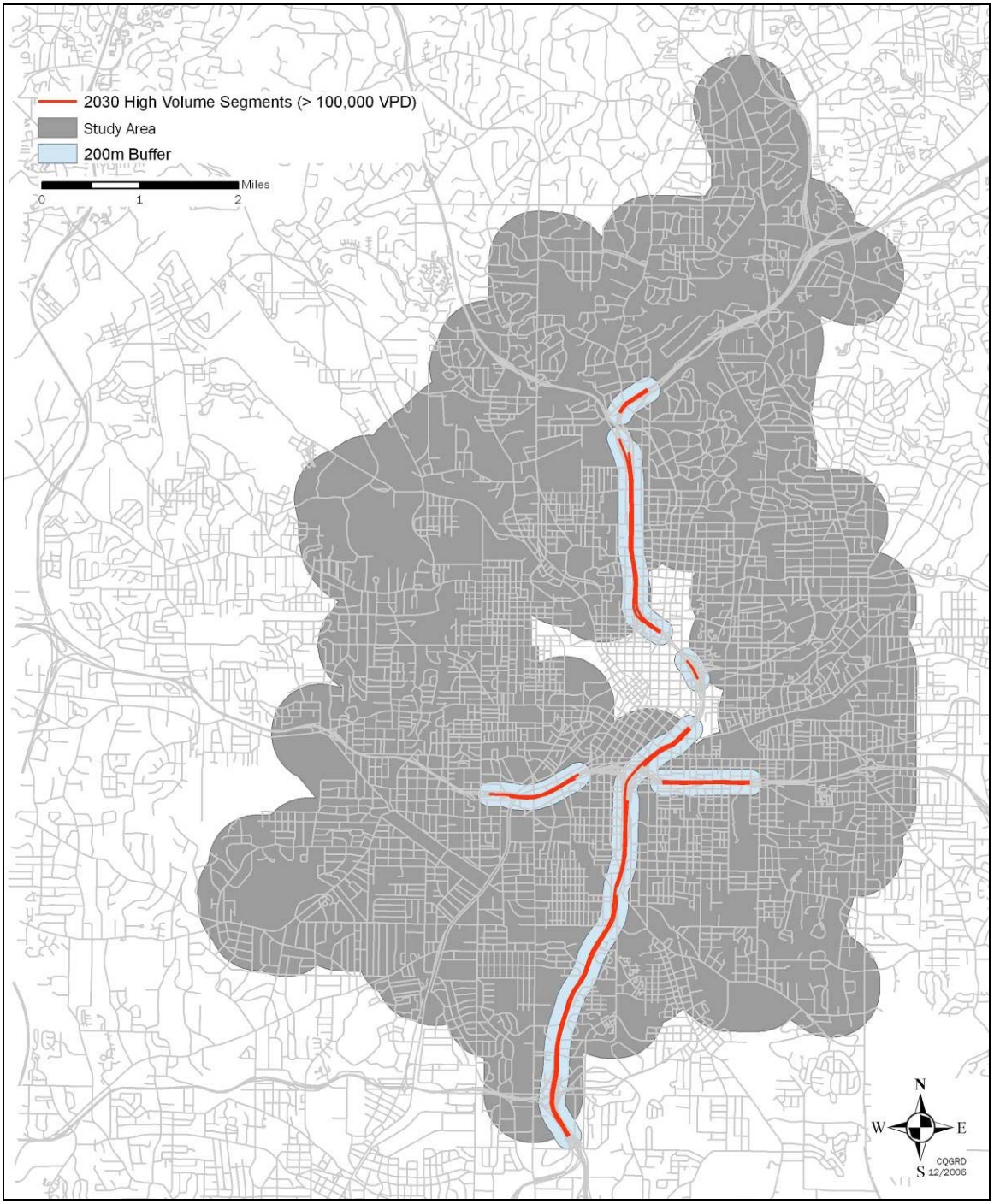
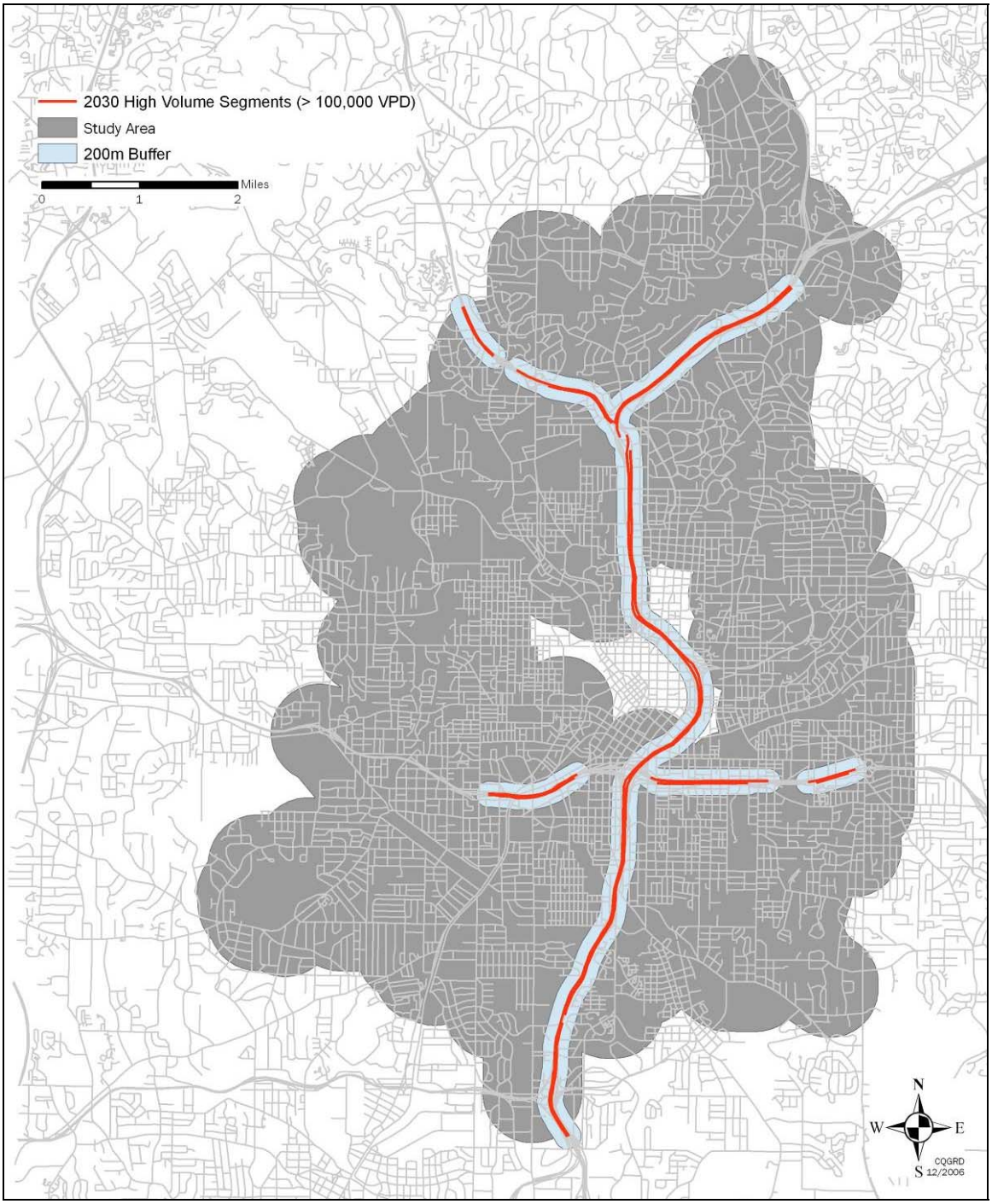


Figure 9.3 2030 High Volume Road Segments without the BeltLine



Figures 9.4 and 9.5 show the two rail facilities, Inman and Tilford Yards and Hulsey Yard. And Figure 9.6 shows the proposed land uses around high volume road segments. To measure the potential living units that will fall within each of the buffers, the potential demand for housing units per acre in each quadrant were taken from section 3 of the Atlanta BeltLine Supporting Documents: *Atlanta BeltLine Development Plan, Future Circulation Plan, Traffic Impacts and Roadway Improvements* prepared by Grice and Associates, and applied to the affected parcels (see Figures 9.4, 9.5, and 9.6)

Figure 9.4 Proposed Land Use around Inman and Tilford Rail Yards

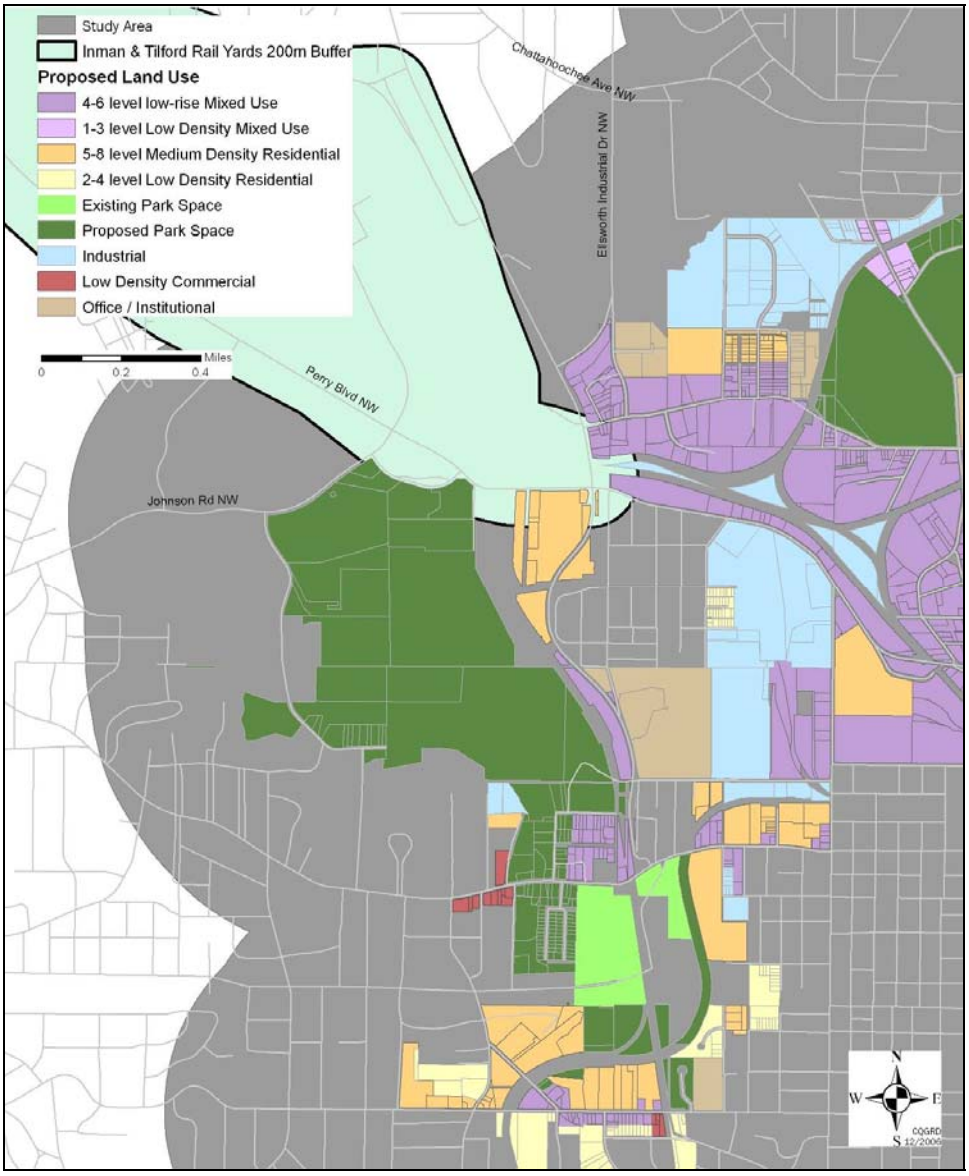


Figure 9.5 Proposed Land Use around Hulsey Rail Yard

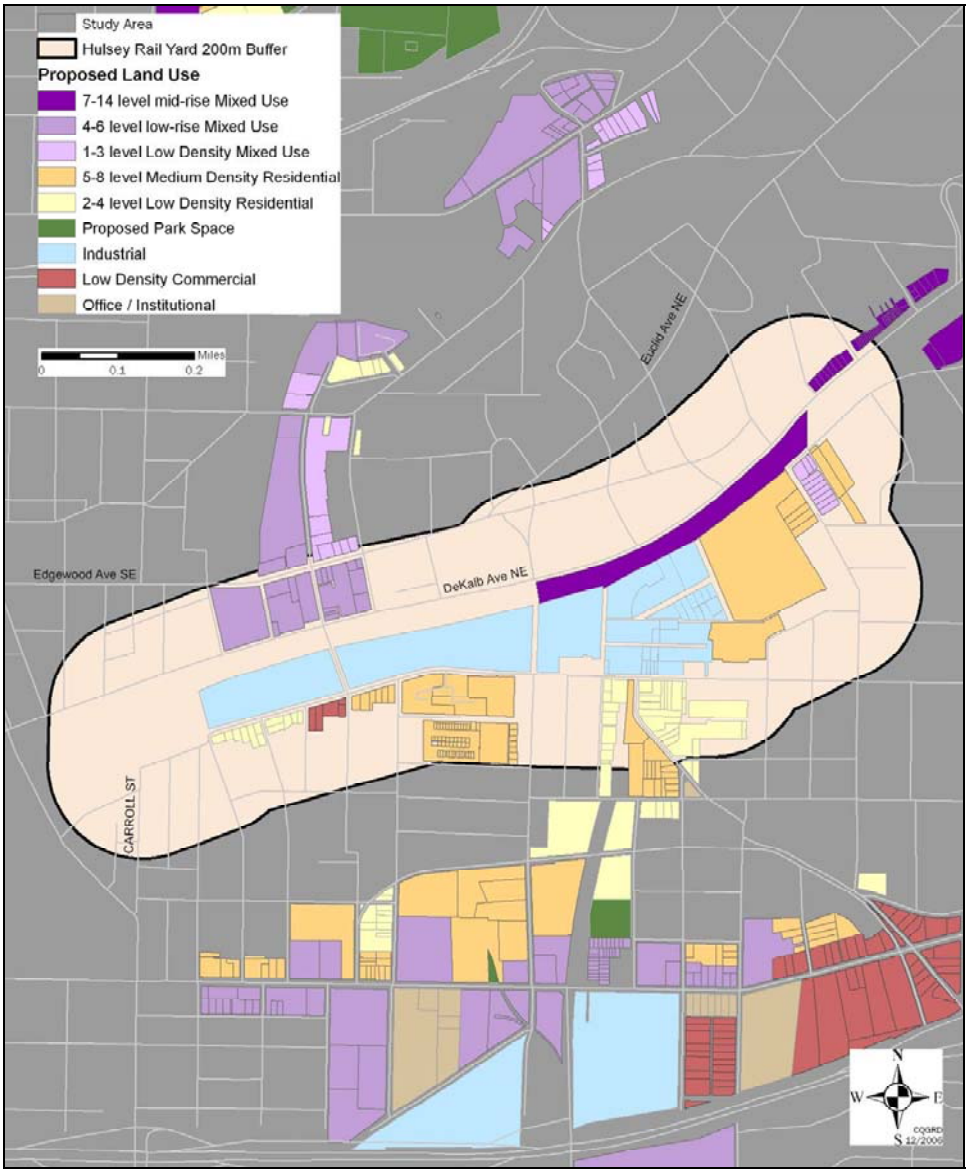
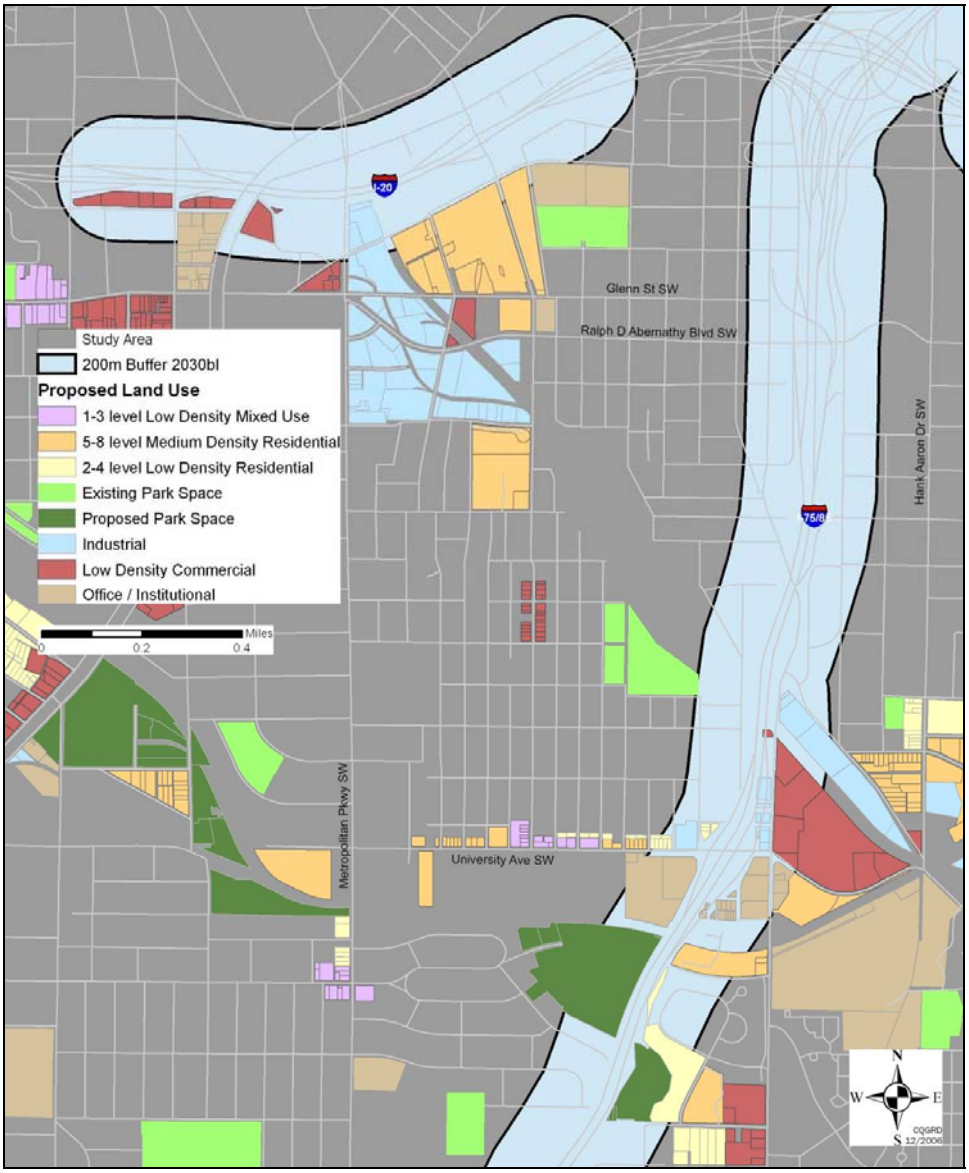


Figure 9.6 Proposed Land Uses around High Volume Road Segments



There are two primary means through which the BeltLine project can impact air quality. The first is the overall impact on the Atlanta region's air quality from the redevelopment, density, and increased transit options that are expected with the build out of the BeltLine. Population in the 13-county Atlanta region is expected to grow from approximately 4 million residents currently to approximately 6 million residents by 2030 (ARC, 2006). This growth will inevitably increase traffic volumes throughout the region by the year 2030. Table 9.1 shows that there will be fewer airborne pollutants in the year 2030 if the BeltLine, and all associated development within the TAD is completed than if the BeltLine is not completed. While this decrease is marginal, it does show the positive impact on the region's air quality that comes from the infill development combined with expanded transit options that is expected when the BeltLine is completed.

Table 9.1 Daily emissions for the Atlanta Region, 2030

	BeltLine in 2030	No BeltLine in 2030	
	Total Daily Emissions (millions of grams)	Total Daily Emissions (millions of grams)	Difference (millions of grams)
Volatile Organic Compounds (VOC)	5,932	6,126	195
Carbon Monoxide (CO)	57,666	59,562	1,895
Nitrogen Oxides (NOx)	11,391	11,766	374
Total Particulate Matter (PM2.5)	248	256	8
Sulfur Dioxide (SO2)	274	283	9
Ammonia (NH3)	504	520	17

Source: Calculations made using 2004 emission factors from Georgia Department of Natural Resources, Environmental Protection Division, Air Protection Branch and projected 2030 VMTs from the Atlanta Regional Commission

The second way in which changes in air quality from the BeltLine may impact health is in the addition of residential units within 200 meters of high volume roads and large sources of diesel emissions. Research has shown that living in close proximity to large point sources of particulate matter can have negative impacts on health (CEPA, 2005; Fischer, et al., 2000; Health Effects Institute, 1999; Health Effects Institute, 2001; Houston, et al. 2006). To measure this, a GIS was used to create 200-meter buffers around road segments with more than 100,000 vehicles per day (VPD) and around the two inter-modal freight yards, Inman Yard and Hulsey Yard, which are within the BeltLine Study Area.

Currently (2005) there are 3,100 living units located within 200 meters of a high-volume (100,000 VPD) roadway. There are currently 894 living units within 200 meters of the Hulsey Rail Yard and no living units within 200 meters of the Inman Rail Yard. When 2030 traffic volumes (using volumes assuming the BeltLine completion) are used, there will be 2,700 existing living units within 200 meters of a high volume (100,000 VPD) roadway. The BeltLine redevelopment plan has the potential to add an additional 1,864 living units within 200 meters of either a high volume (100,000 VPD) road segment or rail yard. Table 9.2 shows how these numbers are allocated to each redevelopment area falling within the 200-meter buffers. Redevelopment due to the BeltLine TAD will create the potential for a net increase of 1,464 living units (734 living units within 200 meters of high volume road segments and 730 living units within 200 meters of a rail yard) over current units.

Table 9.2 Potential New Living Units within 200m Buffer, 2030

	Total Acres of Residential Parcels in 200m Buffer	Potential Development Density (Housing Units/Acre)	Potential Affected Living Units
Hulsey Rail Yard	52.50	7.65	402
Inman Rail Yard	37.36	8.78	328
I-20 West	68.30	12.15	830
I-75/85 South	25.00	12.15	304
Total	**183.16**		**1,864**

The potential construction of living units in close proximity to high volume roadways and rail yards could pose health problems due to the higher exposure to PM in general and especially PM2.5. As mentioned in an earlier part of this section, some of the health problems associated with both chronic and acute exposure to PM2.5

are increased mortality and morbidity rates from cardiovascular and respiratory illnesses, increased risk for lung cancer, and short- and long- term non-cancer health effects such as bronchitis and asthma. Additionally, certain groups are more at risk for these health effects. Chronic and acute exposure can have a detrimental effect on lung development in children leading to lifelong decreases in lung function. The elderly and those with current respiratory ailments are also at greater health risk from these exposures.

9.1.4 Recommendations

- **Locate residential units, schools, daycare centers, senior centers, and hospitals away from high-volume road segments or mitigate air pollution to create positive health outcomes.** Encourage/require developers of "hot spot" parcels to design developments to minimize or eliminate the number of residential dwellings within 600 feet of the high volume road segments.
- **Monitor particulate matter in potentially affected "hot spot" areas.** Hot spots are locales where pollutant concentrations are substantially higher than concentrations indicated by ambient outdoor monitors located in adjacent or surrounding areas. Hot spots can occur in outdoor microenvironments such as high volume roadway segments or near multi-modal freight operations. The pollutant concentrations within hot spots can vary over time depending on various factors including the emission rates, activity levels of contributing sources, and meteorological conditions (CAQMUS, 2004).
- **Notify residents in hot spot areas of air quality risks** and educate them in ways to minimize their exposure.
- **Develop requirements for mitigation measures** that would be triggered by PM levels that exceed standards.
- **Encourage the utilization of electric forklifts and other equipment** at rail and truck yards.
- **In units located in potential hot spot areas, locate air intakes for HVAC as far as possible from existing and expected air pollution sources and educate residents on steps they can take to lessen the effects of particulates on indoor air quality.** Particulates from outside sources can make their way indoors and contribute to poor indoor air quality particularly in residences located in hot spot areas. The California Air Resources Board provides information on strategies for addressing indoor air quality issues.[41]

9.2 Water Resources

For the City of Atlanta, issues surrounding water quality, especially those associated with stormwater runoff, have become common over the past decade. In a natural system, when it rains the stormwater soaks into the soil or runs into streams, rivers, and lakes. In urban environments the natural system is disrupted by the paving of roads, driveways, and parking lots, and the construction of buildings, which create a large proportion of impervious surfaces (areas where stormwater cannot soak into the soil). These impervious surfaces increase the quantity and flow of stormwater and increase pollutants. During heavy rain events, stormwater runoff flows into the combined sewer systems still located in many Atlanta neighborhoods overloading the system and causing untreated wastewater to flow directly into area creeks and rivers. In some extreme instances this overloading of the combined sewer system has led to wastewater infrastructure failure, which in turn has caused sinkholes and flooding in parts of the city. These problems led the Environmental Protection Agency (EPA) to present a consent decree requiring the City to create a program to deal with the polluted stormwater runoff and flooding issues. To comply with this decree, Atlanta created Clean Water Atlanta, the

[41] California Air Resources Board information can be found at www.arb.ca.gov/research/indoor/acdsumm.pdf.

City's "…comprehensive long-term plan to ensure clean drinking water for Atlanta, and clean streams and clean wastewater flows for Atlanta and its downstream neighbors" (City of Atlanta, nd).

One component of the Clean Water Atlanta program is the requirement for addition of greenspace throughout the city to lessen the amount of impervious surfaces that contribute to stormwater runoff. A second component is the use of stormwater best management practices to minimize the amount of stormwater runoff from construction sites and development. Additionally, there is a city-wide upgrade of water and wastewater infrastructure including large tunnels to contain overflow from combined sewer systems until it can be adequately treated. The addition of greenspace and the focus on infill development associated with the BeltLine is consistent with the Clean Water Atlanta program and as such, should provide some overall water quality benefits to the City.[42]

9.2.1 Water Resources and Health

Stormwater runoff can carry large amounts of contaminants, both microbial and chemical, into storm sewers and streams affecting water quality. Stormwater runoff during large storm events can lead to the overloading of combined sewer systems which can result in untreated sewage making its way directly into rivers and streams. Polluted stormwater runoff has been associated with outbreaks of waterborne diseases (Frumkin and Gaffield, 2004; Gaffield et al., 2003). Waterborne illnesses can be caused by drinking contaminated water, recreational contact with contaminated water or by eating produce irrigated with untreated water. The effects of contact or ingestion of contaminated water are much greater in vulnerable populations such as children, the elderly, and those with compromised immune systems (Frumkin and Gaffield, 2004).

Stormwater runoff reduction measures in the construction and redevelopment phases of the BeltLine could help mitigate some of the negative effects of stormwater runoff. For example, some stormwater BMPs such as addition of greenspace, use of vegetated filtration systems (such as stormwater retention features in parks), or use of green roofs on buildings could provide improved access to greenspace and natural settings which can have a positive effect on mental health. The addition of greenspace and the widespread use of green roofs could help in reducing the urban heat-island effect which can contribute to increased levels of ground-ozone formation and heat related illnesses and death (EPA, 2007). According to Gaffield and colleagues (2003), the reduction of urban stormwater runoff and associated nonpoint source pollution can provide a low-cost complement to water treatment infrastructure and health care interventions.

9.2.2 Water Resources and the BeltLine

The BeltLine might affect water quality through possible changes in the amount and quality of stormwater runoff. The increase in impervious surfaces (such as driveways, parking lots, and rooftops) due to redevelopment could increase the amount of stormwater runoff. Conversely, a decrease in impervious surfaces via converting previously impervious surfaces to parks or greenspace, using pervious pavements or concrete for paving, or using rainwater capture mechanisms or green roofs, could decrease the amount of stormwater runoff. Additionally, use of stormwater best management practices (BMPs) for land use and construction activities could reduce the overall quantity of stormwater runoff and improve its quality by removing contaminants.

Stormwater BMPs come in two basic forms structural and non-structural. Structural BMPs are those that physically treat runoff at the point of generation or discharge. Filtration, detention, and retention systems are examples of structural BMPs. Non-structural BMPs are less direct methods designed to address the runoff problem through education, design, and open space protection, to name a few. These non-structural BMPs are typically focused on reducing the quantity, improving the quality, and reducing the speed of stormwater before

[42] The complete scope of the Clean Water Atlanta program and associated projects currently underway can be found at http://www.cleanwateratlanta.org.

it gets to the structural interventions. There are many types of stormwater BMPs available, and a successful stormwater management program will include a variety of these that best suit the specific situation.[43]

The BeltLine could adopt stormwater BMPs in relation to parks, transportation systems, and redevelopment. For example, new streets can be designed with narrower widths to minimize impervious surfaces and pervious materials can be used on lower traffic areas (City of Olympia, WA, 1995; EPA, 2005); parks can be designed to capture and allow for the slow infiltration of stormwater (Schueler, 2000); streams that have previously been buried can be daylighted to allow the sunlight and biological activities to naturally remove bacterial and chemical pollution (Schueler, 2000); and urban forests and wetlands can be preserved for their natural water system functions (Brabec et al., 2002). Many Atlanta-specific watershed management recommendations can be found in *Mitigation of Urban Runoff Impacts on Atlanta Streams* (1998)[44].

9.2.3 Recommendations

- **Adopt a stormwater ordinance.** Such an ordinance should require the use of best management practices on development projects and call for compact development that uses narrower streets, reduced parking requirements, and vegetated buffers along large swaths of pervious surfaces.

- **Protect and enhance existing wetlands and urban forests.** Wetlands and urban forests provide natural stormwater filtration while adding to the city's supply of natural spaces.

- **Study daylighting previously buried streams and restoring other natural functions.** Daylighting of streams can allow for natural functions to remove pollutants and slow the speed of stormwater, to improve stormwater quality. As an added benefit, daylit streams increase opportunities for contact with natural features, which has been shown to have restorative effects.

- **Encourage the creation of green roofs.** Use green roofs, like the one on Atlanta's City Hall, on public buildings in the BeltLine. Encourage private builders to do the same by developing a Green Roof Improvement Fund or similar policy to encourage private developers to install green roofs. In 2006, the City of Chicago initiated a fund that matched private green roof investment, up to $100,000 per project. Chicago's new Millenium Park also qualifies as a green roof because it was constructed over a parking garage.

9.3 Noise

Beginning in the early 1970s, noise and vibration, caused by various modes of transportation, came under scrutiny by the Environmental Protection Agency (EPA). The National Environmental Policy Act (NEPA) requires the preparation of an Environmental Impact Statement (EIS) for every transportation project that involves the federal government at any level. Noise and vibration are two of the environmental impacts that must be evaluated because it has been determined that while they are minor irritants at low levels over short periods of time, at higher decibel levels and over longer periods of time they can have adverse health effects. Ultimately, noise and vibration can impact health and degrade quality of life if not prevented or mitigated (TRB, 2005b).

[43] An overview of those practices can be found at the website of the Environmental Protection Agency: http://www.epa.gov/waterscience/guide/stormwater/#nsbd

[44] This report can be found online at http://gwri.ce.gatech.edu/GAConf/Proceedings/Papers/1999/BrosnanT-99.pdf

9.3.1 Noise, Vibration, and Health

Exposure to noise has been associated with a number of negative health effects. There are psychosocial responses of which noise annoyance is the main cause. Included in psychosocial responses are sleep disturbance, disruption of daily activities, and interference with performance—all subjective responses that pertain to well-being and quality of life. Noise also has physical impacts such as hearing loss, tinnitus, hypertension, ischemic heart disease, and some forms of cardiovascular disease (Van Kempen et al., 2002). Stress-related health effects brought on by noise exposure can be psychological (feelings of depression, fear, resentment, discomfort, displeasure, anger), behavioral (isolation, aggression, abuse of alcohol, drugs, food, and tobacco), or somatic (cardiovascular, gastrointestinal, respiratory illness), and physical (hearing loss, tinnitus) (Porter et al., 1998).

Hearing loss or impairment can occur both from short-term exposure to high noise levels or long-term exposure to lower levels. Hearing loss can result in difficulties in communicating and feelings of isolation and depression. At 85 dB(A)[45], roughly equivalent to the sound of a jack hammer, the risk of damage to the ear is about 10 percent. The odds of damage increases as the decibel level rises. A 24-hour exposure to sound levels of 70 dB(A) or less, roughly equivalent to a food blender, is not anticipated to result in any permanent hearing damage. Children and people who have demonstrated hereditary sensitivity to noise are considered to be the at-risk or sensitive groups (Alenius, 2001).

Annoyance or disturbance is the most common and most researched effect of noise. Noise annoyance is characterized by feelings of displeasure or discomfort towards a particular sound and results in interference with thoughts, feelings, or activities (Passchier-Vermeer and Passchier, 2000). Noise annoyance can result in psychosocial and psychosomatic health effects. The most common source of noise disturbance is road traffic. The random but usually constant nature of traffic noise contributes to its ability to annoy along with its intermittent sound level variations caused by motorcycles, for example, or peak and off-peak traffic patterns (Alenius, 2001). Noise annoyance can disrupt activities such as sleeping. Sleep disturbance can impair the normal functions performed by sleep such as brain restoration and cardiovascular respite. It also has an effect on mood, fatigue, performance, cognitive abilities, vigilance, and can boost epinephrine levels which contributes to stress (Passchier-Vermeer and Passchier, 2000). Sensitive groups include the elderly, the sick, and shift workers. The maximum sound level should not exceed 45 dB(A), similar to a refrigerator, but is ideally around 30 dB(A) (Alenius, 2001).

Stress-related health effects of noise can give rise to psychological, behavioral, and somatic disorders. Studies are inconclusive in determining whether health effects of noise-related stress have long-term, chronic impacts or if they are transient or reversible in nature. Research has detected some impacts on blood pressure, clinical hypertension, ischemic heart disease and other cardiovascular disorders, biochemical effects, changes in the immune system, and potential effects on the unborn child although the evidence to support effects on unborn children is limited (Porter et al., 1998).

In conclusion, research indicates there is sufficient evidence for a causal association between noise and the following health effects: annoyance, disruptions in performance by school children, sleep disturbance, mood, heat rate, hearing loss, and ischemic heart disease. There is limited evidence of a causal relationship for the following health effects, although an association between noise and health has been observed: performance in adults, hormones, forms of cardiovascular disease, biochemical effects, and effects on the immune system. Any attempts to draw a relationship between noise and psychiatric disorders, birth weight, or congenital defects were all either lacking in evidence or inconclusive (Porter et al., 1998).

The complexity of establishing a dose relationship between noise and health impacts stems from issues related to the nature of noise, data gathering methods, and the complication of causal factors. Sound level is

[45] A-weighted sound level describes a receiver's noise level at a point in time

only one factor that determines noise nuisance. Pitch, or frequency, is also important, as are duration and whether the sound is continuous, random, or repeated (Transportation Research Board & National Research Council, 2001). Also contributing to the complexity of the relationship are the means of conducting research and gathering data which primarily rely on subjective reports which are colored by the individual's ability to adapt to noise, one's attitude toward noise disturbance, and one's coping style (Porter et al., 1998) which calls to mind the adage, "what is one man's noise is another man's music." Finally, the causal factors themselves are complex. Genetic pre-disposition to disease, individual lifestyle choices, existing health conditions, and self-selection biases all contribute to the difficulty in determining the cause-effect relationship between noise and health impacts in simple terms (Porter et al., 1998).

9.3.2 Noise, Vibration, and the BeltLine

The BeltLine survey included several questions about noise pollution. Ninety-one percent of respondents expressed concern having low noise pollution would have either a somewhat positive or a very positive effect on their health while 8 percent felt that it would have no effect. In contrast, 59 percent of respondents felt that their communities have high noise pollution while 27 percent stated that their communities currently have low noise pollution. When asked how they feel the BeltLine would change noise levels in their community, 43 percent of respondents anticipated that the BeltLine would reduce noise pollution with 41 percent anticipating no change to current levels. However, 15 percent of respondents felt the BeltLine will exacerbate noise pollution. Responses to an open-ended question about anticipated negative health consequences of the BeltLine had 15 out of 77 respondents stated that they fear an increase in noise from the BeltLine, which will adversely affect their health and quality of life. Concerns about noise were primarily in terms of an increased number of cars on the road, along with redevelopment that would bring land-use changes (residential to commercial/mixed-use), more people, and by extension more noise.

So what are normal noise levels for an urban environment? Typically the noise level generated by two people having a conversation standing three feet apart is in the range of 60-65 dB(A). Noise levels in the home are usually considered acceptable in the 40-45 dB(A) range (FHWA, 2004). A refrigerator at 3 feet away is about 45 dB(A), a washing machine is 65 dB(A), and a food blender is about 75 dB(A) (FTA, 2006). On the other hand, transit noises at 50 feet from the source are significantly higher. A city bus idling is about 75 dB(A), rail transit can range from 65 dB(A) in the station to around 95 dB(A) depending on the technology and track materials, and a horn can register around 90 dB(A) (FTA, 2006).

In contrast to noise, ground-borne vibration is an unusual occurrence for most people in their daily lives. Residential areas typically have vibration velocity levels of around 50 VdB (vibration decibels) or lower, well below the human perception level of about 65 VdB. People begin to experience annoyance at vibration levels of around 70 VdB and tend to be vocal about their annoyance at around 85 VdB. Light rail systems typically generate around 70 VdB or more near the tracks. Bulldozers and other heavy tracked construction equipment generate around 95 VdB at 50 feet from the source (FTA, 2006).

Noise and vibration levels are provided to give a sense of what the BeltLine could add to current urban noise conditions. It is anticipated that the following will be sources of noise and to a lesser degree, vibration, for the BeltLine: light rail (both the system itself and storage and maintenance facilities), cars, trucks, construction equipment, redevelopment, and people. Noise and vibration can be expected to occur in both the short and the long term, with short-term levels related to construction and build-out and long-term levels stemming from the operation of the component parts of the BeltLine, primarily transit and redevelopment. According to the Federal Transit Administration's noise impact criteria for cumulative noise exposure from proposed transit projects, people who are already exposed to high levels of noise should only be expected to tolerate a small increase in the level of noise in their community, whereas people who experience lower levels of noise in their communities can be expected to allow a greater change in community noise before expressing a similar level of annoyance. Communities will vary in their acceptance of noise levels (FTA, 2006).

Built Environment: The BeltLine has already begun and will continue to bring changes to the built environment and some people will be more affected by the accompanying changes in noise levels. Bearing in mind the FTA's noise impact criteria, people living in noisier communities should not be expected to deal with big increases in noise levels (FTA, 2006). It should be anticipated that complaints about noise will likely arise as the BeltLine build-out progresses.

By virtue of the City of Atlanta being an urban environment, the noise levels residents contend with is already higher than in suburban or rural communities. According to the FHWA, urban environments have a continuous level of sound from around 50 dB(A) to 80 dB(A) (FHWA, 2004). However, decibel levels will spike higher than 80 dB(A) with intermittent noise such as car horns or road construction. Acceptability of noise levels also varies by time of day, so urban environments with residential land uses are expected to be quieter at night than during the day, ideally around 40 dB(A) (FHWA, 2004). People who have higher levels of noise tolerance or an ability to cope with higher noise levels may self-select into homes or jobs that have higher decibel levels, for example people who live near highways. However, others opt for more quiet environments and seek neighborhoods that do not abut excessive noise producers.

Self-selection of living environments is an important consideration when discussing potential noise impacts of the BeltLine. Because the BeltLine is a redevelopment and transit/transportation project, the existing built environment will undergo change. These changes include the modification of current land uses, development/redevelopment of property, and construction of a trail and transit system. There are short-term and long-term noise level changes associated with these alterations to the built environment. As neighborhood retail revives, formerly derelict brownfields are redeveloped into mixed-use complexes, and as new building occurs, neighborhoods that abut these areas will experience noise level changes whether via short-term construction noise or long-term operational noise (more cars, additional people, truck-based freight deliveries). In addition, the trail and transit system will also have short- and long-term noise implications related to construction and operation. For some people these changes will blend in with the noise of the existing environment and will have little effect on their quality of life; for others, the changes will annoy and could have short- and long-term negative health implications.

Construction Noise & Vibration: Construction noise and vibration levels will vary depending upon such factors as the type and condition of equipment, whether the equipment is stationary or mobile (crane versus a bulldozer), the type of work being performed, and the composition of the soil (clay, rock, sand) (FTA, 2006). Noise and vibration levels will be of greater concern at night than during the day when urban noise is at its loudest. They will also have greater impact in residential rather than commercial or industrial settings.

Construction noise and vibration levels are of particular concern for the BeltLine because it is composed of several parts each requiring construction (redevelopment, transit, and trails). The BeltLine could potentially have a 25-year construction period, affecting large numbers of residents over that time period. Because the BeltLine is envisioned as a tool to reconnect neighborhoods, the various component parts will be in close proximity to land uses of all kinds including the most noise and vibration sensitive—residential land use. In addition, because the BeltLine is at grade as it winds through neighborhoods, it should be anticipated that some construction might need to occur at night so as not to disrupt daytime traffic patterns. Finally, during the construction process, in addition to noise coming from equipment and construction activities, there will also be construction workers who generate noise through their work, conversations, and use of automobiles.

The FTA points out these sources of construction-based noise and vibration to establish the necessity for conducting either a qualitative or a quantitative assessment of anticipated construction noise prior to the start of a project. Not every project requires an assessment: the need is based upon the type, scale, and duration of the project, as well as the type of equipment to be used and the noise-sensitivity of the surrounding area (FTA, 2006). But regardless of whether or not an assessment is required, as construction of the BeltLine moves

forward, it would be prudent to conduct some form of assessment so as to anticipate problems and to alert nearby neighbors to pending construction. Such cases are good public relations and may in fact help keep the project on schedule (FHWA, 2007).

Operations Noise & Vibration: Long-term noise and vibration concerns stem from the day-to-day operation of the component parts of the BeltLine. Although, it is likely that the parks and trails, once constructed, will not be significant sources of noise or vibration. As mentioned previously, redevelopment might bring a change of land uses or could also see an increase in density, both of which could raise noise to levels higher than previously experienced by adjacent populations. Aside from new buildings with noise generators, such as air conditioning units, truck bays, parking lots and cars, outside seating areas, and late-night hours of operation, the greatest contributor to operationally-based noise will be the transit component of the BeltLine. The Federal Transit Administration in their manual on noise and vibration assembled a table of sources of transit noise. In the case of the BeltLine light rail transit, buses, stations, and storage and maintenance facilities will likely be sources of noise. Table 9.3 is adapted from the FTA's manual (FTA, 2006).

Table 9.3 Sources of Transit Noise

Vehicle/Facility	Dominant Components	Comments
Light Rail Transit (LRT) on exclusive right-of-way	Wheel/rail interaction and guideway amplification	Depends on condition of wheels and rails
	Propulsion system	When accelerating and at higher speeds
	Brakes	When stopping
	Auxiliary equipment	When stopped
	Wheel squeal	On tight curves
	In general	Noise increases with speed and train length
Light Rail Transit in mixed traffic	Wheel squeal	On tight curves
	Auxiliary equipment	When stopped
	Horns and crossing bells	At grade crossings
	In general	Lower speeds mean less noise than for rail rapid transit and LRT on exclusive right-of-way
Diesel Buses	Cooling fans	While idling
	Engine casing	While idling
	Diesel exhaust	At low speeds and while accelerating
	Tire/roadway interaction	At moderate and high speeds
	In general	Includes city buses (generally two axle) and commuter buses (generally three axle)
Bus Storage Yards	Buses starting up	Usually in early morning
	Buses accelerating	Usually near entrances/exits
	Buses idling	Warm-up areas
	In general	Site specific. Often peak periods with significant noise
Rail Transit Storage Yards	Wheel squeal	On tight curves
	Wheel impacts	On joints and switches
	Wheel rolling noise	On tangent track
	Auxiliary equipment	Throughout day and night. Includes air-release noise
	Coupling/uncoupling	On storage tracks
	Signal horns	Throughout yard site
	In general	Site specific. Often early morning and peak periods with significant noise
Maintenance Facilities	Signal horns	Throughout facility
	PA systems	Throughout facility
	Impact tools	Shop buildings
	Car/bus washers/driers	Wash facility
	Vehicle activity	Throughout facility
	In general	Site specific. Considerable activity throughout day and night, some outside
Stations	Automobiles	Patron arrival/departure, especially in early morning
	Buses idling	Bus loading zone
	PA systems	Platform area
	Locomotive idling	At commuter rail terminal stations
	Auxiliary systems	At terminal stations and layover facilities
	In general	Site specific, with peak activity periods

Source: FTA Manual, 2006

MARTA, in its Alternatives Analysis report, conducted a noise and vibration screening analysis based on knowledge of standard noise emissions for particular transit technologies and a cataloguing of the number of noise sensitive receptors (houses and apartment buildings) based on aerial photography located within 200 feet from the centerline of the proposed transit alignment (MARTA, 2007). As a result of this analysis, MARTA concluded that the B2 alternative (Jefferson to Arts Center) will have the least impact on the surrounding community while the B3 alternative will impact the most residential land uses with 445 houses and 60 apartment buildings (individual apartment units were not calculated) for a total of 505 noise sensitive receptors, the most of all alternatives proposed, as compared to 350 for the B2 alternative. Vibration sensitive receptors within a 50-foot potential impact screening area were also analyzed and it was determined that all four alternatives would affect the same number of houses and apartments within the screening distance, although impacts are not expected to be severe (MARTA, 2007).

9.3.3 Recommendations

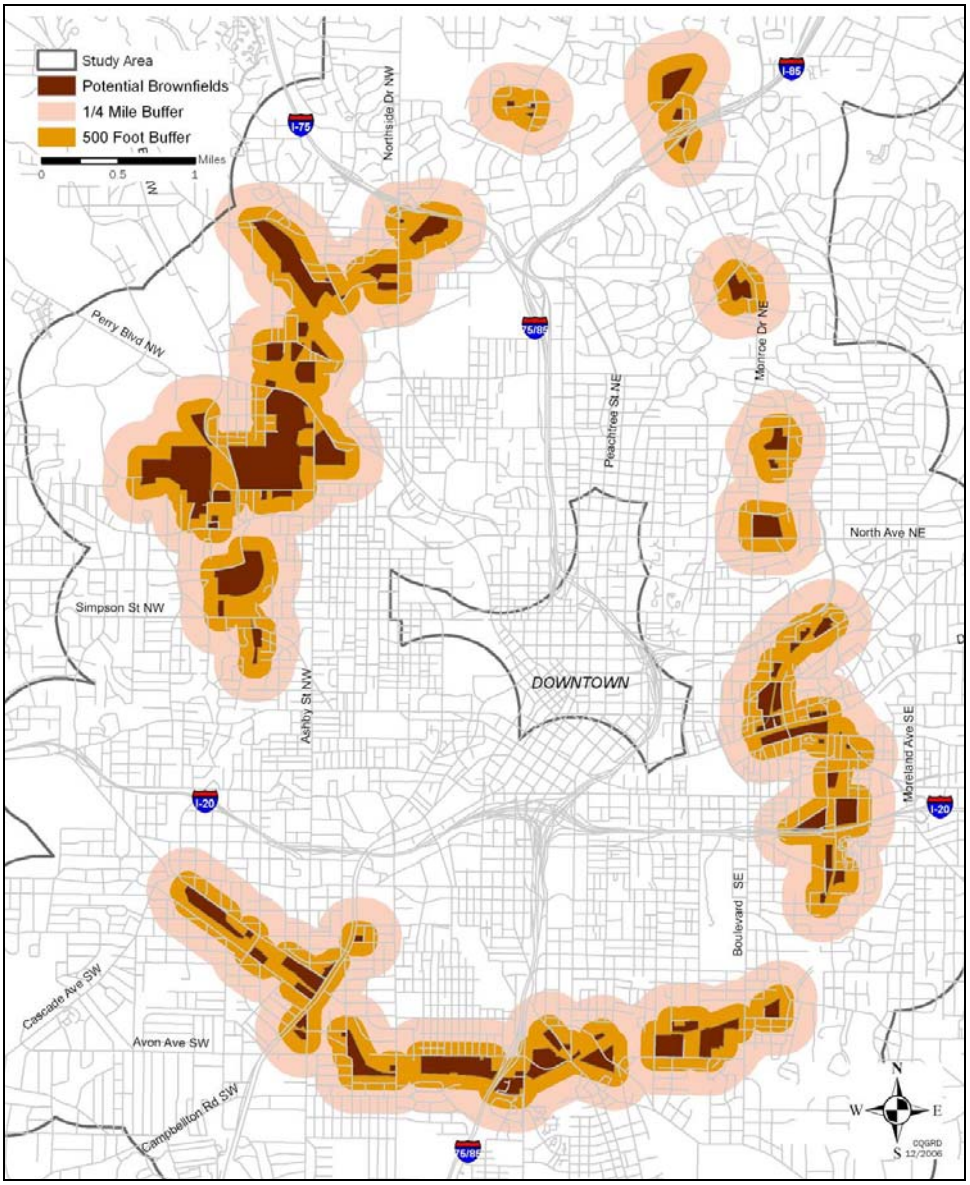
- Design and building considerations:
  - **Where appropriate install noise barriers**, temporary or fixed to protect especially noise-sensitive neighbors. Although such barriers should not present a barrier for connectivity between neighborhoods.
  - **Determine the least obtrusive route for truck traffic** during the construction phase and for long-term mitigation require that commercial buildings that receive deliveries by truck also utilize the least obtrusive route.
  - **Match construction practices to existing or anticipated noise levels.** If new residential units are constructed near especially noisy operations such as maintenance facilities, encourage the builder to incorporate soundproofing materials such as double-paned windows and extra insulation.
- Operations
  - **Require that developers be good neighbors by establishing requirements and methods for contacting adjacent property owners** and alerting them to pending construction including time, duration, expected noise levels, and types of machinery to be used.
  - **Establish timelines for construction of BeltLine infrastructure.** The City should make available timelines for the phasing of construction of the trails and transit system. There should also be a means of registering and responding to complaints by city residents.
  - **Avoid nighttime construction whenever possible** in residential neighborhoods. If construction must occur at night, alert the neighbors and keep them apprised of activities.
  - **It may be necessary to establish quiet zones** that silence train horns according to regulation by the Federal Railroad Administration. Other safety methods will be required in lieu of horns, flashing lights and gates for example.
  - **Educate new businesses about the City's noise ordinance** including what acceptable levels of noise are, when quiet times go into affect, and what the penalties are.

9.4 Brownfields

The BeltLine project increases the prospect of redeveloping abandoned or underutilized properties in the city. However, many of these sites contain remnants of their previous occupants in the form of environmental contaminants. Properties with environmental contamination are known as "brownfields." In their current state, brownfields can have negative health impacts on the surrounding community. Proximity to brownfields sites has been shown to have a statistically significant relationship with increased sickness and disease (Litt et al., 2002; Ding, 2005; Solitare and Greenberg, 2002). Indeed, the presence of brownfield sites in a community can essentially act like a "cancer," as they become havens for criminal activity and centers of neighborhood neglect (Greenberg, 1998). However, brownfield redevelopment, which entails a remediation of the site to acceptable health standards, can cause positive health impacts on the community by reducing the health risks associated with the contamination and mitigating the overall negative impact of brownfield sites on the community (Solitare and Greenberg, 2002). There is also an important environmental justice aspect to brownfield redevelopment as many of these sites are located in low-income and minority neighborhoods (Solitare and Greenberg, 2002; Greenberg, 1998). Due to the potential unevenness of brownfield location across socioeconomic groups throughout the study area, a brief assessment of brownfield redevelopment is warranted.

At this time there is a lack of scientific evidence as to the distance at which a brownfield site begins to have negative health impacts on people. However it is reasonable to assume that the closer one is to a brownfield, the greater the potential for exposure to negative health impacts. To assess the degree to which residents along the BeltLine are currently affected by brownfields, GIS was used to create a radial buffer from the edge of brownfields to determine potentially affected areas. These buffers were then intersected with U.S. Census Block Group data to yield an estimate of the population living within that buffer distance of brownfields. Two buffer distances were created from known brownfield sites in the study area: one quarter mile and 500 feet. Again, there is no scientifically accepted buffer distance that was available for this assessment. However, the distances used here are assumed to be reasonable. Figure 9.7 illustrates the two buffer areas around potential brownfield sites along the BeltLine.

Figure 9.7 Potential Brownfields with Buffers



To assess the current equity of brownfield presence in the BeltLine Study Area, a demographic profile was created for all individuals living near a brownfield site in the study area, shown in Table 9.4. The key findings from this data show that as one gets closer to a brownfield site, the proportion of the population that is white drops slightly, as does per capita income. Given that brownfields tend to be located in poorer and more minority communities, this result is not surprising.

Table 9.4 Profile of Population Living Near Brownfield Sites in the BeltLine Study Area

	City of Atlanta	Study Area	¼ Mile Brownfield Buffer	500 Foot Brownfield Buffer
Total Population	416,474	213,920	44,548	19,668
White	138,352 (33.2%)	80,865 (37.8%)	15,751 (35.4%)	5,906 (30.0%)
Non-white	278,122 (66.8%)	133,055 (62.2%)	28,797 (64.6%)	13,763 (70.0%)
Under Poverty	48,904 (23.0%)	48,904 (22.9%)	10,079 (22.6%)	4,510 (22.9%)
Aged 0-5	93,004 (22.3%)	43,363 (20.3%)	8,758 (19.7%)	3,873 (19.7%)
Aged 65+	40,535 (9.7%)	17,966 (8.4%)	3,592 (8.1%)	1,536 (7.8%)
Rate of Carless Housing Units	21.2%	24.6%	23.4%	24.9%
Per Capita Income	$25,772	$23,925	$22,570	$20,071

Source: U.S. Census Bureau, 2000 Census, SF1 and SF3; CQGRD calculations

9.4.3 Recommendations

- **Encourage the redevelopment of brownfield sites.** Redeveloping underutilized, abandoned, and contaminated sites can reduce health risks and improve quality of life in the communities that surrounded these sites. Since brownfields tend to be located in poorer and minority areas, brownfield redevelopment could reverse some inequities within the BeltLine Study Area.

Section 10: Summary of Recommendations: an impact management plan

The purpose of the impact management plan is to provide an overview of the key findings and recommendations. It also identifies the affected populations and illustrates the ways in which the various issues overlap. For example, a recommendation to address water resources issues through compact development patterns also results in the creation of a more closely knit urban environment that makes walking more convenient, so it can have health benefits related to increases in physical activity and better managed water resources. Specifically, the following table contains:

Key findings: The findings include conclusions from the literature review and results of the BeltLine assessment. The references and analysis that supports the findings in the table can be found in Sections 4 through 9. Each item in this section is designated as having a potentially positive (▲), neutral (O), or negative (▼) health impact. In some cases, the specific circumstances that will create a positive, neutral, or negative impact are uncertain and so combinations of symbols appear.

Affected population(s): For most of the categories the anticipated impacts will be experienced relatively equally by all people in the study area. In some cases a specific group, defined by socioeconomic characteristics or geographic location, may experience a more pronounced health-related effect due to the BeltLine.

Recommendations: The recommendations that appear in this table are an abbreviated version of the recommendations from Sections 4 through 9.

Relationships: The last five columns identify the various categories—access, physical activity, safety, social capital, and environment conditions—of health impacts attributed to each recommendation. The purpose of this identification is to illustrate the complementary nature of many interventions that can support several health benefits.

In reviewing the findings and recommendations it is important to recognize that while all health impacts are important, some have more serious consequences than others. In terms of the BeltLine, issues of access to parks and trails, transit, housing, and healthy foods; opportunities for physical activity; and concerns about safety have the most serious potential health consequences, both positive and negative. The categories of social capital and environmental factors—air quality, water resources, noise, and brownfields—have a lesser magnitude of potential health impacts. This is not to say that issues like air quality and water resources never have serious health outcomes, but instead that the BeltLine will play a lesser role in affecting change in these regards.

Overarching Issues

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
Timing of the BeltLine							
▼O The BeltLine faces the challenge of implementing a unifying revitalization and redevelopment plan, but with a combination of public- and private-sector investment. The difficulty arises because private entities operate within a much different process and timeframe than public entities, especially due to the use of the Tax Allocation District funding mechanism. The result of the differences in public and private progress is a temporal mismatch, where the publicly funded parks and transportation improvements necessary to make the new development livable for both new and existing residents and businesses lag behind private development.	All / most significantly those populations in or adjacent to areas experiencing the most rapid development	**P** Invite a health official to become a member of the BeltLine, Inc. Board.	✖	✖	✖	✖	✖
		P Make health protection and promotion a consideration in public funding priorities and timing by developing a mechanism to consider health impacts throughout the process. Such a tool could be applied by the BeltLine Tax Allocation District (TAD) Advisory Board.	✖	✖	✖	✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
A Well Integrated BeltLine							
▲ The rail corridor that will become the multiuse BeltLine has historically divided people and places. The new vision for this corridor provides the opportunity to reintegrate many neighborhoods. If such an environment is created several health benefits can be realized, including increases in physical activity, improved social capital, and improved access to health promoting goods, services, and amenities. A well integrated BeltLine means two things: (1) its components—trails and parks, transit, and redevelopment—work well together and (2) the entirety of the BeltLine becomes woven into the fabric of the city and region.	All	**P** To ensure that the components of the BeltLine complement each other many city departments—including planning, public works, watershed management, parks and recreation, and others--will need to work together. To enable the departments to effectively collaborate to achieve the BeltLine vision, establish shared performance measures.	✖	✖	✖	✖	✖
		P To better integrate the BeltLine into the existing fabric of the city connect the BeltLine to existing schools in the area through Safe Routes to Schools programs, which include education, outreach, and infrastructure improvements. Through the partnership of the Atlanta Public Schools, the Fulton and DeKalb County Health Departments, BeltLine, Inc., the City of Atlanta, the Georgia Department of Transportation, and others, SRTS can provide mutual benefit by encouraging children to be physically active and reducing school-related traffic congestion.	✖	✖	✖	✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
		P As new transit services are implemented, establish a coordinated fare and schedule system that ensures that existing and new services work together as part of an integrated local and regional transit system. Partners may include MARTA, the Transit Planning Board, BeltLine, Inc., City of Atlanta, the Georgia Regional Transportation Authority, and the Georgia Department of Transportation.	✖	✖		✖	✖
People-oriented Priorities							
▲ Three of the fundamental components of the BeltLine—transit, trails, and redevelopment—are intended to emphasize the mobility of people, not automobiles. This people orientation means that streets are no longer simply conveyors of automobiles, but must serve the needs of multiple modes of travel…becoming "complete streets." A complete street is one that works for motorists, transit riders, bicyclists, and pedestrians, including people with disabilities.	All	Adopt land use regulations that prioritize the needs of pedestrians, bikers, and transit users.	✖	✖	✖	✖	✖
		Employ Context Sensitive Solutions (CSS) approaches for transportation projects to include all stakeholders in the visioning and design process and to implement designs that reflect the environmental, social, and historical environment in which they are situated.	✖	✖	✖	✖	✖
		P Include bicycle and pedestrian advocates on BeltLine advisory committees.	✖	✖	✖		

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
Designing for all Users							
▲ BeltLine users will represent a diverse population that varies in age, income, culture, and ability. Users will include older adults, children, people with disabilities, non-English speakers, and others whose mobility can be affected by short- or long-term limitation in ability.	All, but most directly people with limitations in abilities	Strive to exceed Americans with Disabilities Act standard by educating city staff and developers involved in the BeltLine on the principles and execution of Universal Design. Adhere to Universal Design principles in the development review process.	✖	✖	✖	✖	✖
Involving all Stakeholders							
▲ To reflect the uniqueness of the study area population and the project, three principles regarding the involvement of all stakeholders are important to the implementation of the BeltLine: continuous public involvement, appropriate public involvement, and convenient access to information.	All	**P** Develop a 25-year public involvement process that applies innovative strategies to involve representatives of all stakeholder groups. Because of the 25-year timeframe of the BeltLine it is important that the public involvement process not only include those people who currently live, work, or go to school in the area, but also future residents and even the next generation of citizens.	✖			✖	
		P Establish a single hub for information about the vision and implementation of the BeltLine prominently on the City of Atlanta communications tools, including print and electronic newsletters and the Web site. Such a resource should allow stakeholders to stay abreast of involvement opportunities and progress.	✖			✖	

Access

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
Parks							
▲ Parks provide opportunities for physical activity, social interaction, and improved environmental functions. ▼ The literature show that park access has a tendency to be unequal across socioeconomic groups, with poorer minority groups oftentimes receiving less access to park space. Without access to park space, the opportunities for physical activity and the resulting health benefits of parks are limited. ▲ The creation of the new BeltLine parks will provide walkable park access (within 0.5 miles) to more than 95,000 residents. Of those served, 11,000 people do not currently have walking access to a park. ▼ After the BeltLine is created an estimated 15,370 residents, or seven percent, of the study area population will still not have access to park space.	All	Seek opportunities to create additional park acres in the Southwest planning area.	✖	✖		✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
▼ While the BeltLine will improve Atlanta's ratio of park acres to residents, the addition of new park acres will be offset by an increase in population. If the City does not create additional parkland beyond that for the BeltLine, the citywide ratio of park acres to residents is estimated to decrease between 2000 and 2030. ▲ Across the entire study area, the new BeltLine parks are equitably distributed by socioeconomic status. ▼ In contrast, the parks are not equitably distributed geographically. The Southwest planning area will be relatively underserved by park acres compared to the other planning areas. Using 2000 population, the Southwest will have 7.5 acres/1,000 people, compared to Northeast's 10.7 acres/1,000 people. The Southwest planning area has the largest minority population, as well as the largest number of children under age 18 and adults 65 and older, who often have the greatest restrictions in mobility, therefore nearby parks are of critical importance. Furthermore, the Southwest planning area has the highest rates of death in the study area for several diseases that can be prevented and/or managed by appropriate levels of physical activity.	All / Southwest planning area is of specific concern	**P** Continue to add park acres throughout the City to meet the City's target of 10 acres per 1,000 people. Ensure that new parks are designed and existing parks are retrofitted to optimize use and access.	✖	✖		✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
Trails							
▲ Approximately 88,800 residents, or 41 percent of the study area population, will have access to the trail system. This is a significant increase in trail access in the City of Atlanta.	All	**P** Make trail access points as frequent as possible. Where feasible, provide access points every 1/4 mile.	✖	✖		✖	✖
		P Add trail spurs to create increased access from nearby, and especially underserved, neighborhoods.	✖	✖		✖	✖
		Through the development review process, ensure that BeltLine trails connect to other trail systems and that trail access points are coordinated with transit system design.	✖	✖	✖	✖	✖
		When developing specific trail design standards and operational guidelines, make sure that BeltLine trails can be used for recreation, exercise, and transportation. This may require additional lighting to allow bicycle and walking commuters to use the trails for evening commutes.	✖	✖	✖	✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	**Affected Population(s)**	**Recommendations** P = priority recommendations	**Relationships**				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
Transit							
▲ Approximately 77,000, or 36 percent, of the residents in the study area will have access to the proposed transit system. And an additional 50,000 people, who are anticipated to live in the new housing units within the TAD by 2030 will also have BeltLine transit access. ▲ The distribution of BeltLine transit access, on a system-wide basis, is equitably distributed by socioeconomic status. ▲ Transit can result in a higher labor participation rate and also provides users with increased opportunities for physical activity and better access to essential services, such as healthcare.	All	**P** Critically review development plans located within 1/2 mile of transit stations to ensure safe and convenient walking and biking opportunities. Encourage the creation of transportation infrastructure--including streets, sidewalks, and bike lanes--that is well connected to new and existing transit stops and major destinations.	✖	✖		✖	✖
▼ The BeltLine suffers from a spatial mismatch of jobs, both currently and in the 2030 employment projections. The Southwest and Westside Planning Areas suffer from a lack of employment opportunities, while the Northside and Northeast Planning Areas enjoy an abundance of employment.		Focus new housing and job growth near transit stops and locate new transit stops near existing neighborhoods.	✖	✖		✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
▼ The Northeast Planning Area has the highest potential for transit usage because of an abundance of jobs and a large and more concentrated population. The Southwest and Westside Planning Areas have the least potential for transit usage because of low employment and smaller populations. However, the Southwest and Westside are the most transit dependent areas with the highest rates of carless housing units and the highest transit usage rates. ▲ A comprehensive transit system will be important to transport residents from job-poor neighborhoods to job-rich neighborhoods.							
Housing							
▲ Healthy housing refers to a housing unit that is in good condition, safe, and free from pollutants and excesses in noise, temperature, and humidity. It is also situated in a neighborhood that promotes active living through good design, that is safe, and that provides affordable and appropriate housing choices for residents in all stages of life.	All / with residents in the Westside, Southwest, and Southeast at greater risk of negative impacts associated with rising housing costs.	Require a diversity of housing types and prices within the BeltLine TAD.	✖			✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
▲▼ Significant investment can lead to increases in property values, and therefore housing costs. Renters, people on a fixed income, and lower-income property owners are at greater risk of experiencing negative health impacts of rising housing costs. ▲ 28,000 housing units, approximately 20 percent of which are to be affordable, are expected to be constructed in the TAD, and an additional 110,000 units in the rest of the study area by 2030. O Rental units (approximately 54,000, or 62 percent of all units) are relatively equally dispersed in the study area. Renters are particularly vulnerable to displacement as property owners seek to capitalize on neighborhood improvements by raising rents or converting properties to condominiums or redevelopment O▼ Many census block groups in the Westside, Southwest, and Southeast Planning Areas have a median household income that is 30 to 60 percent of the Area Median Income, and therefore qualify for housing assistance.	All / especially low-income households	**P** Establish policies and programs to prevent displacement in areas surrounding the BeltLine TAD. Efforts like property tax freezes, assistance to make housing improvements, and other programs can reduce displacement of residents from neighborhoods where property values are rapidly increasing. Form partnerships with organizations like the Atlanta Neighborhood Development Partnership, the Atlanta Housing Authority, the Atlanta Housing Association of Neighborhood-Based Developers, and others.	✖			✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	**Affected Population(s)**	**Recommendations** P = priority recommendations	**Relationships**				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
Food							
▲ A diet that consists of fruits, vegetables, and whole grains that is low in fat, added sugar, and salt is recommended for the prevention of cardiovascular disease, diabetes, hypertension, stroke, and certain types of cancers. ▼ Grocery stores tend to locate in wealthier neighborhoods. ▲ The Northside and Northeast of the BeltLine are well-serviced by grocery stores, and the Westside and Southwest side are relatively well served. ▼ The Southeast side of the BeltLine Study Area has less access to grocery stores. ▲ The BeltLine can encourage the location of grocery stores in the Southeast.	All / residents in Southeast planning area are of concern	**P** Seek innovative solutions to provide access to healthy foods in the Southeast planning area. Opportunities include permitting street vendors of fresh fruits and vegetables near transit stations, establishing a weekly farmer's market, developing community gardens, or providing grocers with incentives, like land assembly, to create desirable sites for food stores.	✖	✖		✖	✖

Physical Activity

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
▲ Regular physical activity is beneficial to people of all ages and walks of life, having positive effects on health, longevity, and quality of life. It has been found to improve self-image, self-esteem, physical and mental wellness, and overall health. Negative health effects associated with physical inactivity include heart disease, certain types of cancers, high blood pressure, stroke, osteoporosis, obesity, diabetes, and higher mortality rates. ▲▼ The Southeast, Southwest, and Westside Planning Areas currently have higher mortality rates for diseases related to physical inactivity; therefore, the BeltLine could offer opportunities for an active lifestyle that could increase physical activity in the most vulnerable populations. Although there will be improvements in park access, the Southwest planning area will remain underserved by parks (see Access, parks).	All	**P** Provide a variety of park types, including passive parks and active parks. Install facilities such as sports fields, tennis and basketball courts, and walking circuits that accommodate the needs of all park users, with consideration given to the unique needs of children, older adults, and people with disabilities.	✖	✖	✖	✖	
		P Implement educational interventions both onsite, in parks and along trails, and in the broader Atlanta community to encourage physical activity. The City Parks and Recreation Department can partner with the Fulton County Department of Health and Wellbeing to develop educational signage, handouts, programs, and other interventions.		✖		✖	

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
▲ Because park use is determined by individual characteristics (race, ethnicity, age, education, income, gender), location and access, and park characteristics (size, amenities, safety), it is important to provide a variety of park types (active and passive) with a diversity of facilities (ball fields, skateboard parks, dog parks, playgrounds, picnic facilities, etc.) with varying levels of challenges, and a variety of programming to meet the physical activity needs of the diverse residents. ▲ The bicycle share of urban trips can be increased by giving precedence to cyclists over cars, providing amenities for bikers, creating an integrated signage system, and adopting policies that increased the safety, speed, and convenience of cycling. ▲ As an indication of potential BeltLine use, several polls have shown that between 13 and 20 percent of people state that walking and biking are their preferred modes of travel. Of those that had ridden a bike in the previous year, 46 percent said they would commute to work by bike if bike lanes were available and 53 percent would commute by bike if there were dedicated paths.	All	Design transit stops along the BeltLine that are accessible via the trail and/or a well-connected sidewalk system to enable transit riders to gain their 30 minutes of daily physical activity.	✖	✖		✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	**Affected Population(s)**	**Recommendations** P = priority recommendations	**Relationships**				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
▲ Using transit has been linked to physical activity. One study found that Americans who use transit average 19 minutes of daily walking going to and from transit. Thus increasing access to transit could significantly increase the opportunities to be physically active as most transit trips incorporate walking to and/or from destinations. The study also found that 29 percent of people walking to and from transit achieve the recommended level of 30 minutes of daily physical activity.	All	Provide adequate lighting along the trails, within parks, around transit stops, and along sidewalks and walkways that access these features of the BeltLine. Install police or 911 call boxes at periodic intervals to boost people's sense of personal safety.	✖	✖	✖	✖	
		Collect data on users of parks, trails, and transit, including participation in related physical activity, before and after the implementation of the Beltline in order to monitor and evaluate the effectiveness of infrastructure investment and to further the field of environmental determinants of physical activity.		✖			

Safety

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environment
Injury							
▼ Motor vehicle crashes are the leading cause of death among persons aged 1 to 44 years in the United States. Motor vehicle crashes accounted for 18 percent of the $117 billion spent on injury-attributable medical expenditures in 2000. Pedestrians and cyclists are also vulnerable to injury from motor vehicle crashes. ▲ Various types of countermeasures are available that may reduce the likelihood of pedestrian and/or bicyclist injuries. Effective interventions along the BeltLine route could include sidewalks in urban residential and mixed-use areas; traffic signals at high-speed intersections; exclusive walk signal phasing; refuge islands and raised medians on multi-lane, high traffic volume roads; and increased intensity of roadway lighting to reduce nighttime pedestrian crashes. ▲ Bicycle lanes have been shown to reduce bicycle-motor vehicle crashes by 31 percent.	All	Provide appropriate infrastructure for biking. Implement interventions for pedestrian and cyclist safety that focuses on separation by time and space, increasing pedestrian/cyclist visibility, and reducing motor vehicle speeds.	✖	✖	✖		✖
		Institute regular maintenance, operational oversight, and security on transit and in rail stations to help prevent injuries to transit users.			✖		
		Incorporate injury prevention messages in parks, trails, and transit stations to decrease risk of injury.		✖	✖		

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
Crime							
▼ The BeltLine is less likely to be used if potential users fear being a victim of crime. ▼ Victims of crime report physical aftereffects such as insomnia, skin rashes, panic attacks, headaches, asthma, and nausea, and psychological health impacts such as obsessive behavior, anger, fear, depression, and loss of confidence. Fear of crime, meanwhile, can lead to increased stress and anxiety and increased isolation. ▼ Fear of being attacked while walking or exercising can act as a disincentive to engage in those activities, leading to higher risks of obesity and the negative health impacts associated with inactivity. ▲ The Rails-to-Trails Conservancy found in a 1998 survey of 372 trails that converting an abandoned rail corridor to a trail actually tends to reduce crime. In their survey, less than 4 four percent of urban trails reported a mugging in 1996. ▲ Crime Prevention Through Environmental Design (CPTED) has been shown to reduce crime rates.	All	Design parks, trails, and transit to promote 24-hour formal and informal surveillance and increase feelings of personal safety.		✖	✖	✖	
		As the BeltLine develops, regular maintenance of parks and park facilities, trails, and the transit system including transit cars, should be scheduled and included in the budget.			✖		
		Consider creating a neighborhood watch program, "Adopt a park/trail," or BeltLine patrol or police force to monitor activities on the BeltLine (neighborhood groups can also assist with park and trail clean-up activities).		✖	✖	✖	
		Educate users about ways to maintain personal safety through signage, newsletters, and neighborhood meetings. This BeltLine focused effort can be an expansion of the Atlanta's police force's current activities.			✖		

Social Capital

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	**Affected Population(s)**	**Recommendations** P = priority recommendations	**Relationships**				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
▲ Social capital plays a role in health in several ways: by serving as a source for information and goods, identifying norms of healthy behavior, creating social ties and emotional support, and contributing to collective efficacy or the ability to problem solve to achieve group gain. ▲ Individuals with high social capital tend to live longer and are physically and mentally healthier. Social capital has also been linked to better overall health including better cardiovascular health with reduced risk of stroke and heart attack, reduced risk of cancer, faster recovery from illnesses, and improved mental health. It also has been found to have a positive effect on infant mortality rates. ▲ Research suggests that walkability, automobile dependence, mix-of-uses, density, size of place, traffic volume, homogeneity, presence of public spaces, architecture, and crime all impact social capital by supporting or inhibiting opportunities for formal and informal interaction. ▲ Public participation has been shown to create social capital.	All	Design environments that promote formal and informal social interaction by embracing an expanded definition of public space that includes sidewalks, parking lots, and streets. This goal can be addressed in the site plan review process for new developments.		✖		✖	
		Preserve and protect neighborhoods by requiring that new development complement the existing neighborhood, by creating transitions between single-family housing/low-rise development and taller buildings and commercial properties, and by offering programs and assistance to help at-risk households remain in the community.	✖			✖	

Environment

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
Air Quality							
▲O The marginal reduction in projected daily VMT associated with the BeltLine (four percent) is not expected to have any major effects on health within the region, but the higher levels forecast with no BeltLine project component completion could exacerbate health concerns in children and those with existing respiratory ailments. ▼ The health effects of air pollutants include reduced lung function, asthma and other respiratory illnesses, cancer, irritation of breathing passages, premature death, with children and the elderly being at a higher risk than the general population. ▼ Increased rates of mortality and morbidity from cardiovascular and respiratory diseases have been most strongly associated with short-term (acute) and long-term (chronic) exposure air pollution that contains fine particulate matter.	Residents living within 200 meters of a high-volume roadways or large, active freight yard	**P** Locate residential units, schools, senior centers, day care centers, and hospitals away from high-volume road segments or mitigate air pollution to create positive health outcomes.					✖
		Monitor particulate matter in potentially "hot spot" areas (places where high-traffic volume could result in particulate matter levels exceeding standards). Develop requirements for mitigation measures that would be triggered by PM levels that exceed standards. Mitigation strategies may also include locating air intakes for HVAC as far as possible from existing and expected air pollution sources and educating residents on steps they can take to lessen the effects of particulates on indoor air quality.					✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
▼ Studies have indicated that vehicle-related fine PM become highly concentrated in areas immediately adjacent (200 meters) to major roadways. There is the possibility that approximately 1,800 new residential units within the BeltLine will be constructed in areas with relatively high concentrations of PM 2.5 as a result of proximity (within 200 meters) to high-volume roadways and large rail yards.	All / especially elderly and children						
Water Resources							
▼ Stormwater runoff can carry contaminants, both microbial and chemical, into storm sewers and streams affecting water quality. ▼ Stormwater quantity is increased and quality decreased by the amount of impervious surfaces (areas, like paving and rooftops, where stormwater can not soak into soil). ▲O▼ Since final plans are not available for all new development this study could not assess if there would be an increase (due to new development), decrease (due to conversion of pervious surfaces to parks), or no change in the amount of impervious surfaces due to the BeltLine.	All / with children, older adults, and people with compromised immune systems at greater risk	Adopt a stormwater ordinance to reduce impervious surfaces and hence stormwater runoff. Such an ordinance should call for compact development that uses narrower streets, reduced parking requirements, and vegetated buffers along large swaths of pervious surfaces.	✖	✖	✖	✖	✖
		Protect and enhance existing wetlands and urban forests.					✖
		Study daylighting previously buried streams and restoring other natural functions to manage stormwater runoff.				✖	✖
		Encourage the creation of green roofs (which provide water resources benefits, as well as serving as additional green/public space) by educating developers and builders and by offering incentives.	✖	✖		✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
Noise							
▼ Noise and vibration at higher decibel levels and over longer periods of time can have adverse health effects. O▼ The following are anticipated noise and vibration source from the BeltLine: transit (both the system itself and storage and maintenance facilities), cars, trucks, construction equipment, redevelopment, and people. ▼ Noise and vibration can be expected to occur both in the short- and long-term, with short-term noise levels related to construction and build-out and long-term levels stemming from the operation of the component parts of the BeltLine, primarily transit, redevelopment, and increased population and employment.	All / especially residents living adjacent to transit and freight rail	Where appropriate install noise barriers, temporary or fixed, to protect especially noise-sensitive neighbors.				✖	✖
		Determine the least obtrusive route for truck traffic during the construction phase and for long-term mitigation require that commercial buildings that receive deliveries by truck also utilize the least obtrusive route.		✖	✖	✖	✖
		Match construction practices to existing or anticipated noise levels. For example, in areas with existing or anticipated high noise levels double pane glass and additional wall insulation can be used to dampen outside noise.					✖
		Require that developers be good neighbors by establishing requirements and methods for contacting adjacent property owners and alerting them to pending construction including time, duration, expected noise levels, and types of machinery to be used.				✖	✖

Key Findings Health impact = identified as having potentially positive (▲), neutral (O), or negative (▼) health impacts	Affected Population(s)	Recommendations P = priority recommendations	Relationships				
			Access	Physical Activity	Safety	Social Capital	Environ-ment
▼ The locally preferred alternative according to the MARTA study found that 445 houses and 60 apartment buildings with be within 200 feet of proposed transit alignment and will experience moderate noise disturbance.		Establish timelines for construction of BeltLine infrastructure so that city residents are aware of the potential construction noise and the anticipated duration. Study the creation of railroad quiet zones that silence freight train horns near residential areas according to regulation by the Federal Railroad Administration.			 ✖	✖ ✖	✖ ✖
Brownfield							
▼ The presence of a brownfield in a community has been shown to have negative health impacts on the residents of the community. ▼ Studies suggest that brownfields tend to be located in minority and poorer neighborhoods. For the BeltLine Study Area, this trend is accurate.	Populations living near existing brownfields	Encourage the clean up and redevelopment of brownfield sites.	✖		✖	✖	✖

Section 11: Conclusions

The BeltLine is the largest redevelopment project ever undertaken by the city of Atlanta. It is an appropriate subject for a Health Impact Assessment (HIA) because it includes the transformation of a 22-mile loop of freight rail to parks, trails, transit, and residential and commercial developments. It leverages public funds to attract private investment in the redevelopment of a corridor encircling the city's core. The project has been viewed as a springboard for creating a vision of the Atlanta of tomorrow. This vision is one of greenspace, walkability, high-quality infill development, transit, and healthy communities and businesses. The BeltLine will result in improvements to 700 acres of existing parks and the addition of 1,300 acres of new greenspace and parks. The BeltLine vision includes 33 miles of new multi-use trails connecting 40 parks. In fact, the BeltLine is viewed as a model strategy for redevelopment in urban areas that want to begin to implement a vision that will assure the continuation of a high quality of life for its citizens over the next 50 or more years.

The BeltLine HIA provides an initial assessment of the contribution of the project to achieving a part of this vision by measuring its role in the creation of a more walkable Atlanta, a greener Atlanta, a more connected Atlanta, and ultimately a healthier Atlanta. The HIA provides information to make health consequences part of the policy and design decisions related to the BeltLine by measuring health consequences and informing decision makers and the public about health impacts.

Key Conclusions

The BeltLine HIA has identified numerous potential health effects. Following are several critical findings, as well as brief descriptions of principles and actions that can enhance positive health outcomes.

- The creation of an integrated transit system is required if the BeltLine is to substantially increase mobility and walkability. The goal is to create a seamless system that allows people to conveniently transfer from one place and mode of travel to another. If such a system is created, several health benefits will result. However, this will require that the design of products and environments be usable by all people, to the greatest extent possible. In addition, the design must be flexible, simple, intuitive and appropriately sized and situated.

- Access to parks, trails, transit, and redevelopment is also critical to the success of the BeltLine. The lack of access can negatively impact the ability to engage in physical activity. Studies have shown that park access tends to be unequal across socioeconomic lines, with poor minority groups having the least amount of park access. The findings of the BeltLine HIA suggest that more park acres should be created in the Southwest Planning Areas that appear to be receiving less BeltLine park acres. While the BeltLine will create new park space, Atlanta's population is also increasing. Therefore, the city must continue to acquire park space to meet the needs of an increasing population base.

- Transit opportunities provide users with more opportunities for physical activity, and better access to essential services. Therefore, the transit system must serve multiple purposes. It must increase mobility and accessibility while also providing access to jobs for residents living in communities

without employment opportunities in order to foster employment growth. To foster this development, a seamless transition must exist between parks, trails, new housing and commercial centers. This will also allow growth centers to be located near transit stops.

- As this HIA has shown, mortality rates vary tremendously across the segments of the BeltLine Study Area, indicating significant health disparities. Mortality rates for heart disease, cancer, homicide, diabetes, motor vehicle accidents, and asthma were higher in the Southeast, Southwest, and Westside than in the Northside or Northeast Planning Areas, while rates for many causes of death were greatest in the Southwest. This kind of initial assessment of health disparities in the study area begins to form a baseline against which health outcomes associated with the BeltLine can be compared.

- In Atlanta, the Southeast, Southwest, and Westside Planning Areas have higher mortality rates for chronic diseases that are linked to a lack of physical activity. The BeltLine will create an opportunity for these communities to become more physically active, increasing possible positive health outcomes for the vulnerable populations in these communities. Different communities require different types of parks and they will use them in different ways. Therefore it is important to create a variety of parks. Universal Design principles should be followed in the design of the parks and trails to enable the elderly and disabled to use BeltLine facilities.

- Parks should also be a designed in a way that allows users to feel safe. Lighting, emergency phones, and surveillance contribute to increased feelings of safety. A primary challenge is to achieve a feeling of safety in pedestrians. Countermeasures must be developed to reduce crashes between pedestrians, trains and automobiles. Care must be taken to create a BeltLine that places a high priority on pedestrianism. Effective signage, way finding apparatus, aesthetics, street furniture, and well maintained sidewalks and lighting are effective interventions in achieving a pedestrian friendly environment. Walkability, greenspace, and a built environment that encourages or creates opportunities for social interaction foster social capital and contribute to pedestrian activity.

- A majority of the people surveyed as a part of this HIA believed that the BeltLine will have a positive effect on their health. It must be noted that low income persons were underrepresented in the survey, so the results cannot be considered generalized. While many survey respondents agree the BeltLine will have a positive effect on their health they are very aware of potential negative impacts. It is important that citizens are made aware of any possible negative effects and the plans to mitigate them prior to the commencement of the different projects. It is therefore important that feedback to the public is ongoing with continuous monitoring.

- Public participation increases social capital, therefore the BeltLine should involve an inclusive public participation process. Success in this endeavor could lead to greater civic pride and involvement. It would be advantageous to have a local advisory group to engender more ownership in the HIA as a strategy to increase participation. The demographics of the BeltLine communities vary; therefore an effort must be made to get equal participation from every neighborhood. Different methods for soliciting participation must be developed for different publics, and differences in literacy levels, language, culture, and availability. Within this participatory framework a number of considerations influence both the breadth and quality of inclusiveness. The funding and time available, the latitude given to develop the process and the willingness and capacity of the different stakeholders to participate all influence the success of the outreach program. Extra expenditures of time and resources may be required for this purpose, and this should be an ongoing component of the development process for the duration of the project.

- The BeltLine will have an effect on air quality, water resources, and noise. All of these can positively or negatively affect the environment and health. Air quality is linked to health in many ways. The negative

health effects of pollutants include reduced lung function, respiratory illness, cancer, and premature death. Children and the elderly are at greater risk from air pollution that the general population. Morbidity and mortality from cardiovascular and respiratory diseases have been associated with various indices of air pollution. Automobile travel contributes significantly to air pollution and particulate matter, both of which adversely effect health. The Atlanta Regional Commission projects that there will be a 36 percent increase in traffic volume in the Atlanta region if the BeltLine is completed versus a 40 percent increase if the BeltLine project components are not completed. Where appropriate, it will be necessary to monitor the location of residential units, schools, and senior centers so that residential dwellings are not within 600 feet of high volume road segments.

- In addition, the BeltLine will affect water resources in a number of ways including changes in stormwater runoff, increased impervious surfaces such as driveways, parking lots, and rooftops that would increase stormwater runoff. However the project also allows for the creation of pervious surfaces, such as parks, greenspace, and rainwater capture, thereby decreasing the negative health effects of polluted stormwater runoff.

Lessons Learned

There is increased awareness of the role and impact of major public investments on health. This awareness is more expanded outside of the Unites States, where data, studies, procedures, and training are more developed to facilitate HIAs of public projects and policy initiatives. We in the United States have only recently recognized the importance of understanding the full range and impact of key policy decisions and projects on public health. It is therefore important that a project of the size and significance of the BeltLine serve as an example of how we might further investigate positive and negative health outcomes resulting from redevelopment strategies. In addition, the role of transportation and the need for the better integration of technology and the creation of more transportation alternatives is of critical importance to the city. The pursuit of a major transit investment in the heart of the city is an example of the kind of strategy that must be considered given the increasing population growth and diversity of Atlanta's neighborhoods and its citizens.

HIAs require a baseline description of the social environment; a prediction of potential health impacts; strategies for minimizing negative health outcomes; and continuous monitoring of the project. There are a number of challenges to be expected whenever a new methodology, theory, or evaluation strategy is applied. In the case of the BeltLine HIA, these include: elements that are not readily measurable; data availability; the project definition and scope change during the process; and insufficient financial resources.

The diagnosis of positive and negative health outcomes related to the built environment remain a challenge. The identification of such a vast array of possible outcomes calls for multi-sectoral, multi-level modeling techniques that are currently being tested in studies. These studies are also hindered by a lack of data, especially in the United States. Much of the local, state, and federal data are not available at the appropriate scale or inventories of the built environment are too crude. Furthermore, data gathering of this nature is a costly endeavor, making it one that most jurisdictions cannot afford to undertake.

One of the most important lessons of the BeltLine HIA is the importance of instilling health in discussions of development and transportation planning. To give elected officials, planners, developers, designers, and communities the resources and understanding to talk about the health implications of public projects is an invaluable endeavor. More than environmental impact assessments or quality of life audits, tools like the HIA provide a measurable link between the places we live and our overall health. It makes tangible those quality of life attributes so often sought after and so difficult to define. Besides, the desire to be healthy is universal. While some people prefer dense urban environments and others would rather live in a large-lot subdivision, they all have at least one thing in common. They want to be healthy, making health the consensus builder.

But with this new approach to planning comes a call to action. Even though a much-needed dialogue has started between decision makers, city planners, and public health practitioners about the evolving relationship between the built environment and health, more needs to be done. The link between health and the built environment is a complex subject that deals with environmental exposures, lifestyle, and behavior patterns. Models are being developed and applied that have started to assess the relationship, but care is required to ensure reasonable assumptions, application of variables, analysis techniques, and presentation of results. Furthermore, more data are needed to accurately assess health implications, especially considering the potential for tremendous health disparities based on location, race, ethnicity, and income. And finally, planners must reengage in the public health arena. While much of the research is not conclusive, we are certain that health is associated with the places where we live, work, learn, and recreate. It is in the best interest of the planning profession to be part of the health discussion, just as public health practitioners must be involved in the implementation of urban policy, development, and transportation. Undoubtedly, the lessons learned are the kind that broaden our minds and remind us that each individual has the ability to make a significant impact on the life of another.

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Although this HIA examines numerous health impacts related to the BeltLine, it does not include the many indirect impacts that will result from this redevelopment project. While the BeltLine represents an opportunity to create more greenspace including parks, trails, bicycle paths and transit it also spurs redevelopment, giving the city the opportunity to reconfigure substantial portions of its built environment. If it is successful, the BeltLine can dramatically alter the financial, regulatory, economic and political climate in which development takes places in Atlanta. The success of such a large and transitive project lays the foundation to:

- Shape and create new financing practices and tools that enable the creation of more complex developments,
- Alter city-wide and even region-wide development regulations,
- Expand political and community stances on desirable types of urban development and transportation needs,
- Alter the institutional framework on which the city operates, and
- Establish a standard for the role of public-private partnerships in helping to create a healthier Atlanta of tomorrow.

The contributions of the BeltLine have both negative and positive consequences but it also has the potential to transform the urban communities it connects. From the very beginning the BeltLine vision has been uplifting, seeking to heal long-held physical rifts between neighborhoods, to create a sustainable urban form and transportation system, to bring economic growth to previously neglected neighborhoods, and to accomplish all of this as a successful grassroots effort that has propelled it into the public and private sector arenas.

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Appendix

Appendix 1: BeltLine HIA Advisory Committee

Adjo Amekudzi — Dr. Adjo Amekudzi is an Associate Professor at Georgia Tech's School of Civil and Environmental Engineering. Her research, teaching and professional activities are in the fields of civil infrastructure, asset management, civil engineering systems, and transportation engineering. In 2005 she won the Outstanding Educator Award, and in 1999 she won a Superior Achievement Award from the Federal Highway Administration's Dwight David Eisenhower Fellowship Program. Since 2003 she has taught the Asset Management course for the National Highway Institute.

Dr. Amekudzi chairs the American Society of Civil Engineers' (ASCE) Infrastructure Systems Committee. She is a member of the editorial board of the ASCE *Journal of Infrastructure Systems*, as well as a member of the Transportation Research Board (TRB) (where she is on the subcommittee on sustainable transport indicators), the American Public Works Association (APWA), and the American Society for Engineering Education (ASEE). Her work has appeared in the *Journal of Insurance Regulation*, the *Journal of Urban Planning and Development*, *Public Works Management & Policy*, the *Journal of Environmental Systems*, and several editions of the *Transportation Research Record*.

Dr. Amekudzi has been involved in a number of projects relating to transportation and environmental planning, including two for the Federal Highway Administration. In May 2003 she completed, with Dr. Michael Meyer, Project #8-38 for the National Cooperative Highway Research Program, "Consideration of Environmental Factors in Transportation Planning." That same year, in August 2003, she co-authored "Transportation Improvements and Systems-Level Brownfield Development Programs."

Dr. Amekudzi has been named the principal or co-principal investigator for nearly $1.5 million worth of research projects. She currently has two grants from the Georgia Department of Transportation, one to develop a statewide pedestrian plan and the other to study the feasibility of comprehensive maintenance contracts. She also holds a $244,015 grant from the National Science Foundation for application of portfolio theory and sustainability metrics to civil infrastructure management.

Rajiv Bhatia — Rajiv Bhatia, MD, MPH is the Director of the Occupational and Environmental Health Section of the San Francisco Department of Public Health as well as the Director of the Department's recently created Health Inequities Research Unit. His experience reflects medicine, epidemiology, environmental policy and decision-making, and program implementation & evaluation. His current research focuses on the health effects of pesticides, social, instrumental, & institutional barriers to healthy indoor environments, and the economic effectiveness of supportive housing for homeless individuals. He is also developing and evaluating participatory methods for decision analysis in social and environmental policy through the integration and application of methods such as Participatory Research, Health Impact Assessment and the Danish Consensus Conference. He serves on the Boards of Pesticide Action Network and the Sambhavna Trust in Bhopal, India and is a member of the Health and Social Justice Committee for the National Association of County and City Health Officials.

Susan Handy — Susan Handy is an associate professor in the Department of Environmental Science and the Institute of Transportation Studies at the University of California at Davis. Previously she served on the faculty of the Community and Regional Planning Program in the School of Architecture at the University of Texas at Austin.

Dr. Handy is a member of the Institute of Medicine's Committee on Prevention of Obesity in Children and Youth and the Committee on Land Development and Transportation. She serves as the Chair of the Committee on Telecommunications and Travel Behavior of the Transportation Research Board. Her research focuses on the relationships between transportation and land use, including the impact of land use on travel behavior and the impact of transportation investments on land development patterns. In addition, her work is directed toward strategies for enhancing accessibility and reducing automobile dependence, including land use policies and telecommunications services. She is known internationally for her work on the link between urban form and travel behavior, particularly the link between neighborhood design and the choice to walk, and has published numerous papers on this topic.

Dr. Handy earned a BS in Civil Engineering from Princeton University, an MS in Civil Engineering from Stanford University and a PhD in Regional and City Planning from the University of California at Berkeley.

Mike Meyer — Dr. Michael D. Meyer is a Professor of Civil and Environmental Engineering, and former Chair of the School of Civil and Environmental Engineering at the Georgia Institute of Technology. From 1983 to 1988, Dr. Meyer was Director of Transportation Planning and Development for Massachusetts where he was responsible for statewide planning, project development, traffic engineering, and transportation research. Prior to this, he was a professor in the Department of Civil Engineering at M.I.T. Dr. Meyer has been involved with transportation planning, project development, engineering design and environmental analysis issues at the federal, state, and local levels in his capacity as a state DOT official and through his research.

Dr. Meyer has written over 140 technical articles and has authored or co-authored numerous texts on transportation planning and policy, including a college textbook for McGraw Hill entitled *Urban Transportation Planning: A Decision Oriented Approach.* He is an active member of numerous professional organizations, and has chaired committees relating to transportation planning, public transportation, environmental impact analysis, infrastructure design, transportation policy, transportation education, and intermodal transportation. He has conducted several NCHRP and TCRP projects relating to transportation project development, mobility, and community/environmental impacts. Most recently he is co-project director for an NCHRP project on incorporating environmental considerations into transportation planning and project development; and an NCHRP project that is investigating roadside treatments and their impact on highway safety and road performance. He facilitated an AASHTO environmental stewardship competition, which included judging many states' context sensitive solutions processes. Currently, he is working with the Georgia DOT in developing its context sensitive solutions procedures.

Dr. Meyer is the recipient of numerous awards including the 2000 *Theodore M. Matson Memorial* Award in recognition of outstanding contributions in the field of transportation engineering; the 1995 *Pyke Johnson Award* of the Transportation Research Board for best paper in planning and administration delivered at the TRB Annual Meeting; and the 1988 *Harland Bartholomew Award* of the American Society of Civil Engineers for contribution to the enhancement of the role of the civil engineer in urban planning and development. He was recently appointed to the Executive Committee of the Transportation Research Board.

Dr. Meyer has a B.S. degree in Civil Engineering from the University of Wisconsin, an M.S. degree in Civil Engineering from Northwestern University and a Ph.D. degree in Civil Engineering from M.I.T. He is a registered professional engineer in the State of Georgia.

Jenny Mindell — Jenny Mindell is Clinical Senior Lecturer in the Department of Epidemiology and Public Health, University College London. Her main role is to lead the team from UCL working on the Health Survey for England, the Scottish Health Survey, and the UK-wide Low Income Diet and Nutrition Survey. She graduated from St Mary's Hospital Medical School with an intercalated BSc and MB BS. She trained in general practice and in public health medicine and obtained a PhD from Imperial College in 2002. She was elected a Fellow of the Faculty of Public Health in 2005.

She was previously Deputy Director of the London Health Observatory, the national lead regional public health observatory for inequalities, where she led programs on health impact assessment, web-based knowledge management, and access to and use of non-routinely available data, such as from private healthcare providers. She was also an Honorary Clinical Senior Lecturer at Imperial College London, where she worked on methods to quantify health impacts of policies outside the health services. Earlier research experience includes working in the Clinical Trials Unit in Oxford on a clinical trial of cholesterol reduction and running a tobacco control program in Oxfordshire.

Dr Mindell became a member of the Institute of Learning and Teaching in Higher Education in 2001 and joined the Higher Education Academy's Register of accredited practitioners at its inception in 2004. She teaches undergraduates and postgraduates in epidemiology and public health.

National surveys of health, use of health services, and lifestyles are rich sources of information not only for direct users of the survey reports but also provide a wealth of information about changing lifestyle habits and how these are affected by contemporary circumstances. New studies will incorporate more recent information about earlier participants, to enable comparison between results from cross-sectional surveys with longitudinal follow-up, where cause and effect are more readily differentiated. The main focus of her research for the past decade is in the field of health impact assessment (HIA). Her particular areas of interest are policies that affect determinants of health and of inequalities, particularly transport and air quality management; improving the evidence-base for HIA; quantifying health impacts; and the use of path diagram analysis.

Anne Vernez Moudon — Anne Vernez Moudon is Professor of Architecture, Landscape Architecture, and Urban Design and Planning at the University of Washington, Seattle. She is President of the International Seminar on Urban Morphology (ISUF), an international and interdisciplinary organization of scholars and practitioners; a Faculty Associate at the Lincoln Institute of Land Policy, in Cambridge, MA; a Fellow of the Urban Land Institute in Washington, D.C.; and a National Advisor to the Robert Wood Johnson Foundation program on Active Living Policy and Environmental Studies.

Dr. Moudon holds a B.Arch. (Honors) from the University of California, Berkeley, and a Doctor ès Science from the Ecole Polytechnique Fédérale of Lausanne, Switzerland. Her work focuses on urban form analysis, land monitoring, neighborhood and street design, and non-motorized transportation. Her current research is supported by the U.S. and Washington State departments of Transportation, the Puget Sound Regional Council, the Federal Highway Administration, and the Centers for Disease Control and Prevention.

Her published works include *Built for Change: Neighborhood Architecture in San Francisco* (MIT Press 1986), *Public Streets for Public Use* (Columbia University Press 1991), and *Monitoring Land Supply with Geographic Information Systems* (with M. Hubner, John Wiley & Sons, 2000). She also published several monographs, such as *Master-Planned Communities: Shaping Exurbs in the 1990* (with B. Wiseman and K.J. Kim, distributed by the APA Bookstore, 1992) and *Urban Design: Reshaping Our Cities* (with W. Attoe, University of Washington, College of Architecture and Urban Planning, 1995).

Dr. Moudon has been an active participant in The Mayors' Institute on City Design since 1992. She has consulted for many communities nationally and internationally to develop urban design guidelines for new

construction which respect the character of the existing landscape and built environment and which support non-motorized transportation. She has worked with planning officials, design professionals, and neighborhood groups in the Puget Sound as well as in San Francisco, CA, Toronto and Montreal, Canada, Stockholm, Sweden, among others. She taught courses and conducted seminars in urban design, planning, and housing in Japan, Korea, China, Mexico, Brazil, Venezuela, Colombia, France, the United Kingdom, and Switzerland.

Appendix 2: Content Analysis of Newspaper Coverage

The following is a summary of reaction to perceived Beltline health impacts as reported in the *Atlanta Journal Constitution* (AJC) and *Atlanta Business Chronicle* (ABC). This analysis was based on the question: Will the creation of so many new jobs have a "trickle-down" impact on health?

The individual reactions that have appeared in the *Atlanta Journal Constitution* and *Atlanta Business Chronicle* for each category of health impact—physical activity and obesity, environment, injury, social capital and mental health, social equity, and non-specific health impacts—are listed below in the following format:

> Person/organization commenting, organization (if applicable), comment/summary of comment, source-title, date

Quotes were found using a word search within our compilation of articles document. The search words used were:

Activity	Storm	Accessible/Accessibility
Recreation	Runoff	Disabled/Disabilities
Walk	Injury/Injuries	Handicap/Handicapped
School	Accident	Gentrification/Gentrify
Air	Pedestrian	Minorities/Minority
Noise	Safety	Poor
Redevelop	Mental	Poverty
Water	Commute	Health

PHYSICAL ACTIVITY and OBESITY

Recreational

Dr. William Baker, President Atlanta Regional Health Forum, “Beltline will offer an attractive setting for walking, bicycling and other recreational activity.” AJC-Belt Line will make Atlanta healthier, 1/17/05.

Ira Jackson, President Arthur Blank Foundation, "I'm struck by the conversation of connectivity, paths, green space, parks and the potential of the Belt Line," AJC-Fund lets city nurture plans for a green future, 7/21/03.

Colin Cambell, AJC, “A proposed 22-mile Belt Line in the middle of the city would include hundreds of acres of walkable, bikable green space, ” AJC- Goal of better parks has taken root in Atlanta, 5/16/04.

George Dusenbury, director of Park Pride, and Gary Long, NPU O chair, “We suffer with this lack of parkland even though research has proved that well-maintained parks increase participation in recreational activities, improve public health…” AJC- Parks can give Belt Line community feel, 11/18/04.

James Langford, director Trust for Public Land-Georgia, “With only 3.8 percent of Atlanta's land area preserved as parks and only 7.8 acres of green space for every 1,000 residents, Atlanta ranks near the bottom of major American cities in delivering a park system that offers our residents the healthy recreation opportunities they need.” AJC- Bold Belt Line/park plan would break new ground, 1/3/05.

Wayne Mason, president Madison developers, “Mason said Atlanta is evolving toward a lifestyle more like European cities where urbanites live over shops, travel frequently by transit and share public recreational areas.” AJC- Bullish on the Beltline; Proposed intown loop seen as $1.4 billion economic engine, 1/19/05.

Editors, AJC, “The Belt Line has the potential to be more than just another run-of-the-mill transportation project, but instead a development tool that could help attract new housing, retail and recreational facilities…” AJC- Blank's gift a boost for Belt Line, 2/1/05.

Cathy Woolard, Atlanta City Council president, “Do we continue with the habits of the past, or do we focus on the aspects of our quality of life -- the healthy neighborhoods, the green spaces and the ample mobility -- that made Atlanta such an attractive destination in the first place?...The width of the [Beltline] corridor would also enable us to build a ring of trails and parks that give city residents a new recreational haven.” ABC-Beltline will get Atlanta moving again, 10/10/03.

PATH Foundation, “Now, PATH sees the Belt Line as a connection to six existing trails and as a “recreation amenity” encouraging people to get out of their cars and, instead, walk or ride bikes.” TS-Belt Line stakeholders explain plans, 3/24/05.

Transit

Dr. William Baker, President Atlanta Regional Health Forum, “The Belt Line will enable commuting by foot and bicycle, and by transit --- which includes walking to and from transit stops.” AJC-Belt Line will make Atlanta healthier, 1/17/05.

Editors, AJC, “The Belt Line would intersect with MARTA bus stops and train stations, boosting the system's ridership and usefulness. It could also help connect neighborhoods, emerging job centers

and recreational destinations that now can only be reached by car." AJC-MARTA ought to back Belt Line, 3/3/05.

Cathy Woolard, Atlanta City Council chair, "You walk a block to a new "Belt Line" transit stop, hop on a trolley to the West End MARTA station, catch the northbound train and arrive at Bloomie's in less than half an hour." AJC- Make a beeline for Belt Line, 2/14/03.

Ryan Gravel, "As for the future, Gravel says a study being completed for the Atlanta Regional Commission predicts that in 20 years or so, well over 100,000 people will be living within a five-minute walk of the Belt Line." AJC- Atlanta traffic needs get railroaded by other tiffs, 4/24/03.

Maria Saporta, AJC, "And, of course, more transit encourages walking, cycling and other forms of transportation that are much kinder to the environment than our automobile-dependent society." AJC-Rail plans could unclog arteries, 6/28/04.

Active Transport to School

Michael Holiman, Atlanta Board of Education president, "More than 20 percent of the city's public school students attend a school within a half mile of the proposed project, and more than 41 percent, 21,595 students, attend a school within a mile of it. This could mean safe pathways for more students to walk or bike to school…Holiman said." AJC- Beltline proposal at a crossroads, 2/21/05.

Ray Weeks, BeltLine Partnership president, "Weeks pointed out that 20 percent of Atlanta's 51,000 students attend schools that are located within a half-mile of the Beltline." AJC- Schools evaluate Beltline, 9/15/05.

Howard Kaplan, resident of Atlanta, "My daughters will be able to go to school on the Belt Line (if built) and I would be happy to see them ride it along with the new residents." TS-Letters to the Editor, 7/21/05.

ENVIRONMENT

George Dusenbury, director of Park Pride, and Gary Long, NPU O chair, "We suffer with this lack of parkland even though research has proved that well-maintained parks…clean the environment…" AJC-Parks can give Belt Line community feel, 11/18/04.

Air Quality

Dr. William Baker, President Atlanta Regional Health Forum, "The Belt Line could reduce use of automobiles, whose emissions are major contributors to ozone in Atlanta." AJC-Belt Line will make Atlanta healthier, 1/17/05.

Editors, AJC, "The Belt Line would intersect with MARTA bus stops and train stations, boosting the system's ridership and usefulness. It could also help connect neighborhoods, emerging job centers and recreational destinations that now can only be reached by car… Projects such as the Belt Line will ultimately serve regional transportation goals, such as increasing mobility, easing traffic congestion and improving air quality." AJC-MARTA ought to back Belt Line, 3/3/05.

Maria Saporta, AJC, “And, of course, more transit encourages walking, cycling and other forms of transportation that are much kinder to the environment than our automobile-dependent society.” AJC-Rail plans could unclog arteries, 6/28/04.

Michael Holiman, Atlanta Board of Education president, “More than 20 percent of the city's public school students attend a school within a half mile of the proposed project, and more than 41 percent, 21,595 students, attend a school within a mile of it. This could…replace lines of exhaust-spewing cars picking up and dropping off students on school days, Holiman said.” AJC- Beltline proposal at a crossroads, 2/21/05.

Carla Lattimer, Resident of Atlanta, “Air pollution, a major problem, is worsening. We now have the nation's longest commute. It isn't just developers interested in the Beltline, as the article would leave you to believe; rather, it is those of us who live and work in this city and want to improve our quality of life.” AJC- Readers Write, 7/20/05.

Scott Lee, Resident of Atlanta, “Twenty-two miles of a transit loop around Atlanta would lessen traffic, improve air quality and help shape Atlanta into a world-class city.” AJC- Readers Write, 7/20/05.

Peggy Harper, president Atlanta Planning Advisory Board, “If buying the Beltline keeps my children from having asthma, I'm all for it. And that's exactly what happens when you put in a park and plant trees. The health of an individual goes up.” AJC-The greening of Atlanta, 2/14/05.

Noise

Nkiruka Arene, Resident of Atlanta, “There is no such thing as a "quiet" mass transportation system, and I feel it would result in increased noise and pollution in our neighborhoods.” AJC- Letters to Horizon, 8/11/03.

Brownfield Redevelopment

Dr. William Baker, President Atlanta Regional Health Forum, “Redevelopment of underutilized urban land can reduce sprawl and preserve green space. Redevelopment promotes health by offering economically and socially thriving communities that are walkable.” AJC-Belt Line will make Atlanta healthier, 1/17/05.

Cathy Woolard, Atlanta City Council president, “The true genius of the BeltLine plan, however, may lie in its potential for smart land use and economic development. By linking underused properties and vacant brownfields to a broader transportation network, the BeltLine would open a staggering amount of land up to redevelopment: about 2,500 acres, an area large enough to hold 18 Atlantic Stations.” ABC-Beltline will get Atlanta moving again, 10/10/03.

Cathy Woolard, Atlanta City Council president, “Woolard also says the project is eligible for federal redevelopment grants because of all the brownfields -- industrial wasteland -- along the loop.” CL-11/20/03.

Water

Patty Durand, Sierra Club-Georgia Chapter director, “We're promoting more transit options, partnering with the Beltline, the water coalition --- a consortium of 28 organizations statewide to promote clean water.” AJC- Sierra Club chooses a local, 8/7/05.

Ivory Young, Atlanta City Council member, "Turning to another issue, Young said, "When you have a quarry (the Bellwood Quarry) that is going to be a lake, and you need to find a way to manage stormwater, to me you have an opportunity."" TS- MSAA hears pleas for Beltline support, Aquarium volunteers, 10/6/05.

INJURY

Craig Camuso, CSX Spokesman, "...Camuso said, the rail company has serious concerns about safety and liability issues that would loom over any effort to mix transit with freight trains." AJC- Beltline proposal at a crossroads, 2/21/05.

David Rogers, head of "Our Vision" Design Plan Committee, "Individual neighborhoods must now consider details relevant to development density in their areas, transitional height plans for their neighborhoods and how to provide safe pedestrian access to the Belt Line from all abutting streets." TS- BeltLine Neighbors Coalition kicks into high gear, 8/11/05.

Auto

Dr. William Baker, President Atlanta Regional Health Forum, "Driving less reduces each individual's risk of injury on the highways." AJC-Belt Line will make Atlanta healthier, 1/17/05.

Pedestrian-Transit

N/A

Pedestrian-Auto

Maria Saporta, AJC, "Atlanta has long been viewed as an auto-oriented city that is among the worst for bicyclists and pedestrians. The efforts [including support of the Beltline] of both the PATH Foundation and the Atlanta Bicycle Campaign, as well as Pedestrians Educating Drivers on Safety, will help us change that reputation." AJC-2 projects aim to get area on non-motorized roll, 5/5/03.

Erica Peters, resident of Atlanta, "The Belt Line is such a huge step in making Atlanta an accessible, pedestrian-friendly city that we can take pride in." AJC- Letters to Horizon, 11/22/04.

Recreational

Dr. William Baker, President Atlanta Regional Health Forum, "Good trails and pedestrian infrastructure reduce the risk of pedestrian and bicyclist injuries and deaths." AJC-Belt Line will make Atlanta healthier, 1/17/05.

SOCIAL CAPITAL and MENTAL HEALTH

Social Capital

Dr. William Baker, President Atlanta Regional Health Forum, "The Belt Line will help build community by providing a public setting for people to meet and greet each other." AJC-Belt Line will make Atlanta healthier, 1/17/05.

Ryan Gravel, "Gravel envisioned light-rail cars or trolley-like vehicles gliding along a continuous 22-mile loop that would serve passengers who may be making short hops around the city for work and

recreation." AJC- Belt Line should be on fast track; Rail route through Atlanta's inner core merits both public and private support, 5/17/04.

Wayne Mason, president Madison developers, "Mason said Atlanta is evolving toward a lifestyle more like European cities where urbanites live over shops, travel frequently by transit and share public recreational areas." AJC- Bullish on the Beltline; Proposed intown loop seen as $1.4 billion economic engine, 1/19/05.

Editors, AJC, "The Belt Line would intersect with MARTA bus stops and train stations, boosting the system's ridership and usefulness. It could also help connect neighborhoods, emerging job centers and recreational destinations that now can only be reached by car." AJC-MARTA ought to back Belt Line, 3/3/05.

Shirley Franklin, Atlanta Mayor, "With the Beltline, we have the chance --- and you don't get many chances like this --- to create the live/work/play environment we hear so much about." AJC- DEFINING DEVELOPMENT: GUIDING OUR GROWTH: FIVE WHO WILL LEAD, 9/11/05.

Maria Saporta, AJC, "Transportation investments in rail, pedestrian and bicycle systems also stimulate more dense developments around town centers, where people are within walking distance of jobs, shops, restaurants and parks." AJC- Rail plans could unclog arteries, 6/28/04.

Cathy Woolard, Atlanta City Council president, "The BeltLine would enable residents and workers to efficiently travel around the center of town, opening new land to residential and commercial development." ABC-Beltline will get Atlanta moving again, 10/10/03.

Mental Health

Dr. William Baker, President Atlanta Regional Health Forum, "In many people, driving causes stress, aggravation and even belligerence (think of road rage)." AJC-Belt Line will make Atlanta healthier, 1/17/05.

George Dusenbury, director of Park Pride, and Gary Long, NPU O chair, "Studies even show that spending time in a forested park can make you smarter." AJC-Parks can give Belt Line community feel, 11/18/04.

Commute Impacts

Scott Lee, resident of Atlanta, "We now have the nation's longest commute. It isn't just developers interested in the Beltline, as the article would leave you to believe; rather, it is those of us who live and work in this city and want to improve our quality of life." AJC- Readers Write, 7/20/05.

Peter Harms, resident of Decatur. "If, however, there was more of a commitment to building on the public transportation infrastructure we have, I think we would not spend so much time in our cars and will have a healthier environment to live in." AJC-Letters to Horizon, 11/22/04.

Crime

George Dusenbury, director of Park Pride, and Gary Long, NPU O chair, "We suffer with this lack of parkland even though research has proved that well-maintained parks ...reduce crime." AJC-Parks can give Belt Line community feel, 11/18/04.

Cathy Woolard, Atlanta City Council president, "[Speaking of the Beltline right-of-way] People can have either kudzu and vagrants, or a very big train, or this [the Beltline]. It's all about quality-of-life issues." AJC- Existing web of rail lines key to crafting better transit system, 4/1/02.

SOCIAL EQUITY

Atlanta City Council's Community Development/Human Resources Committee, "an Advisory Committee that will make recommendations to the ADA and city 'on the allocation and distribution of tax allocation bond proceeds within the Beltline Redevelopment Area and the effective and equitable implementation of the Beltline Redevelopment Plan.'" TS- Council unit OKs amended Beltline TAD, 11/3/05.

Accessibility for disadvantaged groups

Robert Bullard, Clark Atlanta University, "...is skeptical of the Beltline's claim to link neighborhoods and foster diversity. He said the proposal represented a tourist-orientated marketing campaign that made no attempt to transport poor African Americans without cars to work." LATimes- An 'Emerald Necklace' May Grace Urban Atlanta, 10/24/05.

Ryan Gravel, "the Beltline Partnership's redevelopment plan will attempt to distribute growth equally, setting up 12 development nodes in the rich and poor areas of the Beltline." LATimes- An 'Emerald Necklace' May Grace Urban Atlanta, 10/24/05.

Editors, CL, "By encircling downtown, the Beltline could throw its benefits in all directions - from the mainly white and upscale northeast to the largely black and poor southwest." CL-9/21/05.

Gentrification

Ty Tagami, AJC, "Many welcome the buzz of activity such development [Beltline] would bring. Others lament the upward trend of housing costs as the city becomes a more attractive place to live for well-off newcomers." AJC- Most incumbents fighting to keep city posts, 9/22/05.

Ryan Gravel, "Though Gravel acknowledges that the Beltline could end up creating a circle of privilege in the urban area — raising home prices and pushing poor African Americans to the suburbs — he says gentrification is happening anyway." LATimes- An 'Emerald Necklace' May Grace Urban Atlanta, 10/24/05.

Editors, CL, "So that families with modest means wouldn't be squeezed out of the city, the project would steer incentives toward developers to build 5,600 units of "work force housing."" CL-9/21/05.

Ray Weeks, Belt Line Partnership chair, "Asked if the planned "workforce housing" will be evenly distributed throughout the various sectors of the city along the Beltline, Weeks said he is not an expert on that issue and expects that a special task force will be set up to work out all the various aspects related to workforce housing. He said he knows, however, the commitment to workforce housing as part of the redevelopment plan is very real." TS-Editor's Notes, 10/2705.

Accessibility for disabled

N/A

NON-SPECIFIC HEALTH IMPACTS

Karen Gravel, resident of Atlanta. “Let's keep in mind that the Belt Line has many facets, all of which benefit our city, our health, our environment and our future.” AJC-Letters to Horizon, 8/3/03.

James Langford, Trust for Public Land, Georgia director, “At TPL, we believe access to parks, trails and natural areas is essential to human health and well-being and is also a cornerstone to livable communities.” Belt Line/park plan would break new ground, 1/3/05.

Ryan Gravel, “It will contribute to citizens' quality of life both by offering parks and green space --- which includes public health and other concerns…” AJC- The greening of Atlanta, 2/14/05.

Cathy Woolard, Atlanta city council president, “It is a smart growth idea ‘that does not cut through historic neighborhoods, but instead brings them together.’” TS- Abandoned Belt Line rails could hold future for Atlanta’s transportation woes, 5/30/02.

Cathy Woolard, Atlanta City Council president, “Furthermore, with an influx of new residents moving closer into the city, the Belt Line accesses developable land and re-uses historic urban fabric in ways that contribute to the health of urban neighborhoods.” TS- Transportation alternatives for a sustainable city, 5/30/02.

Appendix 3: BeltLine Public Involvement and Education Strategy

Goals of outreach	Stakeholder groups	Form of outreach
1. Announce project	Decision makers, Implementers/experts, public	• Letter • News release to local media
	Decision makers, Implementers/experts, public	• Time on agenda of the meetings of the City Council, County Commissioners, School Board, Zoning Commission, BeltLine Partnership, NPU Chairs
2. Educate on HIA and health AND **3.** identify health impacts	Decision makers	Meeting • Web site • Online survey
	Implementers/experts	Meeting
	Public	NPU meetings
4. Get information (data, deadlines, decision points, work plans, etc)	Decision makers and Implementers/experts	• One-on-one contact
5. Identify recommendations	Decision makers, implementers/experts	• One-on-one contact
6. Provide information to make informed decisions*	Decision makers, Implementers/experts, public	• 1 Meeting • Print materials • Web site
7. Share lessons with academics and practitioners*	Academics and practitioners	• journal articles • conference presentations • planning/health publications • Web site

* These tasks take place during and after the assessment period.

Appendix 4: BeltLine HIA Survey Questions and Results (next page)

FINAL BELTLINE HIA SURVEY RESULTS : download on 2.7.07

1. How do you think the following items affect your health? Beside each item below, please indicate what you think the impact will be by marking the appropriate box.

	Very positive effect on my health	Somewhat positive effect on my health	No effect on my health	Somewhat negative effect on my health	Very negative effect on my health	Response Average
Having places for recreation and sports	**74% (357)**	22% (107)	4% (19)	0% (1)	0% (1)	**1.31**
Having places to walk	**82% (398)**	14% (69)	3% (17)	0% (1)	0% (1)	**1.23**
Having places to jog/run	**69% (327)**	17% (79)	13% (63)	1% (3)	0% (2)	**1.47**
Having places to bicycle	**72% (345)**	17% (82)	11% (53)	0% (0)	0% (1)	**1.40**
Having transportation options	**58% (277)**	32% (154)	10% (47)	1% (3)	0% (0)	**1.53**
Having nearby places to shop	**38% (186)**	38% (183)	23% (111)	1% (3)	0% (1)	**1.86**
Having good air quality	**91% (437)**	9% (41)	1% (3)	0% (1)	0% (0)	**1.10**
Having low noise pollution	**60% (294)**	31% (150)	8% (41)	0% (0)	0% (1)	**1.49**
Having low crime rates	**68% (329)**	24% (116)	7% (33)	1% (4)	0% (1)	**1.41**
Having access to jobs	**46% (219)**	33% (159)	21% (103)	0% (0)	0% (0)	**1.76**
Having access to community facilities (churches, schools, police stations, health centers, etc.)	**47% (227)**	38% (182)	16% (76)	0% (0)	0% (0)	**1.69**
Having a sense of community	**56% (273)**	33% (161)	10% (50)	0% (1)	0% (0)	**1.54**
Overall community attractiveness	**54% (263)**	34% (165)	11% (53)	0% (2)	0% (0)	**1.57**

Total Respondents	**487**
(skipped this question)	2

2. Have you ever attended a meeting about the BeltLine?

		Response Percent	Response Total
Yes		38.2%	166
No		**61.8%**	**269**
	Total Respondents		**435**
	(skipped this question)		54

3. Please complete this sentence by marking only ONE box below.

I THINK THE BELTLINE WILL HAVE...

		Response Percent	Response Total
a positive effect on my health		**73.3%**	**346**
a negative effect on my health		1.7%	8
both positive and negative effects on my health		15%	71
no effect on my health		10%	47
	Total Respondents		**472**
	(skipped this question)		17

4. What do you think about your community? Beside each item, please indicate whether you agree with the statement by marking the appropriate box.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Response Average
I have enough places for recreation and sports	6% (30)	25% (116)	13% (62)	**40% (188)**	15% (72)	**3.33**
I have enough places to walk	9% (44)	27% (128)	10% (46)	**35% (162)**	19% (87)	**3.26**
I have enough places to jog/run	8% (36)	21% (99)	19% (86)	**35% (161)**	17% (81)	**3.33**
I have enough places to bicycle	4% (19)	9% (40)	16% (73)	**37% (171)**	34% (159)	**3.89**
I have enough transportation options	4% (19)	9% (44)	11% (49)	32% (151)	**43% (202)**	**4.02**
I have enough places to shop	14% (67)	**30% (138)**	21% (96)	23% (105)	13% (60)	**2.90**
My community has good air quality	1% (6)	6% (27)	19% (89)	34% (157)	**40% (184)**	**4.05**
My community has low noise pollution	2% (10)	15% (72)	23% (109)	**34% (157)**	25% (119)	**3.65**
My community has low crime rates	3% (13)	23% (105)	24% (110)	**34% (157)**	17% (79)	**3.40**
My community has enough jobs	5% (21)	17% (79)	**36% (169)**	27% (123)	16% (72)	**3.31**
My community has enough community facilities	3% (15)	12% (57)	23% (105)	**43% (202)**	18% (86)	**3.62**
My community has a sense of community	13% (59)	**37% (173)**	19% (87)	23% (107)	9% (41)	**2.78**
My community is attractive	15% (69)	**45% (209)**	20% (95)	15% (70)	5% (24)	**2.51**
					Total Respondents	**469**
					(skipped this question)	20

5. How do you think the BeltLine will change your life? Beside each item below, please indicate whether you agree with the statement by marking the appropriate box.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Response Average
The BeltLine will give me more places for recreation and sports	39% (178)	**40% (180)**	15% (68)	4% (19)	2% (8)	**1.89**

The BeltLine will give me more places to walk	**46% (208)**	39% (178)	10% (44)	3% (15)	2% (8)	**1.76**
The BeltLine will give me more places to jog/run	**44% (198)**	33% (147)	18% (80)	3% (15)	2% (9)	**1.86**
The BeltLine will give me more places to bicycle	**49% (222)**	32% (142)	14% (65)	3% (12)	2% (9)	**1.76**
The BeltLine will give me more transportation options	**48% (217)**	32% (144)	13% (58)	4% (20)	3% (12)	**1.82**
The BeltLine will give me more places to shop	22% (101)	**36% (164)**	35% (158)	5% (23)	2% (8)	**2.28**
The BeltLine will improve air quality	28% (128)	**35% (158)**	26% (120)	6% (27)	5% (22)	**2.25**
The BeltLine will reduce noise pollution	18% (83)	25% (113)	**41% (187)**	10% (47)	5% (25)	**2.60**
The BeltLine will reduce crime rates	10% (47)	13% (60)	**58% (261)**	13% (57)	6% (27)	**2.90**
The BeltLine will improve access to jobs	24% (108)	**42% (192)**	25% (114)	6% (26)	3% (13)	**2.21**
The BeltLine will improve access to community facilities	23% (105)	**45% (205)**	25% (114)	4% (18)	2% (10)	**2.17**
The BeltLine will improve the sense of community	30% (134)	**37% (169)**	25% (113)	5% (24)	3% (14)	**2.15**
The BeltLine will improve the community's overall attractiveness	**45% (202)**	33% (148)	15% (67)	4% (17)	3% (15)	**1.88**
					Total Respondents	**456**
					(skipped this question)	33

6. How do you currently travel for the following purposes? For each travel purpose, mark the box under the TRAVEL METHOD YOU USE MOST OFTEN.

	walk	bicycle	bus	train	carpool	private car	other	not applicable	Response Average
Travel for work	5% (21)	6% (26)	1% (4)	6% (26)	2% (8)	**74% (335)**	1% (4)	6% (28)	**5.51**
Travel for school	4% (16)	4% (16)	2% (7)	2% (8)	1% (6)	21% (88)	0% (1)	**67% (283)**	**6.89**
Travel for errands	4% (20)	2% (10)	0% (1)	0% (2)	1% (3)	**91% (410)**	1% (3)	0% (1)	**5.68**

Total Respondents	454
(skipped this question)	35

7. AFTER the BeltLine is completed, how do you think you will travel for the following purposes? For each travel purpose, mark the circle under the TRAVEL METHOD YOU THINK YOU WILL USE MOST OFTEN.

	walk	bicycle	bus	train	carpool	private car	other	not applicable	Response Average
Travel for work	5% (23)	10% (45)	2% (9)	20% (89)	2% (10)	**51% (229)**	1% (6)	8% (37)	**5.04**
Travel for school	3% (14)	5% (21)	3% (13)	5% (21)	1% (5)	14% (57)	0% (1)	**68% (281)**	**6.78**
Travel for errands	12% (52)	11% (49)	1% (5)	17% (76)	0% (2)	**55% (242)**	2% (7)	2% (9)	**4.64**
Total Respondents									451
(skipped this question)									38

8. When the BeltLine is completed, how much do you think you will use the different parts of the BeltLine? Beside each item below, please indicate how often you will use the trails, parks, and public transportation by marking the appropriate box.

	I will use it almost every day	I will use it a few times a week	I will use it at least once a month	I will use it a few times a year	I will not use it	Response Average
Trails	20% (88)	**35% (158)**	25% (110)	16% (71)	4% (20)	**2.50**
Parks	11% (47)	**34% (153)**	34% (150)	18% (79)	4% (18)	**2.70**
Public transportation	18% (82)	**26% (118)**	**26% (118)**	19% (86)	10% (45)	**2.76**
Total Respondents						450
(skipped this question)						39

9. Are you:

		Response Percent	Response Total
Male		43.5%	194
Female		**56.5%**	**252**
	Total Respondents		**446**
	(skipped this question)		43

10. Are you:

		Response Percent	Response Total
American Indian or Alaska Native		0.5%	2
Asian		1.6%	7
Black or African American		16.8%	73
Native Hawaiian or other Pacific Islander		0%	0
White		**76.8%**	**334**
Other (please specify)		4.4%	19
	Total Respondents		**435**
	(skipped this question)		51

11. Are you:

		Response Percent	Response Total
Hispanic or Latino		5%	16

Non-Hispanic or Latino	**95%**	**303**
Total Respondents		**319**
(skipped this question)		170

12. Your age:

	Response Percent	Response Total
0-17 years old	0.2%	1
18-29 years old	24.1%	108
30-49 years old	**48.3%**	**217**
50-69 years old	27.2%	122
70 years old or older	0.2%	1
Total Respondents		**449**
(skipped this question)		40

13. **OPTIONAL:** What is your household income?

	Response Percent	Response Total
$0 - $20,000	4%	17
$20,001 - $30,000	5.2%	22
$30,001 - $40,000	3.1%	13
$40,001 - $50,000	11.6%	49

$50,001 - $60,000	7.5%	32
$60,001 - $70,000	6.8%	29
$70,001 - $80,000	8.3%	35
$80,001+	**39.6%**	**168**
I do not wish to answer this question	13.9%	59
Total Respondents		**424**
(skipped this question)		65

14. How did you hear about this survey? Please mark all boxes that apply.

	Response Percent	Response Total
the newspaper	3.8%	17
a BeltLine meeting	2%	9
a general public meeting	1.1%	5
my neighborhood association	17.5%	79
my Neighborhood Planning Unit	12%	54
school or Parent/Teacher Association	1.3%	6
the Center for Quality Growth Web site	9.8%	44
Other (please specify)	**61%**	**275**
Total Respondents		**451**
(skipped this question)		38

Appendix 5: Universal Design

Neighborhood Design to Enable Older Adults and Children to Lead Active Lives

Since many older adults cannot perform vigorous physical activities they typically walk for exercise (Feskanich, Willett, & Colditz, 2002; Tudor-Locke, Jones, Myers, Paterson, & Ecclestone, 2002). In a six-year longitudinal study, older adults who walked a mile at least once a week were significantly less likely to develop functional limitations (Miller, 2000; Feskanich et al., 2002). Walking also improves cardiovascular endurance, balance and flexibility (A. C. King et al., 1998). Walking as a form of regular physical activity is also important for older adults with disabilities as a means to maintain their functional abilities and independence (Miller, 2000; Shephard, 1997; Brach et. al, 2003) and to lower the chance of increasing their disability (DiPietro, 1996; Ettinger et al., 1997; Spirduso and Cronin, 2001; Hillsdon et al., 2005).

A study in Seattle found significant relationships between community form and level of activity among seniors (Frank, Engelke et al. 2003). Environmental features which impact walking include congested paths and trails; litter; blocked curb cuts; narrow sidewalks; poor street furniture placement; lack of signage, seating, ramps or curb cuts; steep inclines; noise; poor lighting; landscaping and weather conditions (Fänge et al., 2002; Kirschbaum et al., 2001; Matthews & Vujakovic, 1995; Meyers et al., 2002; Shumway-Cook et al., 2002; Shumway-Cook et al., 2003).

Children's needs and abilities are also an important consideration in community design. There were more than 13,000 children age 5 and under in the BeltLine Study Area in 2000 (Census, SF1, 2000). Low levels of physical activity and failure to meet the required activity levels have significant health consequences for children such as obesity, low bone density, and low physical fitness (Trost et al., 2001; Bailey & Martin, 1994). Positive social and emotional health benefits such as higher self esteem, lower anxiety, and lower stress are also associated with physical activity among children. Thirty five percent of children in the US do not meet the minimum physical activity requirements, while 14 percent are totally inactive (CDC, 1997; US Department of Health and Human Services, 2000).

A literature review about the influence of the built environment on children's physical activity by Lawson and Davison suggests that the same factors that affect adults also impact children, including conditions like opportunities for physical activity, accessible facilities and destinations, safety and slower traffic, and appealing physical appearance of the immediate environment. Furthermore, physical activity for children is positively associated with access to local parks, playgrounds, and schools; and availability of sidewalks, crosswalks, traffic lights, and public transportation; and negatively associated with the number of roads to cross, traffic density/speed, and crime (Lawson & Davison). Time spent outdoors is positively associated with physical activity for children. Physical activity for adolescents is positively associated with opportunities for exercise (Sallis et al., 2000).

Neighborhood design has a greater impact on active travel than on other forms of neighborhood-based exercise (Handy, 2004). Subsequently, designation of crosswalks, traffic signals, pedestrian signage, and other amenities become important for access. Traffic speed is recognized as the key determinant for pedestrian injury risk for children (Jacobsen et al., 2000). Precautions such as traffic calming through speed bumps and controlled speed limits are associated with reduced child injury. Traffic safety improvements in California resulted in a 65 percent increase in walking, and 114 percent increase in biking to school among children (Staunton et al., 2003). Additionally, evidence shows that boys walking to school are more physically active over all than those who are driven (Cooper et al, 2003).

Applying the Principles of Universal Design in the BeltLine

Universal Design emphasizes the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design (Mace et al., 1991). Such a design philosophy can enable the BeltLine to become as inclusive as possible and to accommodate all people with different age and ability levels by the same design. Seven principles of Universal Design advocate equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use (CUD, 1997).

- **Equitable use** means that designs need to be useful and marketable to people with different levels of ability. The main goal is to provide one design to accommodate all users. If it is not possible, then equivalent options should be available. It is crucial not to stigmatize individuals with specialized design that segregates or isolates them. For example, the BeltLine transit component should accommodate the needs of elderly and people with disabilities in such a way that they would not need special vehicles for transportation. Furthermore, accessible entrances at the back of the buildings can be a source of stigmatization and embarrassment. Instead, all buildings should accommodate all users at the main entrances (Figure A1). In addition, playground features should be designed to be usable by various heights and ability levels so that children and adults, whether able bodied or using a wheelchair, can get involved in the children's play (Figure A2).

Figure A1. Examples of buildings, illustrating "visual character" in the BeltLine development guideline, have inaccessible entrances (top photographs). Special attention needs to be paid to front entrances usable by all ability and age levels (bottom photographs).

Figure A2. Inclusive playgrounds with accessible and reachable design

- **Flexibility in use** recommends that products, buildings and environments should accommodate a wide range of individual preferences and abilities through various methods of use. Access and use should be possible by both left and right handed users. Products and environments should be compatible with the user's pace to accommodate the use by various ability levels. For example, traffic lights should be timed to give people, especially older adults, children, and people carrying loads or using assistive technology, enough time to cross the streets comfortably and without any hazard. In addition, traffic and pedestrian signals may be designed to provide more information to assist pedestrians and drivers in achieving a safe environment within a shared right-of-way.

- Universal design also advocates for products and environments that enable **Simple and Intuitive Use.** This means that places should be simple enough to understand regardless of an individual's experiences, knowledge, language skills, or concentration level. The BeltLine should be designed to eliminate complexity, organize information based on importance, and be consistent with an individual's expectations and intuition. Putting clear signage at appropriate places for the streets, stops, transit destinations, miles walked or remaining for trails, and maps will be important for all the users of BeltLine.

- **Perceptible Information** should be provided in diverse modes (e.g., auditory, visual, tactile) to match the skills of different users. For example, signs should use contrasting colors for the information and the background (e.g., white on black) to improve legibility, and signage and maps should have big enough letters and Braille for vision impaired users. Furthermore, travelways should use varying texture and color for pavement of streets, sidewalks, and bike paths to provide navigational guidance to older adults and others with vision loss, as well as provide additional locational information for the general public.

Sidewalks, trails, transit stops, and public pedestrian routes can better serve elderly, people with visual impairments, and people using wheelchairs by adding common types of information that can be perceived with several senses. For example, raised tactile surfaces, materials with contrasting sound properties, grooves, contrasting colors, and audible pedestrian signals can be used as detectable warnings and for wayfinding, Raised tactile surfaces contain textures detectable with the touch of a foot or sweep of a cane to warn for upcoming hazards or changes in the pedestrian environment. Raised tactile surfaces include truncated domes, patterned panels, and other textured designs. In United States, surfaces with truncated domes are required at transit stop platforms to indicate drop offs (Figure A3). However, these types of design can easily be employed at trails and sidewalks of the BeltLine.

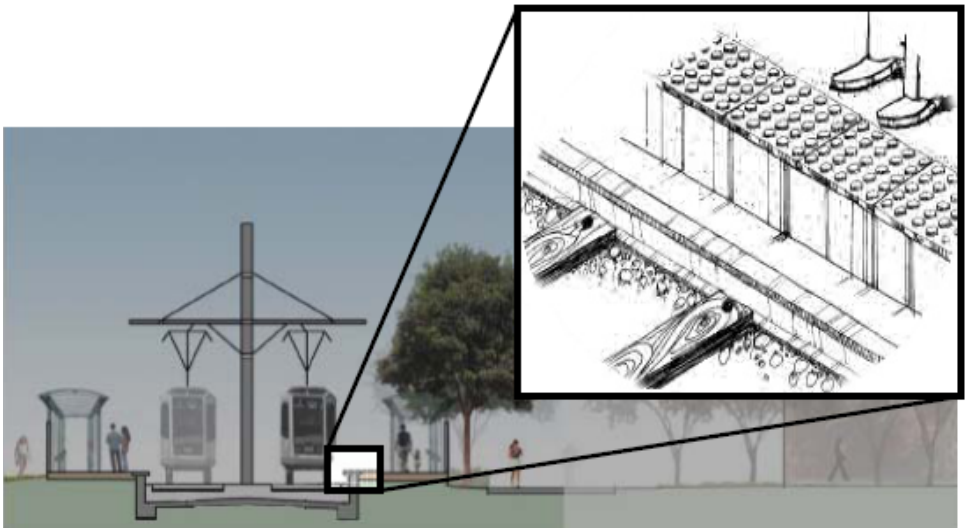

Figure A3. The use of raised tactile surfaces at the BeltLine transit stations (Beneficial Designs, Inc., 1999)

- Tolerance for Error requires designs that minimize hazards and accidents through warnings and the elimination, isolation, or shielding of hazardous elements. The design should seek to minimize unconscious actions for tasks requiring attention, and to encourage users to be aware of their environments. Sidewalks and crossings are important to maximize mobility and minimize hazards for individuals who use wheelchairs, walkers and canes as well as those with an irregular or unsteady gait.

- According to the Low Physical Effort principle, products, buildings, and environments should be designed to be used efficiently and comfortably without the need of an extra operating force, awkward body position, unnecessary repetitive actions, or sustained physical effort. For example, the connectivity of neighborhoods through a web of streets and trails will decrease the time and effort spent reaching destinations compared to conventional community development with dead-end streets and cul-de-sacs. Another opportunity to provide amenities that require low physical effort can be found in seating features. For instance, a bench with a higher seat and handles can support elderly for sitting down and standing up and can also be used by able bodied users. Adjustable seating at public spaces can provide flexible use for wheel chair users as well as for all others (Figure A4).

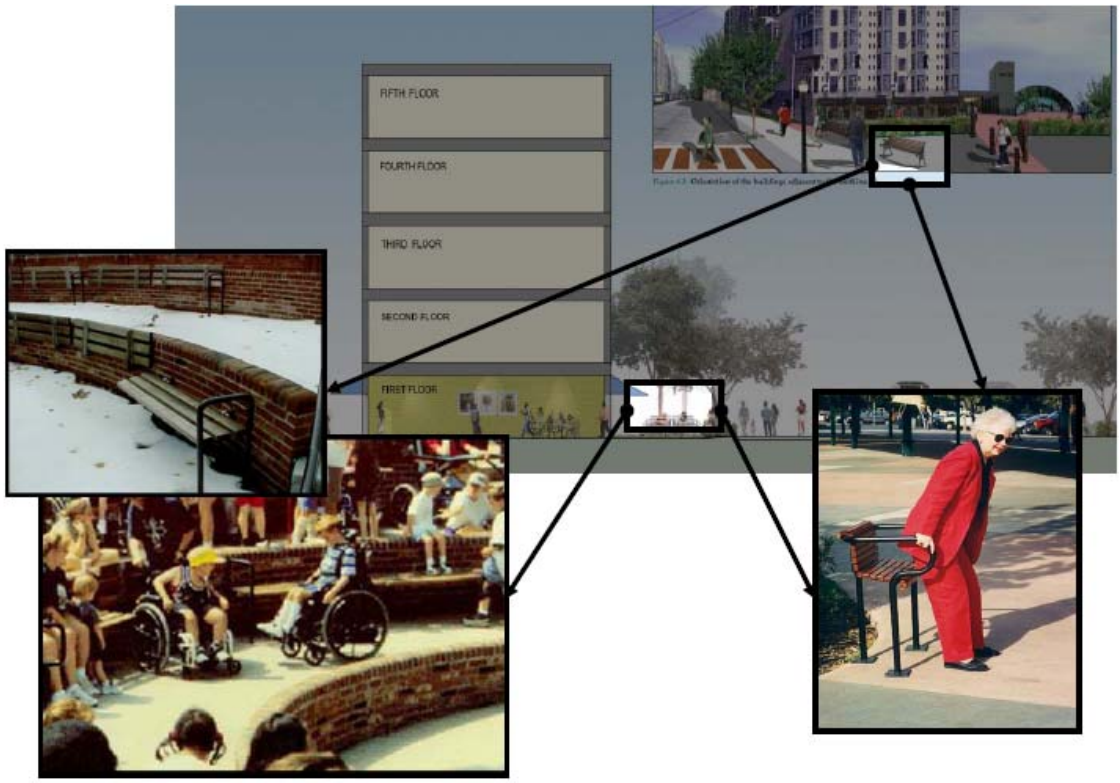

Figure A4. Seating features to accommodate special needs and be inclusive for all ability levels

- The principle of **Size and Space for Approach and Use** states that a design should be an appropriate size for the intended use (i.e., sufficiently large or small) and provide enough space for approach and use by people with different body sizes, assistive devices, or personal assistants. Components should be reachable by all heights and can be operable by all hand and grip sizes. For instance, gates, ticket counters, and machines at the BeltLine stops should be in compliance with this principle. The design guidelines state that the BeltLine developments and facilities should meet applicable Americans with Disabilities Act (ADA) standards. However, there are points where ADA is not sufficient to enable mobility to wheelchair users due to recommended widths of the sidewalks and cross slopes. The width of the sidewalks should be such that two wheelchair users can stroll together, side-by-side or with able-bodied companions and would not be limited by the presence of others. In this instance, the Atlanta Development Authority guidelines exceed ADA standards (Figure A5).

Figure A5. Wide paths or sidewalks with adequate use for everyone