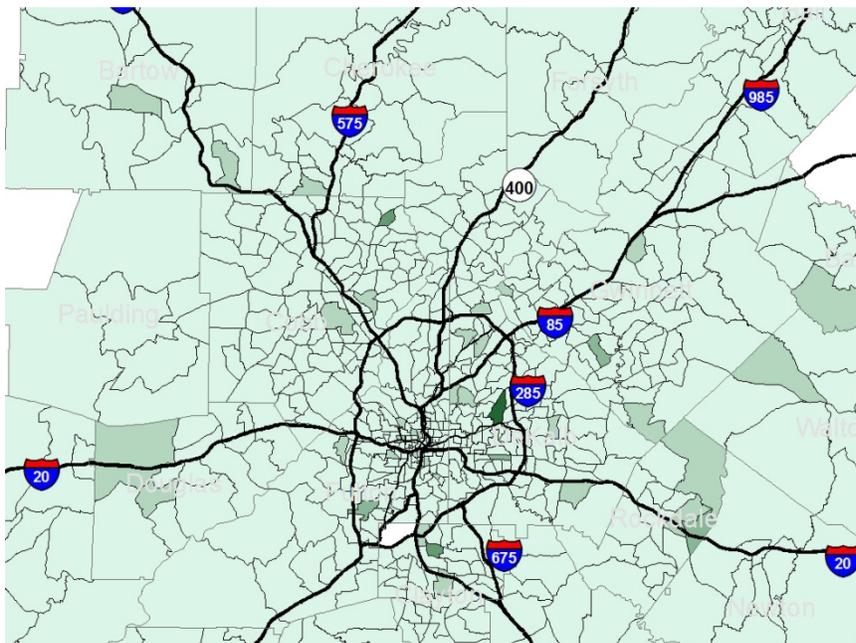


# Health Impact Assessment of Atlanta Regional Plan 2040



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Prepared by Center for Quality Growth and Regional Development  
at the Georgia Institute of Technology

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### About the

#### Health Impact Project

The Health Impact Project, a collaboration of the Robert Wood Johnson Foundation and The Pew Charitable Trusts, is a national initiative designed to promote the use of health impact assessments (HIAs) as a decision-making tool for policymakers. HIAs use a flexible, data-driven approach that identifies the health consequences of new policies and develops practical strategies to enhance their health benefits and minimize adverse effects. For more information, visit [www.healthimpactproject.org](http://www.healthimpactproject.org).

### About the

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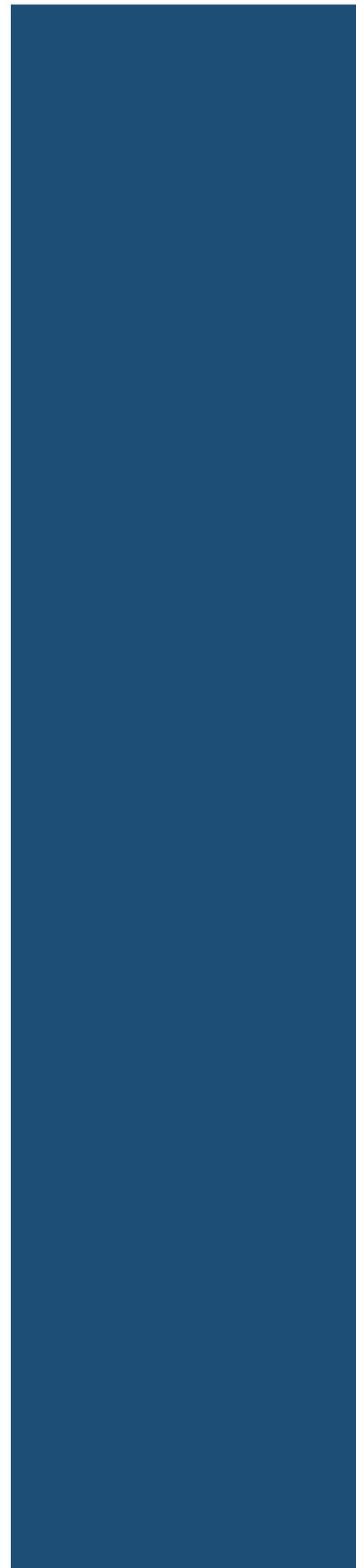


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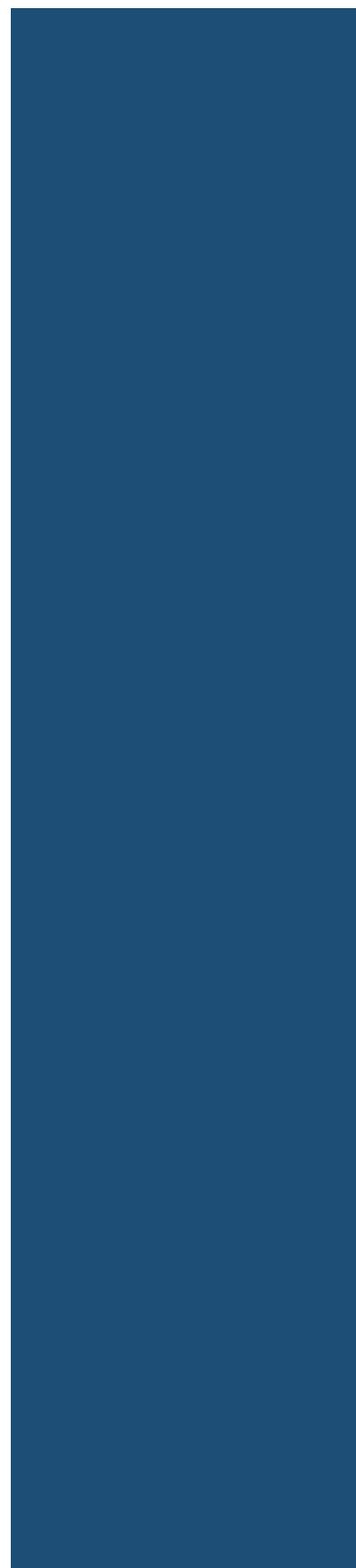
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# Executive Summary

## Introduction

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### Health and Regional Planning

According to the World Health Organization (1948), health is not merely the absence of illness, but complete physical, mental, and social well-being. Good health is prevalent in communities where healthy choices are easy and affordable. Land use and transportation can have unintended effects on health, quality of life, and economic wellbeing in ways that have not been captured in conventional planning practices. Recent research has started to explain many of these connections, generating considerable interest from both the public health and planning disciplines. In public health and in planning, professionals see the protection of health, safety, and welfare of the public as their ultimate goal.

Many years ago, the greatest threats to health were communicable diseases, such as small pox and cholera, and pollution, from industries that emitted smoke and chemicals in the midst of the city. At this time, urban planning sought to reduce overcrowding, limit environmental exposures, and implement sanitary standards for water, sewer, and food processing. These changes successfully mitigated many of the health threats from earlier times, but gradually led to new health threats. Low-density, single-use zoning resulted in cities with a separation of uses where few destinations were within walking distance of each other; driving replaced walking and transit as the dominant form of transportation. As it did, air pollution from cars increased, traffic fatalities became more common, and there was a decline in the amount of physical activity an average American engaged in on a daily basis. This urban form also made it harder for families of limited means to travel around the region for jobs and services, exacerbating socio-economic and health disparities.

Land use and transportation plans were never intended to discourage healthy lifestyles, but priorities changed over time and unintended consequences have revealed themselves. Research shows that it takes more than a doctor's visit and a gym membership for people to be healthy. Today, many metro Atlanta residents live in a place where healthy options are more expensive, more time consuming, or unavailable. The aspects of the manmade environment that enable or discourage healthy living, are known as health determinants. These health determinants are driven by decisions at many levels, from the individual to local, regional, state, and federal policies. When these policies have led to unintended negative consequences in the past, it has been truly unfortunate. Now, as the paths from planning and project select to health, wellbeing, and quality of life are becoming clearer, planners and policy-makers at every level have the responsibility to use this information to make better decisions. For regional planning agencies, upholding this responsibility could contribute significantly to the health of Americans; the largest 100 metropolitan areas are home to more than 65 percent of the U.S. population and produce 75 percent of its economic output. Every regional planning agency should pursue evidence-based healthful urban planning as a key part of their planning and project selection criteria. Previous instances of using health impact assessment (HIA) in regional planning to achieve these goals are few. Although some examples of comprehensive planning HIAs exist in the U.S., the Plan 2040 assessment is one of the earliest HIAs of a regional comprehensive plan for a major metropolitan area.

## Health Impact Assessment

A Health Impact Assessment, or HIA, is “a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of the effects within the population. HIA provides recommendations on monitoring and managing those effects” (National Research Council, 2011).

HIA is a process that uses a variety of methods and approaches to identify and measure potential health impacts, both positive and negative, that may result from a particular policy or project. Furthermore, an HIA seeks 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, for the current project and to set future policies.

### How does HIA prevent disease and promote health?

Many external factors—including, for example, the environment where we live, work, and go to school; social conditions; economic policies and public services—affect the health of individuals and communities. In recent years, research has demonstrated a linkage between the characteristics of the built environment and human health outcomes. The built environment is the manmade surroundings that provide the setting for human activity, such as land use patterns, transportation systems, and urban design. It represents the collective outcome of public and private projects, policies, and other activities and it affects where and how people live, travel, work, shop, and interact with each other. It influences everything from traffic to agriculture, job opportunities to crime rates, air quality to cultural norms, and their daily impact on human health.

The fundamental importance of issues outside the traditional sphere of public health to the health and wellbeing of affected communities has led to the assertion that “policy makers in all sectors and at all levels” should “be aware of the health consequences of their decisions and ... accept their responsibilities for health” (WHO 1986). However, health is not routinely addressed in planning, policy-making, and public works. Policy levers are not in place, and there is no standard procedure for the inclusion of health concerns. Although environmental impact assessment is used to consider some ecological effects for large projects, it has failed to influence many pressing health concerns. Meanwhile, communities contend with many different types of health threats, such as the emerging epidemics of obesity, diabetes, and other chronic diseases; infectious diseases; environmental pollution; and mental illness, without a clear way to address these problems in a comprehensive manner. A new tool is urgently needed, to translate public health data into relevant information for decision-makers in other sectors, and to promote a collaborative and cross-sectoral approach to health promotion and disease prevention. Health Impact Assessment has shown great promise as that tool (Collins 2009).

### Is HIA an effective strategy for health and development?

Many health departments have discovered that HIA is an effective intervention strategy to promote health and prevent disease. The San Francisco Department of Health routinely uses HIA to promote walking and bicycling within pedestrian-friendly development. Also in California, HIA was used to improve after-school and walk-to-school programs, as well as a countywide land use and development plan. London’s health department used HIA to improve the city’s transportation plan for active transportation. The Center for Quality Growth and Regional Development (CQGRD) used HIA to integrate Active Living principles into the City of Decatur’s transportation plan. CQGRD also conducted an HIA of the Atlanta BeltLine and identified numerous ways to improve its effect on

physical activity at the design and project management levels, and through less obvious tactics such as crime prevention. As a result of the HIA, health outcomes are a routine consideration in the BeltLine project implementation.

As these examples show, efforts to find relationships between the built environment and public health and thus create positive health impacts through policy interventions are increasing nationally and internationally. In the Atlanta region, the Atlanta Regional Commission (ARC) is moving to incorporate assessments of the impact of regional plans on health within communities. This study is designed to support ARC's on-going initiatives by developing methodologies for conducting such an assessment, adapting existing methodologies to the specific conditions found in the Atlanta region, and conducting a health impact assessment (HIA) of ARC's Plan 2040 as a pilot for how HIAs can be conducted at the regional level. As previously mentioned, the use of health impact assessment at the regional scale is a new and innovative process.

The impetus behind efforts to promote healthy places is multifaceted. These include changing population preferences and maintaining economic competitiveness:

- *Residents want healthy communities.* Market research has shown unmet demand for “livable” communities – as many as 30% of area residents may be living in a less-healthy community than they would like. In addition, as the demographics of the Atlanta region change, the preferences of the largest population groups are changing. For example, as the regional population ages, single occupancy vehicles are no longer viable for a large number of individuals. In addition, younger adults, Millennials, have been shown to prefer transit and options for multiple modes of travel. These transportation options also can contribute to healthier communities through increased physical activity and social interaction with others.
- *Healthy communities attract economic development.* Every region knows it is competing against other cities to attract businesses and talented workers. Although each business or family has certain personal preferences, other preferences are nearly universal: places that are safe and secure, where the cost of living or doing business is moderate, where the environment is clean and attractive, and where they can be part of a vibrant community.
- *Healthy communities are necessary for economic productivity.* First, they lower operating costs for companies and public agencies by reducing health insurance premiums that continue to rise because of increases in chronic diseases, such as obesity and diabetes. These costs affect profit margins and foreign competitiveness. Second, they lead to higher worker productivity because healthy employees are absent less often and are more productive when they are at work.
- *Healthy communities save public and private sector resources.* While the Atlanta Regional Commission does not pay for health care, except for coverage for its employees, its funding sources – local, state, and federal government – do pay for health care in the form of Medicare, Medicaid, disability benefits, emergency response services, and more. In addition, chronic health or access problems may lead to permanent workforce dropout, increasing demand for other social services.

Both the models used to assess regional development and the tools, such as zoning and transportation projects, used to implement regional plans were developed in prior decades to address problems from those eras. The increasing scale of our cities and our growing understanding of health impacts now requires new models and tools. This research and resulting report provide initial guidance as to how best to proceed.

### **What is the purpose of an HIA?**

HIA has evolved from the awareness that many projects, policies, and initiatives which have no explicit health goals nonetheless impact the health of the population. Four values are integral to HIA – democracy, equity, sustainable development and the ethical use of evidence based on rigorous

structured analyses. Current funding models, zoning ordinances, and transportation project development are based on trends and assumptions from prior decades. The ARC has in place initiatives to promote multimodal projects and complete streets policies which allow the residents of the region to have active and healthier alternatives for travel. This document is intended to build on these initiatives and provide guidance to update the regional planning process to further move the Atlanta region to the forefront of explicitly considering public health in all programs, policies and projects. To address the full range of public health impacts, today's planning methods should incorporate a range of scientific disciplines and methodologies in addition to traditional planning, to begin addressing the health challenges facing our region as well as the nation as a whole.

### **How does an HIA work?**

The steps of an HIA include:

**Screening** determines whether a proposal is likely to have health effects and whether the HIA will provide information useful to the stakeholders and decision-makers.

**Scoping** establishes the scope of health effects that will be included in the HIA, the populations affected, the HIA team, sources of data, methods to be used, and alternatives to be considered.

**Assessment** involves a two-step process that first describes the baseline health status of the affected population and then assesses potential impacts.

**Recommendations** suggest design alternatives that could be implemented to improve health or actions that could be taken to manage the health effects, if any, that are identified.

**Reporting** documents and presents the findings and recommendations to stakeholders and decision-makers.

**Monitoring and evaluation** are variably grouped and described. Monitoring can include monitoring of the adoption and implementation of HIA recommendations or monitoring of changes in health or health determinants. Evaluation can address the process, impact, or outcomes of an HIA.

## Health in Plan 2040

The way that we envision, plan and build our region can help promote active lifestyles, improve traffic safety and air quality, and promote economic and social connectivity. These factors play a role in seven of the ten leading causes of death as well as in a significant percentage of injury, illness, and disability in our region. Healthy and safe community environments include those with affordable, sustainable, and economically vital neighborhoods, clean air and water, and accessible places for an aging and diverse population. PLAN 2040, the long-term regional comprehensive plan prepared for the Atlanta region by the Atlanta Regional Commission (ARC) (adopted in July of 2011), represents an unprecedented opportunity to influence the long term health, sustainability, and prosperity of the region. The plan has been developed through a unique process that integrates land use and transportation policies such that both are considered together. Thus, the impact of various land use scenarios on transportation systems could be evaluated through the planning process.

Considering metro Atlanta resident's health and quality of life in regional land use and transportation planning will allow us to reverse unacceptably high rates of disability and death due to obesity, injury, pollution, and persistent socio-economic disparities. The following report provides a detailed view into how health can be addressed in Plan 2040's transportation performance measures, including a full report of the analytical methodology and process improvement strategies for healthy comprehensive regional planning. Plan 2040 includes objectives and goals for ARC to assist with the allocation of resources. The recommendations that result from this health impact analysis are somewhat different from the objectives and goals that have been established by ARC for this

purpose. Therefore, this report will strive to show how the consideration of health can be effectively integrated into the overall objectives and goals of Plan 2040. Where possible, supporting evidence is provided from transportation and economic research to demonstrate that the recommended changes will not have a negative effect on standard planning objectives, such as mobility, access, or property values, metrics which also support good health.

The Atlanta Regional Commission has already embraced health as an essential element of a thriving and productive region in several important ways. Specifically many of ARC's activities deal with health determinants in indirect ways. Planning and visioning efforts that consider sustainability, equity, aging, housing, transportation, land development, energy, and many other topics will also touch on the elements of a complete, healthful community. For example, the stated goals and objectives of Plan 2040 contain the following elements of "healthy places":

Goals:

1. Lead as the global gateway to the South.
2. Encourage healthy communities.
3. Expand access to community resources.

Objectives:

1. Increase mobility options for people and goods.
2. Foster a healthy, educated, well-trained, safe and secure population.
3. Promote residential choices in locations that are accessible to jobs and services.
4. Improve energy and resource efficiency, while preserving the region's environment and critical assets.
5. Identify innovative approaches to economic recovery and long-term prosperity.

## Health Impact Assessment of Plan 2040

The Center for Quality Growth and Regional Development (CQGRD) with support and funding from the Health Impact Project, a collaboration of the Robert Wood Johnson Foundation and The Pew Charitable Trusts, conducted a Health Impact Assessment (HIA) on Plan 2040, the long-term regional comprehensive plan adopted by the Atlanta Regional Commission (ARC). This plan integrated multiple aspects of regional planning, including transportation and land use, housing, greenspace, water, and air quality, as well as changing demographic and economic scenarios. This unified regional planning effort includes a new Regional Transportation Plan through the year 2040, and a six-year priority Transportation Improvement Program (TIP). It also included a comprehensive Regional Development Plan for the region's 10-county core that will guide future growth and offer policies for shaping the character and function of the region. CQGRD concluded that there are major potential health impacts, both positive and negative, associated with this plan.

The objective of this work was to integrate the HIA process into the larger planning process to the greatest extent possible. An HIA will ensure the explicit consideration for the human health impacts in regional transportation and land use planning. Second, it increases the regional capacity for HIA practice through collaboration with community and research partners, and develops a prototypical approach for measuring and improving regional planning outcomes. Ultimately through the HIA process, sustainability, economic benefit, and health were presented as mutually-supportive and attainable goals of transportation and land use planning. Although some examples of comprehensive planning HIAs exist in the U.S., the Plan 2040 assessment is one of the earliest HIAs of a regional comprehensive plan for a major metropolitan area.

The Plan 2040 HIA process started by identifying health priorities using regional health data, examining variation within the region and among subpopulations, and reviewing Plan 2040 stakeholder involvement. This procedure guided the team to select indicators for regional health trends. CQGRD also conducted a thorough review of relevant health research to identify high priority health determinants related to planning, land use, and transportation. Using this set of key determinants and health indicators, the team reviewed the Plan 2040 process, methods, and supporting materials. Finally, we examined selected case studies and examples. This process resulted in a final report and recommendations, as well as an intermediary comment during the Plan 2040 public comment process and presentations to ARC.

The Atlanta region is facing many health challenges, but planning, guidance, and leadership from the Atlanta Regional Commission and its state and local partners, could position the region for a healthier future, with integration of the recommendations contained in this report. Plan 2040 began to establish goals and strategies for such a transformation. However, healthy regional planning will require updates to many standard practices, from data collection and analysis, to planning and performance measurement, to project evaluation. In its adopted form, Plan 2040 contained some healthful elements, some elements that missed opportunities to promote better health outcomes, and some elements that might negatively impact health. In very general terms, the plan establishes healthy development and zoning guidelines for key regional centers, but is missing some essential details, while the list of programmed and long-term transportation projects may exacerbate current unhealthy conditions.

### **Readers' Guide**

The following pages provide a brief summary of the most significant health determinants we identified in the Atlanta region, beginning on page 17. The healthy planning guidelines, starting on page 22, offer an overview of the policy and planning practices that shape regional health determinants, and the recommended strategies for improving health through Plan 2040 and future regional planning exercises. A resource list is provided at the end of this section. Following the Executive Summary, the full HIA report offers detailed review of the scientific evidence relating to health determinants and healthy planning, our regional analysis, extensive guidance for updating planning methods and policies, and technical assistance, as well as plans for evaluation and follow-up. Analysis and recommendations can be found throughout the “Healthy Planning Concepts” (page 132) and “Healthy Planning Methods” (page 188) sections of the full report, marked with one or more color-coded numbers to indicate potential accountability, by agency or role, for acting on the recommendation.

The key recommendations for the ARC and its partners, explained below and described in detail in the full report, are:

- Design and development
  - Diversify mode share
  - Increase connectivity
  - Increase density/compact development and conserve land outside of centers
  - Design transportation facilities with greater consideration of land use, land access, and multimodal travel
  - Reduce or mitigate land use-transportation conflicts
- Planning methods
  - Include a wide range of health indicators in transportation performance measures and data analysis
  - Standardize project ranking
  - Collaborate with organizations that represent health interests
  - Establish priorities around health
  - Reduce disparities

- Use HIA
- Programs and implementation
  - Ensure that program goals are fully represented in plans and projects
  - Include health metrics

The HIA team plans to partner with ARC in order to provide technical assistance to support healthy regional planning including the adoption of the HIA recommendations. The Center has already conducted one training workshop for this purpose which included a broad spectrum of attendees including ARC personnel, local government planners, public health professionals and others. Additionally, the team plans to evaluate the effectiveness of this HIA based on awareness and implementation of recommendations and conduct additional trainings in the future.

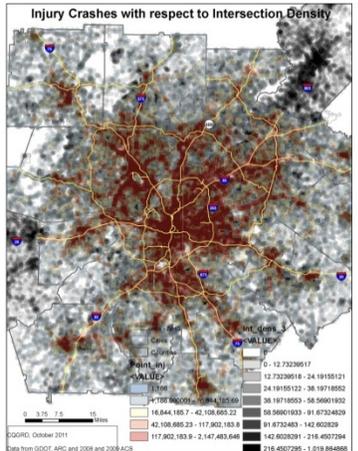
# The Science of Healthy Places

The HIA identified five major areas in which regional planning activities were likely to impact health: Safety and Security; Access, Equity, and Economy; Active Living; Ecology & Environmental Quality; and Civic Life, Social Connections. Although planning and design elements often affected two or more of these areas, this provided a conceptual framework in which to place the evidence review and analysis of baseline conditions in the region. Each of the five areas are briefly described below, for more detail, see the section “The Science of Healthy Places” in the full HIA report.

**Safety and Security**

**Key Concepts:**

- *Death & disability caused by traffic crashes and violent crime;*
- *Impact of perceived risk on healthful behaviors*



**Injury Crashes with respect to Intersection Density**

Legend values:  
 0 - 12,732,961.7  
 12,732,961.7 - 24,191,912.1  
 24,191,912.1 - 38,197,492.2  
 38,197,492.2 - 58,596,913.3  
 58,596,913.3 - 91,873,240.9  
 91,873,240.9 - 142,802,839  
 142,802,839 - 219,450,729.4  
 219,450,729.4 - 419,895,986

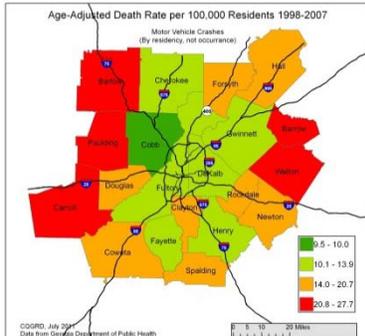
Over 5,000 lives were lost due to car crashes in the Atlanta region between 1999 and 2007, as well as hundreds of thousands of serious injuries. Although fatalities tend to be random events, they are significant in that crashes have a financial toll as well as a human toll, due to the costs to productivity, emergency response, and delay.

Pedestrians, bicycle riders, and the elderly are also over-represented in traffic fatalities. Research indicates that high-quality pedestrian and bicycle facilities on all major roads, connected networks of side streets, lower design speeds, streetscaping, and mixed use development are correlated with reduced rates of serious crashes.

The majority of serious crashes are preventable, with changes to speed and volume of motor vehicle traffic, the design of streets, and the amount of time and distance traveled in the region. Trends can be and are analyzed utilizing five year average crash data which can then be influenced through planning and design.

Intentional injuries due to crime and violence are reduced in communities where there are more trees, where neighbors are acquainted, where citizens informally patrol the street from windows and sidewalks, and where people can get to work even if they don't have a car.

Fears of traffic or crime also impact travel choices and property values. Urban design can create safer spaces with robust bicycle and pedestrian infrastructure, pavement and roadside design elements that discourage speeding, and homes and businesses that engage with the public right-of-way to create a lively and continuously-monitored space.



**Age-Adjusted Death Rate per 100,000 Residents 1998-2007**

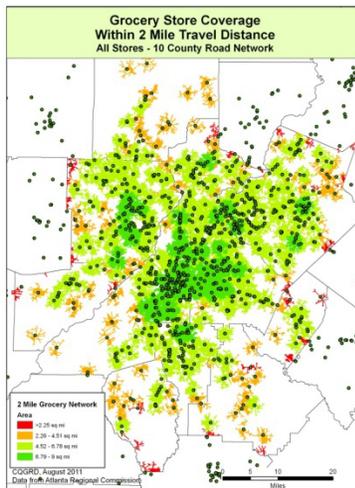
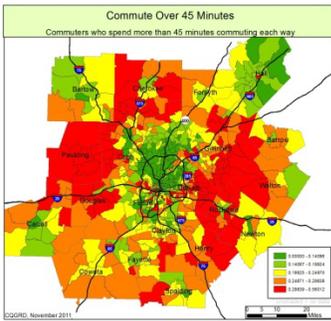
Motor Vehicle Crashes (by residency, not occurrence)

Legend values:  
 0.5 - 10.0  
 10.1 - 13.9  
 14.0 - 20.7  
 20.8 - 27.7

Access, Equity, and Economy

Key Concepts:

- Equitable access to jobs, housing, services, and goods
- Interrelationship between economic status and health through productivity and opportunity, cost of healthy food and housing, cost of transportation access to health care, mental health, and crime
- Regional economic impact of health and economic disparities



Travel options affect access to nutritious food, medicine, and health care, especially for the elderly, children, persons with disabilities, and households with limited time or mobility. The time, cost, and feasibility of daily transportation can prevent lower-income households from getting to work or basic daily needs, and contribute to financial or emotional stress for lower income families. Median transportation costs can range from 5% of household income in regions where travel alternatives exist, up to 20% in a car-dependent community. Low income households may spend up to 40% for their transportation. According to Center for Neighborhood Technology’s Housing +Transportation Index, transportation costs exceed 15% of household income for the vast majority of residents in the Atlanta region. In the City of Atlanta, transportation is generally 15-25% of household income; transportation costs are 30-35% outside of the City.

Research links walkable mixed-use neighborhoods, access to stores and services, multimodal transportation options, and short commutes to better physical, mental, and social health. Crime and mental illness tend to be more prevalent in areas lacking access to economic opportunity.

The Atlanta region currently has limited housing choices near major employment centers, resulting in long commute distances, traffic congestion, and higher “vehicle miles traveled” (VMT). Housing is separated from retail centers as well, increasing the time and money households devote to daily transportation, and reducing access to jobs and services. According to the Brookings Institution, 23% of jobs held by low-income residents in the Atlanta region are accessibility by transit within 90 minutes, compared to 21% or middle-income residents and 21% of high-income residents (2011).

Zoning that places broad restrictions on density and use, and inflicts minimum parking requirements makes walkable, transit-served communities unattainable. It also drives up housing prices and the cost of living.

Building new road capacity has often been tried as a way to reduce travel time due to congestion delay; however, studies suggest that this strategy does not reduce congestion, nor does it improve travel for non-drivers. Congestion pricing and mixed-use zoning appear best suited to improve access.

## Active Living

**Key Concepts:**

- *Role of physical activity in various diseases/leading causes of death;*
- *Role of environment in utilitarian versus intentional physical activity;*
- *Actual physical activity rates*



Development and land-use patterns in the Atlanta region encourage sedentary lifestyles as participating in different forms of physical activity is not necessarily an easy or convenient option. More than 25% of metro Atlanta residents are obese, which increases their medical costs and nearly doubles their risk of premature death. Obesity and lack of physical activity are strongly associated with chronic conditions such as heart disease, stroke, diabetes, certain cancers, and mental disorders (Halpin et al, 2010)..

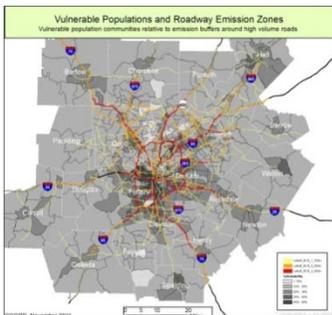
The key elements needed for an active community are highly mixed land uses, short connected blocks, and high-quality infrastructure for pedestrian and bicycle traffic. Sidewalks, convenient crosswalks, bicycle lanes, quality transit service, traffic calming measures, mixed-use zoning, and connected street networks facilitate active transportation and save lives.

However, these design elements are lacking in many parts of the region. Major changes are needed in both land use and transportation practices in order to design active communities and fund adequate multimodal infrastructure.

## Ecology & Environmental Quality

**Key Concepts:**

- Exposure to nature
- Air, noise, water and soil pollution
- Urban climate and global climate change
- Environmental justice
- Contribution of environmental hazards to disease



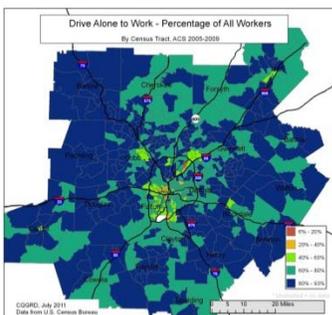
Regional air quality in metro Atlanta has shown improvement, although national ambient air quality thresholds (NAAQS) are still exceeded each year. Roadways, transportation facilities, freight logistics, and industry can create “hot spots” of locally elevated air pollution levels, which may impact homes and schools and may inequitably impact some citizens more than others. These hot spots are linked to increased rates of asthma attack, premature and low birth weight babies, infant mortality, and other respiratory diseases. Other concerns include exposure to nature, air pollution, noise, water and soil pollution, urban climate, global climate change, and environmental justice.

There is a federally required hot-spot analysis that is required to be conducted by project sponsors as part of project development for certain types of projects. The regional plan could potentially reference any mitigation activities resulting from this hot-spot analysis in collaboration with the project sponsor for future plan updates. ARC has already offered to flag programmed transportation projects that may trigger hot-spot analysis. Follow-up can be conducted on these projects with sponsor once analysis is complete.

## Civic Life, Social Connections

**Key Concepts:**

- *Public life & social connection*
- *Definition of health includes emotional well-being and ability to cope with environment*



Individuals who are not well integrated into the social, political and economic networks, those with low social capital, are shown to be at increased risk for poor physical and mental health. Many of these essential social and economic activities take place in public or semi-public spaces.

In streets, parks, and businesses, citizens meet their neighbors, learn, shop, and engage in political expression. Additionally, these settings provide access to unique public resources such as recreational areas, libraries, and social services.

However, communities are struggling to come together as nearly all of their public space is used for motor vehicle movement, most travel in the public realm is made isolated in a private car, and there is insufficient space to congregate. Streets need to be made more livable, and local jurisdictions need to create accessible public spaces.

## Healthy Planning Concepts in the Atlanta Region

The following table defines key planning concepts and practices that can support healthy places, and offers guidance on their usage by ARC and partners in the Atlanta region.

	Findings	Recommendations
Mode Share	<p>Mode share describes the share of travel made by car, transit, walking, bicycling, carpooling, and other methods of travel. Each travel mode has different implications for health. Access to destinations through mobility has a positive impact on health, but the actual travel may have positive or negative effects. Aside from mobility, driving has the largest negative impact, through traffic crashes, sedentary time, emissions, social isolation, and cost. If a larger percentage of trips were made by walking, bicycling, or using transit, we would be likely to see improvements in safety, access and equity, economic stability, physical activity, environmental quality, and civic and social participation</p>	<p>Diversify mode share by funding a larger share of pedestrian, bicycle, and transit projects relative to road capacity projects, introduce more congestion pricing on existing highways, and use multimodal level of service to evaluate the impact of any project. Mode share should be included in transportation performance measures.</p>
Centers, Corridors, and Conservation	<p>This assessment finds that many trends in zoning and development, such as single-use zoning or disconnected street layout, are detrimental to public health. Research shows that walkable, higher-intensity, mixed-use centers, such as those endorsed by ARC’s Livable Centers Initiative, are linked with many positive health impacts – higher levels of physical activity, increased access to jobs and services, lower emissions, and more social participation.</p>	<p>Expand the use of centers; target places with supportive infrastructure or historical use. Centers should provide a diverse mix of uses, diverse housing options and development densities. Neighborhood and town centers may be strung together along multimodal corridors. To make centers effective, the existing development patterns outside of the centers’ boundaries should be conserved whether it is low-density homes, agricultural land, or undeveloped forests.</p>

	Findings	Recommendations
Context Sensitive Design	Road design, including the transition from road edge and right-of-way to adjacent private properties, has a great deal of influence over traffic safety, as well as the sense of place. Both arterials and local streets can be designed for safety and livability. Multimodal access management plays a key role.	Rather than recommending typical roadway design specifications which traditionally improved safety by guardrail installation and tree removal, we advocate Context Sensitive Design for road projects, context-appropriate traffic calming, pedestrian-friendly access management, and lower overall traffic speeds.
Connectivity	Certain land use elements can have an unexpectedly large influence on the creation of healthy places. Development that creates residential and business subdivisions that connect only to major roads and not to each other are associated with reduced rates of physically active transportation and higher rates of traffic deaths and injuries; these roadway patterns are usually coded in subdivision ordinances.	We recommend revising ordinances to create block lengths less than 500 feet, minimize culs-de-sac and dead end streets, link adjacent parcels, and encourage four-way intersections (with potential for motor vehicle traffic calming or diversions).
Parking	The other land use element that may be underestimated is parking policy. Research indicates that the availability and cost of parking have a significant effect on transportation mode choice. The majority of jurisdictions currently implement minimum parking requirements which skew mode share towards driving, a less healthy choice, and appear to reduce economic productivity.	Although parking policies are dictated by local zoning codes, we recommend that ARC work with local jurisdictions and partners to incentivize the establishment of land use based parking maximums or parking caps within the region.

	Findings	Recommendations
Performance Measures	<p>We found that the evaluation measures could be enhanced or amended to aid in developing a transportation plan that will promote health, economic stability, livability, and sustainability. Note that MAP-21 (the new federal transportation legislation) will require a performance based planning process, with specific measures and targets. These recommendations can help supplement other planning measures.</p>	<p>Our recommendations to change or add measures follow. Note that certain measures have a land use element as well as transportation, which we consider necessary for comprehensive performance evaluation. Also evaluate results relative to vulnerable population and environmental justice areas.</p>
	<p><u>Recommended Plan-Level Performance Measures</u></p> <ul style="list-style-type: none"> <li>• Supplement “Number of injury and fatal crashes per 100M VMT” with “Number of injury and fatal crashes per 100K residents.” <i>The supplemental metric gives a more accurate picture of the actual risk ratio faced by residents, and supports efforts to reduce injury rates regardless of future increases or decreases in VMT.</i></li> <li>• Supplement “Average travel time by auto and transit for HBW trip” with “Average travel distance for HBW trip”, with a goal of reducing this metric.</li> <li>• Supplement “Average number of workers reaching major activity/employment centers within 45-minute (autos and transit).” with “Percent of HH within 3 miles (network distance) of major or minor activity center/LCI” and “Ratio of housing to jobs within 5 miles (network distance) of major employment areas.” Supplement “Percent pavement, bridge, and transit infrastructure in good condition.” with “Percent of roads identified in pedestrian/bike heat methods with pedestrian and/or bike facility.” and “Percent of sidewalk and bike path in good condition</li> <li>• Add “Reduction in per capita VMT”, “Percent of trips made by walking or bicycling”, and “Percent of trips made by transit”,</li> <li>• Add “Percent of peak and off-peak trips for which transit is available” and “Discrepancy between transit and automobile travel times, calculated as difference between average travel times</li> <li>• Target equivalent transit travel times between major activity centers and within regional core and employment corridors.</li> <li>• Supplement “Peak-Hour Freeway Speed: Managed lanes, HOV versus General Purpose” with “Consistency of travel time at peak and at off peak, all modes”</li> <li>• Supplement “NO<sub>x</sub>, VOC, PM<sub>2.5</sub>, and GHG” with “Trees and vegetation cover in right-of way”, “Impervious surface land coverage”, and “Percent of freight movement by rail”. Issues with predicting at this level of detail.</li> <li>• Supplement “Percent pavement, bridge, and transit infrastructure in good condition” with “Percent of sidewalks and paths in good condition”, “Percent of sidewalk coverage in latent walking demand sites”, and “Percent of bicycle facility coverage in latent bicycle demand sites”.</li> </ul>	

## Plan 2040 Programs and Projects

The following table describes specific elements of Plan 2040 and its implementation through the organizational framework of the Atlanta Regional Commission, and recommends strategies to improve the impact on health at each step.

	Findings	Recommendations
Regional Planning Framework	<ul style="list-style-type: none"> <li>Plan 2040 framework sought to allocate constrained resources using analysis, transportation performance measures, and transportation-land use integration.</li> <li>Plan 2040 calls on cooperation of all ARC divisions and local and state partners. Vision, goals, and objectives endorse healthy planning directly and indirectly</li> </ul>	<ul style="list-style-type: none"> <li>Ensure that programs and projects will effectively support the vision, goals, and objectives</li> <li>Collaborate with local and state public health departments to update analysis and performance measures</li> <li>Use stakeholder advisory groups to update analysis and performance measures</li> <li>Prioritize health as a way to capture quality of life, environment, equity, and economy</li> <li>Identify best practices through research partners and liaisons with other regional planning agencies, in particular the San Francisco region’s Metropolitan Transportation Commission’s “Transportation Project Performance Assessment”</li> </ul>
Regional Assessment	<ul style="list-style-type: none"> <li>The assessment phase evaluated regional trends in relation to sustainability</li> <li>The assessment identified demographic trends, development trends, transportation options, environmental status, and the policy environment</li> </ul>	<ul style="list-style-type: none"> <li>Incorporate health data (available from the Georgia Department of Public Health) in this phase</li> <li>Address socio-economic and health disparities</li> <li>Increase the emphasis on access (to jobs, to retail, to business markets)</li> <li>Expand range of environmental topics</li> </ul>
Implementation Program	<ul style="list-style-type: none"> <li>Program emphasizes accountability, partnership, and prioritization</li> <li>ARC divisions are tasked and funded with specific steps to accomplish each Plan 2040 objective</li> <li>Program includes the implementation of local government standards to accomplish the policies set out in Plan 2040, which also includes health standards</li> </ul>	<ul style="list-style-type: none"> <li>The full report recommends additional responsibilities to support evidence-based planning, including new types of data collection and analysis, and development of guidelines and procedures to incorporate health objectives</li> </ul>

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Transportation Programming</p>	<ul style="list-style-type: none"> <li>The ARC operates under a larger framework of national and state regulations. This might impose funding distribution limits on performance-based selection</li> <li>Lack of transit operating funds limits performance-based selection</li> </ul>	<ul style="list-style-type: none"> <li>Make evidence-based comparisons across categories</li> <li>Use recommended plan-level performance measures</li> </ul>
	<p style="text-align: center;"><b>Findings</b></p>	<p style="text-align: center;"><b>Recommendations</b></p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Transportation Projects</p>	<ul style="list-style-type: none"> <li>Bicycle, pedestrian, and transit projects are likely to promote health.</li> <li>Legacy project list limits ability to update performance objectives and match projects with development patterns</li> </ul>	<ul style="list-style-type: none"> <li>Use new investment to optimize mode share: increase share of pedestrian, bicycle, and transit funding                         <ul style="list-style-type: none"> <li>Pursue more options for transit operating funds</li> </ul> </li> <li>Road projects should prioritize safety through context sensitive purpose and design, and appropriate design speed</li> <li>Address multimodal capacity, not just demand management</li> <li>Evaluate all projects on equal grounds, using recommended performance measures.</li> <li>Safety and crash reduction projects are likely to improve health when context-sensitive</li> <li>Road pricing may improve health, primarily on existing lanes</li> <li>New roads may have better health impact and benefit-cost ratio than expanding existing roads</li> </ul>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Regional Development Guide</p>	<ul style="list-style-type: none"> <li>Positive objectives to support good health</li> <li>Emphasizes development around activity centers, which are likely to support health</li> <li>Conservation and parking guidelines are lacking or relatively weak</li> <li>Some sensitive uses may be close to busy roads or truck routes</li> </ul>	<ul style="list-style-type: none"> <li>Maximize land use diversity</li> <li>Restore connectivity</li> <li>Allow contextually-appropriate density</li> <li>Support codification of multimodal amenities and public space in new development</li> <li>Conserve land outside of “Places” (developed or undeveloped)</li> <li>Support equitable distribution of centers, especially major employment districts</li> <li>Work with local partners to discourage locating new residences, schools (high school and younger), hospitals, etc. away from high volume roads.</li> <li>Continue to refine methodology for identifying “Places”</li> </ul>

<p>Livable Centers Initiative</p>	<ul style="list-style-type: none"> <li>• Activity centers associated with many positive health determinants</li> <li>• CQGRD 2009 LCI and Health report found that LCIs promote healthy places, as long as they are inclusive and accessible for people of differing income, age, family size, and ability.</li> <li>• The degree of implementation of LCI studies determines the actual health impact.</li> <li>• The LCI program coordinates and integrates transportation projects with land use</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure that all determinants of healthy mode share, access, and safety are present</li> <li>• Ensure that LCI content meets demand and daily needs</li> <li>• Work with communities to create nodes in underserved areas</li> <li>• Develop push-pull strategies to conserve areas outside of centers</li> <li>• Operationalize HIA and healthy community design in LCI studies</li> </ul>
<p>Bicycle and Pedestrian Program</p>	<ul style="list-style-type: none"> <li>• Establish demand for pedestrian and bicycle:             <ul style="list-style-type: none"> <li>• Mobility and access along regionally-significant roadways</li> <li>• Access to transit stations</li> <li>• Access along transit corridors</li> <li>• Access to regionally significant facilities</li> <li>• High risk zones: crashes, carless households, elderly</li> <li>• Livable Centers and other centers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Refining the protocol for a regional priority map</li> <li>• Ensuring that all projects include contextually-appropriate bicycle and pedestrian accommodations</li> <li>• Several demand assessment methods are suggested in the full report</li> </ul>
<p>Lifelong Communities</p>	<ul style="list-style-type: none"> <li>• Program Goals             <ul style="list-style-type: none"> <li>• Promote Housing and Transportation Options</li> <li>• Encourage Healthy Lifestyles</li> <li>• Provide Access to Services and Resources</li> </ul> </li> </ul> <p>Seniors need</p> <p>Multimodal transportation</p> <p>Livable centers</p>	<ul style="list-style-type: none"> <li>• Increase share of multimodal funding in plan</li> <li>• Address senior housing needs</li> </ul>
<p>Equitable Target Area Analysis</p>	<p>Considers: Age, Education, Median Housing Value, Poverty, Race</p> <p>Found that projects are balanced among ETA and non-ETA areas</p> <ul style="list-style-type: none"> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• In future, repeat assessment with health vulnerability measures</li> <li>• Incorporate health metrics</li> </ul>

## Using the Results and Recommendations

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Potential uses of the HIA and its recommendations vary by role. Throughout the report, locate relevant recommendations by looking for the symbol that most closely matches your role.

### ① For Atlanta Regional Commission boards and committees

Using the HIA recommendations to formulate future amendments to Plan 2040; using the HIA recommendations to revise the regional planning process; publicly endorsing the HIA findings; conducting HIA in planning and project development activities; encouraging ARC staff to implement HIA recommendations; encouraging constituent jurisdiction(s) to implement HIA recommendations and methodology; fostering relationships with the public health department; appointing individuals with public health credentials to advisory boards; remaining informed and concerned about healthy public policy.

### ② For Atlanta Regional Commission staff and other regional agencies

Implementing the HIA findings and recommendations to develop plans, policies, projects, and programs; using the HIA recommendations to advocate for changes to regional planning and project development; learning how to use HIA methodology to evaluate plans, policies, projects, and programs; fostering relationships with the public health department and other health professionals; learning how to use public health data in planning; understanding how your work affects health, safety, and welfare; seeking credentials in public health for planning; reviewing relevant items from the Resources section, below.

### ③ For federal and state agencies and governing bodies

Using the HIA recommendations to revise regional land use and transportation planning requirements and transportation funding formulas; publicly endorsing the HIA findings; using HIA in planning, policy, and program development; supporting HIA methodology in planning; fostering relationships with public health agencies; appointing individuals with public health credentials to advisory boards; remaining informed and concerned about healthy public policy.

### ④ For city and county elected officials

Using the HIA results to pass a “health in all policies” ordinance; publicly endorsing the HIA findings; giving planning, zoning, and public works staff explicit encouragement and support to use the HIA findings in their work; fostering relationships with the public health department; appointing individuals with public health credentials to key positions in your government’s departments and advisory boards; remaining informed and concerned about healthy public policy.

### ⑤ For city and county planning, zoning, and public works departments

Using the HIA results to update plans, policies, projects, and ordinances; using the HIA to better understand how your work affects health, safety, and welfare; fostering relationships with the public health department and other health professionals; providing public health partners with the results of monitoring and evaluation activities; learning how to use public health data in planning; seeking credentials in public health for planning; reviewing relevant items from the Resources section, below.

### ⑥ For developers

Using the HIA results to update current and future development plans; hiring individuals with public health credentials to work in your firm; sharing healthy design resources with your professional networks, including clients and consultants; reviewing relevant items from the Resources section.

### **7 For residents, workers, and neighborhood or business associations**

Sharing your opinions about HIA, healthy community design, and healthy public policy with elected officials, public candidates, and planning entities; inviting individuals with public health credentials to assist with community planning activities and participate in local advisory boards; remaining informed and concerned about healthy public policy.

### **8 For public health officials**

Monitoring health indicators in the area; sharing data between ARC and your agency; providing additional healthy public policy resources to decision-makers and community members; remaining informed and concerned about healthy public policy.

### **9 For anyone who wishes to conduct their own HIA**

Please see the Resources section, below.

## Resources

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### Transportation

- Active Living By Design (North Carolina Institute for Public Health/UNC Gillings School of Global Public Health): <http://www.activelivingbydesign.org/>
- Active Living Research resources page (Robert Wood Johnson Foundation): <http://activelivingresearch.org/toolsandresources/all>
- Complete Streets: <http://www.smartgrowthamerica.org/complete-streets>
- Federal Highway Administration:  
[http://www.fhwa.dot.gov/planning/transportation\\_safety\\_planning/index.cfm](http://www.fhwa.dot.gov/planning/transportation_safety_planning/index.cfm)  
[http://www.fhwa.dot.gov/environment/bicycle\\_pedestrian/index.cfm](http://www.fhwa.dot.gov/environment/bicycle_pedestrian/index.cfm)
- American Association of State Highway and Transportation Officials (AASHTO)/Institute of Transportation Engineers (ITE)/Congress for New Urbanism – “Designing Walkable Urban Thoroughfares: <http://www.ite.org/css/> or <http://www.cnu.org/streets>

### Access

- ChangeLab Solutions: healthy planning & food access: <http://changelabsolutions.org/healthy-planning>
- National Association of Home Builders on compact and mixed-use development: <http://www.nahb.org/generic.aspx?sectionID=628&genericContentID=16945>
- Smart Growth America (SGA): <http://www.smartgrowthamerica.org/>

### Community

- Project for Public Spaces: <http://www.pps.org/>
- SGA on revitalization: <http://www.smartgrowthamerica.org/issues/revitalization/>

### Environment

- Environmental Protection Agency (EPA) general information: <http://www.epa.gov/>
- EPA – Environmental Management Systems: <http://www.epa.gov/EMS/index.html>
- EPA – Smart Growth Resources: [http://www.epa.gov/smartgrowth/sg\\_implementation.htm](http://www.epa.gov/smartgrowth/sg_implementation.htm)
- Georgia Dept. of Natural Resources - Partnership for a Sustainable Georgia: <http://www.gasustainability.org/partnership>
- Smart Communities Network – Eco-Industrial Parks: <http://www.smartcommunities.ncat.org/business/ecoparks.shtml>
- US Green Building Council/LEED: <http://www.usgbc.org/>

### HIA Method and Practice

- UCLA HIA Clearinghouse Learning & Information Center: <http://www.hiaguide.org/>
- Online HIA training: <http://professional.captus.com/Planning/hia2> (free)
- Online HIA resources: <http://www.hiaguide.org/training/training-guides/presentations-cdcnacchoapacla-hia-training-workshop>
- CDC on HIA: <http://www.cdc.gov/healthyplaces/hia.htm>
- World Health Organization on HIA: <http://www.who.int/hia/en/>
- International HIA Gateway: [http://www.apho.org.uk/default.aspx?QN=P\\_HIA](http://www.apho.org.uk/default.aspx?QN=P_HIA)
- CQGRD HIA resources: <http://www.cqgrd.gatech.edu/research/healthy-places-impact-assessment/projects>

### **Public Health for Planning and Policymakers**

- APA: <http://www.planning.org/nationalcenters/health/healthimpactassess.htm>  
Also, many planning conferences and events now include sessions on healthy places
- CDC Healthy Community Design: <http://www.cdc.gov/healthyplaces/default.htm>
- American Public Health Association (APHA): <http://www.apha.org/>
- National Environmental Health Association (NEHA): <http://www.neha.org/index.shtml>
- Federal Highway Administration Community Impact Assessment:  
[http://www.ciatrans.net/CIA\\_Quick\\_Reference/Purpose.html](http://www.ciatrans.net/CIA_Quick_Reference/Purpose.html)

### **Local Resources**

- 15-hour Graduate Certificate in Public Health at Georgia State University:  
<http://publichealth.gsu.edu/564.html>
- Healthy Places Research Group: <http://www.cggrd.gatech.edu/healthy-places-research-group/overview>
- Southface – Green building services and host of Sustainable Atlanta Roundtable:  
<http://www.southface.org/>

### **SOURCES:**

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# Background

## *Introduction*

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The Center for Quality Growth and Regional Development (CQGRD) with support and funding from the Health Impact Project, a collaboration of the Robert Wood Johnson Foundation and The Pew Charitable Trusts, conducted a Health Impact Assessment (HIA) on Plan 2040, the long-term regional comprehensive plan adopted by the Atlanta Regional Commission (ARC). This proposed plan will integrate multiple aspects of regional planning, including transportation and land use, housing, greenspace, water, and air quality, as well as changing demographic and economic scenarios. This unified regional planning effort includes a new Regional Transportation Plan through the year 2040, including a six-year priority Transportation Improvement Program (TIP). It will also include a comprehensive Regional Development Plan for the region's 10-county core that will guide future growth and offer policies for shaping the character and function of the region. CQGRD has concluded that there are major potential health impacts, both positive and negative, associated with such a plan.

The objective is to integrate the HIA process into the larger planning process to the greatest extent possible. An HIA will ensure the explicit consideration for the human health impacts in regional transportation and land use planning. Secondly, it will increase the capacity for HIA practice through activities with community and research partners, and develop a prototypical approach for measuring and improving regional planning outcomes. Ultimately through the HIA process, we seek to present sustainability, economic benefit, and health as mutually-supportive and attainable goals of transportation and land use planning.

Like much of the U.S., the Atlanta region anticipates a marked increase of residents over 65, in number and proportion of the total population. This change is expected to drive substantial changes in the demand for housing, transportation, and services including medical care. ARC also forecasts major changes in racial/ethnic distribution and employment sectors. Whites will no longer be in the majority and population growth will outpace employment growth. Currently, the Atlanta region also faces many challenges linked to its land use and transportation practices. These include traffic congestion, air pollution, lack of affordable housing, stress, physical inactivity, and, for many residents, inadequate access to goods and services.

Why should we think about health in a regional planning exercise? The scientific community has come to realize that it takes more than a doctor's visit and a gym membership for people to be healthy. Many Americans currently live in a place where staying healthy is considerably more expensive and difficult than unhealthy options. These conditions have been created unintentionally, as urban planning sought to reduce overcrowding, limit environmental exposures, and implement sanitary standards. Charged with protecting the health, safety, and welfare of the populace, new policies were created to separate homes and businesses, place restrictions on development density, and regulate industry. These changes successfully mitigated many of the health threats of the time. But new health threats began to arise. The new urban form is now seen as contributing to involuntarily sedentary lifestyles, to traffic crashes, to air pollution, and to social and economic isolation. Six of the ten leading causes of death can be partially attributed to these factors, as well as significant percentage of injury, illness, and disability.

Planning for healthy places does not have to be more expensive or compromise other planning objectives. A healthier population can contribute to positive economic outcomes through increased productivity and quality of life. Research suggests that many elements of healthy community design correspond with reduced infrastructure and operational costs and higher tax revenue. Additionally, tax expenditures for Medicare, Medicaid, and other publicly-funded health programs could be significantly reduced. Although our planning, public works, and health agencies have very different mission statements, they share the same fundamental set of responsibilities to American taxpayers and citizens. If government services and economic prosperity are threatened by the new disease burden, all agencies need to react. For planning agencies, this means using scientific discoveries about healthful regional planning as a key part of their planning and project selection criteria.

## What is Health Impact Assessment (HIA)?

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.” 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.

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, 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 socio-ecological 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).

Because HIAs are intended to make health considerations part of the decision-making process, HIA methodologies all share six critical steps:

### **Screening**

Before conducting an HIA, a quick assessment, called a screening, is conducted to decide whether an HIA is warranted and if further action is required. The screening examines whether the policy, program or project being assessed is likely to impact health to a significant extent and whether opportunities to improve the outcome exist.

### **Scoping**

Scoping is a process for establishing the issues to be examined by the HIA by identifying possible negative consequences and benefits associated with the project, the boundaries for analysis, and steps for managing the HIA. Scoping utilizes health status and existing conditions data, initial literature review, and stakeholder participation.

**Appraisal**

Appraisal requires characterizing the nature and magnitude of both harmful and beneficial impacts. The resulting plan identifies positive and negative effects and determines if they are distributed disproportionately over the affected population. Appraisal consists of analysis, baseline health and demographic profiling of the affected communities, identifying and characterizing potential health impacts and reporting on the impacts and developing an impact management plan. A comprehensive appraisal through a systematic investigation and analysis of health impacts using several different methods to consult stakeholders and acquire new information relevant to the assessment is required.

**Recommendations**

After all quantitative and qualitative data have been analyzed; recommendations for an impact management plan are developed. Recommendations are intended to mobilize changes to the project in order to promote good health.

**Dissemination**

The results of the HIA must be imparted to all stakeholders – including the individuals and organizations that determine policy and the communities affected by these decisions – to support understanding of the HIA and implementation of the recommendations.

**Monitoring and Evaluation**

It is recommended that continuous monitoring of the project be conducted to gauge the accuracy and the appropriateness of the impact measures used in HIA, as well as to evaluate the effectiveness of the HIA and identify process improvement opportunities. In addition, actual health outcomes as a result of the project are evaluated.

Previous instances of using health impact assessment in regional planning are few. The most similar projects are for the Wellington, New Zealand Regional Policy Statement (land use and energy); the Humboldt County, California, comprehensive plan (land use); the Queensland, Australia, regional land use plan, and London, England's draft plans (multisectoral including development, transport, social services, and others). Whitmarsh, Turnpenny, and Nykvist (2009) tested a similar process, Integrated Sustainability Assessment for achieving long-term sustainable mobility planning, and found that the social learning created through extensive stakeholder participation and scenario modeling were essential to significantly transform planning results. Forsyth, Slotterback, and Krizek (2010) identified short audit tools, rapid HIA, and threshold mapping as useful methods, among others, for conducting HIA on land use planning. Gunning, Harris, and Mallett (2011) looked at the Queensland case and reported that the regional plan would potentially impact health equity (the inequitable distribution of health status and health impacts across the population, frequently related to economic status, age, racial or ethnic identity, and other characteristics).

## About Health Impact Assessment (HIA) for Planning

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”. HIA is predicated on the concept of health being “a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity,” where groups or individuals can “identify and realize aspirations, to satisfy needs,

and to change or cope with the environment.”<sup>1</sup> 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 given project. The recommendations provide practical solutions that seek to magnify positive health impacts, and remove, mitigate, or minimize negative impacts.

HIA is important to planners because there are many factors – including biological, social and economic, environmental, lifestyle, services, and policy – that influence the ability of a person to be healthy. Of these, there are many factors of the built and policy environments that influence health. It is in these areas where planners can use HIA to inform their work.

Within an HIA, assessment methods follow six basic steps: screening to determine justification of the HIA as a demonstration project, scoping to outline the possible consequences and benefits and identify the boundaries for appraisal, appraisal characterizing the nature and magnitude of both harmful and beneficial impacts, making recommendations for impact management, dissemination of the recommendations to all stakeholders, and monitoring and evaluation to determine the effectiveness of the HIA and identify process improvement opportunities.

HIA works by compiling evidence from health studies that have been reviewed by the scientific community. For example, the assessment might look at all of the peer-reviewed research regarding possible connections between land use and motor vehicle crash rates. Ethical use of the evidence means that researchers only make statements that can be reasonably supported by existing, rigorous studies. Where possible, this work will describe the existing research and explain the likelihood and magnitude for potential health outcome. At all times, HIA methodology will be made transparent so that readers can draw their own conclusions about the findings and recommendations. To be most effective, HIA addresses the real-world tradeoffs that must be made between competing objectives, limited budgets, and conflicts between the interests of different populations (Ezzati, 2003).

In this document, HIA will identify connections between Plan 2040 and the health and quality of life of area residents. It will also identify opportunities to improve health through the project selection and funding criteria, suggest priorities, and highlight any missed opportunities. The format of the HIA is comprehensive: greatly detailed with original literature review and data analysis, plus stakeholder participation. It is primarily concurrent – conducted simultaneously with the adoption of the plan – but also prospective in the sense that it provides recommendations for future regional planning efforts.

## Health Impact Assessment in Regional Planning

Health is not merely the absence of illness, but complete physical, mental, and social wellness. Good health is prevalent in communities where healthy choices are easy and affordable. Land use and transportation can have unintended effects on health, quality of life, and economic wellbeing in ways that have not been captured in conventional planning practices. The way that we envision, plan and build our region can help promote active lifestyles, improve traffic safety and air quality, and promote economic and social connectivity. These factors play a role in seven of the ten leading causes of death as well as significant percentage of injury, illness, and disability in our region. Healthy and safe community environments include those with

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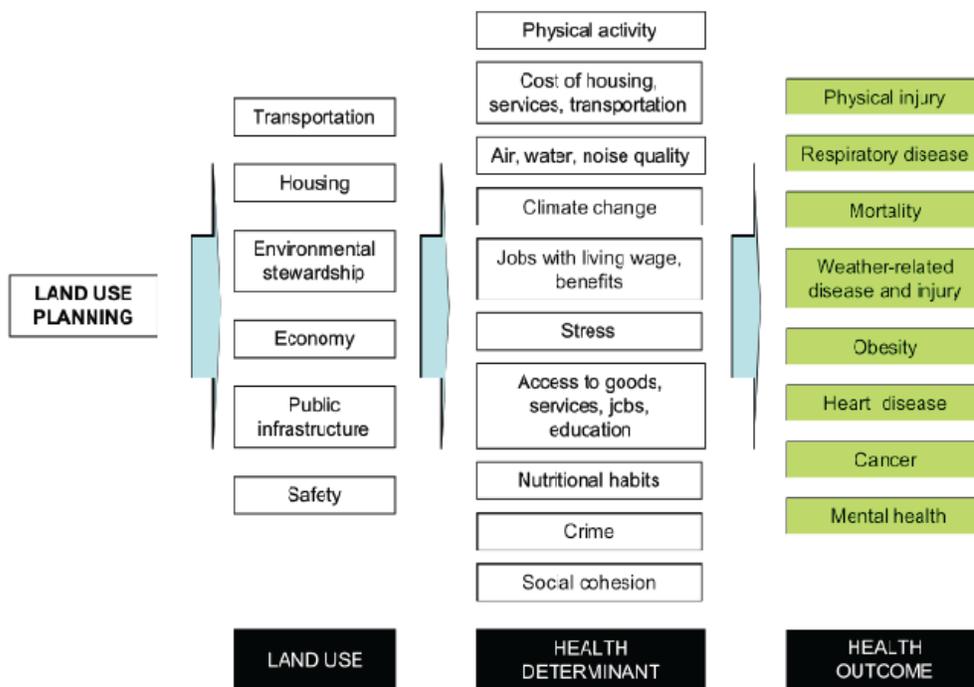
<sup>1</sup> These expanded definitions of health are taken from the World Health Organization and the 1986 Ottawa charter for Health Promotion’s concepts.

affordable, sustainable, and economically vital neighborhoods, clean air and water, and accessible places for an aging and diverse population. PLAN 2040, the long-term regional comprehensive plan being prepared for the Atlanta region by the Atlanta Regional Commission (ARC), represents an unprecedented opportunity to influence the long term health, sustainability, and prosperity of the region.

As Health Impact Assessment has only recently begun to be utilized in the United States, few assessments have been conducted for a regional comprehensive plan such as Plan 2040. HIAs in the United States largely focus on localized projects or plans, and few HIAs on regional transportation or comprehensive plans have been conducted. Although the study areas are not as extensive as the Atlanta metro area, county-level comprehensive plan HIAs provide methodological context for the Plan 2040 assessment.

Two HIAs of county-level comprehensive plan updates have been recently funded by the Minnesota Health Department (Minnesota Health Department, 2011), and the City of Ramsey (MN) HIA intended to inform an upcoming comprehensive plan update (City of Ramsey, 2008). The City of Ramsey HIA utilized a “threshold analysis” methodology, which defined relevant quantitative indicators for each health topic area and rated the study area based on performance. These HIAs were conducted with the assistance of the Design for Health project at the University of Minnesota, which has developed a review checklist to assess health impacts for neighborhood, transportation and comprehensive plans. The checklist was designed to match plan elements required by the regional council, but could be utilized in other regions (Design for Health, 2007).

In Humboldt County, California, an HIA was completed to assess the county’s long-range comprehensive land-use plan. This assessment compared the three land-use Plan Alternatives outlined in the long-range plan and evaluated how land-use indicators and corresponding health outcomes would change based on these possible futures. This HIA revised the Healthy Development Measurement Tool devised by the San Francisco Department of Public Health to create a rural-focused analysis tool. Specific health and land-use indicators were chosen based on stakeholder input, and comprised six categories: housing, transportation, public infrastructure, economy, public safety, and environmental stewardship (Humboldt County Public Health Branch, 2008, see Figure 1).



**Figure 1: Land Use Indicators and Health Outcomes (Humboldt County Public Health Branch, 2008)**

Through a partnership between the tri-county regional council and a public health advocacy organization, an HIA was conducted to assess transit alternatives between the Portland (OR) area and the city of Lake Oswego (Oregon Public Health Institute, 2010). This HIA evaluated potential health outcomes of each transit alternative (no-build, enhanced bus service, and streetcar) as devised by the regional council, preparing recommendations for the regional transit agency in each case. OPHI also conducted an evaluation of recommendation implementation, methodology, and use of the HIA for knowledge and capacity building. This evaluation plan included a detailed set of questions, with relevant methodology and indicators.

Several regional health impact assessments have been conducted in Europe and Australasia, especially focusing on regional policy statements and plans. For example, the London Health Commission carried out a health impact assessment on the Mayor's draft strategies for comprehensive spatial development in the London region (Opinion Leader Research, 2003). By the end of the summer of 2002, HIAs had been carried out on six draft strategies: transport, economic development, air quality, biodiversity, municipal waste management and energy.

Another HIA was conducted in England to assess the potential health impacts of the transportation chapter of the West Midlands Regional Planning Guidance (2005). Its assessment of health impacts of transportation in the West Midlands region included analysis of car ownership and travel behavior, pollution exceedances, and measures of physical activity in the region (i.e. percentage of inactive adults). In terms of formulating a regional transportation plan HIA, it was critical that each local highway authority in the region had conducted one for its transportation plan, and that several other HIAs had been conducted nationally. Generally, the HIA assessed the health implications of minimum and maximum implementation of the planning guidance, focusing on the 12 policies in the transportation chapter assessed as scenarios. Reflecting on the regional HIA process, the authors recognized

the difficulty of assessing health impacts on policies (rather than programs), large number of stakeholders, and difficulty of time constraints and quality of information available.

A HIA on the Greater Christchurch Urban Development Strategy (New Zealand) involved four local governments, the regional council and the national transport agency. This initiative appraised health impacts for four growth management scenarios (business as usual, concentration, consolidation and dispersal) and drafted recommendations. Although advisory groups and stakeholder interviews outlined intersectoral collaboration as an important impact of the HIA process, recommendations regarding intersectoral collaboration were not adopted into the final UDS. The HIA final report was accepted by the Urban Development Strategy forum, and 24 of 32 recommendations were included in the final draft UDS, 17 of which as “action points” (Maathias & Harris-Roxas, 2009). An evaluation of the HIA’s impacts and effectiveness revealed that the Greater Christchurch UDS HIA has contributed to intersectoral initiatives, inclusion of health considerations into public policy discussions and engagement with the Maori.

The Greater Western Sydney Urban Development HIA assessed three regional plans, Sydney Metropolitan Strategy, the NSW State Plan and Growth Centres planning, examining potential effects on population health and wellbeing of planned population growth and urban development in Greater Western Sydney (GWS) over the next twenty five years (Western Sydney Regional Organisation of Councils, 2007). The report found that a population increase will be accompanied by large scale development of housing, transport, employment and social infrastructure; all changes that can potentially affect the health and wellbeing of new residents and people living across the region.

The Canterbury Regional Transport Plan HIA assessed potential health impacts based on the 30-year transportation plan (Gourdie, 2010). The Canterbury HIA utilized simulation models to forecast impacts of two transportation investment scenarios on health-based performance measures. The results indicated that the “increased active and public transport” scenario would lead to improved health outcomes for the region. Another regional planning-focused HIA assessed two provisions of the Wellington (NZ) Regional Policy Statement (Regional Form and Energy), which addresses 12 resource management topics to guide sustainable development in the Greater Wellington area. Main recommendations of the HIA include supporting current housing, renewable energy and densification policies. The HIA also recommended greater emphasis on equity considerations and increased education relating to greenhouse gas emissions.

Regional HIAs in Europe, Australasia and the U.S. demonstrate a precedent for assessing health impacts of regional planning efforts such as Plan 2040. Several of these HIA processes also include efforts to evaluate their impacts and effectiveness, which is particularly essential for impact assessments of governmental plans. Some innovative methodologies of regional HIAs include measurement tools, land-use scenario modeling and “threshold analysis.” Although some examples of comprehensive planning HIAs exist in the U.S., the Plan 2040 assessment is one of the earliest HIAs of a regional comprehensive plan for a major metropolitan area.

## The Atlanta Region

### Regional Demographic and Health Characteristics

The Atlanta region is diverse, home to people of many different racial and ethnic identities, ages, and incomes. However, a range of geographic, cultural, and economic forces has resulted in unique spatial distribution for each characteristic of the population. Table 1 shows the demographic breakdown of the population in the Atlanta region.

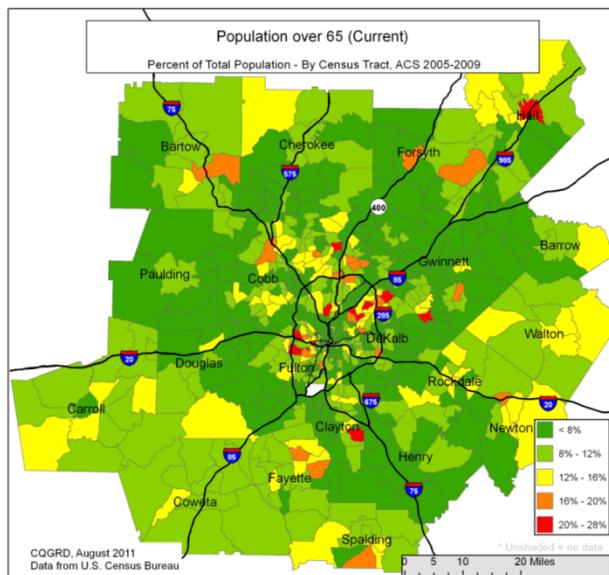
**Table 1: Demographic breakdown of Atlanta region, by county**

	10 County	18 County	20 County	Total Pop <sup>1</sup>	African American <sup>2</sup>	Hispanic <sup>4</sup>	Under 18 <sup>2</sup>	Over 65 <sup>2</sup>	Total Emp <sup>3</sup>	% total pop	MHHI <sup>2</sup>
Barrow				66,400	13%	8%	28%	8%	14,866	22%	\$46,180
Bartow				94,300	9%	6%	28%	10%	30,578	32%	\$46,202
Carroll				111,300	18%	5%	26%	10%	36,663	33%	\$45,380
Cherokee				205,900	6%	9%	28%	7%	44,242	21%	\$64,922
Clayton				281,900	61%	12%	29%	7%	114,760	41%	\$43,583
Cobb				676,800	23%	12%	26%	8%	311,082	46%	\$63,514
Coweta				119,600	17%	6%	27%	9%	31,368	26%	\$59,341
DeKalb				731,200	53%	10%	24%	8%	293,702	40%	\$50,166
Douglas				128,800	36%	6%	28%	7%	38,036	30%	\$49,544
Fayette				106,700	21%	4%	24%	11%	36,362	34%	\$76,633
Forsyth				172,700	3%	8%	28%	7%	59,202	34%	\$83,000
Fulton				957,900	43%	8%	24%	8%	687,142	72%	\$56,162
Gwinnett				757,300	21%	18%	28%	6%	295,315	39%	\$58,566
Hall				175,400	7%	26%	28%	9%	68,261	39%	\$49,015
Henry				192,800	33%	5%	29%	7%	45,619	24%	\$63,660
Newton				97,000	36%	4%	29%	9%	20,005	21%	\$50,207
Paulding				128,400	16%	5%	29%	6%	20,864	16%	\$62,302
Rockdale				85,000	41%	10%	26%	9%	29,154	34%	\$49,447
Spalding				65,700	33%	3%	27%	12%	20,981	32%	\$41,906
Walton				78,700	16%	3%	26%	11%	17,621	22%	\$47,466
<b>Total</b>				<b>5,233,800</b>	<b>31%</b>	<b>11%</b>	<b>26%</b>	<b>8%</b>	<b>2,215,823</b>	<b>42%</b>	

1. Atlanta Regional Commission 2009 Population Estimates
2. US Census Bureau 2009 American Community Survey, except for Spalding County which is 2006-2008 ACS data
3. Atlanta Regional Commission 2009 Employment Estimates
4. US Census Bureau 2008 estimates

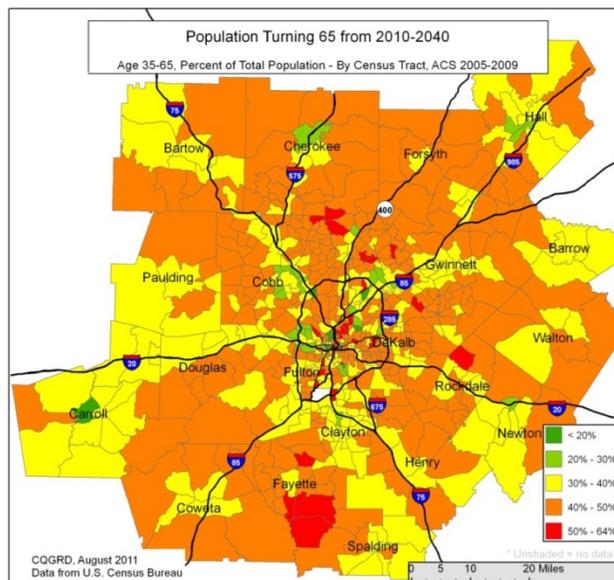
The regional planning area is expected to age considerably by 2040. Although there were concentrations of elderly residents in region in 2009 (Figure 2), by 2040 the percentage of residents over 65 is expected to more than double. Figure 3 shows the percentage of residents that would turn 65 between 2009 and 2040 (without accounting for deaths). The percentage of the population over 65 is also expected to increase, from 8% to approximately 20%.

Additionally, the highest concentrations of disabled persons are found in western exurban counties, as well as Carroll County (Figure 18, 12-16%). These demographic trends have important implications for regional planning, especially health and accessibility.



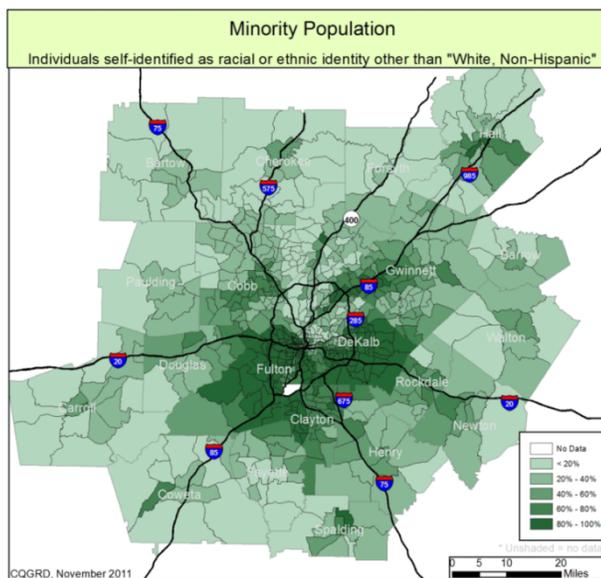
**Figure 2: Population over 65**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau.



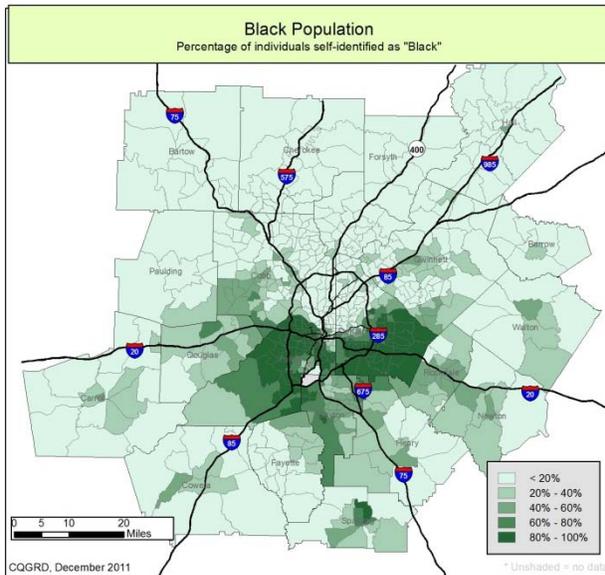
**Figure 3: Population turning 65 by 2040**

Figure 5 through Figure 8 show how racial and ethnic identities are distributed, or concentrated, throughout the region. Looking at ethnicity in more detail, the Asian population is relatively concentrated near Buford highway in the I-85 corridor outside the perimeter (Figure 7). The I-85 corridor also has a high Hispanic population, as do tracts in Hall County (Figure 6). The multiethnic populations in the metro region are relatively dispersed, with significant concentrations in much of the suburban areas (Figure 8). In Figure 4, the overall minority population appears to be located predominantly in Fulton, DeKalb and Clayton counties, as well as Cobb and Gwinnett.



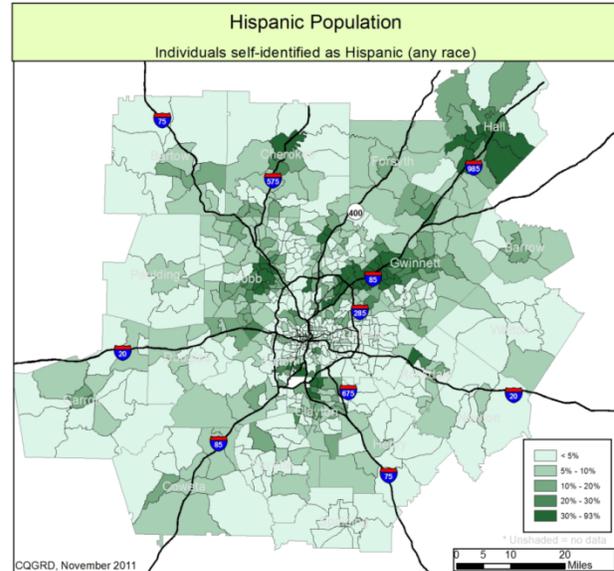
**Figure 4: Minority population**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau

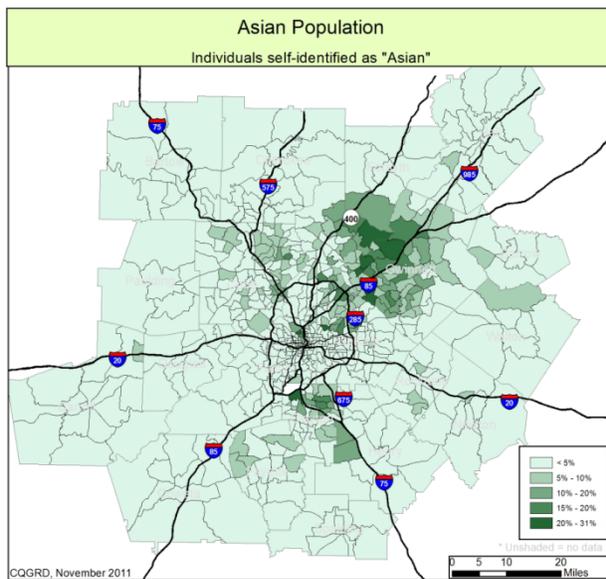


**Figure 5: Black population**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau

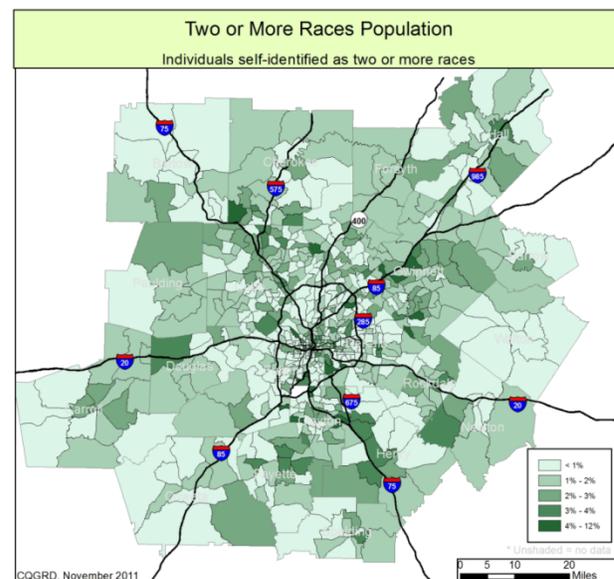


**Figure 6: Hispanic population**



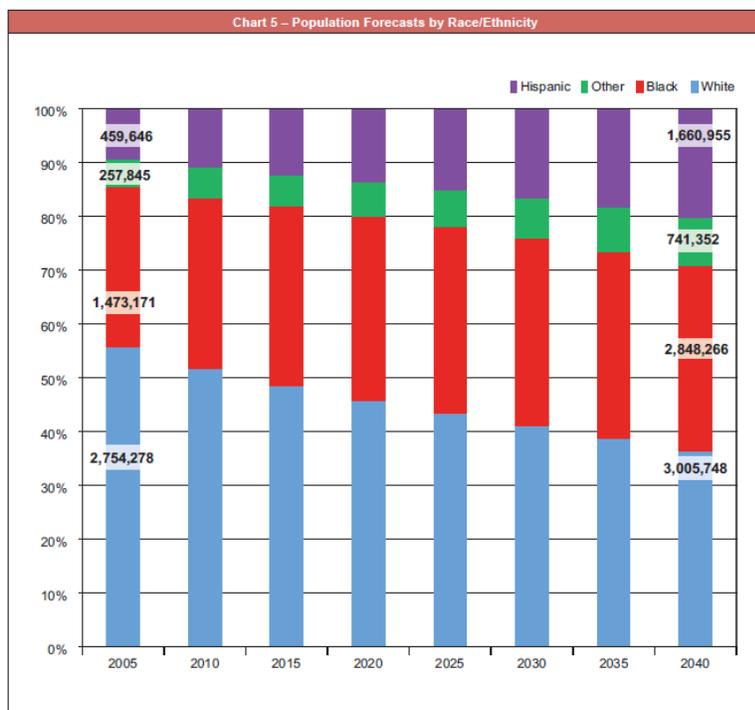
**Figure 7: Asian population**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau



**Figure 8: Two or more races population**

By 2020, it is expected that fewer than 50% of the region's residents will identify themselves as Non-Hispanic White (Figure 9), according to forecasts by the Atlanta Regional Commission. This may have many long term implications for housing and transportation preferences, cultural and socio-economic patterns, and health trends.



**Figure 9: Population forecasts by race/ethnicity**

Source: Atlanta Regional Commission. ARC's 20-County Forecasts: What the Future Holds. *Regional Snapshot*: June 2009

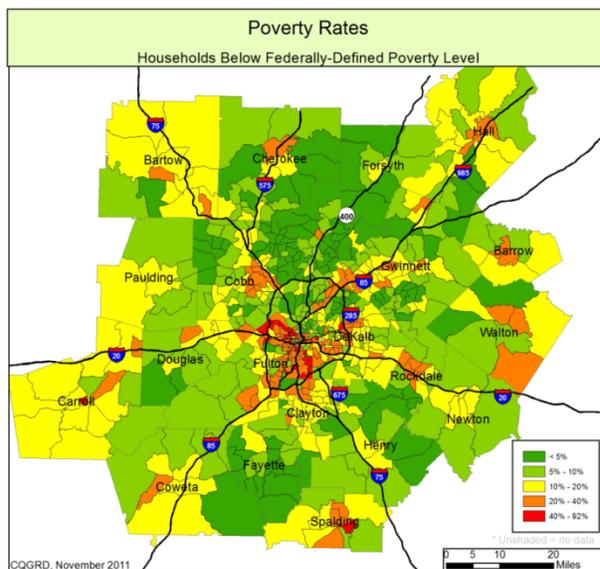
Several counties in the region had relatively large percentages of minority and dependent populations living in poverty. Outer counties Barrow, Bartow, Carroll and Hall and core metro counties DeKalb and Fulton have high percentages of African Americans living below the poverty level. All counties with data available show high levels of Hispanic poverty relative to their overall poverty rates. Clayton, DeKalb, Gwinnett and Forsyth have the highest Hispanic poverty rates. Five outer counties; Barrow, Bartow, Hall, Spalding and Walton, and one core metro county, Clayton, had high levels of dependent population (population under 18 plus population over 65 divided by the population 18-64) as well as high levels of dependent population living in poverty (Table 2).

**Table 2: Poverty statistics by county**

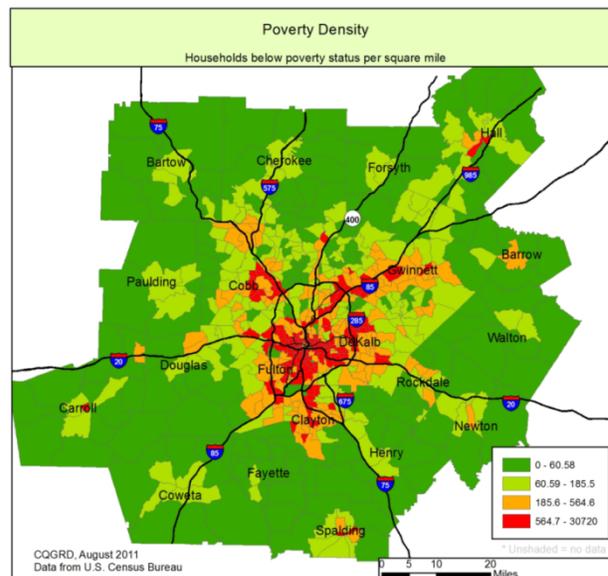
	10 County	18 County	20 County	% of Population In Poverty	% African American in Poverty	% Hispanic in Poverty	% of Dependent Population in Poverty
Barrow				12.6%	23.9%	17.0%	15.6%
Bartow				14.0%	24.4%	30.6%	17.1%
Carroll				17.3%	26.4%	33.4%	18.6%
Cherokee				8.8%	12.2%	21.9%	14.1%
Clayton				16.7%	15.2%	34.6%	21.8%
Cobb				10.6%	15.1%	26.1%	12.8%
Coweta				10.2%	24.6%	18.7%	13.5%
DeKalb				16.1%	18.4%	29.2%	20.9%
Douglas				11.3%	14.1%	20.5%	14.3%
Fayette				4.7%	4.4%	22.4%	5.4%
Forsyth				6.0%	6.6%	22.8%	6.5%
Fulton				15.3%	24.9%	22.4%	19.4%
Gwinnett				11.0%	11.8%	26.4%	13.9%
Hall				14.8%	23.6%	27.8%	18.7%
Henry				8.3%	11.7%	21.4%	10.5%
Newton				12.7%	16.8%	20.6%	14.3%
Paulding				8.2%	7.2%	14.5%	9.8%
Rockdale				12.3%	14.1%	35.1%	15.9%
Spalding***				16.1%	34.8%	28.2%	19.7%
Walton				12.5%	27.6%	50.0%	15.2%

Source: Unless noted, all data are from the 2006-2010 American Community Survey (ACS)

Overall county-level poverty rates showed highest poverty rates in Fulton, DeKalb and Spalding counties (Figure 10). Another indicator of the concentration of poverty, poverty density, highlights areas in south Atlanta, Clayton County, and along highway corridors (Figure 11).



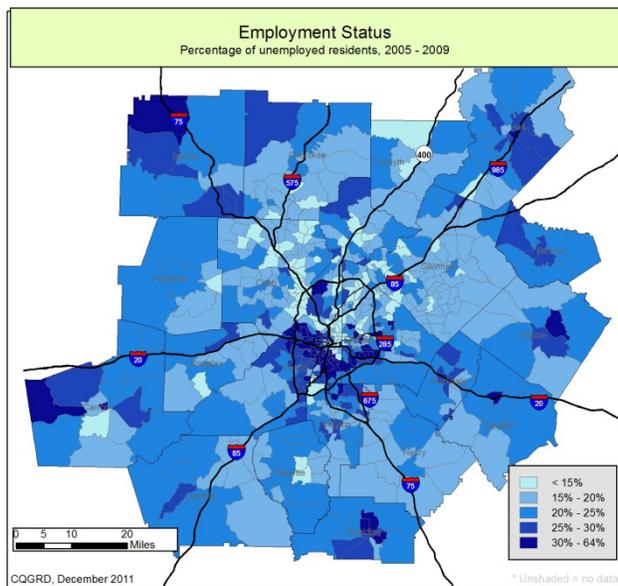
**Figure 10: Poverty rates**



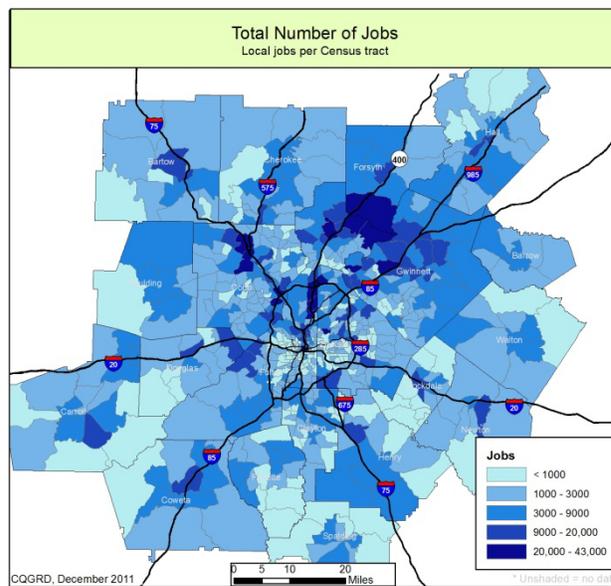
**Figure 11: Poverty density**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau

Turning to socioeconomic characteristics, employment locations were relatively dispersed throughout the region with concentrations in north Atlanta and northern suburban areas (Figure 13). Rates of unemployment were highest in southeast and southwest Atlanta, with additional concentrations at the outer edges and throughout the southern half of the region (Figure 12).



**Figure 12: Employment status by Census tract**



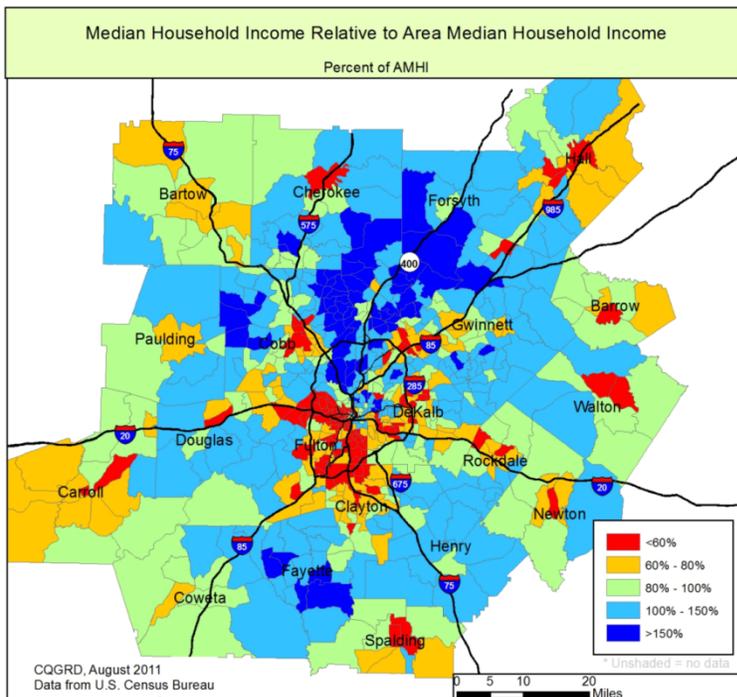
**Figure 13: Number of jobs per Census tract**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau

These spatial trends were echoed in percentage of low-income workers, poverty rates, and percentage of children receiving public assistance (Figure 10 through Figure 17).

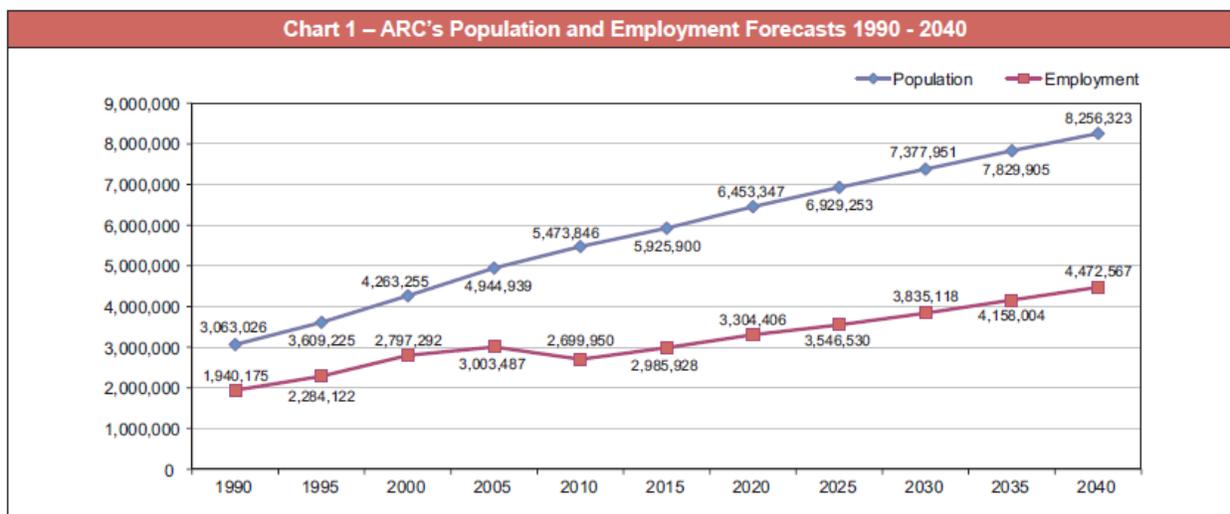
These socioeconomic and spatial trends continue in the spread of median income relative to area median incomes (Figure 14). Median household income varied significantly throughout

the region as well. Figure 14 depicts regional household incomes as a percent of Area Median Household Income (AMHI).



**Figure 14: Median household income relative to area median household income**  
 Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau.

Figure 15 shows ARC’s forecasts indicating that the region’s gains in population will outpace the region’s gains in employment over the next 30 years. The entire region was projected to grow by several million residents.



**Figure 15: Population and employment forecasts**  
 Source: Atlanta Regional Commission. ARC’s 20-County Forecasts: What the Future Holds. *Regional Snapshot*: June 2009

Other measures which potentially affect the regional population’s health status include low levels of education, indicated by lack of a high school diploma (or equivalent) for someone over

the age of 25; children in need or with disabilities, indicated by use of public assistance or Supplemental Security Income (SSI); and individuals with a documented disability. Disability information was not available at the Census tract scale.

The highest rates of population over 25 without a high school diploma were seen primarily in outer counties. Clayton and Douglas counties, core metro counties, have a higher than average rate of population over 25 without a high school diploma (Figure 16). The core metro counties, Clayton, DeKalb, Douglas and Fulton had high rates of population under 18 living in households receiving supplemental security income (SSI) or other public assistance in the past twelve months (Figure 17). High rates were also seen in some of the outer counties.

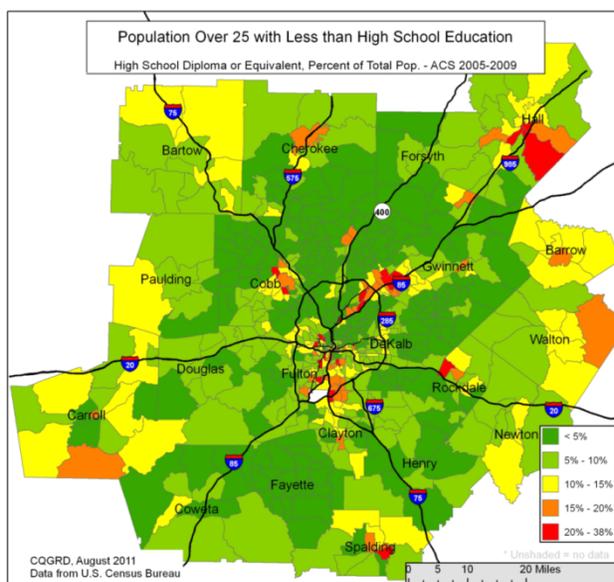


Figure 16: Percent of population over age 25 without high school diploma equivalent

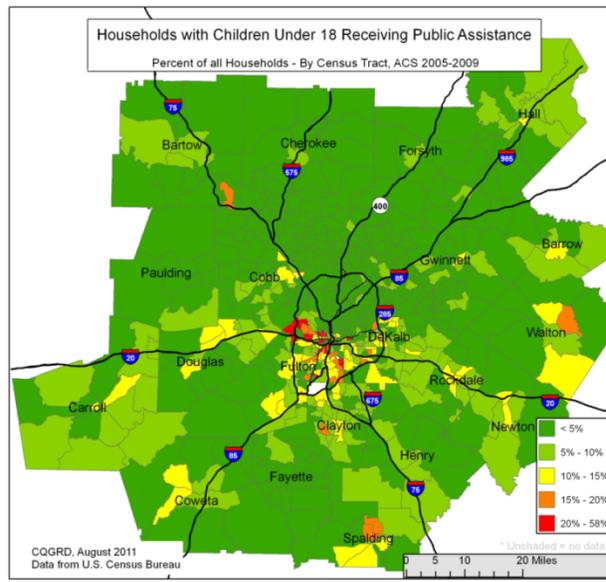


Figure 17: Children under 18 receiving public assistance

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau

The counties with the highest rates of disabilities were outer counties; Barrow, Carroll, Newton and Walton (Figure 18).

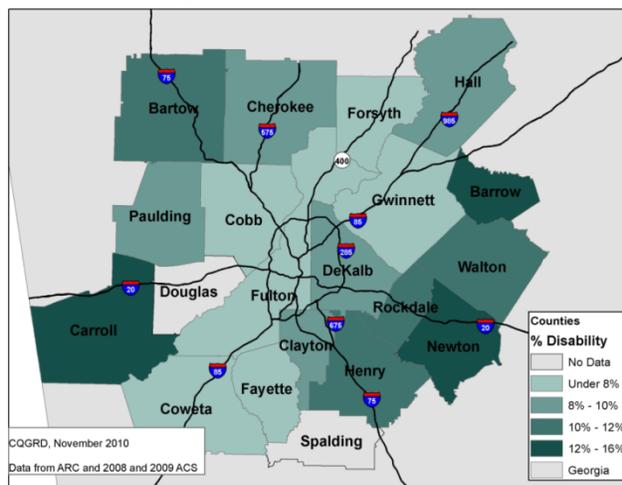
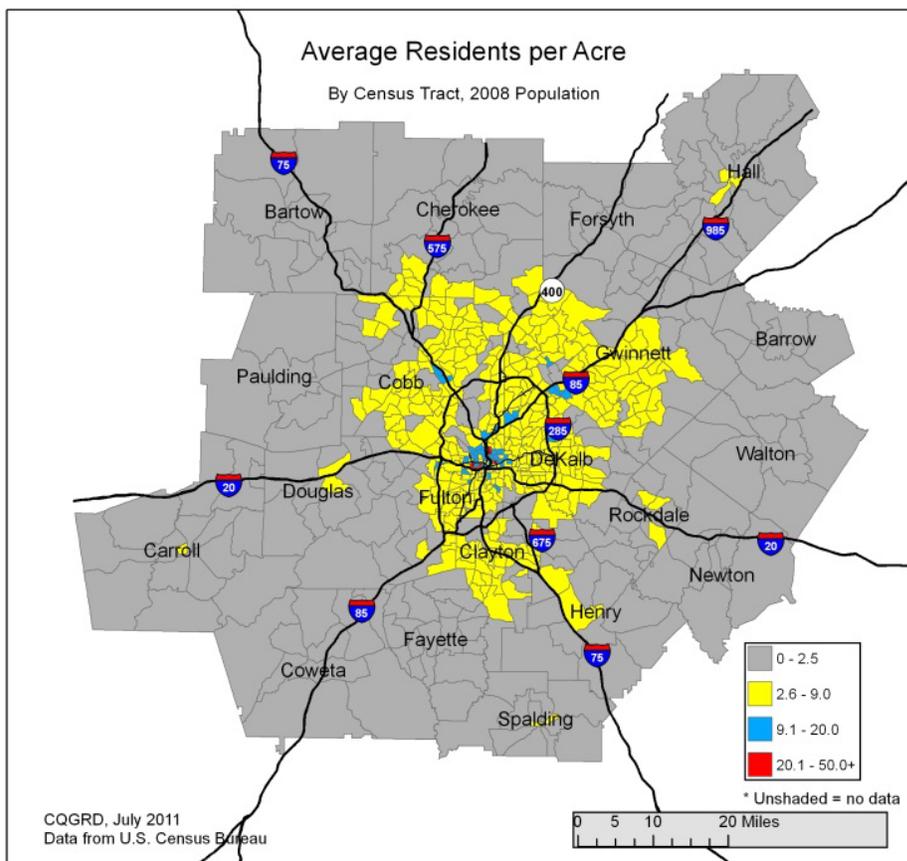


Figure 18: Percentage disability

The HIA team also identified initial differences in transportation and land use patterns. Regional variation in travel mode to work and travel time to work. Throughout the region, mode share for walking and biking trips are low. DeKalb and Fulton counties have the highest rates of public transportation mode share. MARTA (bus and rail) serves these two counties. Data regarding the travel mode to transit are not shown here; non-motorized modes would typically offer more physical activity and fewer emissions than driving or carpooling. Eight of the ten core metro counties have higher than [regional] average percentages of workers who spend 30-60 minutes traveling to work. The core counties of Gwinnett, Henry, Rockdale and Douglas have higher than [regional] average percentages of workers who have a travel time to work of over 60 minutes. These patterns are described and depicted in much greater detail in later sections of the report.

There was also wide variation in land use patterns. The region includes rural areas and clustered skyscrapers, traditional town centers, residential neighborhoods, industrial districts, and many configurations of commercial development. Figure 19 represents residential density in the region. Gray-shaded areas have fewer than 2.5 residents per acre, or about one residential unit per acre, based on regional average household size. Yellow areas have an average density of 2.6 to 9.0 residents per acre. Based on transportation studies, these areas would be more densely settled but unable to support transit service, making them largely reliant on automotive travel. However, these figures represent the average density across the entire Census tract; they do not distinguish higher-density corridors or towns from their surrounding areas. Some medium density areas, in blue, have from 9.1 to 20.0 residents per acre, indicating areas that support frequent transit service and potential walkability. Finally, a few areas in red indicate high density places in downtown and midtown Atlanta.



**Figure 19: Population density**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau

In the Atlanta region, health data are available by county or public health district in tabular format, as well as a few summaries prepared by the Georgia Department of Public Health for the 28-county metropolitan statistical area (MSA). Data are available in visual format only for Census tracts. The region includes all or portions of eight public health districts, shown in Figure 20. At the time of this HIA, the Atlanta Regional Commission did not have any data sharing arrangements with public health departments.

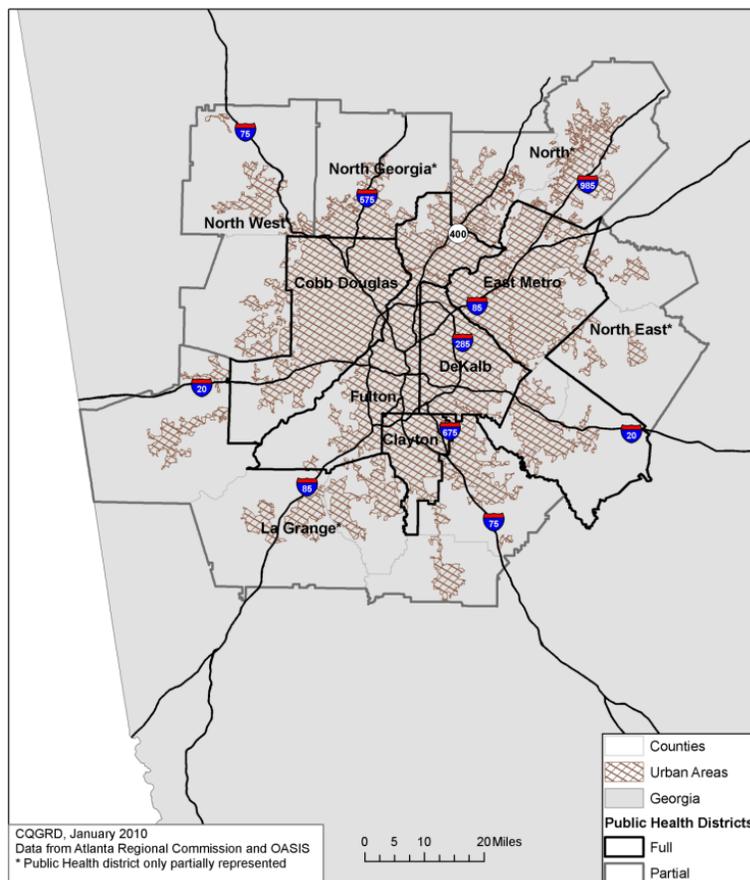
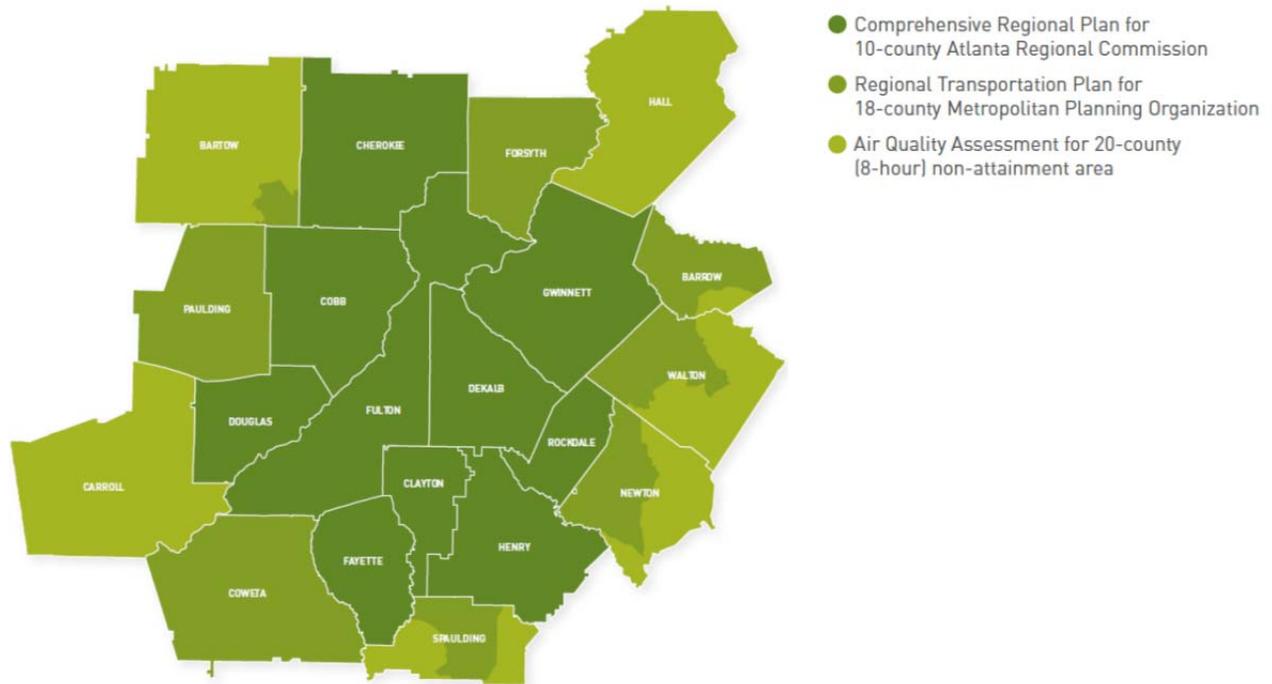


Figure 20: Public health districts

## Atlanta Regional Commission

The Atlanta Regional Commission (ARC) is designated as a Metropolitan Planning Organization (MPO) by the U.S. Department of Transportation (USDOT), as well as a Metropolitan Area Planning and Development Commission and Regional Commission under the laws of the State of Georgia.

As the regional planning and intergovernmental coordination agency, ARC is the forum through which officials of local governments in the Atlanta region confer to solve mutual problems and decide issues of region-wide importance. ARC serves a 10-county development planning area, an 18-county (and partial county) transportation planning area, and a 20-county federal air quality non-attainment area, as well as providing some support for the 28-county Consolidated Statistical Area as designated by the U.S. Census Bureau. Figure 1 shows the boundaries of the 10, 18, and 20 county regions. While most of the work of ARC is in the area of planning, ARC generally does not implement plans. As such, ARC's regional planning may exert significant influence over health outcomes associated with transportation, land use, and other planning activities. State and local government also plays a key role in implementation of plans and projects, particularly in project management, design, and operation/maintenance.



**Figure 21: ARC Boundaries**  
Source: Atlanta Regional Commission

## Plan 2040

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As the MPO for the Atlanta region, ARC is required by the U.S. Department of Transportation (USDOT) to develop a fiscally-constrained long-range Regional Transportation Plan (RTP) that covers a minimum 20-year time span as well as a short-range Transportation Improvement Program (TIP) that covers a minimum of four years. The TIP serves as the prioritized first four years of the RTP, and is subject to more specific, annual fiscal constraint requirements. In an air quality nonattainment area like Atlanta, a Conformity Determination Report must also be prepared to document that the transportation plan will not cause or contribute to worsened air quality.

Every twenty, at a minimum, ARC must update the RTP, and every six years ARC updates the corresponding TIP based on the region's changing vision, demographics, development, and funding. Amendments to the plan and program may be made between updates. Any project seeking federal transportation funds, or any project of regional significance (regardless of fund source) in an air quality nonattainment area, must be channeled through ARC's transportation planning process. Approved transportation projects are implemented by cities, counties, and the state. In the same nature, ARC conducts the regional land use planning process, but development decisions and zoning are implemented by city and county governments. It is important to note that projects falling on local and collector streets are largely excluded from regional plan process because they typically do not require Federal funds or are not considered regionally significant. This is important because many of the types of transportation improvements that are necessary to influence health outcomes are very local in nature and may not be captured in RTP/TIP process directly.

PLAN 2040 is the 29-year long range plan for the Atlanta metropolitan region and is the first ever integrated transportation and land use plan in the region. Under its authority as a regional commission, ARC is responsible for developing and implementing regional planning policies for the 10-county Atlanta Metropolitan region. This includes Georgia's regional planning requirements that call for the completion of a regional assessment, a stakeholder involvement program and a regional agenda. Additionally as part of this process, ARC is required by the Georgia Department of Community Affairs (DCA) to have an "implementation program" for PLAN 2040 which consists of:<sup>2</sup>

1. Guiding Principles: Policies necessary to provide ongoing guidance and direction to regional leaders.
2. Performance Standards: there are two achievement thresholds; minimum standard and excellence standard.
3. Strategies: Recommended activities that actors other than ARC may take to implement the regional plan.
4. Regional Work Program: Specific activities the ARC will undertake to implement the regional plan during the upcoming five-year period (Georgia Department of Community Affairs, 2009).

The previous transportation plan, Envision6, was completed in 2007 and provided the 2008-2013 transportation funding program as well as long-range transportation planning through 2030. In February 2009, ARC initiated the integrated Plan 2040 process, and was completed by July 31, 2011. During 2009 and 2010, ARC staff and board members developed the vision,

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goals and objectives, implementation framework, and draft plan, as well as conducting online and in-person public meetings. During the first half of 2011, the plan was reviewed by board members and outside reviewing agencies. The plan was officially adopted in July 2011.

Plan 2040 generates demographic and employment forecasts through the year 2040 and uses these forecasts as a basis for infrastructure and service demand on a regional scale. The region is projected to grow by approximately 3 million people to a total of 8.3 million by 2040. Job growth projections are slower, growing from 2.7 million in 2010 to 4.5 million by 2040 after declining during the period 2005 to 2010. Overall, the labor participation rate is expected to decline from almost 70% in 2010 to just 62% in 2040 (Atlanta Regional Commission, 2009a). Much of this decline is attributed to the growing proportion of senior citizens while some decline may be directly related to economic or other factors. Regardless of the causes, it raises questions about the functionality or sustainability of a region with relatively low workforce participation.

## Health and Outreach in Plan 2040

Plan 2040 was built on ARC's ongoing efforts to plan and evaluate, educate citizens about the planning process, engage businesses and residents to reveal their needs and desires, and to capture the long-term changes that the region could or should experience. As a result of these efforts, ARC had started to address topics such as health, equity, aging, sustainability, and livability. This included:

- A forum on health during the Fifty Forward initiative, a series of quarterly "future forums" held during 2008 and 2009 to explore trends, issues and possibilities for the Atlanta region during the next 50 years.
- Three regional forums on health hosted by the Civic League of Regional Atlanta in 2009 and 2010.
- Goals and objectives related to health in Plan 2040.

In addition to these initiatives which focused explicitly on health, it should be noted that many of ARC's other activities deal with health determinants in indirect ways. Planning and visioning efforts that consider sustainability, equity, aging, housing, transportation, land development, energy, and many other topics will also touch on the elements of a complete, healthful community.

### Health in Fifty Forward

The Fifty Forward health forum noted that access to health care (location of services and ability to afford service) was influenced by planning, but also discussed the role of environment and behavior in overall health and disease prevention. The forum referenced access to healthy food, walkable communities that support active transportation, and clean air as three key examples of ways that the built environment impacts health. It also endorsed a "health in all policies" approach.

### Regional Health Forums

Between October 2009 and January 2010, the Civic League for Regional Atlanta held three forums on the topic of health, in different locations around the Atlanta region. The events were held in Clayton County, Decatur, and Gwinnett County in support of the Fifty Forward initiative. Around 150 people participated. Participants were asked: How can we make the Atlanta Region the healthiest region in the country? Common themes included:

- Encourage walking, biking and other forms of active transportation with appropriate community design, such as sidewalks, trails, and walkable destinations.

- Encourage people to eat healthier foods by making fresh vegetables and other healthy foods more available, such as with stores and community gardens.
- Coordinating public policy with health care initiatives and services.
- Supporting mental, social, and physical wellbeing in all ways, including education, community interaction, and stimulating environments.

### **Outreach, Engagement, and Health in Plan 2040**

Plan 2040 used six online public meetings, information from Fifty Forward and Civic League forums (which included the health forums described above, as well as dozens of others), and numerous meetings with stakeholder groups. Online public meetings looked at Vision and Goals (April-May, 2010), Guiding Principles for Plan Policies (June-July, 2010), Growth Patterns and Transportation Funding Sources (August-September, 2010), Focusing Our Resources; Maximizing Transportation Resources (November-December, 2010), Draft Transportation Recommendations (March-April, 2011), and PLAN 2040 Results and the Path Forward (May-June, 2011). Each online public meeting included videos and presentations as well as an online survey. Stakeholder groups that participated in the process included ARC's standing social equity advisory committee, bicycle and pedestrian task force, a transit operators committee, and many others. Feedback from participants emphasized economic prosperity, equity, environmental quality, sustainability, walkable communities and nodes, and many references to healthy communities.

Pursuant to these inputs, ARC has developed three overarching goals and five objectives for Plan 2040:

#### Goals:

1. Lead as the global gateway to the South.
2. Encourage healthy communities.
3. Expand access to community resources.

#### Objectives:

1. Increase mobility options for people and goods.
2. Foster a healthy, educated, well-trained, safe and secure population.
3. Promote residential choices in locations that are accessible to jobs and services.
4. Improve energy and resource efficiency, while preserving the region's environment and critical assets.
5. Identify innovative approaches to economic recovery and long-term prosperity (Atlanta Regional Commission, 2011).

The second goal, "Encourage Healthy Communities", meshes very well with the concept of a holistic view of public health. According to the World Health Organization's 1948 Constitution, health is "a state of complete physical, social, and mental well-being, and not merely the absence of disease or infirmity." This definition was later expanded by the Ottawa Charter for Health Promotion in 1986 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." Known as health determinants, factors which influence the ability to be healthy include biological, social, economic, environmental, lifestyle, health services, and policy. Many external factors—such as the environment where we live and work, and the social and economic factors, policies, and services shaping the environment—affect the ability to cope with the environment as addressed in the expanded definition. Additionally, expanded access to community resources (e.g. jobs, services, social networks, greenspace) can have a positive impact on the health of the region. This goal received 98% agreement from participants in the online Vision and Goals public meeting, a higher level of agreement than the other two goals.

The objectives are meant to provide guidance towards measurable outcomes. Increased mobility options can lead to less travel time, more physical activity, more leisure time and better air quality, all of which can have a positive impact on health. Increased residential choices can lead to reduced commute times and increased social capital and quality of life. While these goals and objectives bring the concept of health into the planning discussion, a diverse metropolitan area such as Atlanta needs more than a single region-wide strategy. Metro Atlanta is home to individuals with disabilities, cultural differences, and economic or educational challenges, and to senior citizens, children, and infants – with some people or households falling into multiple categories.

## Plan 2040 HIA Framework

The goal of the Health Impact Assessment framework was to lay out an evidence-based framework for assessing a large, complex, long-range plan encompassing multiple jurisdictions and unknown future variables. The first steps in the HIA process for Plan 2040 were to identify regional health priorities to assess and to identify potential stakeholder concerns relating to health in Plan 2040.

The initial scoping of this HIA has been based on reviewing stakeholder feedback from over 100 public meetings and 3 on-line public meetings and from working with the HIA advisory committee made up of 16 individuals representing different stakeholder groups. The ARC's public involvement process was based on the larger PLAN 2040 approach and did not specifically address health. However, the feedback brought up many issues that are directly related to health. Stakeholders wanted more transportation options in the region, wanted to live near work, want more and better connected greenspace, want choices in housing location and type, want growth to occur around existing development and infrastructure, and are worried about the aging of the population.

After initial priorities and concerns were outlined, current health research was reviewed in order to generate a list of potential indicators that generate information about health determinants or health status. Based on the literature review, potential health indicators to assess in Plan 2040 were outlined, including safety/security, access to services, economic development, physical activity and air quality.

Next, Plan 2040 was reviewed in order to provide an overview and synopsis of the plan and its background. It was important to consider the scales of the plan, from regional to the neighborhood level. The substantive elements of the plan were reviewed (i.e. transportation, land use), as well as the types of analysis used in the planning process.

From these analyses, health indicators were selected in order to assess health trends on a regional scale. For example, "active living" health indicators included obesity and other chronic disease rates, as well as rates of commuting by alternative modes. In analysis of these regional health indicators, particular attention was paid to spatial variation within region and variation between subpopulations (by socioeconomic status, ethnicity, etc.). Several case studies were examined in order to identify and appraise representative cases used to drill down health impacts to specific scales and plan elements. These case studies included LCI projects, and transportation issues ranging from freight to bike and pedestrian planning.

Based on peer-reviewed literature and expert consultation, we evaluated the extent to which health was incorporated into the Plan 2040 planning process. This evaluation included consideration of decision support systems, and coordination with neighborhood and

jurisdictional planning. Finally, the HIA process provides evidence-based recommendations to mitigate negative health impacts and health disparities while maximizing health benefits in Plan 2040.

## Plan 2040 HIA Outreach and Technical Assistance

### HIA for Healthy Public Policy Workshop

In August 2010, the HIA team conducted a workshop for regional planners, policy-makers, and public health professionals interested in learning how to conduct a health impact assessment. Attendees included representatives from ARC, local governments, and departments of public health. This workshop presented information about general HIA methodology, examples of HIAs throughout the Atlanta region, practice cases for implementation, and preliminary results from this Plan 2040 HIA. Feedback from this training workshop was generally positive, although some attendees expressed concerns about jurisdictional partnering (with health departments) and the difficulty of applying HIA in the workplace at some state agencies.

### Outreach with Atlanta Regional Commission

During the course of the HIA, the research team met with ARC staff on multiple occasions and made three presentations to the ARC technical subcommittees. ARC staff, including department directors, expressed interest in using HIA to better understand their agency's impact on health, and to more effectively work towards their planning objectives. During team meetings, staff shared details about the planning and programming that were most suitable to adaptation and the priorities of ARC where the HIA recommendations might most closely align. The respective teams also discussed logistics of implementing recommendations, and provided critical analysis on the feasibility of preliminary recommendations. CQGRD staff also met with ARC's Equitable Target Areas expert to discuss health risk methodology.

The HIA team made presentations at the completion of the scoping phase to ARC's Transportation Coordinating Committee (TCC), Transportation and Air Quality Committee (TAQC), and executive board; the team also presented the final results and recommendations to TCC. Following these presentations, the presenters heard comments and questions from the committees. The committee members were supportive of the intent of the HIA, but expressed some concerns about the accuracy of the results, the ability to apply them to planning processes, and the potential limitations on HIA implementation due to cost or policy restrictions. ARC also endorsed use of the HIA results and future HIA process in their Plan 2040 implementation plan, with assistance from CQGRD.

### Healthy Places Research Group

The HIA team also received feedback from participants in the Healthy Places Research Group (HPRG). In December, 2010, Jason Barringer and Michelle Rushing presented the scoping that has been done to date on the PLAN 2040 HIA as well as the output of the November Advisory Committee meeting. Comments and concerns from participants focused around

- Evaluation of the level of correspondence between the Plan 2040 vision and the Plan 2040 project list.
- Lack of data regarding connectivity and bicycle or pedestrian infrastructure.
- The limitations on controlling for socio-economic status in order to gain a better understanding of the influence of the built environment.

A second presentation was made to HPRG in December 2011. The HIA team presented their findings and recommendations and took comments. The majority of the comments focused on

implementation of the HIA recommendations, including how regional planners and other agencies could identify and prioritize the recommendations that were in their purview.

### **Stakeholder Advisory Group**

The HIA team convened an advisory group that included members of ARC, the state public health department, and various stakeholder associations. Over the course of two meetings, the group developed a list of primary health concerns, including their potential impacts related to regional planning and the distribution of impacts. The selected topics were:

#### **1. Access and Social Equity**

Equitable mobility and access to the transportation network relates to better access to jobs, goods and services, especially for at-risk groups. Improved access for these groups can lead to higher social capital, fewer health disparities, and lower community crime rates. There are many areas of the Atlanta region that have large populations living in poverty and the region as a whole is aging. In an area dominated by car travel, many of these groups are limited in their ability to get around. These groups have poor access to social services, jobs and healthy foods. “Food deserts” are areas characterized by shortage of healthy food availability (such as retail grocery stores) and can increase the risk of diet-related health problems. For vulnerable populations, this translates to a higher risk of obesity related chronic disease conditions.

##### *Potential Positive Impacts:*

- Spreading the concept of lifelong communities (e.g. Mableton)

##### *Potential Negative Impacts:*

- Culturally appropriate foods not always accessible
- More dependence on fast foods, convenience items in ex-urban areas (lack of healthy food choice in strip centers)
- Food deserts in all areas (urban, suburban and exurban)
- Dependent populations and populations living in poverty are moving to the suburbs and exurbs. Simultaneously, poverty is on the rise among existing suburban populations. Displacement of poorer populations from gentrification and job losses due to the economic recession are partly responsible for these phenomena
  - Lack of accessible public transportation in suburbs for everyday use (the ability to get to doctor’s appointment, grocery store, etc.)

##### *Who may be impacted:*

- Immigrant communities and people with language barriers
- Populations living in food deserts
- Non-car households
- Populations, especially at-risk ones, living in the outlying areas
  - Low income neighborhoods with a high percentage of minorities, in the core counties

#### **2. Spatial Mismatch**

Spatial mismatch in a region can lead to a lack of access to quality jobs and services and can have detrimental effects on household budgets due to increased travel and housing costs. Additionally, spatial mismatch can lead to a lack of access to nutritious foods, quality health services, and other social services such as job training and education. In the Atlanta region, jobs and housing are not located near each other leading to long travel times, congestion, etc. Throughout the stakeholder engagement process there was a call to developing near and utilizing existing infrastructure and job centers through in-fill development and increased

densities rather than greenfield development. Discussions referenced the Livable Centers Initiative and use of existing corridors and town centers.

*Potential Positive Impacts:*

- Policies addressing and providing for mixed income housing
- Potential of adding transit options to employment centers and placing employment centers near transit
- Better overall transit options throughout the region
- Potential to better incorporate industrial and agricultural lands throughout the region
- Focus on existing communities and infrastructure. Encouraging infill development can help reduce VMT
- Improvement of connectivity
- Increasing transportation choice
- Opportunity to show sensitivity to local communities through the use of context sensitive solutions and approaches. This is especially important around transit stops and in communities with a high number of pedestrians (e.g. Buford Highway).

*Potential Negative Impacts:*

- In many urban areas of the region, current zoning laws are not compatible with mixed uses, urban gardening and other strategies for mitigating spatial mismatch.

*Who may be impacted:*

- Populations that are transit dependent
- Populations that have limited access to goods and services
- Populations living in “bedroom communities”
- Populations living in food or job deserts

### **3. Active Transportation and Mobility**

Physical activity levels are associated with the incidence of cardiovascular disease, stroke, obesity, high blood pressure and diabetes. A transportation system that provides alternatives to the automobile and promotes connectivity can lead to increased levels of daily physical activity which can lead to healthier outcomes and lower incidences of these health problems. The Atlanta region is very large and contains many destinations. Travel times throughout the region have been increasing and with few exceptions, there are not transportation options available for the region’s residents. As it is, 75% of the region’s residents have no transportation option other than driving according to Plan 2040 survey responses. There is a need to connect not only jobs and housing, but also greenspace, various modes of transportation, and the various city centers that are located throughout the region. The Atlanta region is one of the most congested in the nation. Additionally, many areas have been built in ways that do not promote walking or biking between destinations, leading to a lack of physical activity.

*Potential Positive Impacts:*

- Access to greenspace
- Density around major corridors leading to more active transportation
- Mix of uses
- Walkable communities/sidewalks
- Safety
- Connectivity

*Potential Negative Impacts:*

- Limited funding leading to a lack of provision of non-SOV alternatives/funding going primarily to roads

- Voices of the underserved not being taken into consideration in the prioritization of improvements
- Gentrification and displacement
- Cultural factors in rural areas (affecting levels of physical activity)
- Lack of access to greenspace in outlying counties due to private ownership

*Who may be impacted:*

- Potential negative impacts on vulnerable or environmental justice populations depending on the spatial allocation of projects/focus
- Potential negative impacts on low income populations (especially in outlying areas) with limited or no access to alternative forms of transportation.
- Negative impacts on outlying counties if there is too much focus on the core.

#### **4. Air-quality**

Ambient and localized pollution levels are associated with asthma onset and severity, respiratory diseases, infant mortality and low birth weight. Regional air quality is perceived to be very poor.

*Potential Positive Impacts:*

- Improved overall AQ in region

*Potential Negative Impacts:*

- Hot spots around high volume and/or congested roadways

*Who may be impacted:*

- Those living or working in or near hot spots, especially, expectant mothers, children and the elderly.

The Advisory Committee was convened two additional times. They met in March, 2011, to review the proposed HIA scope. At this meeting, participants noted that many elements of Plan 2040, especially the Regional Development Guide, could promote health if they were properly prioritized and implemented by local governments in their zoning and comprehensive plan. Committee members encouraged the HIA to focus on both positive and negative potential impacts of the plan. The Advisory Committee also met in January, 2012, to review the draft findings and recommendations. At this meeting, participants focused on suggestions for prioritizing the recommendations so each stakeholder could easily understand the recommendations they should address immediately. They also requested summary briefs relevant to specific programs, departments, or topics, and an outreach program so the HIA team could work with specific stakeholder groups to refine the implementation process. Topical interest focused on crime prevention, social capital relative to commute options, equitable development, and new methodologies.

## Survey

The research team created an online survey which was linked from the Plan 2040 website, and also promoted in newsletters from ARC and CQGRD. The survey asked respondents about the existing Atlanta region as well as its potential future forms, and how they thought these aspects of the region affected their health. The survey also collected some demographic information, and asked respondents to describe Plan 2040 in their own words. 103 surveys were received. Relative to the Atlanta region, higher income households were over-represented and lower income ones under-represented. No children and only 5 older adults responded. Additionally, individuals identifying their race as White were greatly over-represented (84.7%) relative to all other racial identities. About one third of all respondents were from Fulton

County, 15% from DeKalb County, and other responses coming from Cherokee, Cobb, Coweta, Clayton, Fayette, Gwinnett, Henry, and Rockdale counties. Nearly half of all respondents worked in Fulton County. 54% had heard of Plan 2040, a third had participated in Plan 2040 public meetings.

Survey participants were shown a list of items associated with better health outcomes and asked how they felt that these items affected their health. Air quality and walkability ranked highest for having a positive health impact, while respondents felt less strongly about access to stores or community facilities, such as churches (Figure 22).

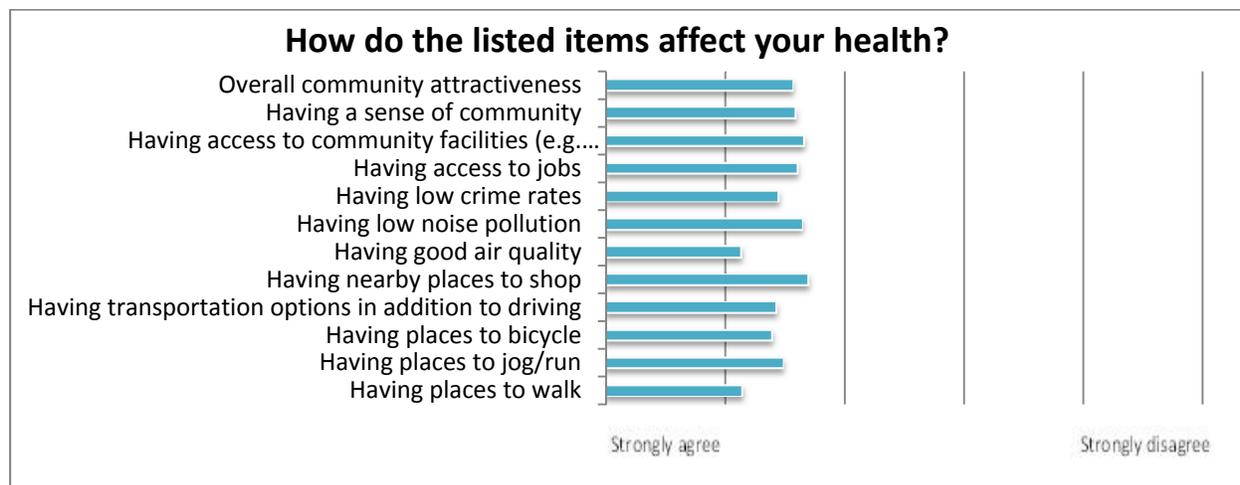
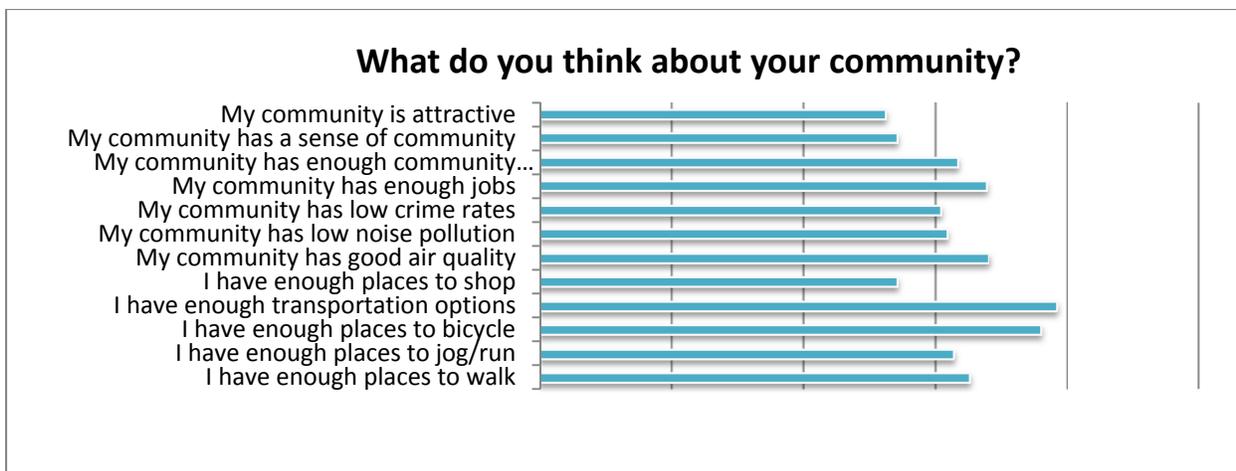


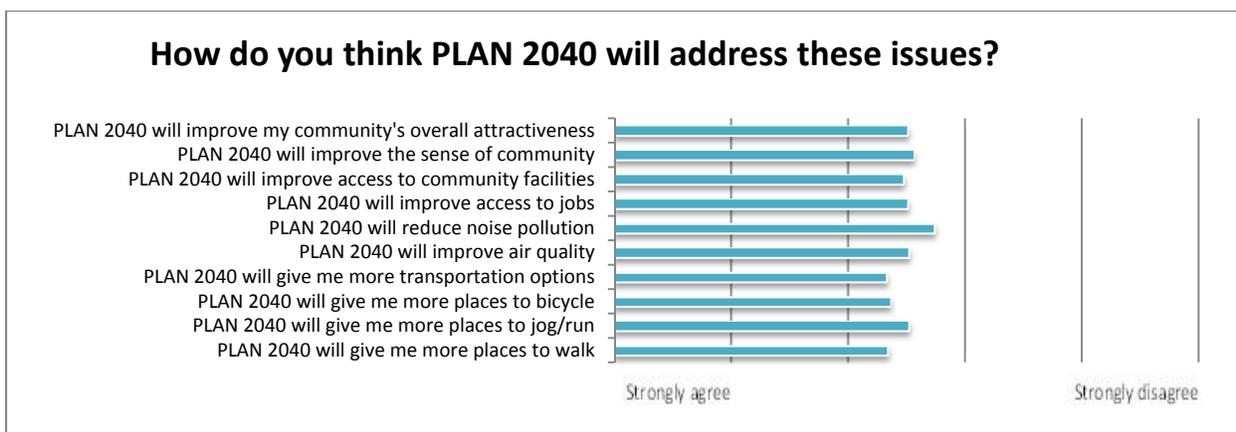
Figure 22: Perceived impact of community design on health

59.4% of respondents felt that Plan 2040 would have a positive effect on their health, while 4.2% felt it would have negative effects; 18.8% thought it would have both positive and negative effects, and 17.7% indicated that it would not impact their health. Participants who indicated it would have a positive impact referred to better land use-transportation coordination, walkable communities, less driving and lower traffic emissions, shorter travel distances and more transportation choices, and more greenspace. Some of those who saw it as having negative effects did so primarily due to a perception that the plan promoted unchecked development or due to their anxieties over the impact of regional transit, while others thought that the plan included too many road expansion projects and not enough transit, too much low-density development, or simply would not have a transformative effect on current patterns. Figure 23 shows how respondents rated their existing built environment.



**Figure 23: Rating of existing community design**

Additionally, survey respondents were asked to score how Plan 2040 might affect each item. The respondents were least satisfied with their current transportation options and with inadequate opportunities to bicycle, while being most satisfied with shopping opportunities and community attractiveness. They were most likely to agree that Plan 2040 would increase transportation options, especially walking and bicycling, and least likely to think that Plan 2040 would reduce noise (Figure 24).



**Figure 24: Plan 2040 and Health**

Some aspects of Plan 2040's potential impact on health elicited stronger agreement than others. Figure 25 shows how responses were divided on this question. More respondents strongly agreed that Plan 2040 would give them more transportation options and improve air quality relative to those who thought Plan 2040 would reduce noise.

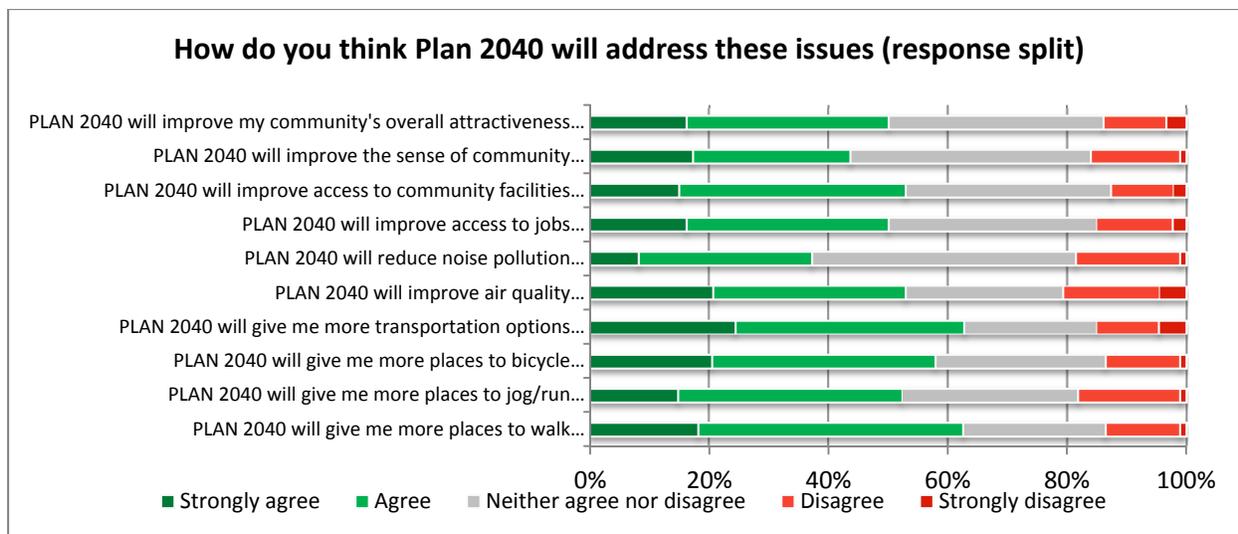


Figure 25: Plan 2040 and Health (response split)

# State of the Region's Health

For the most part, Atlanta region is healthier than the rest of the state but less healthy than the US as a whole (852.9 deaths per 100,000 compared to 803.6 nationally and 915.5 statewide). An initial analysis of regional health data suggested that socio-economic and health disparities were highly relevant to the regional disease burden. Certain diseases track with poverty, such as diabetes, and were observed in the poorest parts of the region including the southern inner core, second ring suburbs, and exurban fringes. Other diseases, such as cancer deaths, were most prevalent in outlying counties with low density and low proportion of jobs, services, and medical care, and possibly more rural attributes. Rate of deaths from mental and behavioral disorders have been increasing relatively steeply. These are not related to drug overdoses, which are on the decline.

Table 3 compares regional mean rates of some key health indicators against national rates, and also shows the range of regional rates. Unless otherwise noted, all death rates in this report are age-adjusted. Age-adjustment is a statistical process applied to rates of disease, death, injuries or other health outcomes which allows communities with different age structures to be compared. These rates are those that *would be expected* if the age composition of each county's population were the same as that in a standard population

**Table 3: Death rates, by cause**

Cause	Type	Regional Rate (1999-2007)	Regional Min.	Regional Max.	Regional Disparity	National Rate (2007)
Ischemic Heart Disease	Death	116.6	92.7	188.7	X 2.0	126.0
Hypertensive Heart Disease	Death	13.7	2.2	23.5	X 10.5	9.5
Stroke	Death	55.1	47.5	81.8	X 1.5	42.2
Diabetes	Death	19.4	13.8	25.6	X 2.0	22.5
Chronic Lower Respiratory Disease	Death	33.5	22.9	56.8	X 2.0	35.3
Asthma	ER Visits	539.6	252.7	859.8	X 3.5	573*
Breast Cancer	Death	14.5	10.6	17.9	X 2.0	12.9
Motor Vehicle Crash	Death	13.9	11.7	27.7	X 2.5	14.4
HIV	Death	8.8	0.9	22.6	X 25.0	3.7
Homicide	Death	7.8	1.7	14.2	X 8.5	6.1
Infant Mortality**	Death	9.1	5.1	12.5	X 2.5	6.75

All Causes	Death	852	737	1082	X 1.5	760.2
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Rates are age-adjusted, per 100,000 residents.

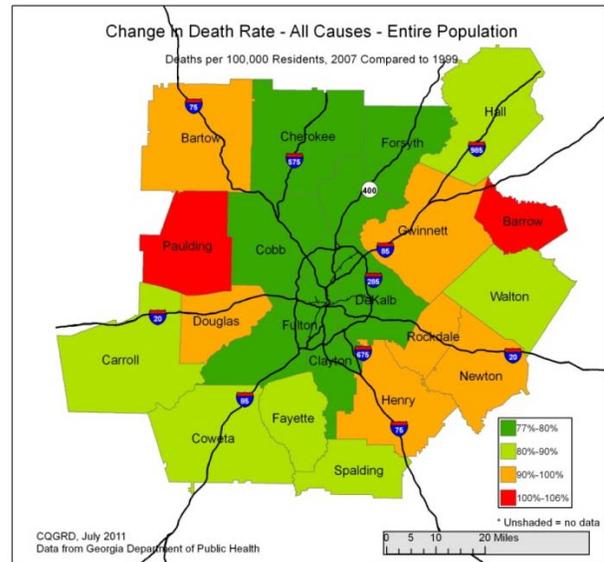
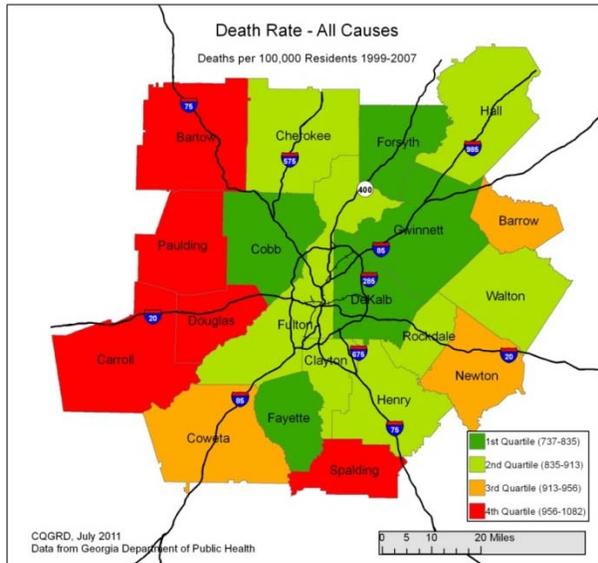
\*National asthma ER visit rate is from 1992-2004

\*\*Infant mortality rates are per 1,000 live births.

Sources: Online Analytical Statistical Information System, Office of Health Indicators for Planning (OHIP), Georgia Department of Public Health; Freymann, G. R., Attaway, R. M., Butler, S. B., Rogers, M. Y. (2008). 2007 Georgia Vital Statistics Report. Georgia Department of Public Health; Hall, M. J., DeFrances, C. J., Williams, S. N., Golosinskiy, A., and Schwartzman, A. (2010). National Hospital Discharge Survey: 2007 Summary. National Health Statistics Report, 29; Xu, J., Kochanek, K. D., Murphy, S. L., and Tejada-Vera, B. (2010). Deaths: Final Data for 2007. National Vital Statistics Reports 58:19 ; CDC. (2007b). National Surveillance for Asthma - United States, 1980-2004. Table 23..

Rates of major causes of death seem to be declining slightly (e.g. stroke, ischemic heart disease). However, rates of underlying causes seem to be increasing, such as obesity. Gains may be due to better medical treatment. Within the region, disease rates differ significantly from one county or neighborhood to another. There are further health status differences for some subpopulations (e.g. Hispanic, Black, or lower income) within a given area. Hypertension, homicide, and HIV significantly higher among Black population regionally, and higher in the core counties, possibly due to racial and ethnic spatial distribution. Blacks are more at risk for HIV relative to other racial identities in outlying counties, and rates there appear to be trending upward in these areas, with high but steady rates in the core counties. Wealthier suburban counties trend lower on most diseases, while the most outlying counties have the highest combined risk of death or illness due to high rates of motor vehicle injury, cancer deaths, heart disease, and other factors. Vast health disparities exist between counties; hospitalization for ischemic heart disease is more than three times higher in Bartow County than Fulton County. Hispanics are faring much better than average on the leading causes of death.

In Figure 26 we show the age adjusted death rate by county, by quartile. Lower numbers are better; the national rate (760.2 deaths per 100,000 people) is most closely equivalent to the first quartile (dark green). Higher rates indicate that the population is experiencing premature deaths due to injury or disease. Figure 27 shows the change in the death rate from 1999 to 2007. Counties shown in dark green reduced their death rate to 80% or less of its 1999 level, while counties in red saw their death rate increase.



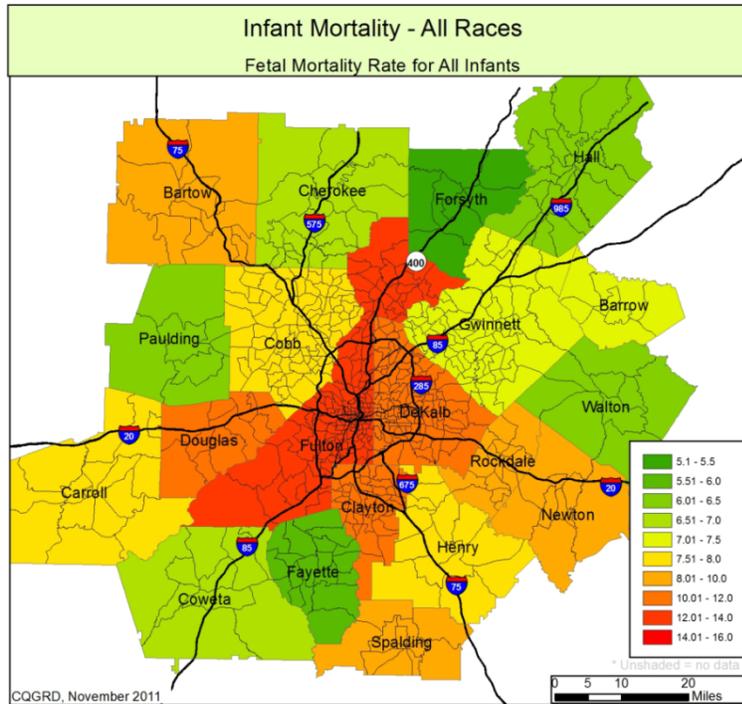
**Figure 26: Death rate, all causes**

**Figure 27: Change in death rate, all causes**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

Spalding, Barrow, and Bartow top many of the lists and show the least improvement over time. Coweta, Carroll, Paulding, and Walton make frequent visits near the top of the lists as well. Hall shows high rates of suicide and drug use. Fayette, Forsyth, and Cherokee fare well in many measures. Clayton shares the problems of the core counties without the advantages of the suburban areas. Gwinnett, Cobb, and Douglas are a balance of high and low rates. Fulton and DeKalb perform well on congestive heart diseases, suicide, and motor vehicle crashes but poorly on homicide, HIV, diabetes, and hypertension.

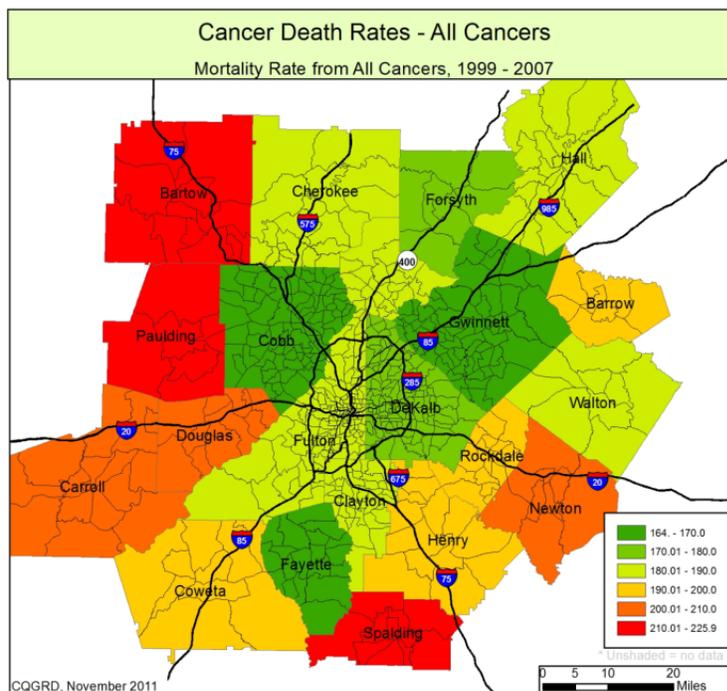
Infant mortality rates, which are influenced by poor air quality, lack of access to health care, and unhealthy behaviors such as smoking, as well as other undefined correlations with lower socio-economic status and minority identity, differ widely across the region (Figure 28). Leading causes of death or illness vary based on the physical environment, social environment, and demographic and socio-economic factors, described in subsequent paragraphs.



**Figure 28: Infant mortality, all races**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

In 2005, the five leading causes of death in Georgia were heart disease, cancer, stroke, chronic lower respiratory disease, and unintentional injury (CDC, 2008). Cancer death rates were higher in exurban counties, especially on the western side of the MPO boundary.



**Figure 29: Cancer death rates**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

## Health Disparities

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In Health Disparities, we identify several types of health disparities, in which total death rates or rates of a given illness are much higher in some populations or some parts of the region than others. Health disparities may be observed relative to socio-economic status, race, ethnicity, gender, age, and other characteristics, or by neighborhood or community. These disparities may be affected by many of the elements described throughout this report – concentration of populations by poverty status or racial identity, social and civic engagement, availability of healthy foods and safe places to be active, access to jobs and educational opportunities, or presence of environmental pollutants. See the CDC website at <http://www.cdc.gov/omhd/topic/healthdisparities.html> for more information. Sources of disparities may include:

- **Vulnerable Populations:** Racial or ethnic groups that have experienced discrimination currently (e.g. immigrants) or in the past (e.g. people with African ancestry); lower-income households; single-parent households; people with disabilities; elderly residents, especially those without support from family members; and other groups that may experience restrictions on their transportation, housing, and living choices; plus any resident of a neighborhood that has a high proportion of residents so disadvantaged. Vulnerable populations may be at greater risk for poor health status and may be less able to engage in community decision-making or cope with changes.
- **Environmental Justice:** Some neighborhoods may be at greater health risk due to the presence of environmental hazards, including air, soil, and water pollution (for instance, from busy highways or industrial activities) as well as nuisance uses such as landfills. The presence of such hazards may result in lower land values, which can increase the likelihood that lower-income, or otherwise disadvantaged, households will occupy the area.
- **Maintaining Freedom:** A significant percentage of the region's population reports some sort of disability that affects their personal mobility. This percentage is expected to increase over time due to higher rates of certain risk factors, such as diabetes and obesity, which are associated with the development of disabilities over time (blindness, amputation, and stroke). Persons with disabilities may experience restrictions on their transportation, employment, and housing options; this trend may increase demand for alternatives to driving and for a wider range of accessible housing. Traditionally, paratransit has provided mobility services for people with significant disabilities, but the service is considerably more expensive than route transit; some advocates have suggested that these mobility services could be provided with an equal or greater level of convenience to users with expansion of regular transit service and better pedestrian facilities for accessing transit stops. There is also a recognized need for greater regional coordination of paratransit services.
- **Aging Atlanta:** As addressed in LifeLong Communities (above), the population over 65 is expected to increase from about 8% to approximately 20% in the region. This population will likely have different mobility needs including a gradual decline in their ability to operate a motor vehicle, different daily travel patterns, and different housing needs and interests.
- **Growing Up in Atlanta:** Children have unique travel needs in terms of access to school, other educational activities, and recreation. In addition to promoting physical activity and safety with Safe Routes to School, children's needs can be addressed through school siting, routine accommodations for walking and bicycling, increased

connectivity, expanded transit service, conservation of greenspace, and programs to educate students about the planning process and engage them in it.

## Defining Vulnerable Populations

Aday (1994) defined risk factors for poor health status based on personal, social, and community characteristics, and labeled subgroups that exhibit one or more of these risk factors “vulnerable populations.”

The Atlanta Regional Commission Equitable Target Areas (ETA) use five criteria from the Census 2005-2009 ACS, the same data utilized in the HIA, by census tract. They use Age (over 65), Education (no high school equivalent), Median Housing Value, Poverty, and Race (non-white). Data is presented showing three levels (equal interval) above/below the regional median. These data were compiled into an ETA index PLAN 2040 Technical Appendix, ), max=17, min=5, median=8). They also presented county rates of disabled population above and below the federal poverty level, and census tract rates of low English proficiency, carless, and projected 2040 carless households. The analysis applied above-median ETA index tracts over the 2010 and 2040 multimodal accessibility measure (MMA), which suggested that accessibility would improve in some ETA areas (especially in the region core, inside of I-285) but remain the same or decline in others (especially outside of I-285). Overlaid with the UGPM, it indicated that 40% of the regional and local centers were in ETA areas. ETA tracts could be found in every area type, although perhaps at different rates. The analysis found about 60% of Plan 2040 transportation projects located in ETA communities by per capita cost. Projects were presented by transit, bicycle or pedestrian, roadway, or other, and not separated by severity of ETA index; a greater share of transit and bicycle/pedestrian dollars was located in above-median ETA tracts. It found the jobs-housing balance increasing in ETA areas from just below 1.1 to 1.25, while non-ETA areas showed a marginal decline, staying just above 1.1. Their analysis also indicated that 76% of LCI areas are in or adjacent to ETA communities. It appeared however that they were skewed away from the most severe ETA areas.

In its Health Impact Assessment of Piedmont Hospital, CQGRD defined a vulnerability index based on 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 was converted to a percentage and then multiplied together. This yields a vulnerability score of between 1 (most vulnerable) and 0 (least vulnerable).

**Table 4: Comparisons of relative risk by Community and Individual Resources**

Category	Higher Risk	Lower Risk
<i>The people: social status</i>		
Age	Infants Children Adolescents Elderly	Working-age adults
Sex	Females	Males
Race and ethnicity	African Americans Hispanics Native Americans Asian Americans	Whites
<i>The ties between people: social capital</i>		
Family structure	Living alone	Extended families

	Female-headed families	Two-parent families
Marital status	Single Separated Divorced Widowed	Married/mingles
Voluntary organizations	Nonmember	Member
Social networks	Weak	Strong
<i>The neighborhood: human capital</i>		
Schools	Less than high school	High school +
Jobs	Unemployed Blue collar	White collar
Income	Poor Near poor	Nonpoor
Housing	Substandard	Adequate +

Gunning, Harris, and Mallett (2011) used the following vulnerability indicators in an equity-focused health impact assessment of the Queensland, Australia area regional plan:

- Age: children, young people, adults, older people
- Gender: men and women
- Ethnicity/culture: Aboriginal and Torres Strait Islander people and communities, Australian South Sea Islander people and communities, and non-English-speaking groups
- Socio-economic position: lower income, middle-income or upper income people
- Location of residence: current residents as compared with newer residents
- Employment: unemployed, or workers in different occupations
- Existing levels of health/disability: people who are frail or who have disabilities or who suffer from chronic ill-health

Galea, Tracy, Hoggatt, DiMaggio, and Karpati (2011) conducted a meta-analysis of 47 studies of all-cause mortality that considered social factors as a contributing cause. They calculated relative risk based on education, income, race, and social support factors. The following factors are linked to increase risk of mortality for adults:

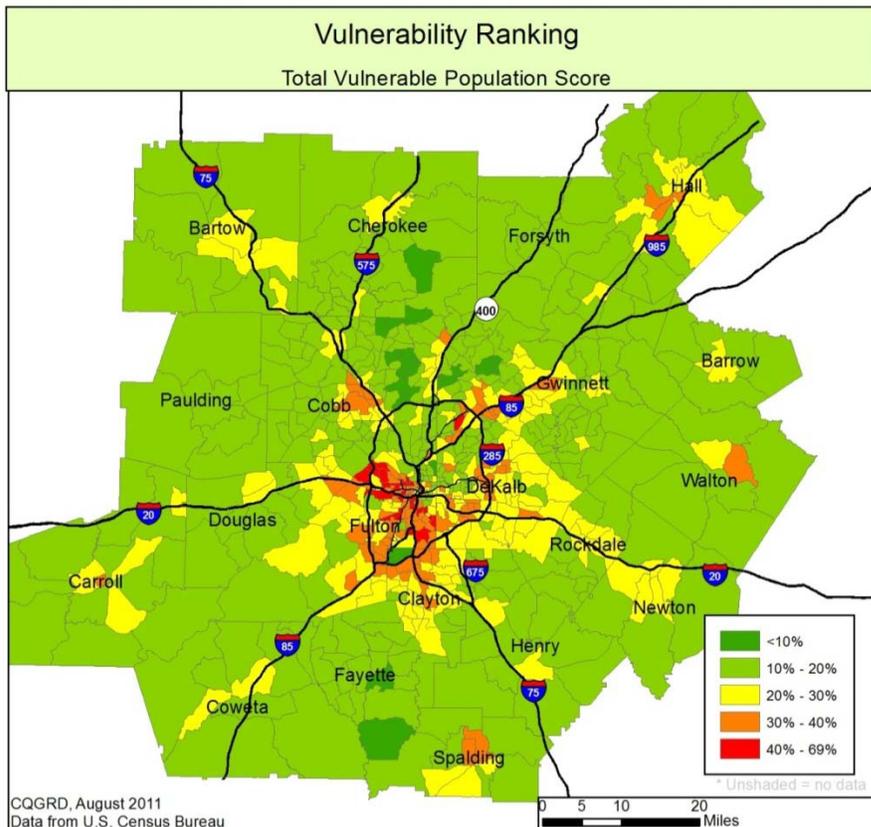
**Table 5: Health Risk Factors**

Factor	Definition	Source	Risk
<b>Individual Level</b>			
Low education	Adult educated less than high school or equivalent	US Census	Age 25-64: 1.81 Age 65+: <i>not significant</i>
Poverty	Household income <\$10,000 or below poverty level	US Census	Age 25-64: 1.75 Age 65+: 1.40
Low social support	"Low" score on a social network index	National Health and Nutrition Examination Survey (NHANES)	Age 25-64: 1.34 Age 65+: 1.34
<b>Area Level</b>			
Area poverty rate	≥ 20% of adult	US Census	1.22

	population in poverty		
Income inequality	Gini coefficient 1 standard deviation above mean or $\geq 25\%$	US Census	1.17
Racial segregation	% of Black population 1 standard deviation above mean or $\geq 25\%$	US Census	1.59

The US Department of Housing and Urban Development defines a middle-class or low poverty neighborhood as less than 10% of residents below poverty; Brookings Institution's definition of extreme poverty neighborhood is more than 40% of households below poverty; Galea et al. (2011) define a high-poverty neighborhood as more than 20% adults below poverty.

In this analysis, "Vulnerable Populations" were defined based on the percentage of population under 18, over 65, of color or ethnic, unemployed, less than high school educated; the percentage of households female-headed, in poverty, renting, carless. "Health Risk" was calculated based on the percentage of population under 18, over 65, of color or ethnic, unemployed or working in a blue-collar job, less than high school educated; the percentage of households female-headed, in poverty. Comprehensive data regarding social and civic participation or substandard housing was not available. See Regional Demographic and Health Characteristics on page 39 for detailed demographic maps. This analysis results in the vulnerability rankings shown in Figure 30, ranked from 0% (not vulnerable) to 100% (maximum vulnerability).



**Figure 30: Vulnerable Population rankings**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau – ACS 2005-2009.

Health disparities exist relative to racial and ethnic identity in the region. Death rates vary between White and Black individuals, as do changes in death rate over time and infant mortality rates. For example, white infant mortality rates in the metro region range from 4.8-8, while black infant mortality rate ranges from 8.01-20.0 (Figure 32, Figure 31).

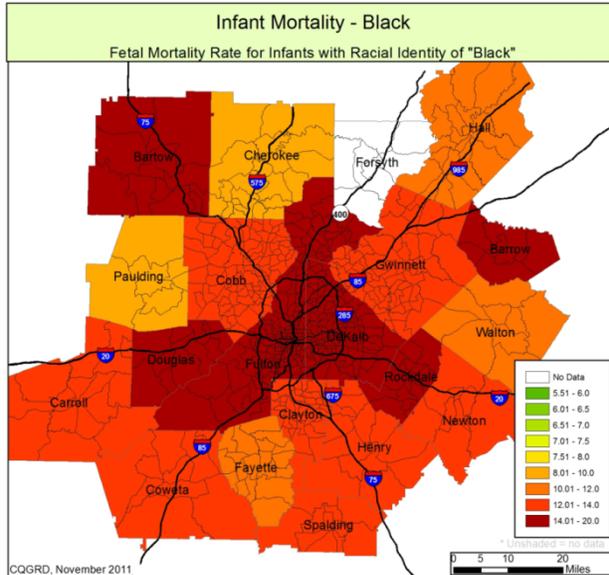


Figure 31: Infant mortality, black

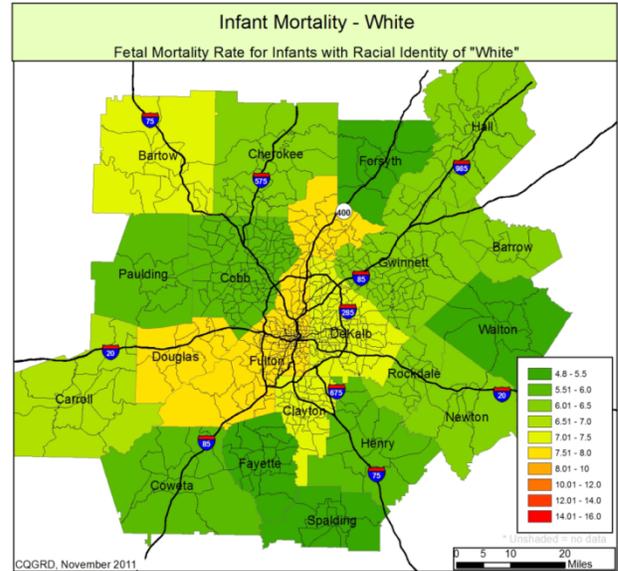


Figure 32: Infant mortality, white

Figure 33 and Figure 34 show deaths per 100,000 black or white residents, respectively. The overall black death rate is high in Fulton, Hall, Bartow, Carroll and Spalding counties (Figure 33). Conversely, the overall white death rate is highest in eastern exurban counties (Figure 34).

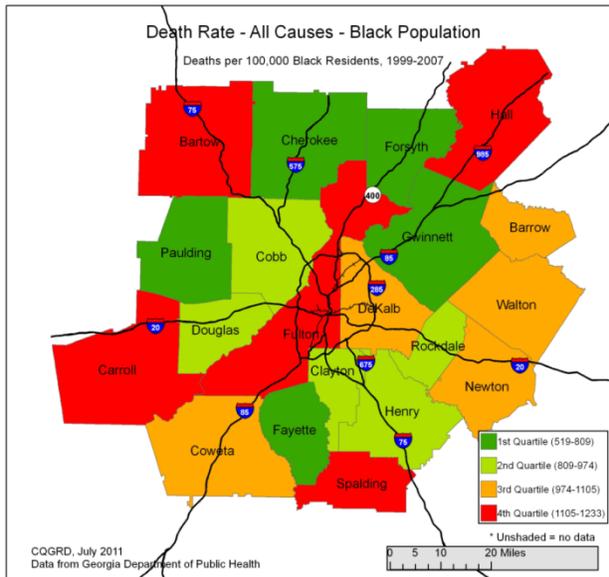


Figure 33: Death rate, black population

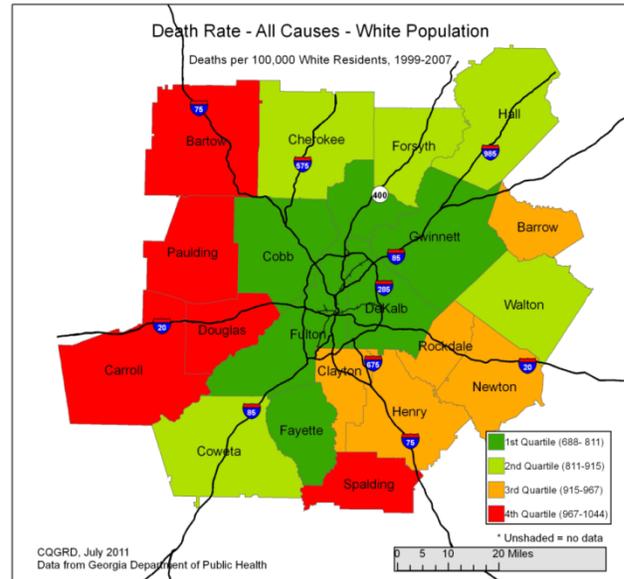
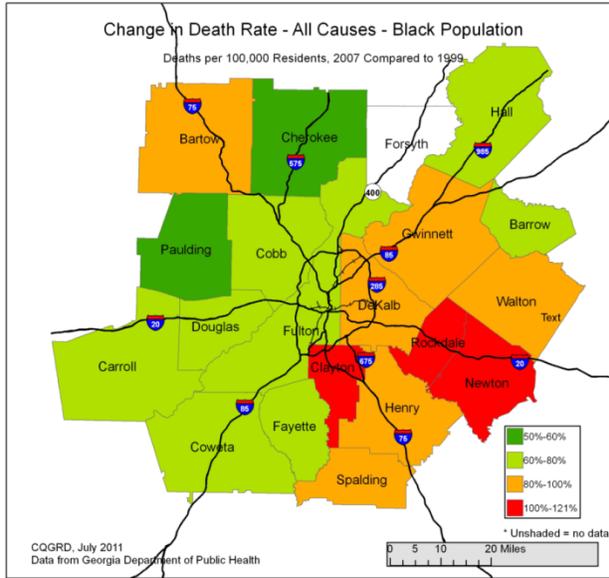


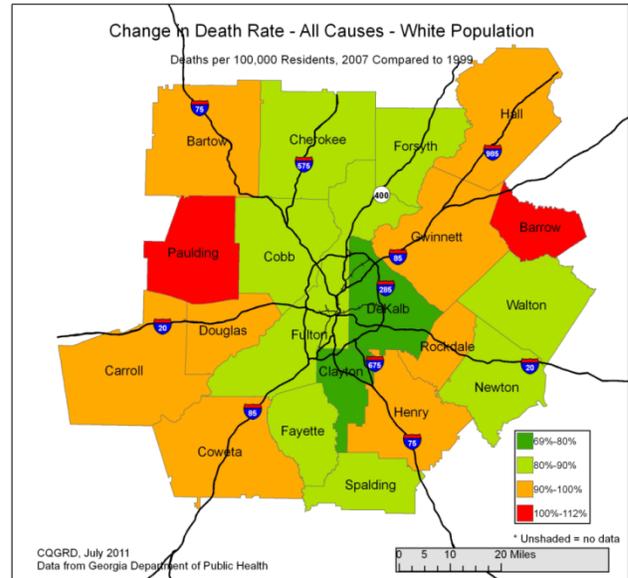
Figure 34: Death rate, white population

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

However, black death rate is decreasing in many central city and eastern suburban areas, and it is increasing southeast and east of Atlanta (Figure 35). The white death rate is decreasing most in DeKalb and Clayton counties and is increasing in eastern exurban and western suburban/exurban counties (Figure 36).



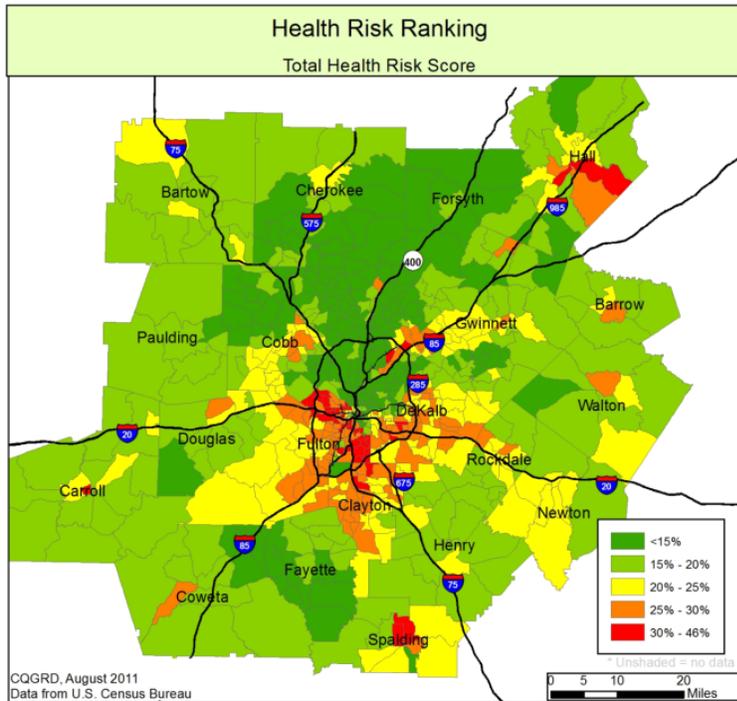
**Figure 35: Change in death rate, black population**



**Figure 36: Change in death rate, white population**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

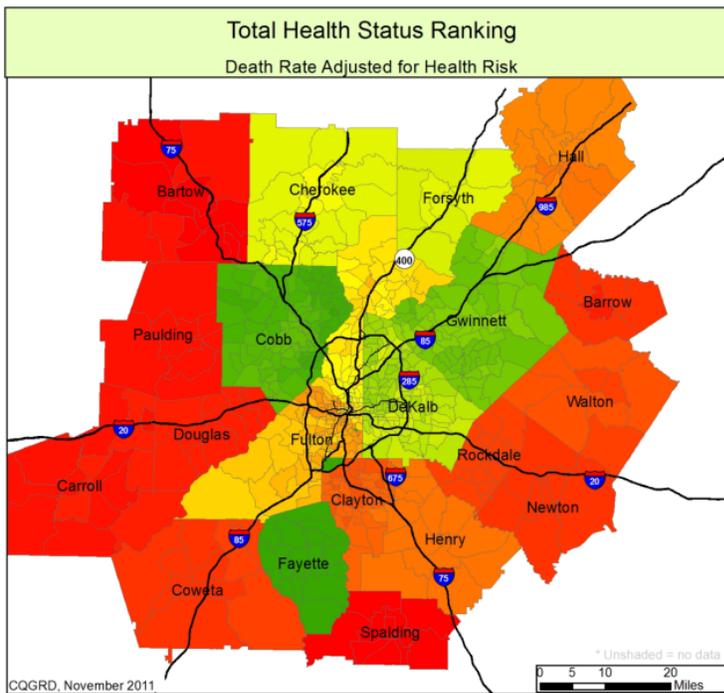
Health risk was determined as a function of the proportion of residents or households under age 18, over age 65, headed by a single female, of color or ethnic identity, with less than a high-school degree (or equivalent) after age 25, unemployed, employed in a blue collar job, and below the federal poverty level (Figure 37).



**Figure 37: Health risk ranking**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

The overall “health risk” is highest in south Atlanta and in certain tracts in Hall and Spalding counties. In Figure 38, when the death rate is adjusted for “health risk,” the majority of exurban counties (except for Cherokee and Forsyth counties) have the highest death rates. In addition, death rates in Fulton County substantially increase after adjustment for health risk.



**Figure 38: County death rates adjusted for socio-economic health risk ranking**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

# The Science of Healthy Places

## *Introduction*

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Many of the serious and prevalent health problems in metropolitan Atlanta have been linked to the built environment, and specifically to transportation and land use. Furthermore, there are health disparities linked to socio-economic status, age, race, and/or ethnicity, which correspond with land use and transportation. Specifically, some aspects of the built environment seem to exacerbate differences in socio-economic status through the cost of living, educational opportunities, employment opportunities, and personal loss of productivity due to poorer physical and mental health. There are also convincing correlations between the built environment and more prevalent or more highly adverse health outcomes for children, the elderly, and neighborhoods with a large number of residents of color. This HIA will need to consider ways in which Plan 2040 might impact socio-economic status and health disparities. However, it will also need to control for socio-economic status (SES), age, and race/ ethnic identity in order to conduct other analyses. It will also need to control for rates of tobacco use, which increase risks for many diseases.

The purpose of this HIA is to understand how land use, transportation, and related regional policies may be contributing to the burden of deaths and diseases in metro Atlanta as well as to their distribution within the population. The health statistics presented here provide clues to issues in the built environment. These are determined using numerous health studies, conducted throughout the U.S. and the world, that have contributed to our current understanding of healthful environments.

As implied by the goals and objectives of PLAN 2040, there are many circumstances in which this exercise can address potential health impacts. Plan 2040 is designed to assess air quality issues for the entire 20-county region. In addition, both transportation and land use have been shown to affect emission levels. Land use and transportation are associated with outdoor air pollution—which may affect indoor air quality—particularly tropospheric ozone and particulate matter. Air pollution, in turn, is linked with many diseases, such as asthma, lower respiratory disease, and heart disease. Transportation and land use are also associated with greenhouse gas emissions, which appear to be a major contributing factor in manmade climate change (EPA, 2006c, Dale, 1997). While the health effects of climate change are not well known, severe weather events, food and water shortages, and the spread of vector-borne infectious diseases is likely. The Interagency Working Group on Climate Change and Health has identified twelve groups of public health issues that are likely to be exacerbated by climate change, including respiratory ailments, cancers, cardiovascular disease and stroke, foodborne diseases and nutrition due to potential food shortages, heat-related ailments, prenatal and early childhood developmental ailments, mental health issues due to displacement and climate-related stresses, neurological disorders, vector-borne diseases, waterborne diseases, and weather-related mortality (2010). Thus, all levels of Plan 2040 have the potential to impact health through air quality.

## Safety and Security

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### Exposure to Crash Risk

There were 41,059 traffic-related deaths reported in the United States in 2007 (National Highway Traffic Safety Administration, n.d.). This constituted the leading cause of death for individuals ages one to 34 (CDC, 2011). Deaths from heart disease, stroke, and cancer, which are largely affected by physical activity levels, another outcome of transportation practices (Kushi, Byers, et al. 2006, McTiernan, Ulrich et al. 1998, Powell, Thompson et al. 1987, Shiroma & Lee 2010), exceed deaths due to traffic crashes among adults over age 34. Additionally, crashes result in almost 3 million injuries per year. The Task Force on Community Preventive Services estimates this creates an economic burden of about \$150 billion each year, including \$52 billion in property damage, \$42 billion in lost productivity, and \$17 billion in medical expenses (2001), while the FHWA suggests that the cost of crashes in urban areas alone may amount to as much as \$160 billion, or \$230 billion for the nation as a whole (2008). Of the 41,059 traffic fatalities, 4,654 were pedestrians, 5,154 motorcyclists, and 698 bicyclists (FHWA, 2008).

In total, the cost of fatal crashes to the Atlanta region was \$2.9 billion, and injury crashes were responsible for \$7.8 billion of comprehensive costs. The sum of injury and fatality crashes thus cost the region \$10.8 billion, compared against \$2.5 billion in estimated congestion costs from the UMR. The Atlanta region had the second highest per capita crash costs out of 14 cities in the "Very Large" category - \$1,929 (Cambridge Systematics Inc., 2011).

Pedestrian crashes were more likely to occur within urban areas, and are more likely to occur at non-intersection locations (FHWA, 2004). Rural crashes were more likely to be fatal, which has been attributed to increased driver speeds. Although less than one-quarter of all driving takes place in a rural setting (FHWA, n.d.), more than half of all fatal motor vehicle crashes occur in rural areas (NHTSA, n.d.). Rates of pedestrian fatalities are higher in urban areas (Zhu, Cummings, Chu & Xiang, 2008).

Vulnerable populations typically have a higher risk of unintentional injury. There are disparities by income, age, ethnicity, gender, and urban or rural residency (Garrison & Crump, 2007). Traffic-related crashes are the leading cause of death for children (Paulozzi, 2006), and children from low-income households die due to crash injuries at higher rates than children from higher SES households. Additionally, people of color and those earning less than \$25,000 per year are much more likely to walk or bicycle (Pucher & Renne, 2003), and the pedestrian victim of a car collision is statistically more likely to be a person of color (Cheung, 1999). Higher pedestrian fatalities have also been noted around low-income neighborhoods. Schools with a high proportion of students of color are less likely to have continuous, well-maintained pedestrian facilities (Zhu & Lee 2008). The elderly and the disabled are at greater risk because of physical or mental limitations on their perception and movement. Pedestrians, bicyclists, and motorcyclists (including mopeds and scooters) are much more vulnerable than car or truck occupants in a crash. Recent studies have shown that per-cyclist risk of crash is reduced as the proportion of bicycle mode share increases (University of New South Wales, 2008), and there is a similar effect for pedestrians (Jacobsen, 2003).

Collisions or crashes involving road users often result in physical traumas, which can lead to disability or death. A crash may involve a single bicycle or motor vehicle, multiple vehicles, or any number of vehicles and pedestrians. Road design can increase crash risk by determining where and how traffic movements will occur. Further, road design can exacerbate conflicts

between two or more road users; changes in speed or direction; safety of at-grade rail crossings; and road user speeds, visibility, and attentiveness. Designing a road to control traffic flow as well as to accommodate all of the movements that any user might want to make, safely and without excessive delay, is the key. In urban areas, access management plays a large role. In a rural setting, the challenge can be accommodating slow or non-motorized traffic without promoting higher speeds. Areas on the metropolitan fringe may be particularly vulnerable as these areas begin to carry more traffic than on roads intended for rural use. While each road is different, users of all types must be anticipated, and design should be context sensitive. The principles of injury mitigation are outlined below. Many serious crashes might be prevented with changes to the policy and travel environment.

Literature demonstrates links between crashes prevalence and severity related to traffic volume, travel time, travel speeds, availability of travel alternatives for risky drivers, availability of appropriate bicycle and pedestrian facilities, and other design and operational factors. Rifaat and Tay (2009) and Rifaat, Tay, and de Barros (2010) evaluated motor vehicle crashes relative to the local street pattern (rectilinear grid, “warped” network, “loop and lollipop”, or mixed). Their conclusion was that a higher crash rate occurred in grid networks when all crashes were evaluated as the equivalent of property damage only (PDO) crashes. However, they were unable to control for motor vehicle traffic volume and other confounders, and used incomplete representations of local land use. Additionally, the studies excluded major roads; the fundamental difference between grid networks and the other networks studies is that the other networks offset a significant portion of travel from local streets to collector and arterial roads, and potentially increases trip length and speed.

Thus this research may inaccurately represent the total impact of less-gridded networks on crash rates. Other research suggests that when confounding factors such as traffic volume and traffic speed are considered, dense street networks are actually safer for pedestrians in terms of crash risk (Ewing & Dumbaugh, 2009). From a health perspective, injury and fatality crashes are of much greater interest, although PDO crashes could impact health through stress, fear, economic burden, emergency response resource allocation, delay, and other mechanisms. These findings have implications for zoning ordinances.

According to a study conducted for the National Highway Traffic Safety Administration, speeding is a factor in about one-third of all traffic-related fatalities. In the urban setting, the largest number of all traffic fatalities occurred on principal arterial roads, followed by minor arterials and local roads. Rural areas saw fatal crashes distributed more broadly across major collectors, arterials, and local roads. Although fatalities tend to be random events, the largest number of traffic fatalities in which speed was a factor were found on rural major collectors, urban principal arterials, and local roads in both contexts, even when factored for miles traveled per roadway class (Liu, Chen, Subramanian, and Utter, 2005). Prior studies have shown that changes to posted speed limits have only about a 1.5 mile per hour difference in average speed (Parker, 1997). Speeding has traditionally been addressed through traffic enforcement, but some researchers have suggested that it is more effective to change the design speed of the road (Donnell, Himes, Mahoney, and Porter, 2009). Roads can be made safer for motor vehicles by moving fixed objects back from the roadside; widening travel lanes; and employing channelization, acceleration lanes, and grade separation at intersections. However, such designs are associated with increased driving speed and less driver attentiveness, and thus with increased crash severity, higher risk for pedestrians and cyclists, and a less suitable environment for local access. Some studies have found a linear

relationship between increased speeds and increased crash rates, as well as increased delay due to crash incidents. Other studies have only found an increase in severity. The potential safety impacts of roadway design are related to context-sensitive factors, and appropriate countermeasures should consider the 4 Es of safety: education, enforcement, engineering and emergency services.

Although it is an urban area, the Atlanta region has rural expanses which are subject to the higher crash risk observed in rural areas. Through Plan 2040, ARC can fund program infrastructure and operational changes to regionally-significant roads, and provide design recommendations to local transportation departments. Ultimately, it is up to the local project sponsor to implement design changes. Rural crashes include multi-vehicle crashes at driveways and intersections, and single vehicle run-off-road crashes. Conventional treatments to rural roads have included warning signs for turning traffic, curves, and other hazards, removal of roadside objects, pavement markings and rumble strips, and barriers such as guardrails. However, there has been concern that these treatments create a false sense of safety in drivers leading to less-cautious driving which overcompensates for safety treatments and results in no change to crash rates. Additionally, bicycle and pedestrian traffic is greatly affected by treatments to the roadside or shoulder, and by intersection redesign. Alternative treatments have been proposed and found to improve safety. Richter and Zierke (2010) reported that converting low volume (< 3,000 vehicles per day) rural roads from two marked lanes to a single lane in the center of the road reduced speed and reduced run-off-road crashes. Stamatiadis, Bailey, Grossardt and Ripy (2010) found that lane narrowness, shoulder narrowness, roadside barriers (from cables to walls), and roadside vegetation (from grass to trees) had progressive effects on driver discomfort which caused them to reduce speed.

### **Transit safety**

Travel by transit is a generally safe mode of transportation. According to an analysis by the Victoria Transport Policy Institute, 2001 crash rates per billion passenger miles was 0.6 for bus, 1.8 for heavy rail, 0.1 for commuter rail, and 0.7 for light rail, compared to 7.9 for passenger car, 8.2 for light trucks (including SUVs), and 303 for motorcycles (Litman & Fitzroy, 2011). On a national scale, heavy rail agencies reported 33 injuries per 100 million passenger miles between 2002 and 2008, while light rail agencies reported 40 injuries per 100 million passenger miles during the same time period (Nelson & Streit, 2011). In a study comparing transit safety data from the National Transit Database compiled by the Federal Transit Administration which analyzed data provided to this Federal Agency by transit service around the country, including MARTA, between other modes and among 27 transit authorities, MARTA reported 1394 incidents, 1347 injuries and 6 fatalities from 2002 to 2008. Incident data reported to FTA by transit agencies includes collisions, derailments, fires and slips. For reporting purposes, injuries include any physical harm as a result of an incident, while reported fatalities do not include deaths due to illness or natural causes on transit property. The study generally found an inconsistent safety record among the agencies studied, especially considering the transit safety records within the same state agency and under the same regulatory regime. However, as demonstrated by the figures MARTA reported to FTA, fatality rates were very low (i.e. one fatality recorded per year). (Nelson & Streit, 2011)

Although bus transit is regarded as a very safe mode of transportation, few studies have analyzed injury and incident rates for passengers on bus transit (Shaw & Gillispie, 2003). In a study of bus transit accident data on mid-size public transportation agencies in Florida, detailed analyses on accidents were not conducted due to the small number of incidents during the reporting period. However, the report recommended more standardized data collection for public transportation agencies, and suggested that further research on bus

transit incidents and injuries would likely aid efforts to improve safety (Buchacz Sapper & Page, 2004).

### **Road and rail safety: Terrorism and Disaster Management**

Recent events, including the 2005 terrorist attacks on London's transit system, have raised concerns about the safety of public ground transportation and potential vulnerabilities to terrorist threat. However, literature shows even if risks of murder and terrorism are taken into account, public transit is still a much safer mode of transport than the private automobile (Litman, 2005, citing Lucy, 2003). Evidence suggests that travelers would increase their injury risk if they shifted to private cars due to fear of a terrorist attack (Litman, 2005), as shown by the net increases in deaths due to reduced subway usage in London and New York City. However, surface public transportation systems are still a potential target of terrorist attacks, as demonstrated by bus and rail bombings in various countries. Since the September 2011 attacks, many transit systems have increased security and updated disaster management planning to prepare for potential attacks.

The potential vulnerability of transportation systems to terrorist threats also makes transportation systems vulnerable to the spread of infectious disease. Due to the large amount of people in an enclosed area and the high turnover of passengers, public ground transportation systems may facilitate the movement of disease vectors (Tatem, Rogers & Hay, 2006). However, a study of acute respiratory infection (ARI) risk and public transport use did not support a suspension of mass transit systems to prevent pandemic spread, even though recent public transit use was a risk factor for ARI exposure (Troko et al. 2011). Generally, transportation agencies are required to generate and document emergency preparedness plans which include planning addressing terrorism and weapons of mass destruction (US DOT, 2003). Beyond public transportation vehicles, an initiative by the Congress for the New Urbanism has addressed linkages between emergency response and street network design. This research suggests that well-connected streets may provide increased access to emergency vehicles, as well as increasing pedestrian safety (Wren, n.d.). Further, a study of emergency response time and land use patterns found that areas with predominately lower density development and a lack of street connectivity were significantly associated with increased emergency response time (Trowbridge, Gurka & O'Connor, 2009).

### **Intentional injury and the built environment**

Tract-level studies have demonstrated disparities between indicators of physical and social disorder as well as health disparities between neighborhoods. A study in Illinois examined the health effects of neighborhood disadvantage, as disadvantage was associated with disorder and a breakdown in social control (Ross & Mirowsky, 2001). Disadvantaged neighborhoods are often marked by concentrated poverty, low rates of homeownership and college education, and single-parent households. The study examined the effects of these variables on physical activity, stress and fear. Neighborhood disadvantage and disorder can contribute to low health status by inhibiting physical activity via walking, and cause stress, which may increase vulnerability to infection and disease. However, the hypothesis linking neighborhood disadvantage to decreased walking was not supported by the results. The study found support for the mediation factor of social and environmental disorder to explain the association between neighborhood disorder and health, especially relating to the health impacts of stress caused by crime and fear of crime.

The connections between intentional injury, concentrated disadvantage and informal social controls were explored further in subsequent studies. One study investigated the hypothesis that collective efficacy mediates the association between violence and economic disadvantage at the neighborhood level (Sampson, Raudenbush & Earls, 1997). This argument suggests that

the ability of neighbors to maintain informal social order breaks down in areas of concentrated poverty and leads to higher incidence of interpersonal violence. Controlling for all other effects, collective efficacy was negatively correlated with interpersonal violence. An interesting result of the study was that the effects of social composition on violence were reduced when collective efficacy was added to the models, implying a mediating effect between collective efficacy and neighborhood disadvantage. The statistical significance of collective efficacy held when controlling for other social variables, past homicides, and predominantly African-American neighborhoods (Sampson, Raudenbush & Earls, 1997). The results of this study were supported by later research (Browning, Feinberg & Dietz, 2004; Carr, 2003).

As concentrated poverty is considered a determinant of crime and intentional injury, some have advocated mixed-income development to mitigate this effect (Wilson, 1987). Although causality was not investigated, research has shown that crime rates dropped significantly after housing projects in Atlanta were revitalized into mixed-income communities (Boston, 2005). Also, a study of a mixed-income revitalization project in Chicago supported the proposition that mixed-income developments experience reduced crime rates (Rosenbaum, Stroh & Flynn, 1998), although this effect may be attributable to strict screening processes and management rather than mixed-income housing (Smith, 2002). Further, some studies have found that the move toward mixed-income housing developments is a less significant factor for social capital (a correlate of reduced crime rates) than the presence of neighborhood services and facilities (Dekker and Bolt, 2005; Curley, 2010).

Many are surprised to hear that the rate of intentional injuries – those due to crime and violence – can be influenced by the built environment. But these occur at lower rates, all other things being equal, in communities where there are more trees, where neighbors are acquainted, where citizens informally patrol the street from windows and sidewalks, and where people can get to work even if they don't have a car (Goodell & Williams, 2007). A study of the risks of "leaving home" in 15 metropolitan areas showed that the risks of traffic fatalities and homicides were higher in ex-urban counties than in central city or inner suburban areas (Lucy, 2003). The study found that lower-density urban development was associated with higher mortality rates, pointing to the influence of built environment characteristics for indicators of safety and security. Additionally, the author noted the prevalence of two-lane (local) roads, higher driving speeds and separation from emergency services contributed to the greater dangers of ex-urban counties.

A study of property crime in Seattle, 1998-2000 found that land-use and built environment characteristics had a greater effect on crime than demographic characteristics, especially linking proximity to highways and risks of auto theft and burglary (Matthews, Yang, Hayslett & Ruback, 2010). Several studies have demonstrated an association between bus ridership and proximity to transit stations and crime (Block & Davis, 1996; Loukaitou-Sideris, 1999; Matthews, Yang, Hayslett & Ruback, 2010). However, Matthews, Yang, Hayslett & Ruback (2010) found that of property crimes studied, bus ridership was only associated with theft.

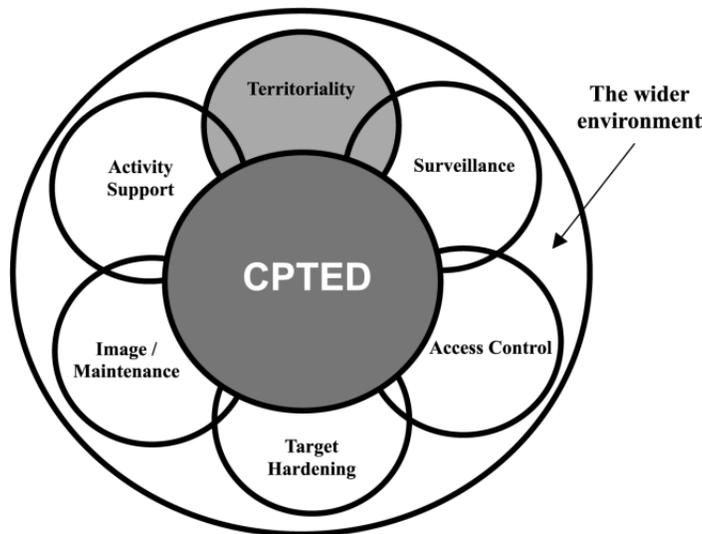


Figure 39: CPTED conceptual model (Cozens, Saville & Hillier, 2005)

These place-based studies evaluating the associations between built environment features and crime point to the potential of built environment interventions to create safer neighborhoods and public spaces. The Crime Prevention Through Environmental Design (CPTED) literature provides some evidentiary support for the efficacy of individual and multiple place-based crime prevention initiatives, intended to change behavior of potential perpetrators by altering the physical environment where crimes occur (Cozens, Saville & Hillier, 2005). The “first-generation” CPTED strategies may involve efforts to increase surveillance of urban spaces, support

“safe” activities, maintain the appearance of safe places or control access points. For example, built environment features such as lighting, street-facing windows or limited shrubbery may increase informal surveillance and reduce crime. Additionally, well-maintained places with high occupancy may reduce the appearance of a particular urban area as a “hot spot” for crime, as stated in the “broken windows” theory (Wilson & Kelling, 1982). Although CPTED studies also lend some support to environmental design that encourages pedestrian flow, crowding may also lead to opportunities for crime. In general, although CPTED interventions have been largely successful in the literature, it is often difficult to separate out effects of individual strategies (Cozens, Saville & Hillier, 2005).

Social “disamenities” such as crime rates may also impact the uses of neighborhood physical activity sites. Addressing the paradox of higher obesity rates among black and Hispanic residents given greater park access in New York City, a study examined the prevalence of neighborhood “disamenities” and proximity to parks (Weiss et al., 2011). The study found that black and Hispanic residents have greater access to parks but are also exposed to greater “disamenities,” such as undesirable land uses, crime (measured by homicide rate), and traffic hazards. This study echoes a larger literature on the existence of crime and crime perception as a major deterrent to physical activity and health promotion (Foster & Giles-Corti, 2008; Harrison, Gemmel & Heller, 2007).

Fears of traffic or crime also impact travel choices and property values. Perceptions of crime may often influence residential choices, and perceptions often reflect common stereotypes of the relative safety of urban vs. suburban areas (see Poe, 2002). A cross-sectional study of suburban housing developments in Western Australia and perceptions of crime suggested that urban design can create safer spaces with robust bicycle and pedestrian infrastructure, pavement and roadside design elements that discourage speeding, and homes and businesses that engage with the public right-of-way to create a lively and continuously-monitored space (Foster, Giles-Corti & Knuiman, 2010).

Crime and intentional injury rates have been linked with a variety of social and environmental design factors. Although neighborhood-level disparities point to a strong effect of socioeconomic status on crime rates, literature demonstrates the effects of social capital and

informal social control on crime and the perceptions of crime. The CPTED literature suggests that characteristics of the built environment may encourage or inhibit criminal behavior in certain neighborhoods, although other studies question the application of physical solutions to social problems such as the new federal emphasis on mixed-income housing developments.

### Safety and Security: Health indicators

Over 5000 lives were lost due to car crashes in the Atlanta region between 1999 and 2007, not to mention hundreds of thousands of serious injuries. Pedestrians and bicycle and motorcycle riders are over-represented in traffic fatalities. Transportation-related injuries may be underreported – these figures refer to motor vehicle crashes that occur on roadways. Incidents that occur when a pedestrian falls, bicycles crash, or an injury happens in a parking lot or driveway are not reported in this data. Transportation agencies have had safety goals and programs for decades, with mixed results. Fatality and injury rates per mile traveled did decline, but total vehicle miles traveled (VMT) increased such that the per capita injury and fatality rate stayed flat. It has only been since approximately 2007, as VMT flattened and even started to decline, that total injuries and fatalities have decreased. One of the most worrisome aspects of traffic-related injuries is that the U.S. rate is much higher than most other developed countries. Of the 34 OECD nations, only six have a higher rate of traffic fatalities than the U.S. – Mexico, Greece, and some countries in Eastern Europe – and the U.S. rate is more than double that of nine other countries, as shown in Figure 40. This creates a unique burden of disease for Americans.

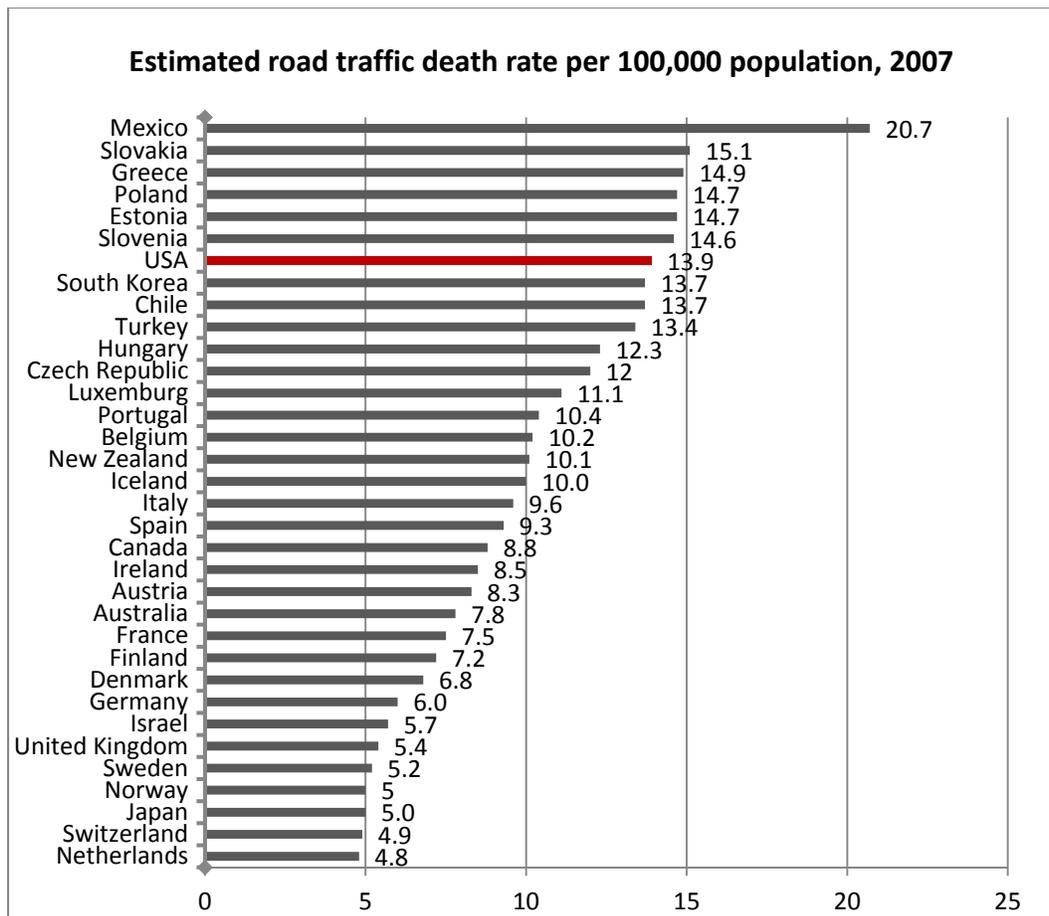
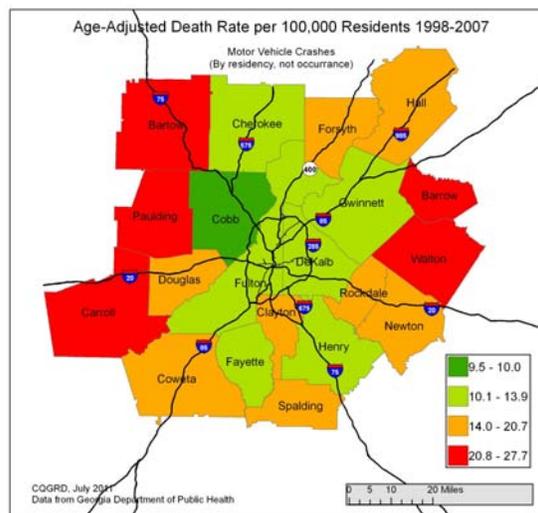


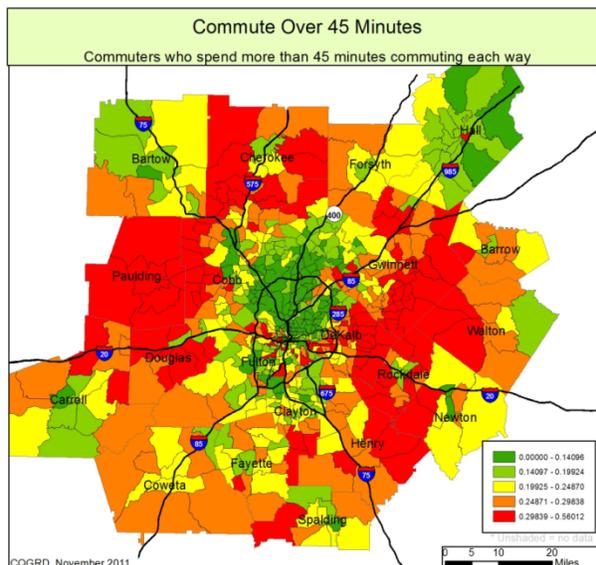
Figure 40: Road traffic death rate, 2007

Motor vehicle crashes are the leading cause of death for Georgia residents from age 5 to 44 (CDC, 2007). Crashes can be more prevalent and more severe as traffic increases, as residents spend more time in transportation, as travel speeds increase, as travel alternatives for unsafe drivers become less available, when appropriate bicycle and pedestrian facilities are lacking, and other design and operational factors. In the Atlanta region, the average age-adjusted death rate due to motor vehicle crashes is 13.9 for the years 1998-2007. Note that these figures include Hall and Carroll counties in addition to the MPO transportation planning district. Also, note that crash rates from the Georgia Department of Public Health (DPH) are reported based on residence, not the location of the crash. Therefore, these rates refer to the risk experienced by individual residents of the county. Variation in the rates can be explained by variation in the mean for the distances traveled, driving speed, roadway characteristics, and possibly risky behavior that affect driving (such as drug use).

Figure 41 displays the rate of deaths caused by motor vehicle crash relative to county of residence (regardless of where the crash occurred). The lowest death rate in the region was Cobb County with 9.5 deaths per 100,000 residents, which was still higher than half of the OECD countries shown in Figure 40. The highest rate – nearly triple the lowest – was 27.7 deaths per 100,000, found in Barrow County. In general, higher rates were more prevalent in further outlying counties. These rates include motor vehicle occupants, motorcyclists, pedestrians, and bicyclists.



**Figure 41: Death rate, motor vehicle crashes**  
 Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

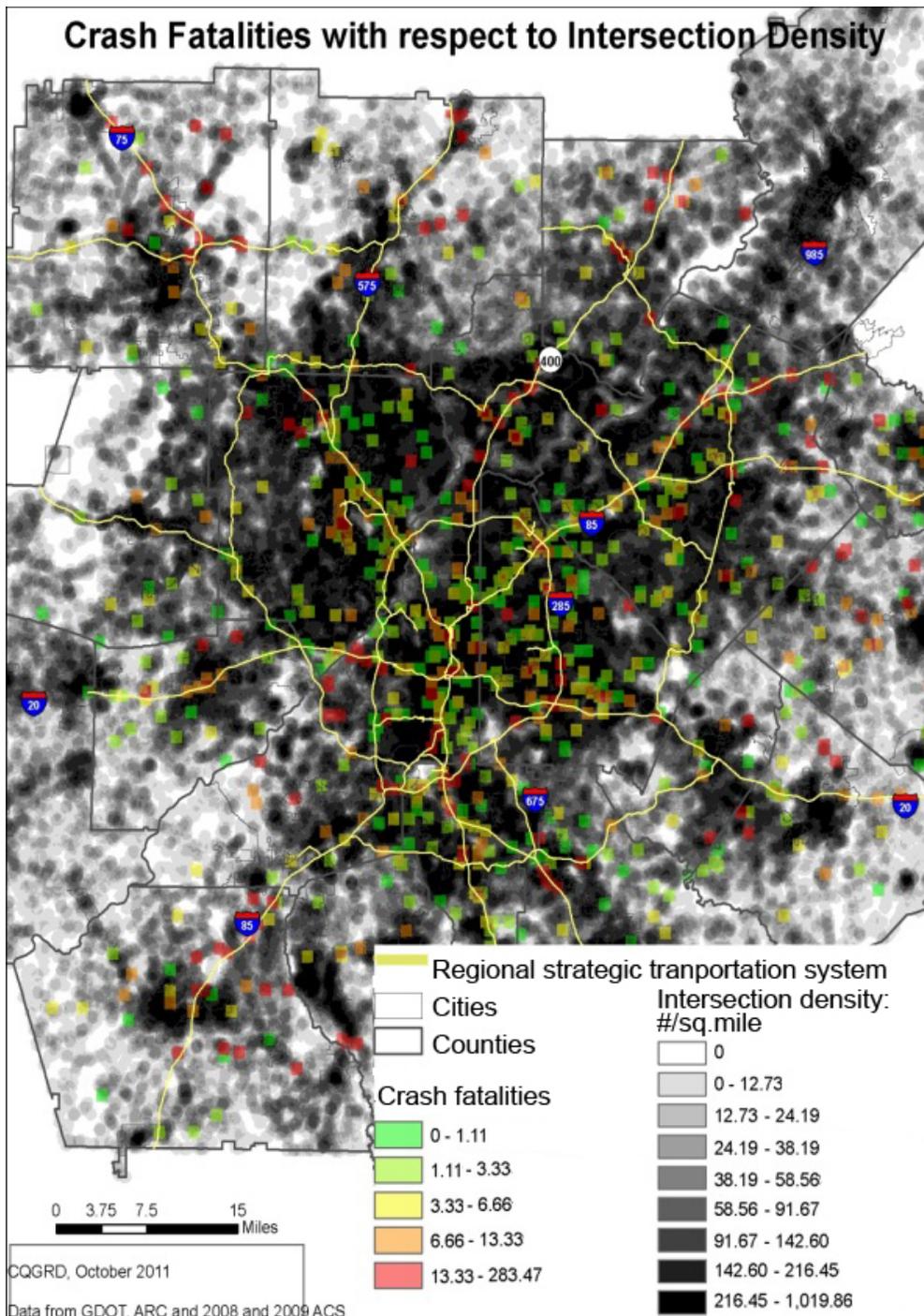


This appraisal sought to identify characteristics of the physical, social, or policy environment that could elevate crash rates for certain populations or places. As noted in the literature review, above, total personal exposure to crash risk (increased time or distance driving or walking) is associated with higher crash rates. Using commute time as a proxy for total exposure (Figure 42), this appeared to explain some of the regional variation in motor vehicle crash deaths by residence. However, some other anomalies emerged, such as the variation between Bartow and Cherokee

**Figure 42: Percentage of workers with average commute longer than 45 minutes (one-way)** counties.

Prepared by Center for Quality Growth and Regional Development.  
Data source: OASIS, Georgia Dept. of Public Health.

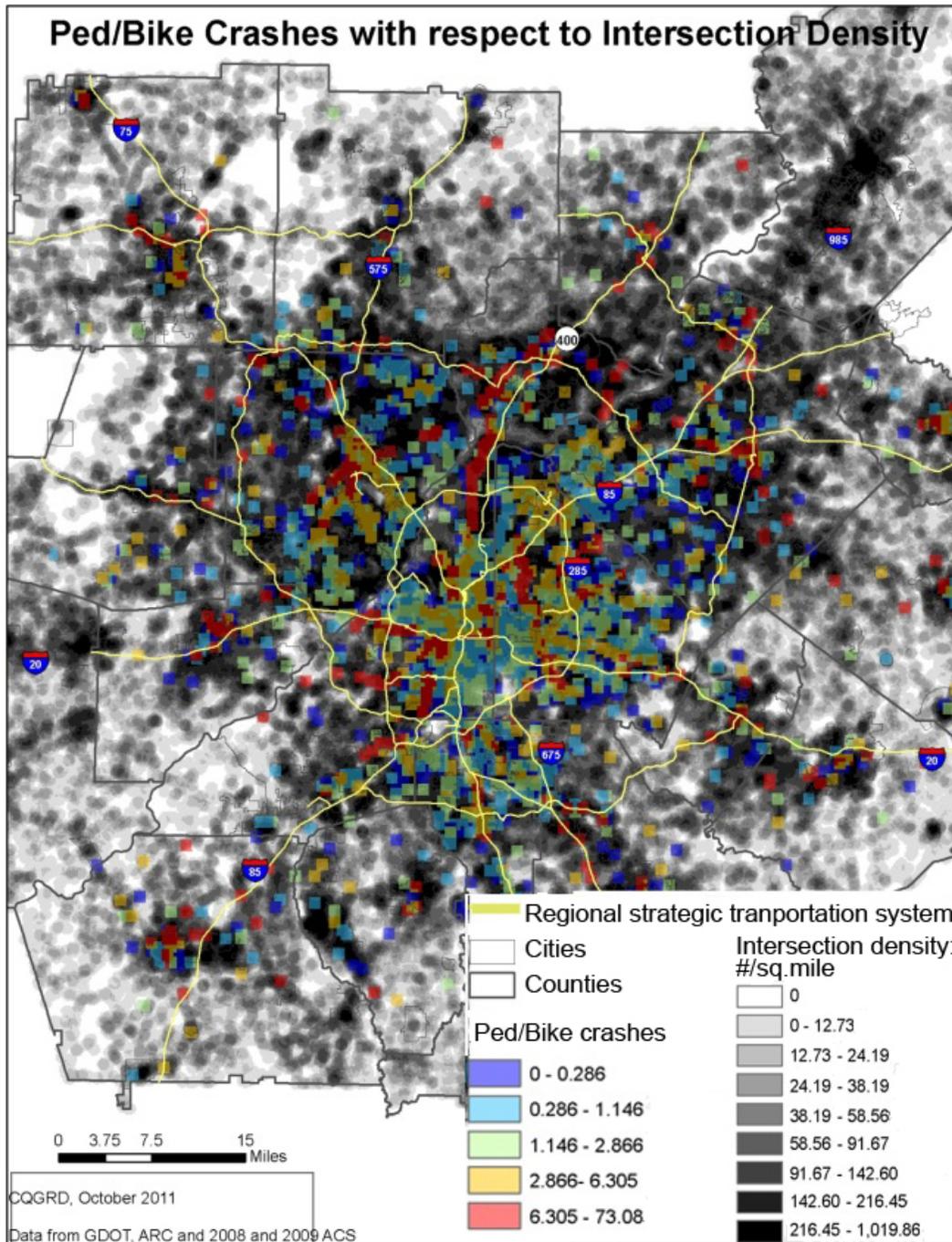
Lower four-way intersection density was associated in the literature with increased crash severity, especially for pedestrian and bicycle crashes. In Figure 43, fatal crash density by crash location (with lower density nodes in green and higher density in red) is mapped against four-way intersection density (higher density of intersections is indicated by darker shades of gray or black). Crash data were not available for Carroll or Hall counties. In this analysis, there appear to be fatal crash locations distributed relatively evenly inside the I-285 loop (the “Perimeter”) and in the areas just to the northwest and northeast outside the Perimeter. However, some more concentrated fatal crash nodes appear further out to the northwest in outer Cobb and in Bartow County. Many fatal crash nodes do appear to cluster in areas of lower intersection density, and along major highways.



**Figure 43: Crash fatalities and intersection density**

Prepared by Center for Quality Growth and Regional Development. Data sources: Georgia Department of Transportation & U.S. Census Bureau/TIGER. Note: Crash data not available for Hall and Carroll counties

In Figure 44, comparing all injury crashes involving bicyclists or pedestrians against the road network identifies some high risk locations. In this case, bike/pedestrian injury nodes appear clustered along several corridors in south Fulton County, in western DeKalb County, and in northern Fulton County (Roswell Rd.), with additional clusters in outlying counties.

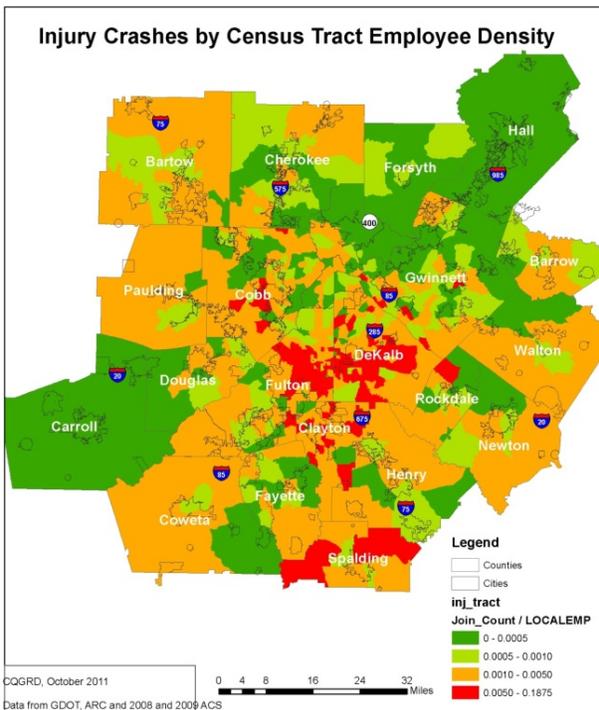


**Figure 44: Pedestrian and bicycle injury crashes and intersection density**

Prepared by Center for Quality Growth and Regional Development. Data sources: Georgia Department of Transportation & U.S. Census Bureau/TIGER. Note: Crash data not available for Hall and Carroll counties

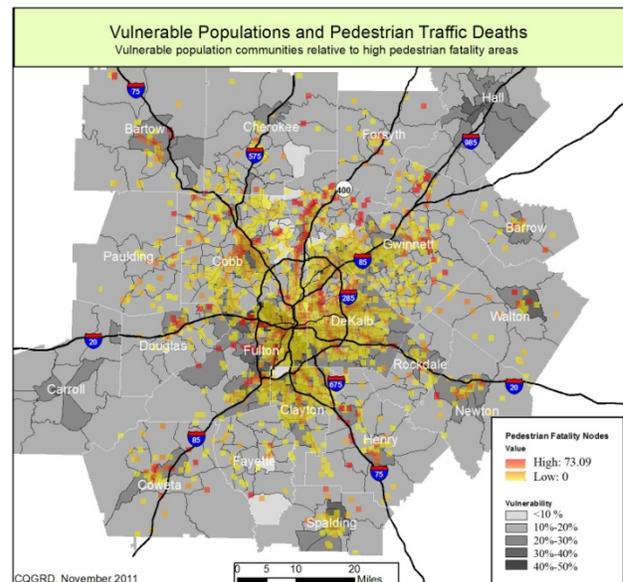
Injury crashes are also associated with traffic volume and motor vehicle traffic speed. However, the HIA team encountered data limitations relating to traffic volume and speed. Only a small number of road segments had traffic volume associated with them. Speed limit data were available for a limited number of roads, but not actual travel speeds. Additionally, there was no data regarding bicycle or pedestrian volume.

The HIA team theorized that crash locations could have a correlation with employment density, by generating traffic volume or congestion. As areas of higher employment density might indicate higher crash density, injury crashes have been normalized by total employment for the Census tract (Figure 13, Figure 45). This data suggests that after normalization, areas in south Atlanta (Fulton, DeKalb and Clayton county) have higher crash to employment ratios (shown in red), indicating that these communities may be excessively impacted by traffic conditions or design. Crash data were not provided for Hall and Carroll counties. Pedestrian fatalities appear to have some clustering around districts with a high percentage of vulnerability (Figure 46).



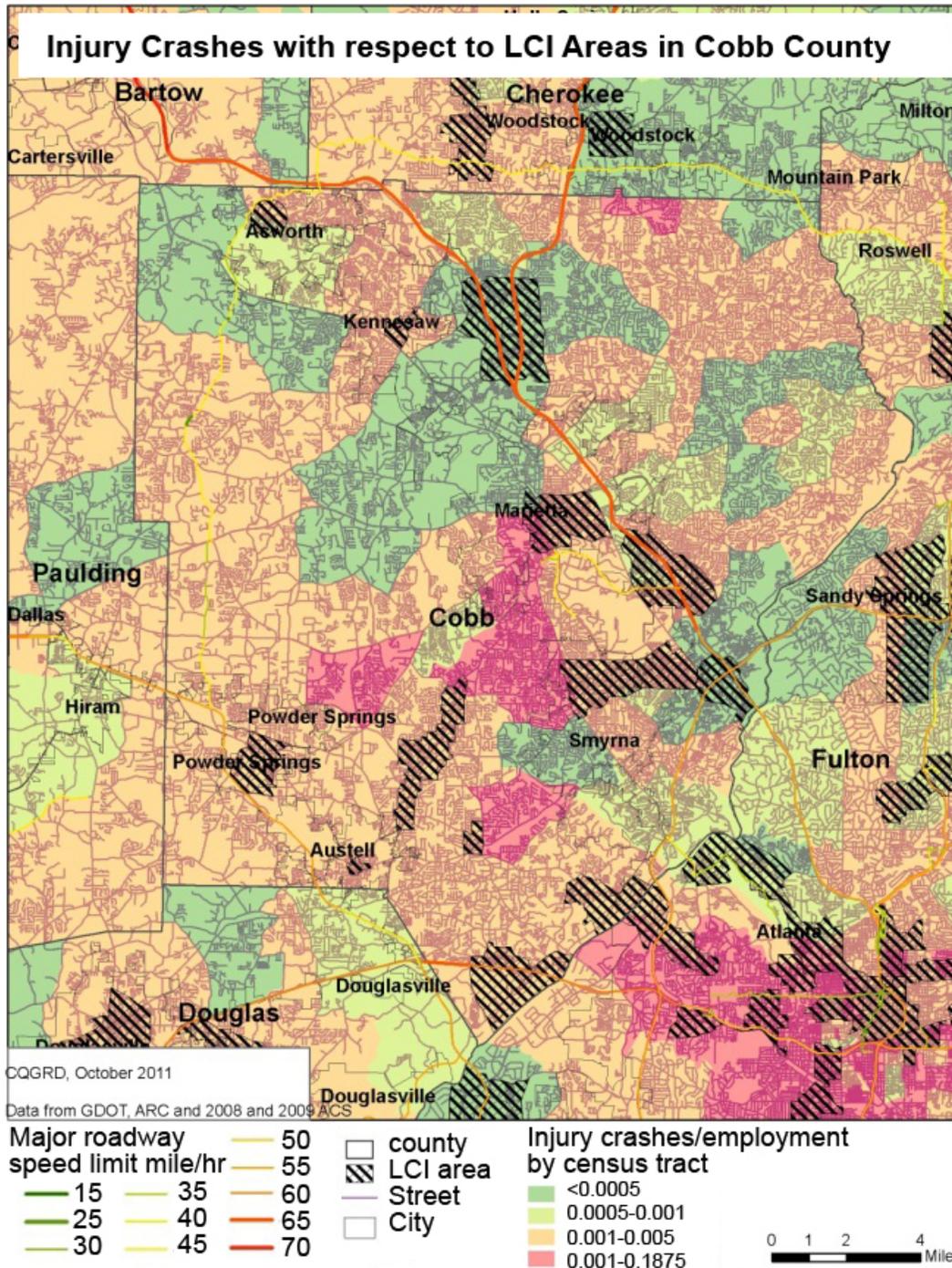
**Figure 45: Injury crashes, census tract employee density**

Prepared by Center for Quality Growth and Regional Development. Data sources: Georgia Department of Transportation, U.S Census Bureau & Claritas BusinessPoint. Note: Crash data not available for Hall and Carroll counties



**Figure 46: Distribution of pedestrian fatalities relative to vulnerable communities**

Combining potentially protective elements of land use and transportation planning, Livable Centers Initiative (LCI) areas may be associated with lower injury crash densities (Figure 47). An examination of crash to employment density ratios and LCI locations suggests that the highest ratios may be more likely to occur outside of LCI districts, potentially recommending these districts as a safety element.



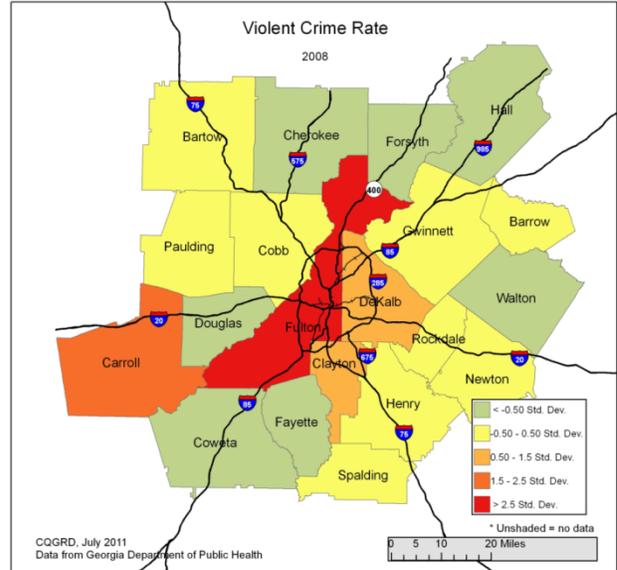
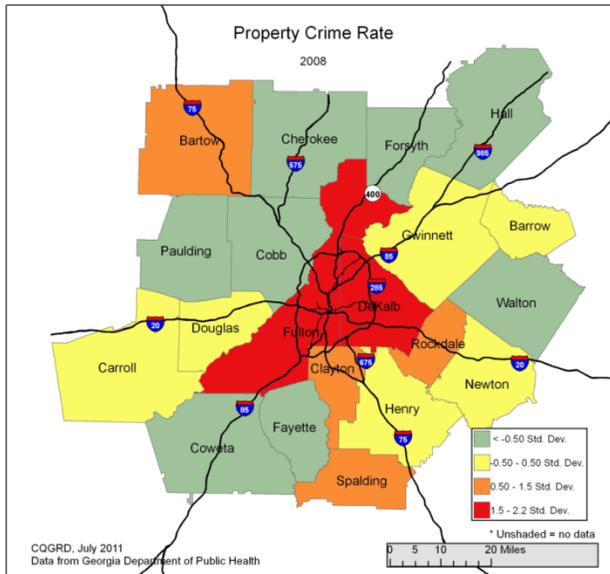
**Figure 47: Injury crashes and LCI areas, Cobb County**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, Georgia Department of Transportation & U.S. Census Bureau/TIGER.

Regarding intentional injury, detailed geographical data was not widely available. Homicide deaths and hospitalization rates could be obtained by county or visualized by Census tract, and crime rates were available by county from the University of Georgia. Demographic data regarding poverty, income, and other indicators of disadvantage were available by Census tract from the U.S. Census Bureau's American Community Survey, and employment opportunities

could be estimated from Claritas BusinessPoint data. A limited list of public community centers was available through the Atlanta Regional Commission. However, many metrics were not available in a usable format, including crime rates on a finer geographic scale, urban design and landscape, or a complete list of community amenities.

In the Atlanta region, rates of property and violent crime were highest in central counties, followed by several outer counties (Figure 48, Figure 49). Highest rates of property crime were found in Fulton and DeKalb counties, while the highest rate of violent crime was found in Fulton County.

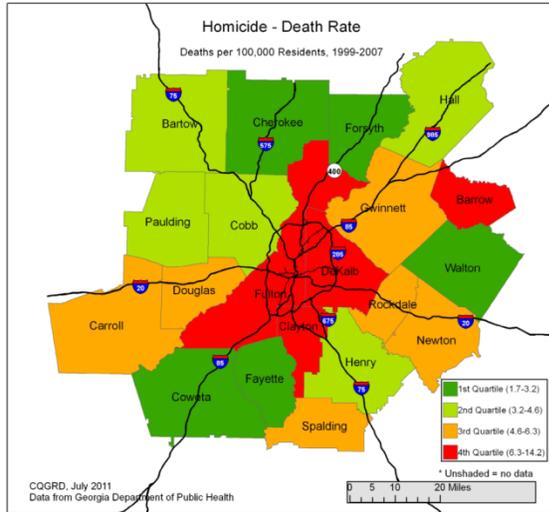


**Figure 48: Property crime rate, 2008**

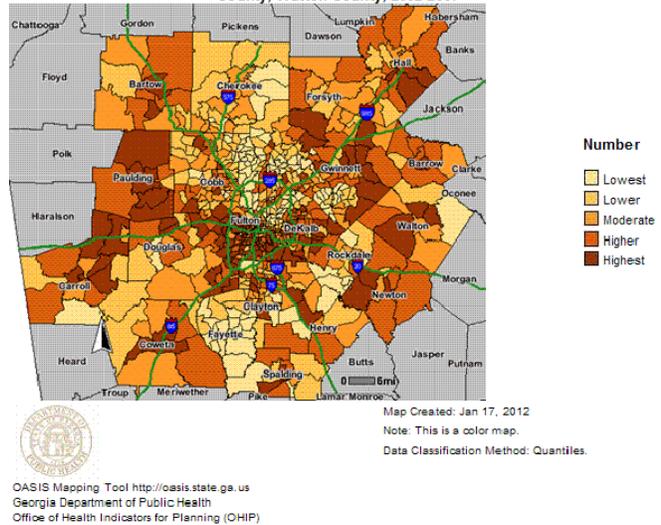
**Figure 49: Violent crime rate, 2008**

Prepared by Center for Quality Growth and Regional Development. Data source: Georgia Statistics System, University of Georgia.

The highest homicide rates were found in Fulton, DeKalb, Clayton, and Barrow counties (Figure 50). This data indicates a range of homicide-related death rates ranging from 1.7/100,000 residents to 14.2/100,000. However, a map of emergency department visits for homicide (whether the victim survived or not) generated through the Georgia Department of Public Health’s OASIS system suggests a wider distribution of violence (Figure 51). Emergency department data was not available prior to 2002.



**Figure 50: Homicide, death rate**



**Figure 51: Distribution of ER visits for homicide, 2002-2007**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

Several of the figures in previous sections on Atlanta’s demographic identity (page 39) and health disparities (page 66) depict the unequal distribution of income and poverty throughout the region. Poverty density, a correlate of crime rates (shown earlier in Figure 11, page 44) can identify areas of concentrated poverty.

## Access, Equity, and Economy

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### Introduction

Health disparities are linked to socio-economic status, age, race, and/or ethnicity, which correspond with land use and transportation. Specifically, some aspects of the built environment seem to exacerbate differences in socio-economic status through the cost of living, educational opportunities, employment opportunities, and personal loss of productivity due to poorer physical and mental health. Land-use and development patterns are often guided by zoning for density, land-use and parking requirements. As demonstrated by the following literature, the Atlanta region's dispersed employment patterns and separation of residential and business zones may contribute to: longer commute distances, increased traffic congestion, higher vehicle miles traveled (VMT), increased time and cost for daily transportation, and reduced access to goods and services.

### Travel time and cost to work

Travel distance affects access to nutritious food, medicine, and health care, especially for the elderly, children, persons with disabilities, and households with limited time or mobility. Places that are characterized by lower density, single use development patterns are typically less walkable and thus less likely to include the types of economic conditions necessary to support transit-served communities. This can also have an impact on household travel costs. Median transportation costs can grow from 5% of household income where travel alternatives exist, up to 20% in a car-dependent community, or up to 40% for low income households (Litman, 2010). Research also links walkable neighborhoods, access to retail, and short commutes to better physical, mental, and social health (Malekafzali, 2009).

Obesity and lack of sufficient physical activity, which are risk factors for heart disease, stroke, diabetes, sleep disorders, joint disorders, mental disorders, and some cancers, appear to be more prevalent in residential places with longer distances between destinations (e.g. home, places of employment, schools, and basic retail services), places lacking in bicycle and pedestrian facilities, places lacking in recreation facilities, and other factors.

Litman (2002) identified equity impacts that should be considered in transportation planning, and cited a number of examples to illustrate transportation equity analysis. One example addressed economic opportunity, and suggested that overall economic productivity and employment does not necessarily increase as a result of increased vehicle travel.

Low-income households are more affected by transportation expenses than others and can spend up to 40 percent of their income on transportation. These underserved populations tend to be minority or of lower economic status (Renalds, Smith & Hale, 2010). Affected by high unemployment rates and lack of services, these populations rely on walking, bicycling, and public transportation to achieve economic stability. In many low-income communities, transportation to a hospital or medical office is completely lacking, except by ambulance. Additionally, almost one-third of Americans do not drive (National Center for Chronic Disease Prevention and Health Promotion, 2009). This group includes children under age 16, elderly individuals who can no longer drive safely, people who cannot afford to own and operate a car, and people with disabilities, among others. These individuals constitute a significant part of the economy, as workers, students, and consumers. Without transportation, they experience difficulty accessing jobs, healthcare, churches, stores, government services, and friends or family.

In a recent global commuting study conducted by IBM, 56% of commuters said that if they could spend less time commuting, they would use that time to see friends and family. 48% said they would also use the extra time for exercise, 40% would engage in recreation, and 29% said they would catch up on sleep. In that same study, commuters reported increased stress and decreased productivity due to traffic during their commute, even as they reported that traffic was better than the previous year. 41% of the commuters saw public transportation as the solution to their commute problems (Gyimesi, Vincent & Lamba, 2011).

### **Jobs, Schools, Housing Access**

The health of an adult individual and their household significantly improves with satisfying employment at a livable wage relative to the local market. Employment can provide or allow the household to acquire quality housing, nutritious food, education, transportation, medical care or coverage, savings, and many other necessities of a healthful life. Lack of access to employment, under-employment, or jobs which do not pay a living wage or provide sufficient benefits can contribute to stress, depression, malnourishment or obesity, homelessness, and many other negative outcomes.

Doyle, Kavanagh, Metcalfe, and Lavin (2005) provided a comprehensive review on the impacts of employment, and by extension unemployment on health. According to their findings, unemployment is a stressful event and can have marked negative effects on one's health. These may include but are not limited to premature mortality; poverty due to long-term unemployment may result in individuals having less healthy lifestyles and being exposed to more unhealthy environments; financial strains may contribute to one being more depression prone; affects psychological well-being which might result in anxiety, self-harm or even suicide; individuals might be more likely to undertake unhealthy practices such as drinking and smoke; increased risk of coronary heart disease due to increased stress; etc. Doyle, et al. (2005) also found evidence that certain sections of society are more vulnerable to unemployment such as individuals with disabilities, the elderly, females (under-represented in workforce), travelers and migrants. The types of jobs held by individuals are also a factor to health for example, temporary workers (exposed to poor working conditions, less likely to receive training, job insecurity). Commuting patterns and mode choice can also have effects on individual health which can include reduced physical activity; increased stress due to long travel distances and times; increased commuting to access employment may contribute to air pollution, accidents, noise, etc. It would be important to influence not only the quantity of jobs that persons have access to but also the quality of jobs (types of jobs attracted to an area).

In 2010, 86% of Americans commuted by car, and only 5.1% commuted by public transportation. In the ten-county Atlanta region, 87% commuted by car and 4.2% commuted by public transportation. The majority of metro area Americans lived outside the central city, and many companies are now located in suburban areas. Changing land-use and economic patterns have created longer distances between housing, jobs and services and increased dependency on motorized transportation. These patterns have had a disproportionate impact on lower-income people, who often live in central cities and have fewer transportation choices (Dombroski, 2005).

The "spatial mismatch hypothesis" suggests that greater distances between jobs and housing, particularly for lower-income communities, has contributed to higher unemployment (Holzer, 1991; Boustan & Margo, 2010). However, recent research has revealed the importance of mode choice and transportation access in employment. Studies in Detroit and Los Angeles provide support for the claim that access to transportation contributed to unemployment for minorities, i.e. lack of access to cars limits employment opportunity (Gautier & Zenou, 2010; Grengs, 2009). These studies suggest that greater investment in mass transportation and

greater access to cars would improve employment outcomes for poor people and people of color. However, it is recognized that discrimination, distance to jobs and access to social networks also play a role in obtaining employment.

Several studies found that distance to work is one of several important factors in residential location choice (Levine, 1998; Peng, 1997), and that households used residential relocation to reduce their distance to work (Clark, Huang & Withers, 2003). Based on a study of “jobs-housing balance” and residential choice in Minneapolis, Levine (1998) suggested that a relaxation of restrictive land-use policies would lead to more residential choices.

Strategies that reduce travel distance to jobs, goods, and services can improve access for nearby residents and workers, while also increasing active transportation and reducing the number of miles traveled by car. On a large scale, these changes can increase physical activity, reduce injuries, and reduce noise and air pollution. However, such changes are contingent on the success of the new land use patterns and new businesses introduced into the existing community, and that success is not guaranteed. Some recent studies may help explain varying rates of success through the spatial distribution or clustering of housing types, business types, and civic uses.

Compatible design and gentle, graduated transitions between changes in density and mix of uses plays a major role in acceptance from current and future residents (Searle & Filion, 2011). Searle and Filion (2011) reviewed planning and development trends in Sydney, Australia and Toronto, Canada from the 1940s through the 2000s. They found that quality transit services, especially commuter rail, were a factor in the success of high density multiuse development nodes. Toronto utilized nodes to facilitate higher density developments without encroaching on existing single family neighborhoods and to coordinate growth patterns with planned and existing transportation investments. This plan was balanced with a “greenbelt” program which conserved large areas of undeveloped land at the edge of the city. Citizens had become more supportive of higher intensity development due to their concerns about environmental health impacts and loss of significant natural resources, although there was almost ubiquitous fear that such development would be pursued in a way that destroyed the value of their neighborhood through random placement of incongruous structures. Additionally, nodal development that targets residential density without comparable growth in office and retail at the same node was less likely to produce successful results (Searle & Filion, 2011).

Cervero and Duncan (2006) summarized previous literature on the effect shorter distances to shopping or to work have on travel time and distance. They noted that there was considerable, but not wholly consistent, research supporting both of these strategies as means to reduce vehicle miles traveled (VMT) and vehicle hours traveled (VHT). In their own analysis of travel patterns in the San Francisco area, they found that trips to multiple destinations (including work, shopping, or personal services) were frequently combined in a single excursion, although travelers did not go far out of their way to add destinations. The number of jobs and the number of occupationally-matched jobs within four miles of the residence reduced personal VMT and VHT, and more so than the presence of retail and service businesses within that distance.

#### **Travel time and cost to healthy food sources**

Distance to retail services, especially full service grocery stores, has been shown to limit access to nutritious foods and increase household food costs (Larson, Story & Nelson, 2009). Larson, Story, and Nelson (2009) provided a review of major works or studies that address the relationship between neighborhood access to healthy food options (supermarkets and

restaurants) and the influence on health factors such as dietary intake and risk of obesity. Their review found that residents of neighborhoods with greater access to supermarkets and large grocery chains that offer healthier food options such as fresh fruits and vegetables tend to have healthier dietary intake and lower risk of obesity than individuals with limited access to these establishments and greater access to convenience stores. Residents of low income, minority, and rural communities tend to have less access to retail establishments with healthier food choices (supermarkets and large groceries) (Larson et al., 2009). Likewise, in a study of 10,763 individuals living in 207 different Census tracts, Morland, Diez Roux, and Wing, (2006) found that the presence of a chain supermarket in the Census tract was associated with lower rates of overweight and obesity, while the presence of convenience stores and other grocery stores correlated with higher rates of overweight and obesity.

Low food outlet density seems to have a greater impact on lower-income or otherwise disadvantaged households, who may enjoy shorter travel distances to food markets, a greater likelihood of fruit and vegetable markets, and better selection of healthy foods at the stores in their neighborhood (Ball, Timperio, & Crawford, 2009). The nutritional value of products offered at food stores (whether convenience stores or grocery stores) and their prices additionally impact consumption of fruits and vegetables, sugar, and fat, particularly for disadvantaged families and teenagers (Ball, Timperio, & Crawford, 2009; Powell, Auld, Chaloupka, O'Malley & Johnston, 2007). Additionally, proximity to restaurants and their overall density shows correlation with food consumption patterns, BMI, and related diseases, particularly for fast food restaurants (Morland & Evenson, 2009; Powell, Chaloupka, & Bao, 2007; Treuhaft & Karpyn, 2010).

Based on a review of studies concerning food deserts and the impacts of increased access to healthy foods on health factors, Treuhaft and Karpyn (2010) concluded that individuals with increased access to full service restaurants tended to have better dietary intake and reduced risk of obesity due to the quality of food available and the cost constraint of meals from full service restaurants in comparison to fast food establishments. They also found that the introduction of new and improved healthy food retail in underserved communities adds to job creation in those communities and contributes to the revitalization of low-income neighborhoods. However, consumption of healthy foods can be a complex relationship between retail availability, cost, cultural preferences, and presence of alternative sources (such as food gardens or farm stands) (Sparks, Bania, & Leete, 2011). Other retail and service location proximity appears to influence health, too – for instance, pharmacies, libraries, and medical centers. Travel time and cost for accessing these locations factors into their overall availability, resulting in reduced access when transportation options are limited.

### **Access to medical services**

In all of these cases, access to primary health care and emergency services may be a factor in hospitalization rates and preventive practices which affect the actual health outcome of risk factors and exposures. Access is partially mediated by proximity to medical providers, availability of health insurance through employment and benefits, and medical care costs (relative to other costs of living). A study in El Paso (Law & VanDerslice, 2011) found substantial disparities in health insurance coverage between Hispanic and non-Hispanic individuals, largely related to affordability (citizenship status was not included in the analysis).

Regular and convenient access to medical care also may help control or prevent disease. For instance, Moist et al. (2008) discovered that people who had to travel a greater distance to their dialysis treatment were at greater risk for dying and experienced worsened quality of life due to their health.

### **Economic impacts of access**

A new round of studies are showing that new low density commercial development and new low density residential development in previously undeveloped areas cost the local jurisdiction considerably more in expenditures than they generate in tax revenue (Katz, 2011; Leeman, Ohm, & Rose, 2011). Mixed use, higher-density development in existing town centers generated tax returns several times higher per acre at lower infrastructure and service costs (Katz, 2011), while compact housing had about half the infrastructure costs of more scattered residences (James Duncan and Associates, Florida Department of Community Affairs & Governor's Task Force on Urban Growth Patterns, 1989). Centers that include food shopping tend to fare better than those that do not (Bromley & Thomas, 2002).

School quality, access to jobs, and crime rates can also have a sizable impact on home values (see Economic Opportunities and Community Preservation and Revitalization sections) (Gibbons & Machin, 2008). Families will also pay more for an otherwise similar house in a neighborhood with low levels of air pollution (Smith & Huang, 1995). Several measures of walkability appear to impact housing prices. Eppli and Tu (2000) discovered that homebuyers paid more for homes in neighborhoods that provided a good walking environment. The CEOs for Cities organization analyzed property values related to their "WalkScore" score, a measure which represents the number of destinations in walking distance, and found that higher scores could account for a more than \$30,000 price premium in some markets (Cortright, 2009). Some consumer surveys have identified a stated preference for neighborhoods with sidewalks among potential homebuyers. Two earlier studies linked lower traffic volume with increased home values up to 18% (Bagby, 1980; Hughes & Sirmans, 1992).

Additionally, access to high-quality transit services can elevate residential and commercial property values. Debrezion, Pels, and Rietveld (2007) conducted a meta-analysis of 57 datasets that compared property values based on their distance from rail stations. Based on these studies, they determined that properties within ¼ mile of a commuter rail commanded significantly higher prices, while subway and bus rapid transit stations showed no significant effect. The difference was greatest for commercial properties. A study conducted in Bogotá, Colombia, however, did find that proximity to the extensive bus rapid transit system increased property values in middle-income neighborhoods, but not lower-income areas (Muñoz-Raskin, 2010). Increases in residential property value with proximity to a rail station have also been seen in Dallas, Washington DC, the Netherlands, and others (FTA, 2000; Pagliara & Papa, 2011; Tinbergen Institute, 2006; Weinstein & Clower, 1999).

## **Access and Equity: Health indicators**

Land-use and transportation considerations could play a significant role in economic opportunity in the Atlanta region. Limited alternatives to driving are likely to negatively impact carless households, non-drivers (such as children and people with disabilities), and even households which share a car among two or more drivers (7.5% of regional households). In total, about 6% of households in Atlanta are carless. The highest proportion of carless households (at least 10% of households, shown in orange and red) are located in the downtown/ Midtown area of Atlanta, Atlanta's westside extending past I-285, and in the south Atlanta/ East Point/ College Park/ Hapeville area, as well as a few districts in DeKalb County inside I-285 (Figure 52). However, places where at least five percent of households do not own a car (in yellow) can also be observed in Cobb, Douglas, Gwinnett, Walton, Bartow, and Spalding counties. This is reflected in travel mode to work, which finds a large proportion of residents from Census tracts with high carless rates get to work by walking, bicycling, taking transit, or carpooling (Figure 53). However, commute options are limited by the availability of commute alternatives, leading to a higher share of non-driving commutes along premium

transit routes relative to car ownership, and lower shares elsewhere in the region. Over half of the zero-vehicle households in the region do not have any workers in the household, while the other half uses other means to get to work.

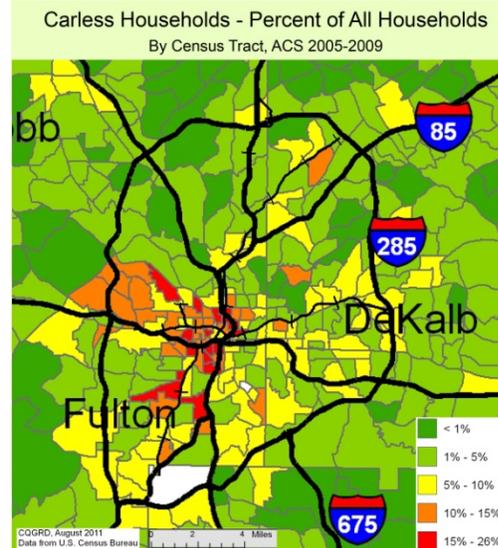


Figure 52: Carless households

Prepared by Center for Quality Growth and Regional Development. Data sources: U.S Census Bureau

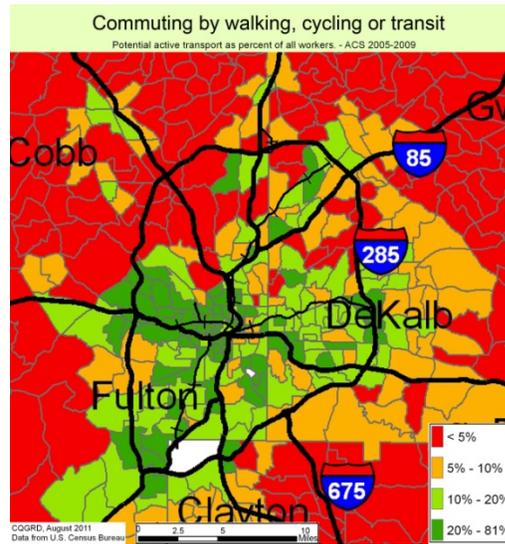


Figure 53: Share of alternative commute to work (not drive alone)

Distance to work can be depicted in several ways. One method is to look at the location of jobs relative to residence. Figure 54 shows the overall distribution of jobs in the region, while Figure 55 shows the ratio of local employment to household density (at the Census tract level).

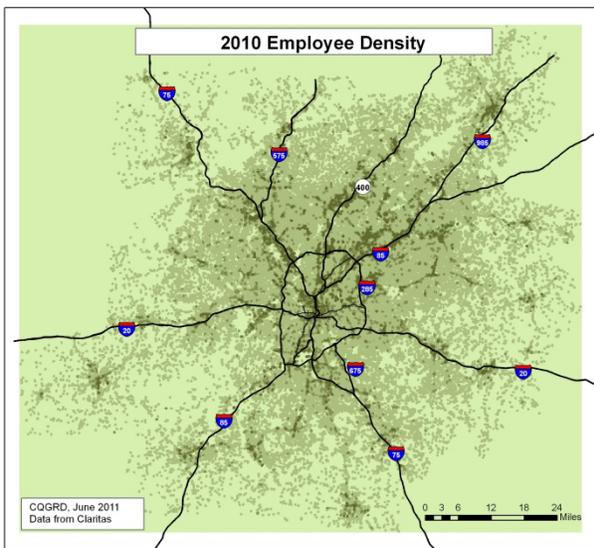


Figure 54: Employment density in the region

Prepared by Center for Quality Growth and Regional Development. Data source: Claritas BusinessPoint

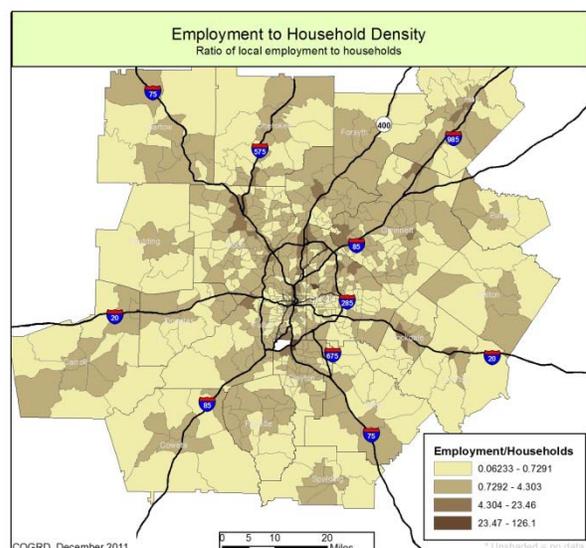
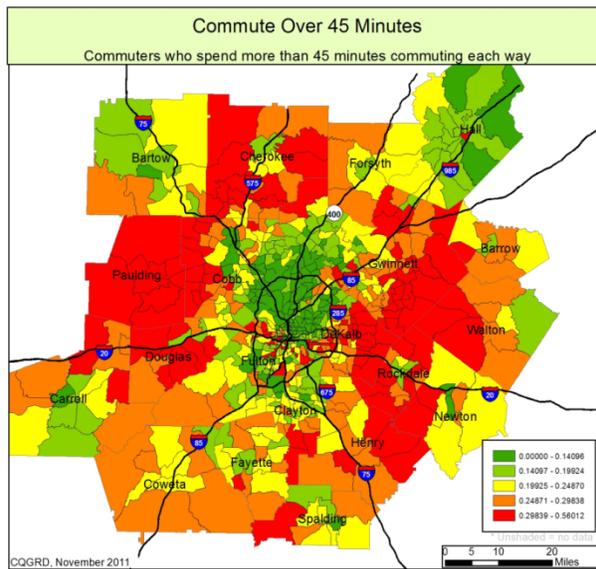


Figure 55: Employment to household density

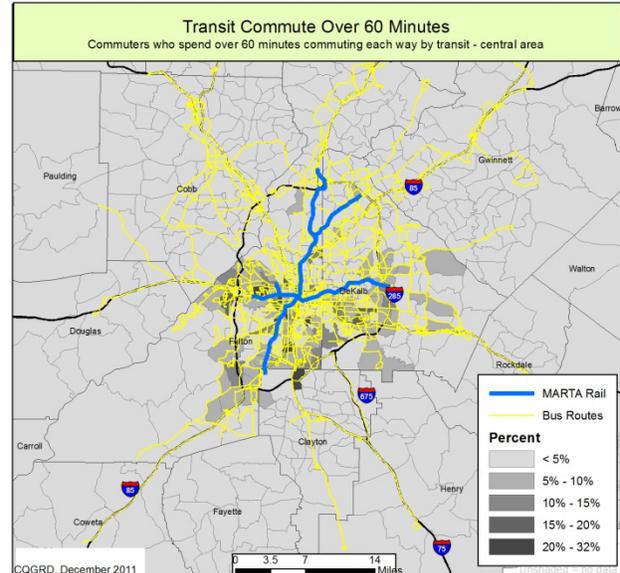
Prepared by Center for Quality Growth and Regional Development. Data sources: U.S Census Bureau

Another measure of access to work is commute time. A large percentage of commuting workers experience long commute times, defined in Plan 2040 as a commute longer than 45 minutes, shown in Figure 56. Areas with a high proportion of carless households are shown to experience long commute times, particularly long transit commute times (Figure 57). As described above in the literature review, long commute times can increase household

expenses or make a particular job opportunity infeasible. There appears to be a clear link between the job to household ratio seen in and resulting commute times.



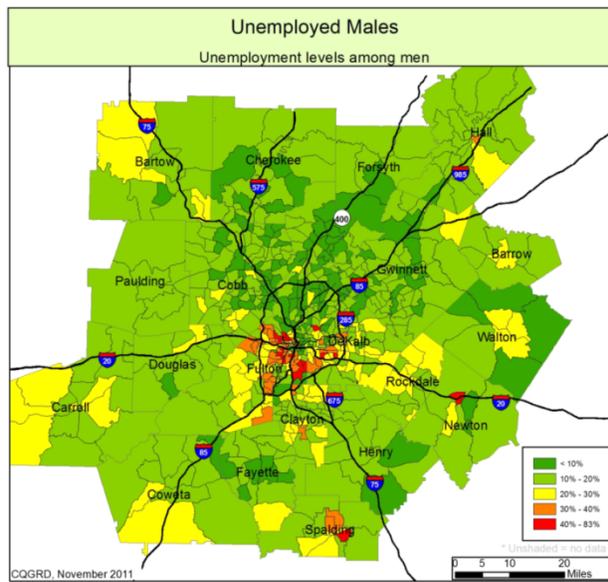
**Figure 56: Commute over 45 minutes**



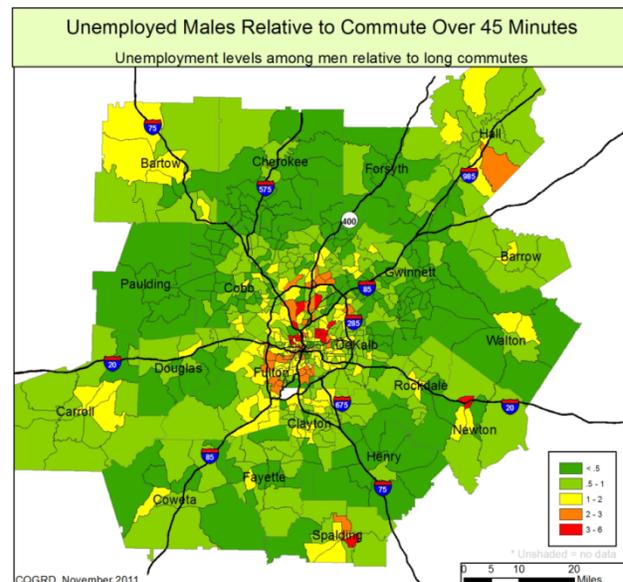
**Figure 57: Transit commute over 60 minutes**

Prepared by Center for Quality Growth and Regional Development. Data sources: U.S Census Bureau

Normalizing male unemployment rates (Figure 58) against long commute times appears to explain high unemployment rates in some of the region's most disadvantaged neighborhoods in west Atlanta, although it highlights areas where other factors are at issue (Figure 59).



**Figure 58: Unemployed males**

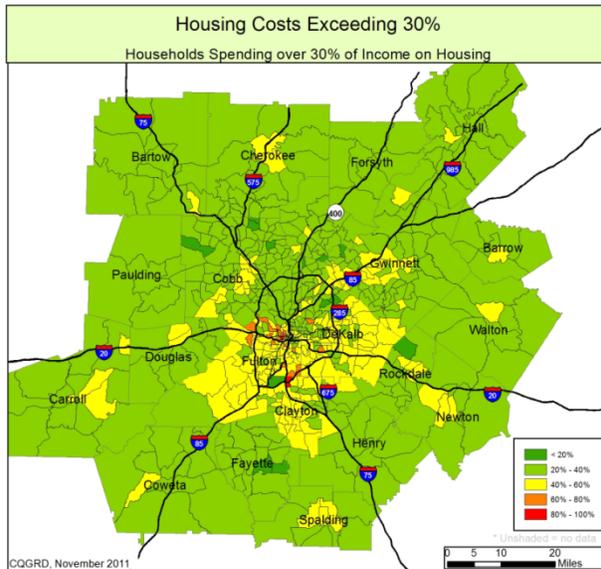


**Figure 59: Unemployment and commute**

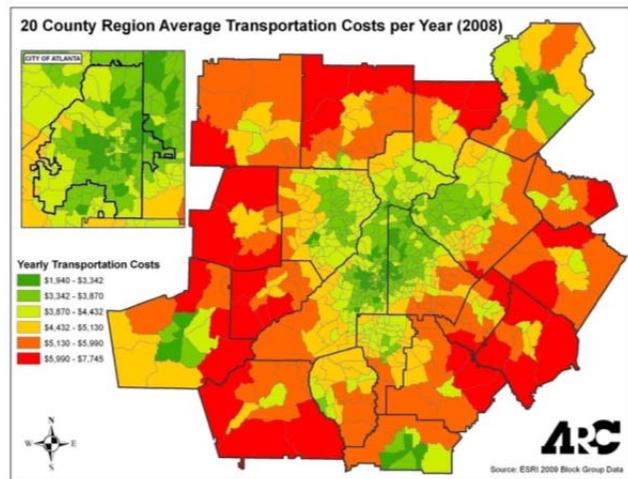
Prepared by Center for Quality Growth and Regional Development. Data sources: U.S Census Bureau

Much of the metro area suffers from high housing and transportation costs, especially concentrated in the outlying areas. Figure 61 shows the proportion of households that were spending more than 30% of their income on housing in the 2005-2009 American Community Survey. According to the U.S. Department of Housing and Urban Development, the generally accepted definition of affordability is for a household to pay no more than 30% of its annual

income on housing. Families who pay more than 30% of their income for housing are considered cost burdened and may have difficulty affording necessities such as food, clothing, transportation and medical care (US Department of Housing and Urban Development, 2011). Areas in light green depict parts of the region in which at least one fifth of renting or home owning households exceed affordability guidelines; yellow areas indicate that more than two-fifths of households are affected; orange indicates more than three fifths; and red indicates at least four-fifths of households are included. Figure 62 shows average annual household transportation costs, as calculated by the Atlanta Regional Commission for Plan 2040. Darker green areas have the lowest transportation costs, starting at \$1,940.00; red indicates higher costs up to a maximum annual transportation cost of \$7,745.00.

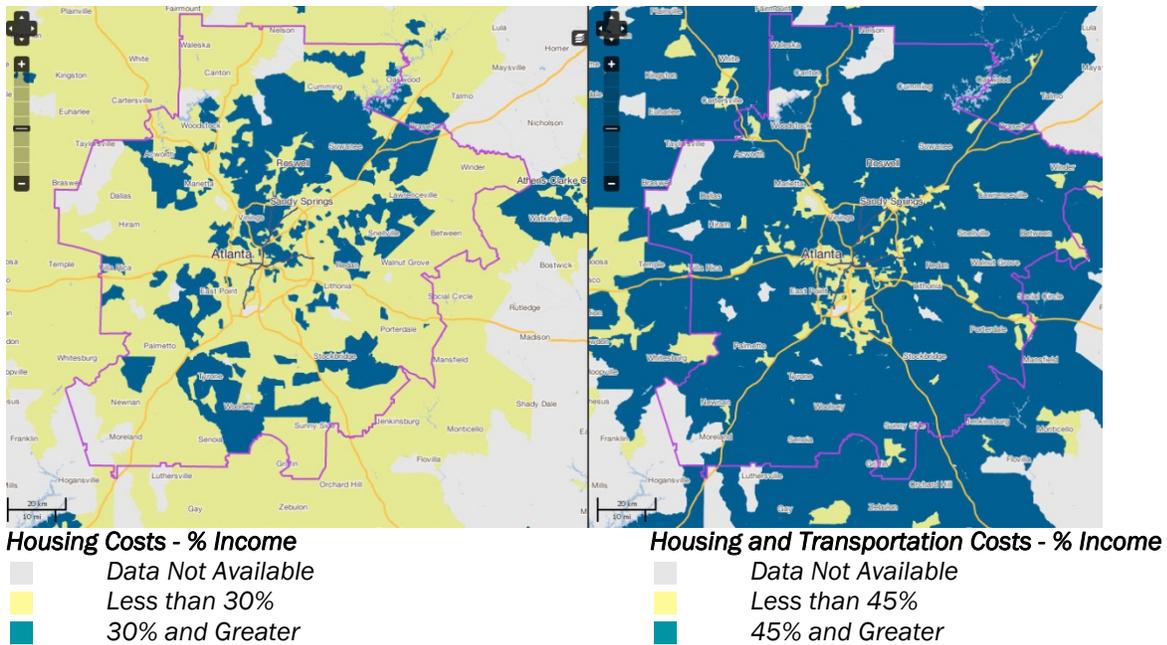


**Figure 60: Unaffordable housing**  
 Prepared by Center for Quality Growth and Regional Development. Data sources: U.S Census Bureau



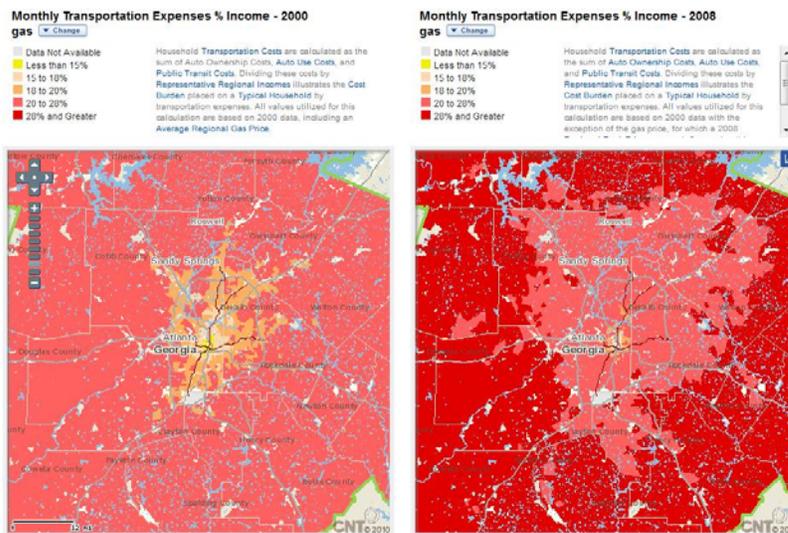
**Figure 61: Average annual household transportation costs, 2008**  
 Prepared by Atlanta Regional Commission. Source: ARC Draft PLAN 2040 Regional Assessment

The Center for Neighborhood Technology (CNT), a Chicago-based research center promoting urban sustainability, has conducted extensive analysis on the economic impacts of land use and transportation. Figure 62 shows a traditional housing affordability index (left image) compared their “Housing and Transportation Affordability Index” (HTAI) (right image). Their methodology, which is available to planning agencies, identifies the majority of the Atlanta region as being unaffordable to its residents.



**Figure 62: Housing and transportation costs, as % of income**  
 Prepared by Center for Neighborhood Technology (<http://htaindex.cnt.org/>)

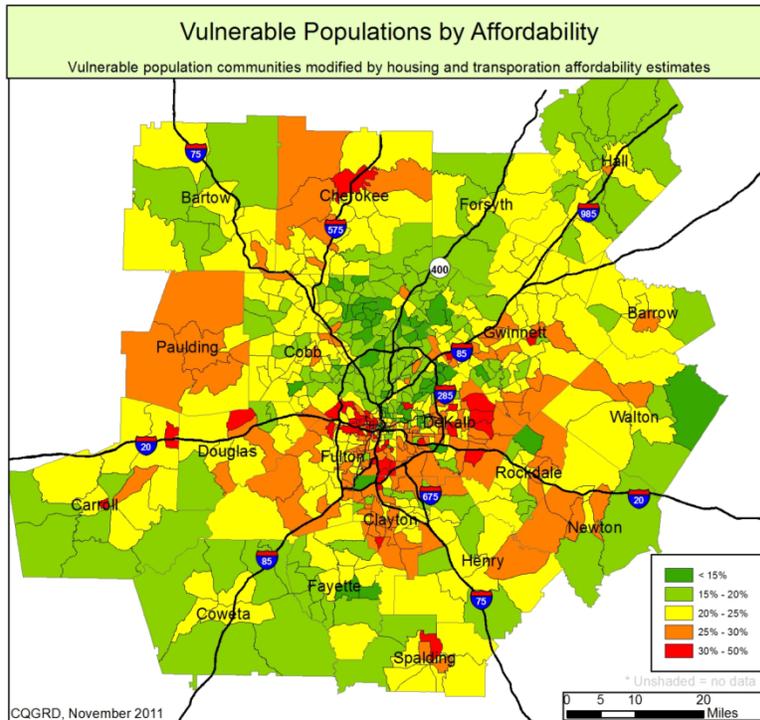
Other elements of CNT’s work reveals that metro Atlanta residents are highly vulnerable to increases in fuel prices, with fuel price increases over the past decade driving many households to spend more than 28% of their income on transportation costs, especially households located in lower density areas lacking in employment opportunities and transportation alternatives (Figure 63).



**Figure 63: Monthly household transportation expenses – 2000 compared to 2008**  
 Prepared by Center for Neighborhood Technology (<http://htaindex.cnt.org/>)

Combining the original HIA vulnerable population analysis with indicators of housing unaffordability (households spending more than 30% of income on housing) and transportation unaffordability (percentage of commuters with one-way commute over 45 minutes), our analysis suggested that many parts of the region were at risk in the case of increasing fuel costs, economic downturn, or other sources of household financial strain (Figure 64). These

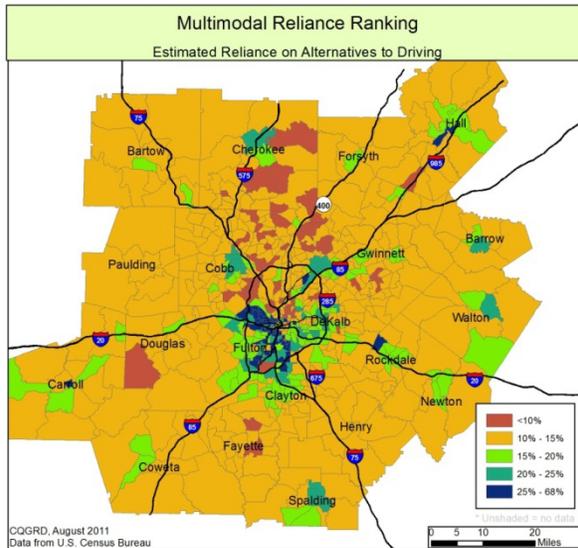
conditions could affect families living in areas with long travel distances to employment and services. Alternately, reductions in transit availability could impact households that had been using those services to stay within their household budget.



**Figure 64: Vulnerable population communities by housing and transportation affordability**

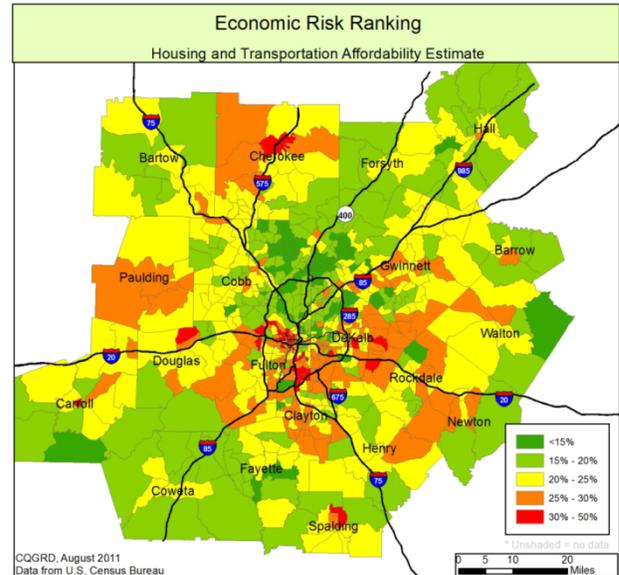
Prepared by Center for Quality Growth and Regional Development. Data sources: U.S Census Bureau

Our analysis also generated a “multimodal reliance” ranking based on the proportion of children and senior citizens in a Census tract, the percentage of carless households, and the percentage of commuters who did not drive alone to work (Figure 65). Those who cannot drive due to age, ability, or affordability may experience particularly restricted access if transit, walking, or bicycling is not available (Figure 65). In terms of economic impacts of access in the Atlanta region, Figure 66 shows the level of “economic risk” determined by housing and transportation affordability. In the core areas, the largest levels of economic risk are found near and south of I-20. Large tracts with relatively high economic risk are also found in suburban and outlying counties, especially south, southwest and east of the city. Interestingly, there are few census tracts in the metro area with very low “economic risk”, although those are largely concentrated in the northside suburban areas.



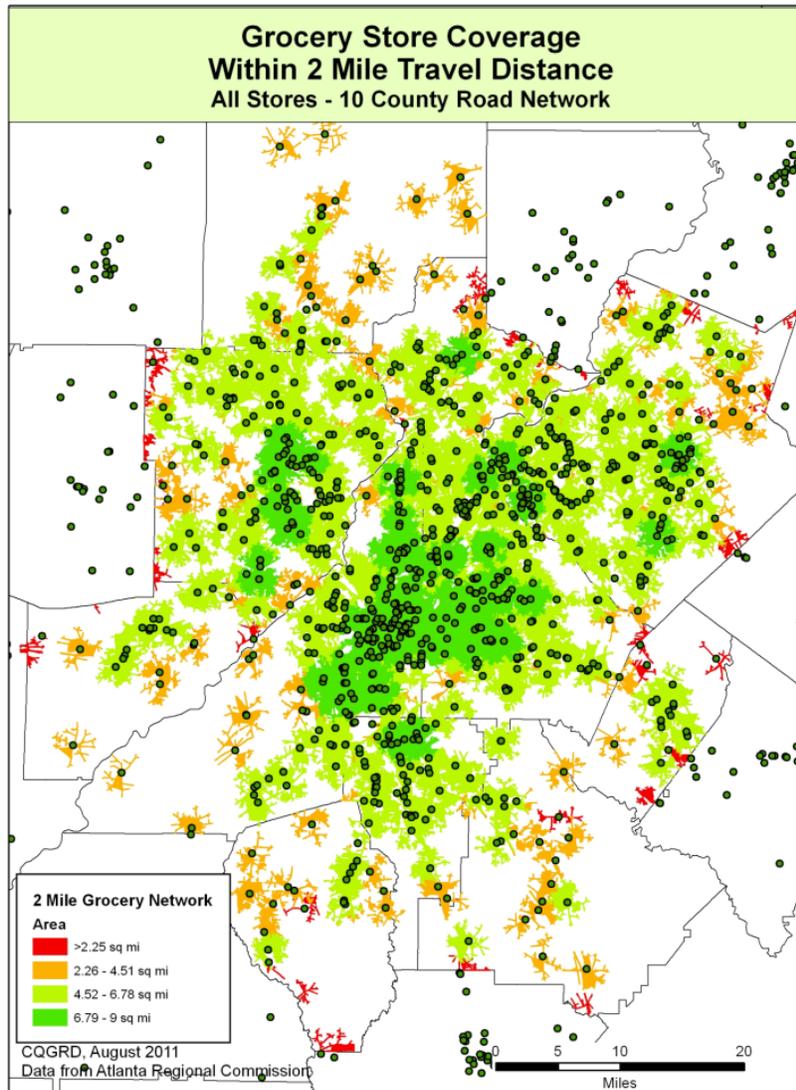
**Figure 65: Census tracts most likely to depend on walking, bicycling, or transit for daily access**

Prepared by Center for Quality Growth and Regional Development. Data sources: U.S Census Bureau



**Figure 66: Economic risk, by housing and transportation affordability**

Access-related health can also be influenced by the location of health services, access to health insurance (through employment or purchasing power), access to other daily health needs such as groceries (Figure 65) and pharmacy, and access to other amenities such as parks and community centers.



**Figure 67: Property access within 2 mile travel distance from a grocery store**

Unshaded points = no street network data

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, Claritas BusinessPoint, & U.S. Census Bureau/TIGER.

A study of the City of Atlanta (Dunkley, Helling & Sawicki, 2004) 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. 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 usually placed on larger lot sizes in suburban, rather than urban, areas and frequently most easily accessed by car. Figure 67 shows the road network covered by grocery stores within a 2 mile radius within the ten counties in ARC's land use jurisdiction. The map demonstrates that grocery stores in the central city will reach a larger number of residences, largely due to the density of the road network. On the other hand, grocery stores located in outlying areas might only serve few residences (within 2 miles).

## Active Living

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Physical inactivity and elevated body mass index (BMI) are among the most pressing health concerns today. 54% of Atlanta Metro residents do not get the recommended amount of physical activity, and lack of physical activity contributes to the three leading causes of death in the metro region. Thirty-four percent of Americans are obese, and more than two-thirds are overweight or obese. Obesity, defined as a BMI over 30, leads to elevated risk for heart disease, type 2 diabetes, cancer (including breast cancer and colon cancer), high blood pressure, stroke, liver disease, sleep disorders, arthritis, and infertility. Obese individuals are twice as likely to die prematurely as their non-obese counterparts. Sixteen percent of American children are obese, many of them already at risk for heart disease and type 2 diabetes (National Center for Chronic Disease Prevention, 2009). Physical inactivity is a primary factor in obesity, and it is thought to contribute to approximately 30 percent of all U.S. deaths. Physical inactivity is estimated to have cost the United States more than \$250 billion in 2006 (Chenoweth & Leutzinger, 2006).

### **Physical Activity and Chronic Diseases**

The rate of physical activity in the United States has been declining, as the rates for certain types of disease have been rising; obesity rates and BMI measures across the population in the United States have also been rising (Lopez, 2004). 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. Obesity and overweight leads to 2.8 million deaths annually, while physical inactivity separately contributes to 3.2 million deaths annually (World Health Organization, 2009). Whereas infectious disease results from contact with viruses and bacteria, chronic disease is largely, although not exclusively, an issue of lifestyle, environment and long-term exposure. Among other behavioral and environmental conditions, physical inactivity is considered a major risk factor for contracting non-communicable (chronic) disease (WHO, 2011). Physical inactivity is a contributing factor in 21.5% of ischemic heart disease, 11% ischemic stroke, 14% diabetes, 16% of colon cancer and 10% of breast cancer (Bull et al., 2004; as cited in de Nazelle et al., 2011).

As research shows that many chronic diseases can be prevented or controlled by increasing physical activity levels, physical activity promotion 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 (Humphrey, 2005). The literature demonstrates robust evidence that physical activity is associated with positive health outcomes, while some studies suggest that active commuting (walking or cycling for transportation) is an effective method of achieving desired activity levels (USDHHS, 2008; Matthews et al., 2007; Andersen, Schnor, Schroll & Hein, 2000).

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, Williamson & Gail 2005). However, 55% of American adults do not engage in sufficient physical activity to reduce risks and achieve these health benefits (Brennan Ramirez, Hoehner, Brownson, Cook, et al., 2006; Centers for Disease Control and Prevention, 2004; Macera, Ham, Yore, Jones, et al., 2005). Health agencies generally recommend 30 minutes or more of moderate physical activity on at least five days a week to achieve health benefits (Haskell, Lee, Pate, Powell, et al., 2007).

Fortunately, even modest increases in physical activity have the potential to produce significant health benefits (Haskell, Lee, Pate, Powell, et al., 2007). 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. The benefits of regular physical activity extend to both older and younger adults (Kaplan, 1996; Paffenbarger, Hyde, Wing, Lee, et al., 1993; Sherman, D'Agostino, Cobb & Kammell, 1994; Humphrey, 2005). In fact, benefits of physical activity have been seen in all segments of the population including people with disabilities and chronic diseases (Humphrey, 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; Humphrey, 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; WHO, 2004; WHO, 2005).

### **Physical Activity and the Built Environment: Encouraging active transport**

Prior to the focus on the built environment within public health research, transportation planning researchers have examined associations between the built environment and travel behavior. This body of research demonstrates that growing automobile dependence may have considerable implications for physical activity and health. For example, a 2004 study in Atlanta, Georgia, found that each additional hour spent in the car was associated with a 6 percent increase in the likelihood of becoming obese and every kilometer walked per day was associated with a 4.8 percent reduction in the likelihood of becoming obese (Frank, Andresen & Schmid, 2004).

Walking has been shown to be the most accessible method of incorporating physical activity into daily activities. The easiest and most common type of daily physical activity available to the most people is walking. Walking is confirmed to be a preferred form of physical activity by an overwhelming majority of study populations across different gender, age, and income groups. (Lee & Moudon, 2004). Four studies (Ball, Bauman, Leslie & Owen, 2001; Booth, Bauman, Owen & Gore, 1997; Giles-Corti & Donovan, 2002; Troped, Saunders, Reininger, Ureda & Thompson, 2001) report walking as the most frequently engaged physical activity.

An increase in the amount of daily physical activity could be achieved through the use of active transport for routine activities. Both walking and cycling can be done for multiple purposes including leisure, recreation, or exercise; for occupational purposes; and for basic transportation, including shopping or going to work (Sallis, Frank, Saelens & Kraft, 2004). *Active* (or non-motorized) *transportation* is a form of physical activity, and evidence suggests that the use of active transportation is related to transportation and land-use policy. For example, a built environment that encourages integrating active transportation with other daily activities such as work, commuting and child care, may contribute to increased walking and cycling (Booth, Bauman, Owen & Gore, 1997).

Recent studies suggest that mode shifts to active transportation (walking and cycling) generate positive health outcomes through increased physical activity (Woodcock et al., 2009; de Hartog, Boogaard, Nijland & Hoek, 2010). For example, a study in Copenhagen, Denmark found that bicycling to work (average cycling time to work was three hours per week) was associated with 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, Schnorr, Schroll & Hein, 2000). Another study 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<sup>2</sup>), waist circumference (1 cm) and change in BMI over 5 years (0.06 kg/m<sup>2</sup>) than those who did not expend energy getting to work (Wagner et al. 2001).

A review of evidence linking active commuting and cardiovascular disease demonstrated the protective effect of active commuting, as active commuting was associated with an overall 11% reduction in cardiovascular risk (Hamer & Chida 2008). In a study evaluating the effects of a work travel plan on reported commuting patterns, the number of respondents walking to work increased from 19% in 1998 to 30% in 2007. The majority of “usual” walkers and cyclists were estimated to meet greater than 80% of recommended physical activity levels, demonstrating possible health improvements associated with changing commuting patterns (Brockman & Fox, 2011).

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 were also the least 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 & Dannenberg, 2005).

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, Ha & Lee, 1999). Studies have shown that walking has positive effects on the accumulation of physical activity and therefore has positive effects on health. Frank 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, Black and Chen (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.

Therefore, policies and programs which have been shown to increase the amount of daily physical activity could potentially help to reduce the occurrence of certain diseases. Walking and cycling are two of the most common and accessible means of incorporating physical activity into daily activities, with walking being the most common.

Reviewing the existing transportation literature, several studies have presented frameworks for attributes of neighborhoods and the built environment that encourage active commuting. 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). Khisty proposed seven factors to reduce barriers to walking: increased attractiveness, comfort, convenience, population density, mixed land use, safety, system coherence, and continuity (Craig, Brownson, Cragg & Dunn 2002, Khisty 1994). Pikora et al

(2003) developed a framework that identifies four features of neighborhoods that are likely to be associated with people's walking and cycling: functional, safety, aesthetics and destinations. Research on the characteristics of walking behavior has shown that walking for recreation was associated with functional features of local environments whereas walking for transport was associated with destinations (Pikora et al., 2006).

Many studies have examined the role of built environment characteristics in mode choice and associated public health outcomes related to physical activity. 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, Snyder & Stanilov, 1997; Frank & Engelke 2001). For example, greater density is associated with increased transit use, walking and less driving (Ewing & Cervero, 2010, Marshall, 2008). Studies suggest evidence for benefits of pedestrian friendly design (Heath, 2006, Sallis et al., 2009, Van Dyck, Cardon, Deforche & De Bourdeaudhuij, 2010). According to a study on walkability and transit-oriented development, density and connectivity encourage transit use and may increase the distance pedestrians are willing to walk to access transit services (Canepa, 2007). One study found that children living in neighborhoods built after 1969 were more likely to be obese than children living in pre-1969 neighborhoods, which may be associated with changes in land use patterns and built environment design (Spence, Cutumisu, Edwards & Evans, 2008). In addition, a study of pedestrian path choice suggested an association between a “good” pedestrian environment and the utility of walking and that the effect would justify policy intervention to alter the built environment to encourage walking (Guo, 2009).

However, not all studies have demonstrated a clear association between built environment characteristics and mode choices or physical activity outcomes. For example, studies of adult populations in Australia and Washington State found that built environment characteristics was not associated with BMI and did not find built environment characteristics predictive of walking for exercise (Christian, Giles-Corti, Knuiiman, Timperio & Foster, 2011, Lovasi et al., 2008).

A recent report by the Transportation Research Board/Institute of Medicine on physical activity and the built environment 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 (Humphrey, 2005; CDC, 2006). The Task Force concluded that street-scale and community-scale design interventions were effective at increasing walking and cycling (CDC, 2006). The current discrepancies between research results in this area likely reflects differences in research design, specific built environment characteristics studied, and the difficulties in establishing causality or separating effects of different variables (Humphrey, 2005).

Transportation mode choices related to active transportation reflects two fundamental aspects of land use: proximity, as determined by density of land uses and land use mix; and connectivity, which is the ease of movement between origins and destinations within the existing street and sidewalk – pathway structure. Connectivity is also increased with the absence of barriers to walking or cycling, and multiple route options increase the viability of walking or cycling as a mode choice (Saelens, Sallis, Black & Chen, 2003). Population density and mixed-use zoning are positive correlates of walking, as is availability of mass-transit. (Craig et al. 2002) Studies repeatedly demonstrate that mixed land use diversity is the urban design variable most likely to affect the walkability of neighborhoods, primarily by influencing the accessibility and convenience of locations (Saelens, Sallis, Black & Chen, 2003, Giles-Corti & Donovan 2002, Handy & Clifton, 2001).

Studies which explored mode choice between motorized and non-motorized methods of transport showed that 40% of respondents considered the lack or poor condition of pedestrian and cycling routes as limiting their walking and cycling to work, and about 30% considered these activities as unsafe modes of transportation. Fear of accidents limited physically active commuting in 30% of all women and in 14% of all men. (Oja, Vuori & Paronen 1998) In a recent study of mode choice and street network characteristics in 24 California cities, density, street connectivity, and grid network were significantly associated with increased bike, walking and transit (Marshall & Garrick, 2010). In this study, street features such as on-street parking, bike lanes, and sidewalks were associated with less driving. Intersection density was “almost always” associated with walking and cycling, while street pattern and land-use mix were highly associated with increased mode share of walking and cycling. There is strong evidence for infrastructure changes and promotional campaigns potentially effecting behavioral changes towards active transportation (Ogilvie, Egan, Hamilton & Petticrew, 2004; Pucher, Dill & Handy, 2010; WHO-UNECE, 2009).

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. Respondents reported increased total weekly activity levels, in many cases enough to move them from the “insufficient” to “meeting recommendations” categories of physical activity (Greenberg & Renne, 2005).

The studies’ findings imply that, to enhance the health and well-being of the population, infrastructure for walking and biking needs to become an integral part of public transportation systems and services. Highly connected, mixed-use development should be actively pursued to entice increases in walking and biking for transportation (Rutherford, Ishimaru, Change & McCormack, 1995; Hess, Moudon, Snyder & Stanilov, 1999; Moudon & Hess, 2000).

Individual characteristics such as gender, race, and age have been shown to affect the relationship between physical activity and the built environment. A few studies help illustrate the potential influence of individual factors. Several studies demonstrated links between gender, socioeconomic status and active transportation (Kitchen, Williams & Chowhan 2011, De Bourdeaudhuij, Sallis & Saelens 2003, Baig, Hameed, Li, Shorthouse, Roalfe & Daley, 2009). For example, in a longitudinal study of physical activity in Australian middle-aged adults, statistically significant differences were found between socioeconomically “advantaged” and “disadvantaged” neighborhoods (Turrell et al., 2010). In a study of active commuting in the Netherlands (given a supportive built environment), adolescents from non-Western backgrounds were more likely to walk than cycle to school, suggesting the importance of culture in affecting attitudes toward transportation modes (Bere, van der Horst, Oenema, Prins & Brug 2008).

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 & Schmid, 2003; Lockett, Willis & Edwards 2005; de Vries, Bakker, van Mechelen & Hopman-Rock, 2007). A study in the Netherlands demonstrated that 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 et al., 2007). Traffic speed is the key determinant for pedestrian injury risk for children (Jacobsen 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 & Kallins, 2003).

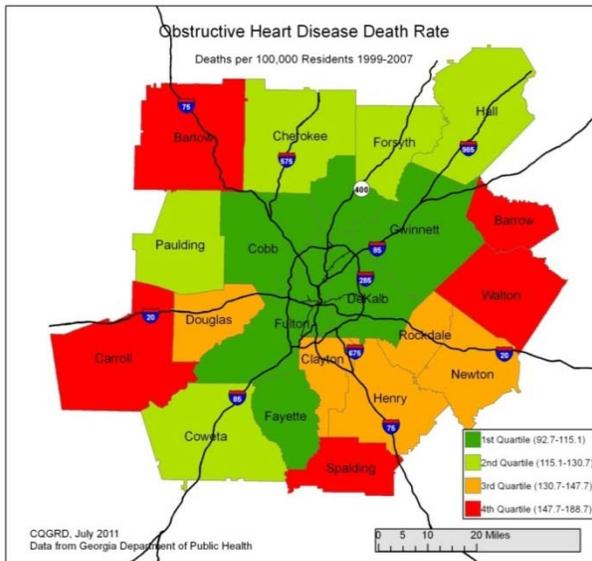
Since many older adults cannot perform vigorous physical activities they typically walk for exercise (Feskanich, Willis & Colditz, 2002; Tudor-Locke, Jones, Myers, Paterson & Ecclestone, 2002). In a six-year longitudinal study, older adults who walked a mile at least once a week were significantly less likely to develop functional limitations (Miller, 2000; Feskanich et al., 2002). Walking also improves cardiovascular endurance, balance and flexibility (King et al., 1998). A study in Seattle found significant relationships between community form and level of activity among seniors (Frank et al., 2003). Seniors in Ottawa, Canada, reported that traffic hazards and fear of falling are barriers to walking. Respondents reported that they would be assisted by convenient routes and destinations, good public transportation, aesthetics, benches, and restrooms (Lockett, Willis et al. 2005). 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 et al., 2000; Dean & Shepherd, 1997; Brach et al., 2003) and to decrease the chance of increasing their disability (DiPietro, 1996; Ettinger et al., 1997; Spirduso & Cronin, 2001; Hillsdon, Foster & Thorogood 2005).

Active transportation has been recognized by the literature as a pathway to increased physical activity levels and as having a protective effect against a variety of chronic diseases. It is also recognized that aspects of urban form and the built environment can have a promoting or discouraging effect on mode choice, especially in the areas of land-use mix, transportation infrastructure, streetscape design and road network connectivity. However, persistent population differences in the outcomes and efficacy of policy interventions to promote physical activity demonstrate the need to consider the diverging needs of various populations in any policy intervention and communication of interventions applied to the urban form. More research is needed to further examine the dynamics between built environment features, transportation and health promotion, especially given the methodological challenges in this type of research. However, the evidence is sufficient to begin consideration of policy interventions in order to promote behaviors such as active transportation to achieve desired health outcomes.

## **Physical Activity: Health indicators**

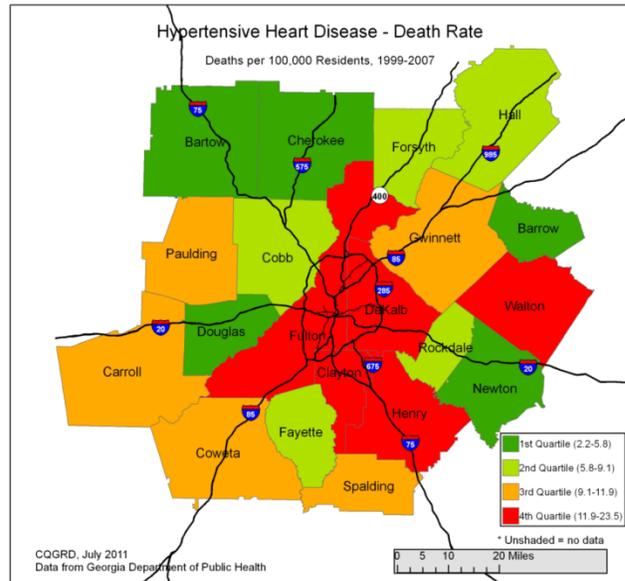
The Atlanta region is facing an epidemic: sedentary lives. Physical activity has been engineered out of daily life, and simple activities like walking to school or to the store have become the exception. Sidewalks, convenient crosswalks, bicycle lanes, traffic calming measures, mixed-use zoning, and connected street networks facilitate active transportation and save lives: heart disease, stroke, diabetes, certain cancers, and mental disorders are all linked to a lack of physical activity. The key elements needed for an active community are highly mixed land uses, short connected blocks, and high-quality infrastructure for pedestrian and bicycle traffic. However, these design elements are lacking in many parts of the region. In 2009, the Atlanta region had an obesity rate of 25.1% and an overweight rate of 38.9% by BMI, compared with 34.8% overweight and 20.9% obese in 2002 (SMART BRFS). Obesity increases medical costs and nearly doubles their risk of premature death.

Rates for obstructive heart disease and chronic lower respiratory disease deaths are highest in exurban counties, particularly eastern, southeastern and northwestern counties (Figure 68). Additionally, death rates for hypertensive heart disease are highest in central core counties and counties south of the City (Figure 69).



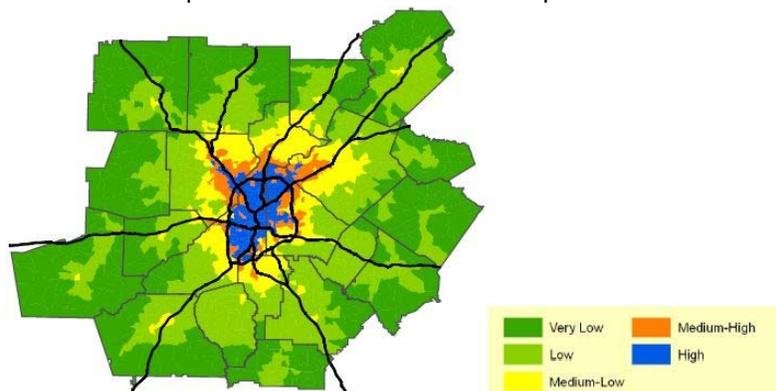
**Figure 68: Obstructive heart disease death rate**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.



**Figure 69: Hypertensive heart disease death rate**

Our analysis looked at some of the built environment determinants of active transportation. This included ARC's multimodal accessibility analysis, which included transit and residential density (Figure 70). Rail transit in the region serves a very limited area. Bus service is frequent on a few corridors, while many other routes have long headways or only operate at peak commute times. The system utilizes a park-and-ride model in many places, rather than walkable development around stations or stops.

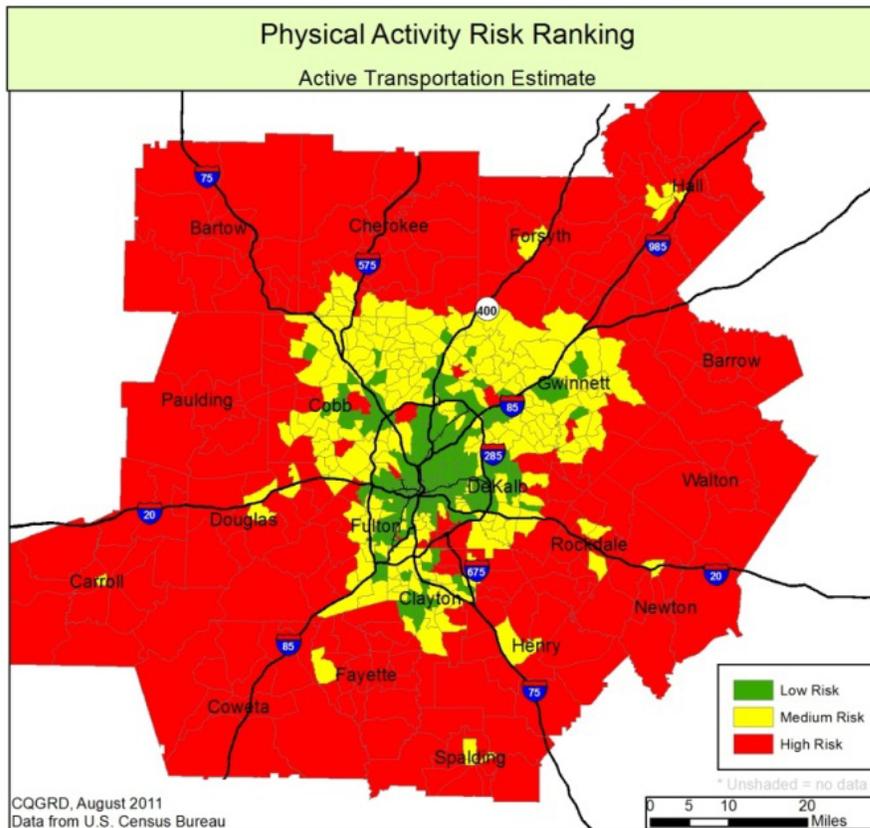


**Figure 70: Atlanta Regional Commission multi-modal accessibility results**

Prepared by Atlanta Regional Commission.

Indices of populations at risk for low physical activity in the metro area were calculated based on share of commuters who carpool or drive alone, travel time to work, and density. Additionally, physical activity status was calculated by county based on rates of obstructive (ischemic) heart disease, hypertensive heart disease, stroke, and diabetes. The highest risk for activity-related chronic disease was in outlying and suburban counties (with the exception of the inner-ring northern suburbs). The lowest physical activity risk was found in central city areas, especially in northeast Atlanta. When physical activity status was adjusted for physical activity risk, the highest disease rates are found in exurban counties, with medium risk in the

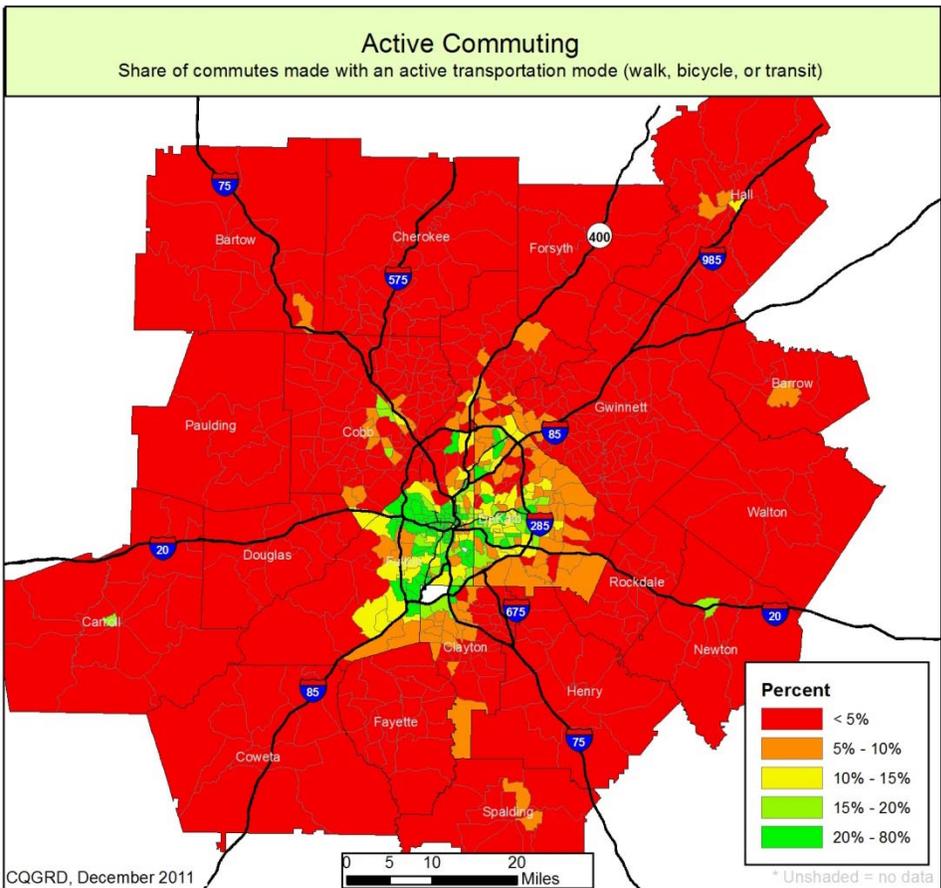
Westside central city area (Figure 71). This map echoes the multi-modal accessibility map generated by ARC (Figure 70, above).



**Figure 71: Environmental and demographic risk for lower rate of physical activity**

Prepared by Center for Quality Growth and Regional Development. Data sources: U.S Census Bureau – ACS 2005-2009, Georgia Department of Public Health

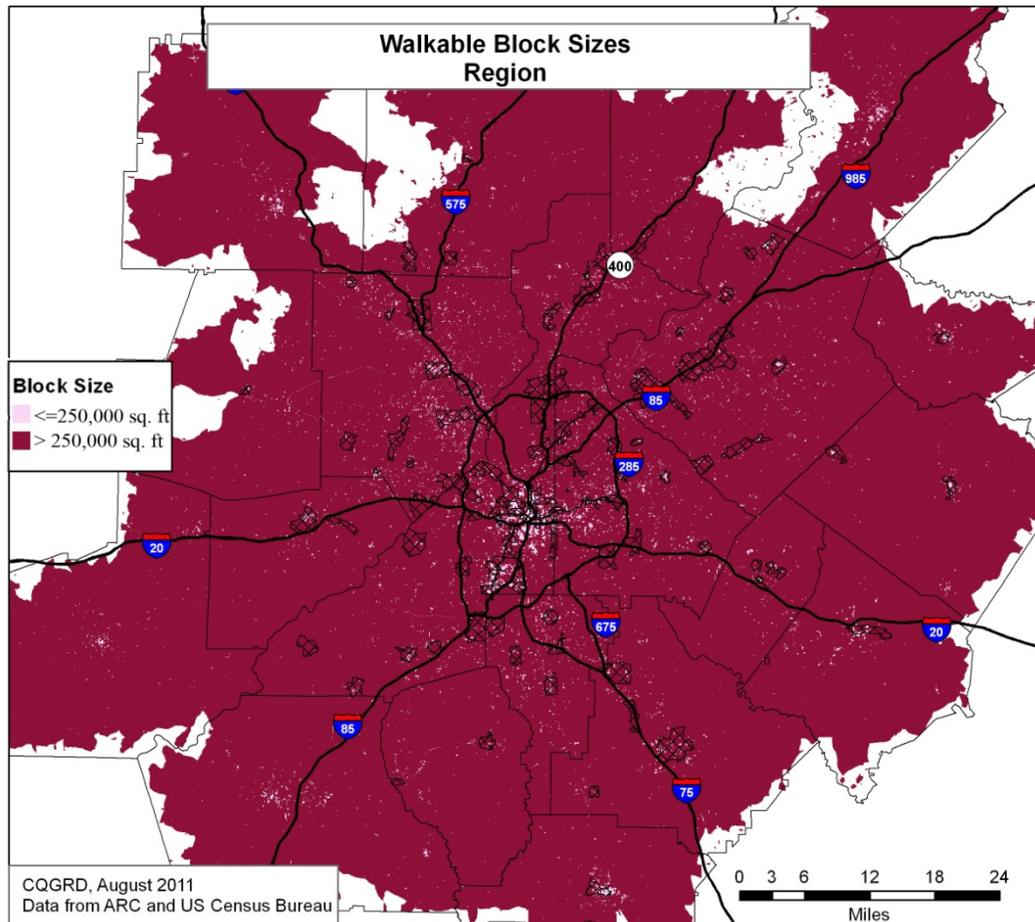
Additionally, American Community Survey data was used to calculate the percentage of residents in each Census tract who commuted by walking, bicycling, or transit (Figure 72), each of which was shown in the literature to provide physical activity health benefits. While socio-economic status may be a factor in some travel mode choices, multi-modal accessibility and convenience is likely to influence these patterns.



**Figure 72: Percentage of commuters using a form of active transportation**

Prepared by Center for Quality Growth and Regional Development. Data sources: U.S. Census Bureau – ACS 2005-2009, Georgia Department of Public Health

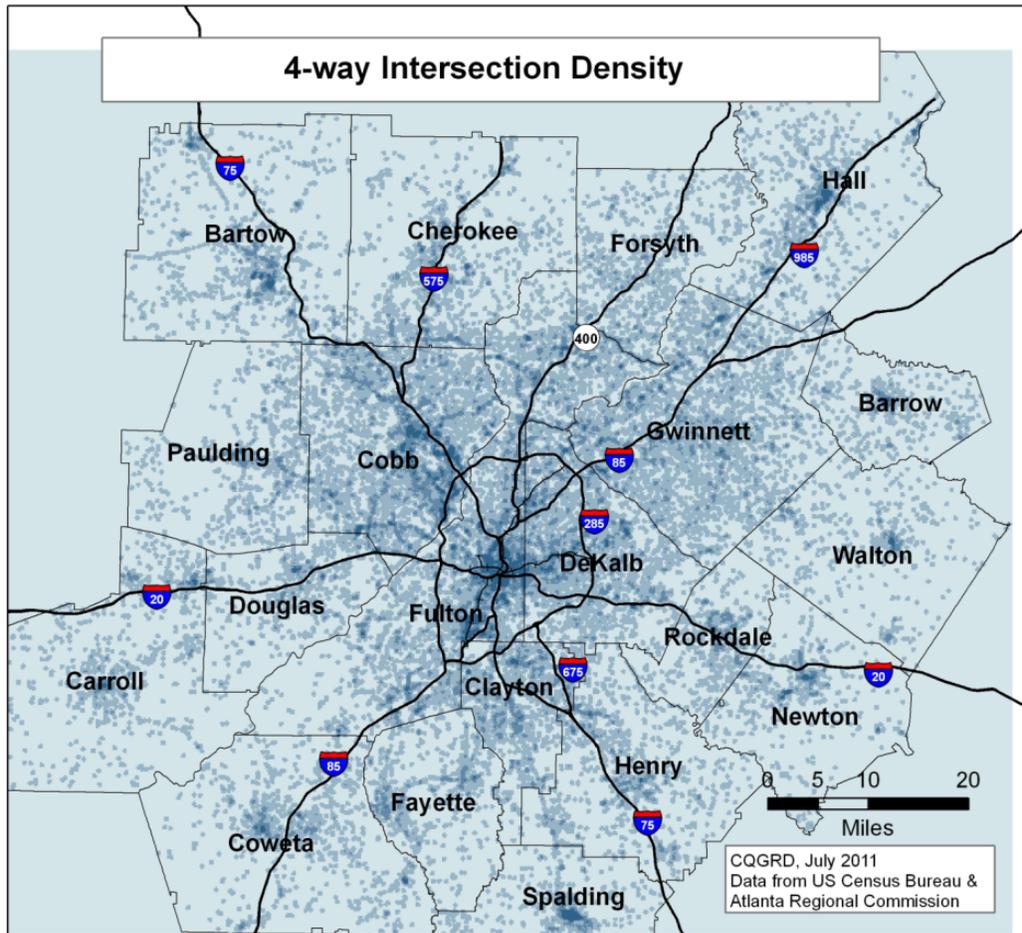
Density, a correlate of active transportation, was presented at the Census tract level in Figure 19 on page 48, but no density metrics were available at the scale of a walkable activity center. Areas outside of the regional core were generally very low density, with some higher-density areas around the Cumberland district. Another correlate, distance to destinations, could roughly be estimated by employment density as shown in Figure 54 on page 94. The third primary correlate of active transportation, connectivity, was represented in two ways using the street network: block size and four-way intersection density. Most of the metro area does not have walkable block sizes, with notable exception in the central core and in historic downtowns (Figure 73).



**Figure 73: Walkable blocks (less than 500' X 500')**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, Georgia Department of Transportation & U.S. Census Bureau/TIGER.

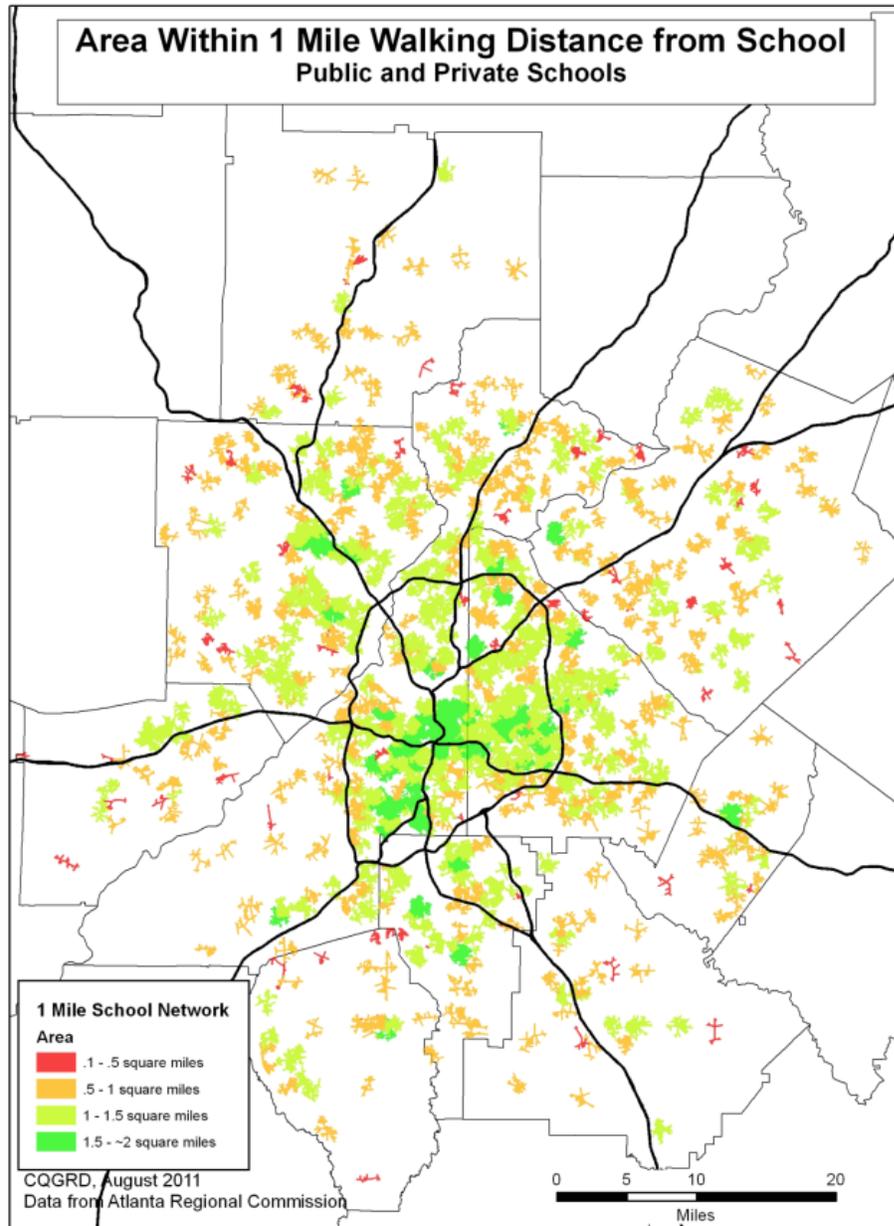
The central core and historic downtowns also have the highest intersection density in the region (Figure 74). Again, some corridors of higher intersection density appear to be forming along the eastern MARTA line, the Cobb Parkway corridor, north Atlanta, and the East Point/College Park area. However, intersection density is uniformly low across Gwinnett County, north Fulton County, and suburban areas.



**Figure 74: 4-way intersection density**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, Georgia Department of Transportation & U.S. Census Bureau/TIGER.

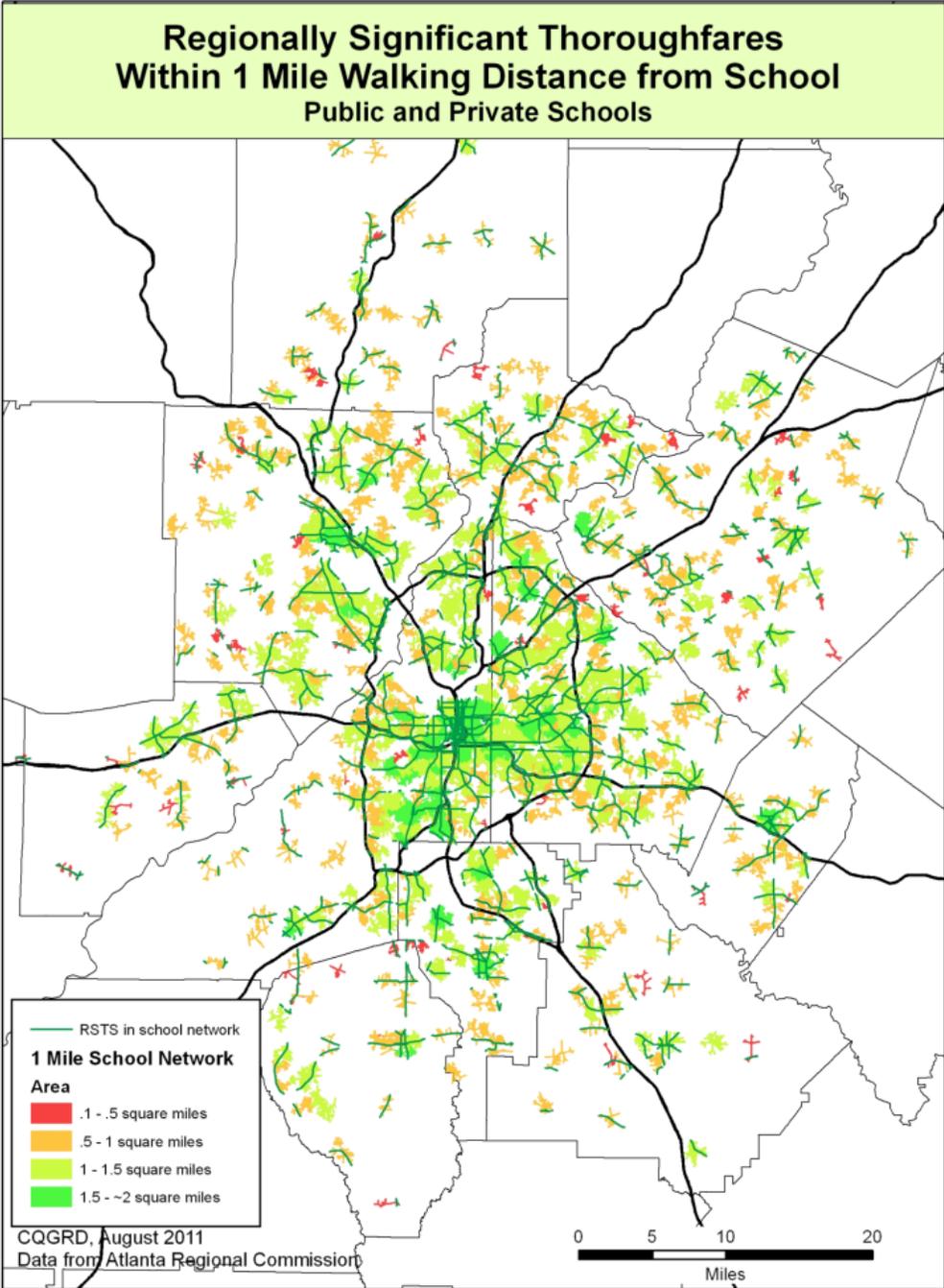
For children, we evaluated opportunities to walk or bicycle to school, looking at homes within a 1 mile road network distance. Spatial analysis showed that schools located in more urbanized areas with a connected street network can serve significantly more households within that distance (Figure 75) (ten county region only). Schools in areas with a connected street network had a 1-mile “walk-shed” of 1.5 to 2 square miles, while nearby schools in disconnected development patterns served less than .5 square miles.



**Figure 75: Area within walking distance from school**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, Georgia Department of Transportation & U.S. Census Bureau/TIGER.

Many schools are located on or near regionally significant thoroughfares (Figure 76), meaning that children who walk or bicycle to school may need to travel along these roads or cross them to reach the school from their home. This indicates that a sizable portion of the designated Regionally Significant Transportation System needs to accommodate this travel in the form of safe and appropriate walking and bicycling facilities.



**Figure 76: Regionally significant thoroughfares within walking distance from school**  
Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, Georgia Department of Transportation & U.S. Census Bureau/TIGER.

## ***Ecology, Energy, Environmental Quality***

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### **Introduction**

Looking beyond the region, there may be ecological impacts which directly and indirectly influence the ability to be healthy. This could include greenhouse gas emissions, water consumption and runoff, availability and viability of agricultural resources, and availability of natural habitats. While many infectious and environmental health issues have been alleviated through sanitation, planning and building ordinances, and medical advances, these issues could still reemerge if they are not being accounted for in planning activities.

### **Air quality**

Motor vehicle traffic presents a unique public health risk because of the toxicity of its emissions and its extensive integration within communities. Recent research links diesel exhaust to lung cancer, cardiopulmonary disease, and other causes of death. More than 42 percent of Americans live in places that exceed national air quality standards for ozone or fine particulate matter. Asthma affects 9 percent of U.S. children and 7 percent of adults (Jackson, 2003).

Asthma hospitalizations and emergency department (ED) visits have a strong correlation with regional vehicle miles traveled (VMT), localized traffic volumes, and industrial emissions. Asthma attacks are also associated with substandard housing (impacted by socio-economic status (SES) and housing prices) and secondhand smoke (influenced by SES, educational attainment, and other factors). Asthma can lead to elevated medical costs and lost productivity, especially for school children.

Fine and ultrafine particulate matter (PM<sub>2.5</sub> and PM<sub>0.1</sub>) contribute to heart disease and chronic lower respiratory disease. Ozone contributes to asthma and other respiratory diseases. These air pollutants are a product of transportation-related emissions, as well as emission from industry and energy production. Air quality levels are strongly influenced by transportation and land use plans that govern motorized VMT and location of mobile source emissions, energy efficiency of structures and operations, and pollution sinks (such as tree cover) as well as seasonal fluctuations in temperature and weather.

Roadways, other transportation facilities, freight logistics, and industry can create “hot spots” of locally elevated air pollution levels, which may impact homes and schools and may inequitably impact some citizens more than others. Air pollution hot spots are linked to increased rates of asthma attack, premature and low birth weight babies, infant mortality, and other respiratory diseases. These sources also contribute to regional levels of five criteria pollutants (carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), coarse and fine particulate matter (PM), and sulfur dioxide (SO<sub>2</sub>)). Additionally, emissions of carbon dioxide and other greenhouse gases are linked to climate change which may affect health through impacts on agriculture, water supply, heat waves and tornadoes, and spread of tropical diseases. Proximity to high-volume motor vehicle emission sources, such as major highways and congested areas, appears to significantly influence exposure.

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, 2006b). Changes in vehicle emissions, including carbon monoxide, nitrogen oxides, particulate matter, and hydrocarbons are linked to changes in motor vehicle

trips, miles, or hours of operation (EPA, 2007; Samet, 2007). Nitrogen oxides and hydrocarbons (also called volatile organic compounds) combine in sunlight to form ground-level ozone. Diesel freight transport generates these pollutants as well as high levels of black carbon, sulfur dioxide, and some suspected carcinogens.

However, freight rail generates significantly fewer emissions per ton-mile than freight trucking (You, Lee, Ritchie, Saphores, et al., 2010; Zhu, Hinds, Kim, Shen & Sioutas, 2002). These air toxics contribute to respiratory and cardiovascular diseases, and other disorders (EPA, 2001). Although freight rail planning is outside of ARC's scope, coordination should be pursued as a collaborative planning strategy with GDOT, FRA, and private freight rail owner/operators. Polluting land uses, including industrial facilities and transportation hubs, have also been identified as sources of air toxics at the local and regional level (Corburn, 2007; Willis & Keller, 2007).

Short- and long-term exposure to air pollutants can have health effects at both a regional and local scale. Increased rates of disease and death from cardiovascular and respiratory diseases have been associated with various measures of air pollution, including those generated by the burning of fossil fuels and those created by road and vehicle wear (Health Effects Institute, 1999; Lippman, Ito, Nadas & Burnett, 2002; Samet, 2007). Over 150 studies have identified correlations of exposure to particulate matter with cardiovascular and respiratory diseases, even at very low levels (Peters & Pope, 2002). Proximity to high-volume motor vehicle emission sources (highways, major roads, and congested areas) appears to significantly influence exposure (Corburn, 2007; Venkatram, Isakov, Seila, & Baldauf, 2009).

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 inconclusive 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. Additionally, PM 2.5 is seen to have an adverse effect on lung development in adolescents that can lead to lifelong lung deficiency (Gauderman, McConnell, Gliland, London, et al., 2000; Gauderman, Avol, Gliland, Vora, 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 admissions and that modest amounts of air pollutants are associated with small changes in cardiac function in the elderly (Barnett, Williams, Schwartz, Best, et al., 2006; Mar, Koenig, Jansen, Sullivan, 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, Wu, Ong, & Winer, 2006; Fischer, Hoek, van Reeuwijk, Briggs, et al., 2000).

There are mitigation strategies for transportation-related air pollutant emissions. Van Houtte, Eisinger and Niemeier (2008) found that freight truck operations affected their impact on air quality; stop-and-go traffic, high speeds, heavy loads, and hills contributed to a higher rate of emissions. They suggested routing trucks away from congested areas and hills, and limiting their weight and speed. Freight rail typically has lower emissions per ton of freight than trucking, and can be used to reduce roadway (line) emissions as well as the localized emissions around logistics hubs. A study of the Ports of Los Angeles and Long Beach in California concluded that relatively minute shifts from truck to rail – less than 1% of total movements – could produce 5% to 10% reductions in carbon monoxide, nitrogen oxides, particulate matter, and hydrocarbons (You, Lee, Ritchie, Saphores, et al., 2010). Reducing overall congestion is likely to reduce emissions as well, however research suggests that congestion maintains a static level on unpriced roads (Cervero and Hansen, 2002; Noland, 2001). Congestion pricing may reduce congestion (Duranton & Turner, 2008, Kall, Guensler, Rodgers, & Pandey, 2009). Providing pedestrian, bicycle, and transit alternatives may reduce localized emissions at destinations, and will at least improve mobility without increasing congestion.

Air pollution from roadways (also known as line source emissions) decreases with distance; exposure is most likely within 200 feet of a road carrying more than 50,000 vehicles per day, or within 100 feet of a road carrying 25,000-49,999 vehicles per day (significant amounts of truck traffic may change these criteria). Locating sensitive uses – residences, child care facilities and schools, and medical centers outside of these buffers can reduce health impacts (Brugge, Durant, & Rioux, 2007; Zhu, Hinds, Kim, Shen, et al., 2002).

Fuller, Bai, Eisinger, and Niemeier (2009) evaluated the effectiveness of sound barriers and vegetation adjacent to high-volume roadways for reducing exposure to pollutants at homes and other sites near the roadway. They found that sound walls did not reduce spread of pollutants, but that vegetation did. Their paper provides a table for selecting the most effective vegetation for pollutant reduction. It recommends hardy, long-lived evergreen conifer trees with dense leaf structure, and finds they are more effective when planted densely and as close to the emissions source as possible. Tree barriers may help reduce emissions from point sources, such as factories and warehouses, as well. Environmental management of industrial emissions – e.g. scrubbers or low emission processes – and ordinances to reduce truck idling could have an impact on local emissions levels.

Pollutants don't disperse evenly throughout the city, and being in a car or even a building provides little protection. In fact, a bicyclist can have lower exposure levels to pollution. According to Rank, Folke and Jespersen (2001), a car occupant (with closed windows and vents) is somewhat protected from immediate exposures (i.e. a passing truck), but accumulates a higher level of pollution inside the vehicle during their trip. A cyclist, however, is in a cleaner microenvironment most of the time—only experiencing exposure when they are close to a dirty vehicle. How fast you breathe (your rate of respiration) can also affect exposure levels – breathing faster increases your intake of pollution. You can also manage your exposure levels by choosing routes with lower traffic volume. Busy streets and truck routes will

have higher levels of pollution, while a parallel side street a few blocks away can be significantly less polluted. Scientists consistently find that people who cycle regularly are in better health and live longer than those who do not bicycle.

### **Urban climate and Global Climate Change**

Widespread impervious surfaces in developed areas have resulted in the “urban heat island effect,” which refers to the phenomenon of elevated temperatures in urban areas. A study of land use change and Atlanta’s urban heat island showed that the widespread conversion of forest and cropland into impervious surfaces from the 1970s to the 1990s resulted in an urban heat island (at city boundary levels) and a significant increase in ground-level ozone (Lo & Quattrochi, 2003). Ground level ozone is a determinant of cardiovascular and respiratory disease. The study also did not show a strong spatial correlation between chronic diseases and the urban heat island, but this may be due to the level of analysis (county) and the lack of controls for other factors, such as smoking. In addition to the heat island effect, land-use patterns also likely contribute to increased air emissions from transportation. Atlanta’s urban heat island has also induced a convergence zone, creating several storms downwind of the urban heat island (Lo & Quattrochi, 2003; Bornstein & Lin, 2000). These studies demonstrate that the prevailing land-use patterns in the metro area may have significant impacts on environmental quality and health status, demonstrating the links between land-use, climate and health. A study investigating the relationship between urban form and extreme heat events (such as heat waves, often resulting from the urban heat island effect) found that the rate of increase of extreme heat events is higher in “sprawling” cities than in “compact” cities (Stone, Hess & Frumkin, 2010). These findings could have important implications for future climate change impacts in a sprawling metropolitan area such as Atlanta.

Transportation-related emissions of carbon dioxide is also linked to anthropogenic climate change which could affect food and water supply, adverse weather events, and expanding transmissible disease vectors (EPA, 2006b; Haines, Kovats, Campbell-Lendrum, & Corvalan, 2006; Younger, Morrow-Almeida, Vindigni, & Dannenberg, 2008). A review of current evidence on the health impacts of climate change suggests that global climate change may result in increased deaths from heat stress and flooding, increased microbial and pathogen activity, and adverse economic and social impacts from displacement (McMichael, Woodruff & Hales, 2006).

### **Noise**

Exposure to noise has been associated with a number of negative health effects. 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, Flindell & Berry, 1998).

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).

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, 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 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 & 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, similar to a refrigerator, but is ideally around 30 dB (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, heart 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. 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).

### **Water quality**

In the Atlanta region, issues surrounding water quality, especially those associated with stormwater runoff, have become common over the past decade. In a natural system, 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.

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 & Gaffield, 2004; Gaffield, Goo, Richards & Jackson, 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 & Gaffield, 2004).

Some stormwater best management practices include the 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.

### **Soil quality**

Incursion of industrial and other pollutants has resulted in contamination of soil and groundwater in many areas. According to the US Department of Agriculture, some urban soils have been contaminated by transportation related emissions, metals runoff from industrial or agricultural uses, and seepage of landfills or dump sites (USDA, 2005). Industrial contamination can result in turning a site into a “brownfield,” which must be remediated in order to enable non-industrial uses in the future. In addition, soil contamination can lead to groundwater contamination, which is dangerous for human and environmental health. Soil contamination can also pose human health risks through bioaccumulation, in which humans eat animals that have been contaminated by plants or microorganisms growing in contaminated soils (Turner, 2009).

### **Greenspace**

The presence of greenery has been linked to lower crime rates and better mental health, air quality improvement, and micro-climate improvement. Green streets are designed to improve

stormwater retention, enhance aesthetics, and reduce impervious surfaces through the careful use of materials and landscaping. The presence of a thriving natural environment can also boost property values.

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, Mang & Evans, 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 & 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 & 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, Watanabe & Nakamura, 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 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 & Taylor, 2004).

### **Environmental Justice**

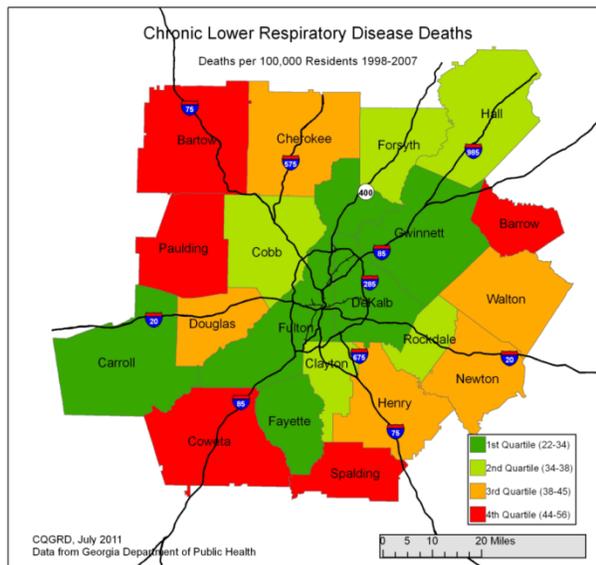
Environmental justice refers to the disproportionate exposures faced by poor communities and communities of color to hazardous facilities, environmental contaminants and health risks. It has been recognized that the geographic location of "locally undesirable land uses" such as landfills, industrial facilities and highways are unequally distributed and lead to substantial health disparities (Cutter, 1995). This phenomenon has led to the designation of "environmental justice communities" (similar to the definition of vulnerable populations in this HIA), which can be defined as communities with a high proportion of low-income, minority or foreign born residents.

## **Environment and Ecology: Health indicators**

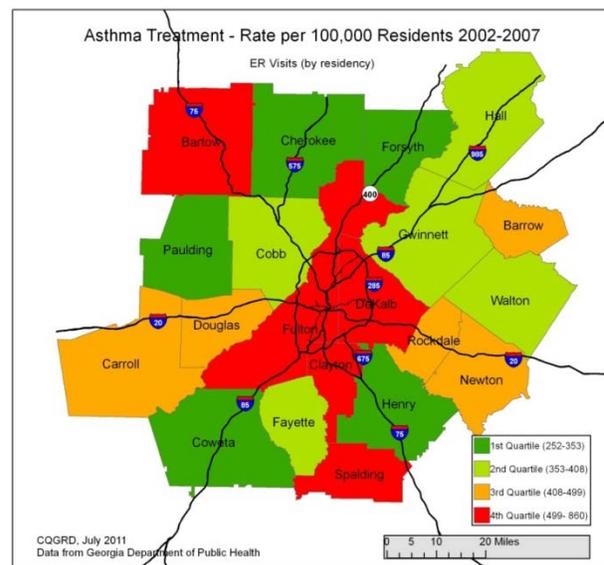
Regional air quality in metro Atlanta has shown improvement, although national ambient air quality standards (NAAQS) are still exceeded each year. The regional picture fails to convey the full public health issues related to air quality, however. Roadways, other transportation facilities, freight logistics, and industry can create "hot spots" of locally elevated air pollution levels, which may impact homes and schools and may inequitably impact some citizens more than others. These hot spots are linked to increased rates of asthma attack, premature and low birth weight babies, infant mortality, and other respiratory diseases (Corburn, 2007;

Venkatram, Isakov, Seila, & Baldauf, 2009). Environmental contaminants also contribute to cancer risk, along with genetics, health behaviors, and other factors.

In the Atlanta metro, the highest rate of deaths from chronic lower respiratory disease (CLRD) were found at the fringes of the region (Figure 77), while the highest rate of asthma attacks (as indicated by visits to the emergency department) was found in the regional core (Figure 78). The higher rates of respiratory disease deaths in outlying counties may be associated with socioeconomic conditions in those counties, while asthma rates in core counties are likely associated with air pollutant exposures due to higher traffic volumes. Additionally, high rates of asthma treatment by ER visits were also found in several outlying counties (Bartow and Spalding), which may be a result of other social or environmental factors (or air quality impacts from other point and non-source pollution unrelated to traffic volume).



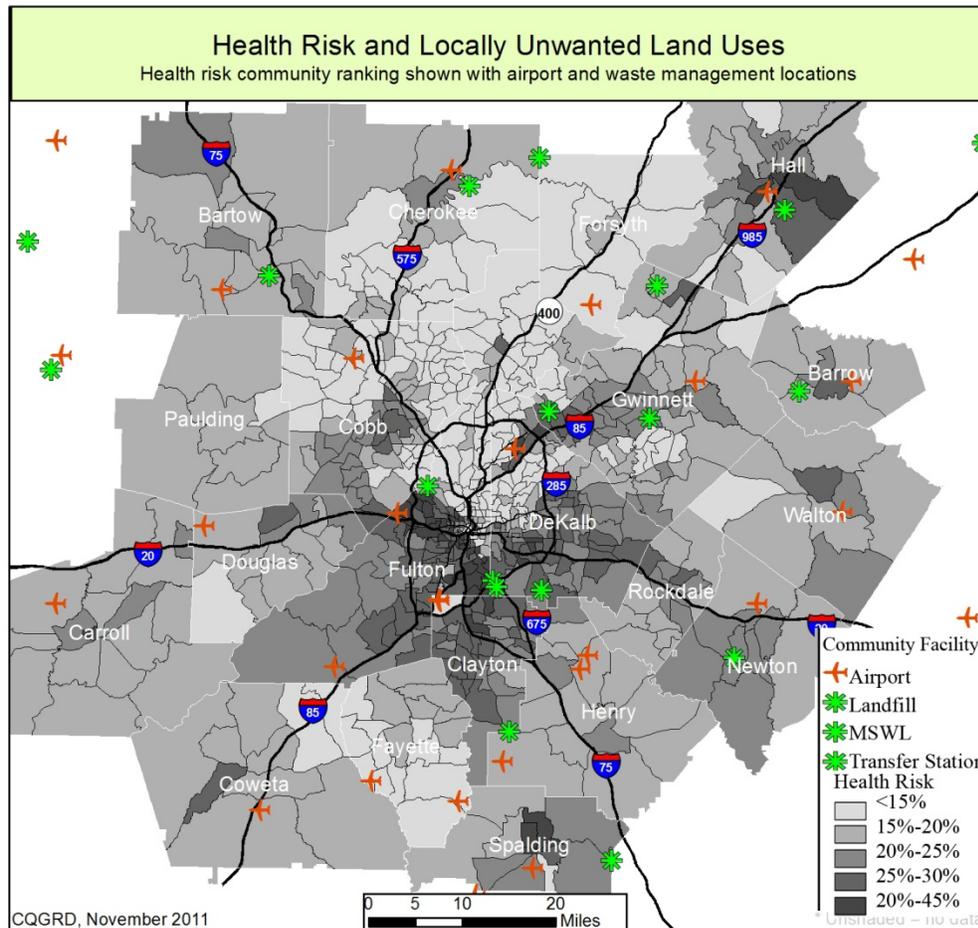
**Figure 77: Chronic lower respiratory disease deaths**



**Figure 78: Asthma ER visits**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

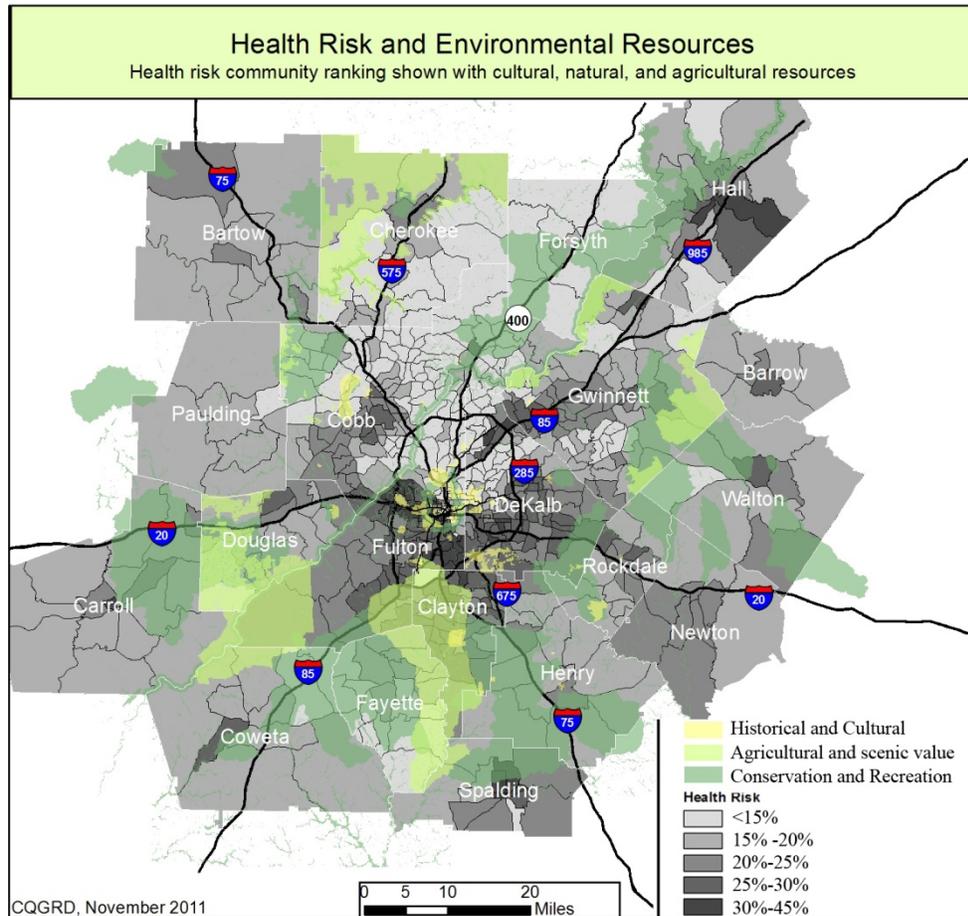
Figure 79 shows the spatial distribution of locally undesirable land uses (LULUs), which includes airports (red airplane symbol) and landfills (green asterisk symbol) relative to the community health risk ranking developed in the Health Disparities section (page 66). Although LULUs are dispersed throughout the metro region, the majority are located in areas with a higher community health risk ranking.



**Figure 79: Health risk and undesirable land use**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau.

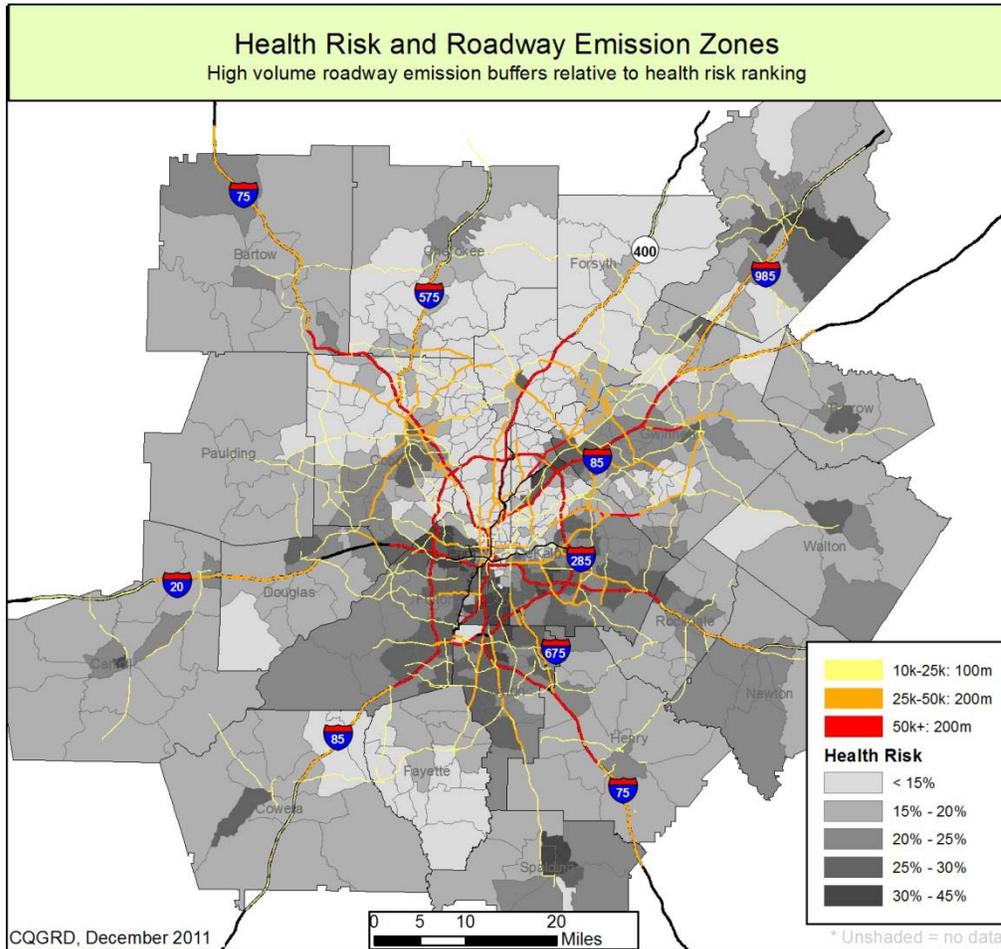
Access to cultural, natural and environmental resources has been associated with better health outcomes as described above, and access is linked with their distribution throughout the community. ARC's regionally important resources plan identified areas of conservation or recreational value, historic and cultural resources, and areas of agricultural and scenic value. These areas were mapped against regional health risk rankings (Figure 80). This assessment found several large areas throughout the region that were lacking some or all of these resources, including eastern Cobb and Cherokee counties; most of Barrow, Bartow, Newton, and Paulding counties; western Gwinnett; and the majority of DeKalb County. The most distressed areas of south Atlanta and south DeKalb were notably lacking in natural and scenic resources, a potentially serious contribution to their health burden. The densely populated regional core had the highest concentration of cultural resources but lacked much access to major natural resources.



**Figure 80: Health risk and environmental resources**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau.

According to spatial data on roadway emissions and locations of high health risk communities, these communities may be exposed to areas of high roadway emissions (Figure 81). Using daily traffic volume statistics from ARC, our analysis mapped a 200 meter buffer around roads with 25,001 to 50,000 average annual daily traffic volume (AADT) shown in orange or more than 50,000 AADT shown in red, and a 100 meter buffer around roads with 10,001 to 25,000 AADT shown in yellow, based on guidance from the literature review. Note that high risk areas along I-20, inside the southern arc of I-285, and along I-85 to the north may be susceptible to exposure.



**Figure 81: Roadway emission zones relative to health risk**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau.

## Civic Life, Social Connections

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Community interaction can be facilitated by settings that foster casual social interaction and provide sufficient leisure time to engage in social and charitable activities. Perpetuation of local or locally-oriented businesses may also strengthen community bonds. This sense of community participation has been associated with wide-ranging improvements in mental and physical health and economic well-being, and political engagement on the larger level. Urban planning can govern the amount of public and semi-public space and its uses, travel mode choice and time spent commuting, business location and operational costs, and other relevant factors.

Many essential social and economic activities take place in public or semi-public spaces. People must leave their private homes in order to interact in society. In streets, parks, and businesses they meet their neighbors, learn, shop, and even engage in political expression. Additionally, these settings provide access to unique public resources such as recreational areas, libraries, and social services. However, communities are struggling to come together as nearly all of their public space is used for motor vehicle movement, most travel in the public realm is made isolated in a private car, and there is insufficient space to congregate (Gehl, 2011). Individuals who are not well integrated into the social, political and economic networks, those with low social capital, are shown to be at increased risk for poor physical and mental health.

Social capital—the collective benefits conferred by social networks—decreases 10 percent for each additional 10 minutes spent commuting (National Surface Transportation Policy and Revenue Study Commission, 2007) and is lower for people who live on streets with high traffic volume (Puentes, 2008). Mental health is assailed as traffic congestion, traffic danger, and commuting add to daily stress and prevent people from spending enough time with their families or engaging in more productive and enjoyable activities. Transportation expenditures are the second-largest expense for an American household, and some households spend more than 22 percent of their income on transportation. In 1998, this expense approached \$9,000 per household (NSTPRSC, 2007).

### **Social Capital and Health**

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 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. Social capital is built both formally, through participation in group activities, and informally, through casual association and encounters. Putnam examined the concept of social capital, describes two types of social capital: bonding and bridging. Bonding social capital ties people together through inclusion (intra-community ties), 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 among groups (Putnam, 2000; Ewing & Kreutzer, 2006).

Social capital is often measured through associative variables of civic engagement (community participation) and trust (Kritsotakis & Gamarnikow, 2004; McKenzie, Whitley & Weich, 2002). However, more comprehensive models for measuring social capital are important in capturing

the diversity of social interactions, the diversity of community composition as well as to tailor-make health interventions to the particular community being studied (children, elderly, etc.; Kritsotakis, & Gamarnikow, 2004). Although Putnam's model is often utilized in the literature, there are alternative models to evaluate social capital, such as Bourdieu's social capital theory (Carpiano, 2007). Recent research on social capital (and other neighborhood effects) has encountered numerous methodological challenges, especially in terms of separating the effects of confounding variables and eliminating self-selection bias in neighborhoods choice (Sampson, Morenoff & Gannon-Rowley, 2002). However, social capital literature seems to provide support for the linkages between neighborhood characteristics, social capital and positive health outcomes.

Overall, a decline of participation in various civic associations and of socialization with neighbors has been recorded in the United States (Putnam, 1995). Studies suggest that 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, King, Noort, Jordens & Lloyd, 2000). In contrast, people socially engaged in their communities live longer and are healthier both physically and psychologically (Kaplan, Kaplan & Ryan, 1998; House, Landis & Umberson., 1988; Berkman, 1979; Seeman, Kaplan, Knudsen, Cohen & Guralnik, 1987; Kawachi, 1999; Berkman, Glass, Brissette & Seeman, 2000; Kawachi & Berkman, 2001; Brummett et al., 2001).

Some researchers argue that social capital impacts health in several ways: by serving as a source of information and goods, identifying norms of healthy behavior, creating social ties and emotional support; and contributing to collective efficacy (UCBHIG, 2007). When information regarding health care is shared among members of a socially cohesive group, this information directly impacts the health of those involved. Further, identifying norms of healthy behavior can be used to reinforce healthy living 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).

Social capital has been linked to a variety of health outcomes, such as prolonged life expectancy and improved physical condition and mental health (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). 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, Grant & Thomas, 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).

A study of three neighborhoods in Washington, DC explored the linkages between the presence and capacity of local institutions and several indicators of social capital. Roman & Moore (2004) found that the quantity of religious institutions and pro-social places (i.e. parks, schools, recreation centers) were correlated with trust, community participation and block satisfaction. In addition, the study found that the distance or accessibility to these institutions was associated with higher levels of social capital indicators (Roman & Moore 2004). A study of religious effects on community participation found that among the sample of church-going Protestants, church participation was the strongest predictor of all types of formal volunteering (Park & Smith, 2002). These studies indicate the importance of local, community institutions for the creation of social, healthy places.

The linkages between institution accessibility and community participation indicate the importance of the built environment for social capital. 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. Built environments that promote social interaction can produce mutually reinforcing effects on place attachment or "sense of place" and social capital (Wood and Giles-Corti, 2008; Waxman, 2003).

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. In a study by Besser et al (2008), social capital was operationalized as travel purpose (socially-oriented trips). The study suggests that for every additional 10-minute increment in the categorical commute time variable, there is a corresponding increase in risk of no socially-oriented trips (increase in commute time negatively correlated with social capital). 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)

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). 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. This view is also strongly advocated by New Urbanism and their associated design tenets (Wood and Giles-Corti, 2008). Lund (2002) tested New Urbanist hypotheses in a study comparing the "sense of community" among pedestrian-oriented and auto-dependent neighborhoods in Portland, Oregon. Built environment

characteristics of the pedestrian-oriented neighborhoods studied included high street connectivity, housing mix and pedestrian amenities. The study found that individuals in pedestrian-oriented neighborhoods perceived greater sense of community. In addition, the study found that sense of community was more strongly correlated with recreational walking trips rather than destination trips (Lund, 2002). Although the issue of self-selection bias in neighborhood choice remains, the study supports the assertion that features of the pedestrian environment can promote social interaction and build social capital.

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). For example, a study of health outcomes and community participation in rural areas found that although low-density rural residents reported increased community involvement, high-density urban residents reported greater levels of physical activity and health status (Greiner, Li, Kawachi, Hunt & Ahluwalia, 2004). The study lends support for the association between positive health outcomes and increased density, except in the high-density rural environment. 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).

Several studies demonstrate the linkages between land-use mixing, access to amenities and social capital. In a study of physical activity, social capital and the built environment, social capital was associated with access to services (restaurants, bars, libraries and museums) and associated with lower pedestrian injury rates. However, social capital indicators were negatively associated with land use mixing and access to parks and transit (Wen & Zhang 2009). A study of Australian suburban neighborhoods found that the number and quality of destinations was associated with social capital (Wood et al., 2008), while a study in Portland, Oregon (Lund 2003) found that local retail access was positively associated with social capital indicators in inner-city (but not suburban) neighborhoods.

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, Mowen & Cohen, 2005; Leyden, 2003). In a study of parks, physical activity and social capital in New Orleans, parks with higher social capital were found to have more park users and more than four times the amount of physical activity than parks with lower social capital (Broyles, Mown, Theall, Gustat & Rung, 2011).

The design of the built environment in terms of architecture can also have an effect on social capital. 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. 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 (Lavin et al., 2006).

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).

In a study of collective efficacy and built environment features, the presence of parks and neighborhood disadvantage were significant predictors of collective efficacy. 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, Rivard & Seto, 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).

Declining social capital is also associated with 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. Several studies focused on the relationship between neighborhood “quality” and characteristics and social capital. The results of six studies suggest a linkage between neighborhood quality and social cohesion factors; although density variables were negatively associated with social interaction (Dempsey, 2008). However, a study of social capital and built environment perceptions indicated methodological difficulties in establishing “neighborhood quality” as a contextual variable related to social capital (Araya et al., 2006).

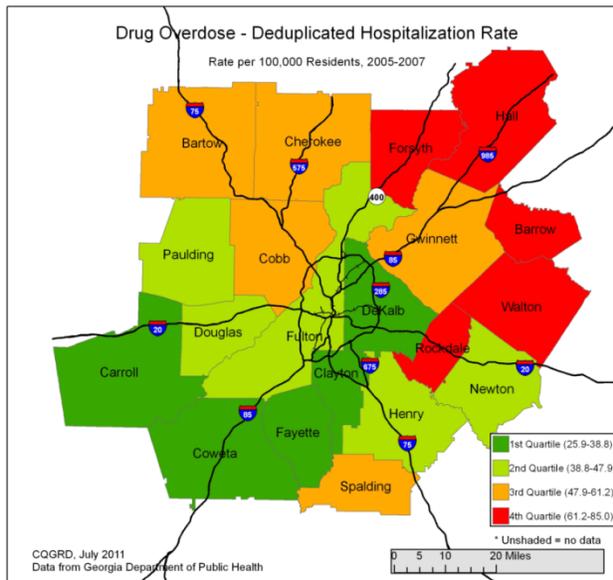
Examining recent literature, substantial linkages exist between indicators of social capital and a variety of associative variables relevant for urban design and health promotion. As numerous studies suggest, access to services and public spaces, pedestrian amenities and local institutions can affect residents’ social capital and potentially affect selected health outcomes such as physical activity levels and described health status. However, social capital research is in its early stages, and further research is necessary to examine the effects of self-selection bias and establish causality among the associative variables determined to affect social capital.

## **Civic Life: Health indicators**

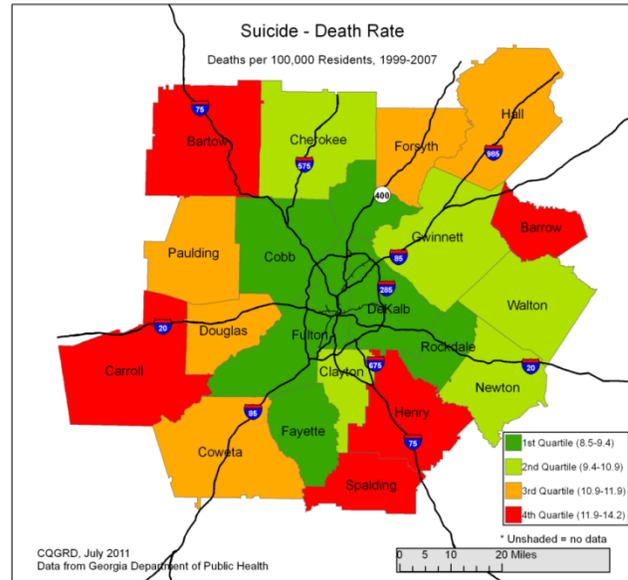
Indicators of social capital, civic participation, and mental wellness can include rates of suicide, drug overdose, homicide and sexually transmitted diseases. Additional indicators can include voter turnout rates, frequency of participation in family or community activities, religious services attendance, frequency of social interactions, subjective sense of social or emotional support as reported on a survey, or self-reported health-related quality of life (HRQOL) regarding number of days of mental distress, but data for these indicators were not available.

Rates of drug overdose hospitalizations were highest in eastern exurban counties (Figure 82). Rates ranged from 25.9 per 100,000 people in the county with the lowest rate (in dark green)

to 85.0 per 100,000 at the upper end of the highest range (in red). Death rates due to suicide were also higher in outlying counties, especially to the south and west of the region (Figure 83).



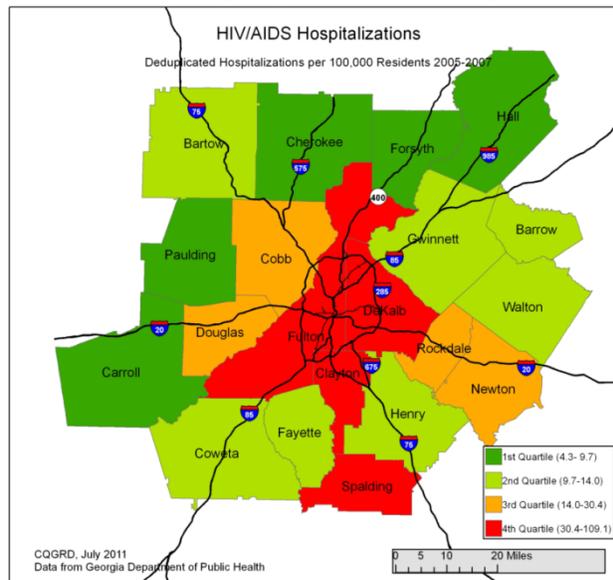
**Figure 82: Drug overdose hospitalizations**



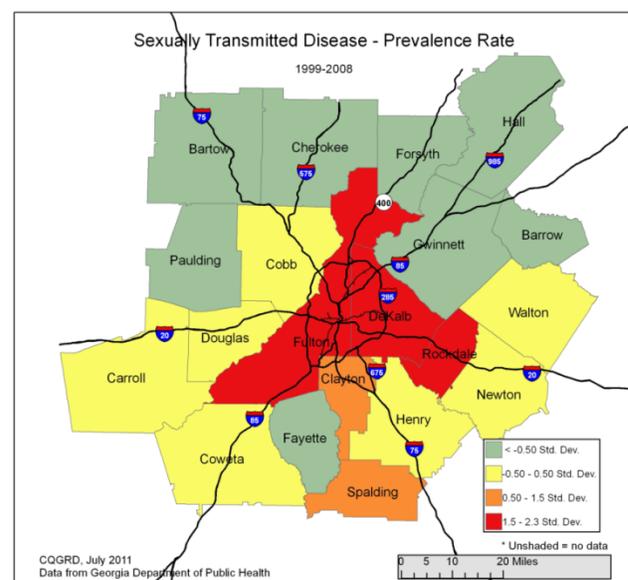
**Figure 83: Suicide death rate**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

Rates for HIV/AIDS hospitalizations and STD prevalence, however, were highest in core counties, including Clayton and Spalding counties (Figure 84, Figure 85).



**Figure 84: HIV/AIDS hospitalizations**



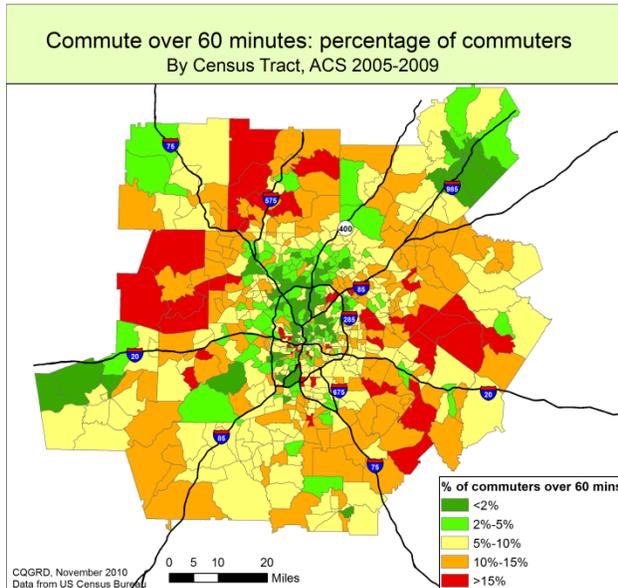
**Figure 85: STD prevalence rate**

Prepared by Center for Quality Growth and Regional Development. Data source: OASIS, Georgia Dept. of Public Health.

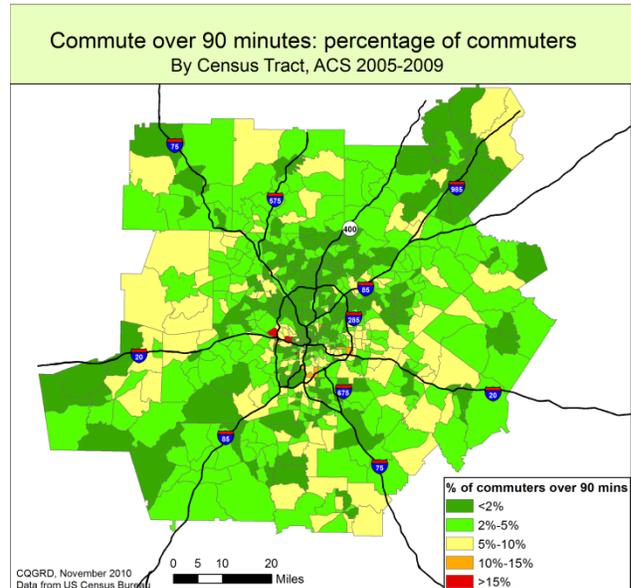
Prepared by Center for Quality Growth and Regional Development. Data source: University of Georgia.

From the perspective of built environmental factors in civic and social participation, emotional support, and mental and behavioral wellbeing, we considered time and mode of commute which could contribute to social isolation and reduce the amount of time available for participation in communal activities. Much of the Atlanta region is dominated by some

characteristics of low social capital, especially long commute times and commuters who drive alone. As shown in Figure 86, a high percentage of commuters outside the inner suburban ring commute over 60 minutes to get to work, especially in eastern, western and northern areas. Finally, a relatively small percentage of metro commuters (5-10% in some tracts) take over 90 minutes to get to work each way (Figure 87).



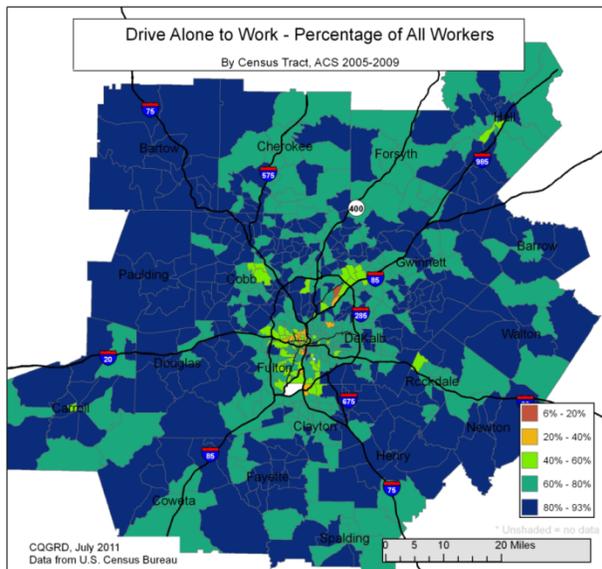
**Figure 86: Commute over 60 minutes**



**Figure 87: Commute over 90 minutes**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau – ACS 2005-2009.

With the exception of some central areas, the majority of metro area residents drive alone to work (from 60-93%, see Figure 88). Combined with long commute times, this has important implications for opportunities for social connections. However, other elements of civic participation and social capital remain unexplained. Location, and age, of LCI recipients may show some correlation with health status, as an indicator of the presence or absence of places to engage in social and civic activities.



**Figure 88: Drive alone to work**

Prepared by Center for Quality Growth and Regional Development.  
Data source: U.S. Census Bureau – ACS 2005-2009.

# Healthy Planning Concepts

Previous chapters have described how planning and policy decisions can contribute to an environment that supports healthy lifestyles, or make healthy living more difficult. The Atlanta Regional Commission has established healthy development and planning as an overall goal of Plan 2040. However, Plan 2040 does not contain details on the process to successfully integrate public health into the Plan or contain clear health related implementation strategies. The following chapter strives to provide some of this additional detail. It includes core planning concepts that support safety and security, access, economic stability, active living, environmental quality, and civic life.

## Key to recommendations

Look for the following numbers to identify recommendations relevant to your agency or role:

- ① For Atlanta Regional Commission boards and committees
- ② For Atlanta Regional Commission staff and other regional agencies
- ③ For federal and state agencies and governing bodies
- ④ For city and county elected officials
- ⑤ For city and county planning, zoning, and public works departments
- ⑥ For developers
- ⑦ For residents, workers, and neighborhood or business associations
- ⑧ For public health officials

## Transportation

As a whole, our transportation system is shaped by many forces. Some routes, including highways, follow the paths that were originally worn down by foot and horse traffic, and later paved. Many city streets and streetcar lines were originally laid out by private developers, while business magnates invested in profitable networks of stagecoaches, trains, streetcars, and buses. Today, private developers continue to construct a significant proportion of our traveled ways as they build subdivisions and complexes, but now they are constrained by subdivision ordinances and other codes in terms of street layout, design, and operation as well as more stringent environmental regulations. Some transit services are still provided by private investors, such as shuttle services for hotels and business districts. Major transportation management is now conducted by public agencies, however. This process utilizes demand forecasting and public input, but is also constrained by the prevalent political atmosphere. Additionally, this attempt in transportation planning to react in advance to anticipated changes can actually become the force that shapes future development and travel patterns.

Publicly managed transportation should in theory provide more equitable services to the entire population. However, as discussed in earlier sections, the present funding system, which is dictated by Federal planning and programming rules, actually penalizes lower-income families and mobility-challenged citizens. This method is used to plan and evaluate transportation system performance nationwide, and is therefore problematic for these reasons nationwide. Also as described above, transportation has been linked to numerous health impacts. The Victoria Transport Policy Institute reports that transportation is a factor in 7 of the 10 leading causes of death (Litman, 2003). As described in the Science of Healthy Places, transportation mode, operation, and volume are associated with rates of physical activity, rates of traffic injury, level of access to jobs and services, and environmental quality.

How well can transportation metrics account for these outcomes? We find that the predominant methods in use for recent decades have been poorly equipped for maximizing economic productivity, health, and quality of life. Plan 2040 utilized a wider range of metrics intended to correspond with their five major objectives. See page 203 for further discussion of performance metrics. In this section, we explain key metrics which, taken together, capture the transportation system's performance as a host of movement, access, interaction, economy, ecology, and human activity.

### Mode Share

#### Discussion

Mode share describes the share of travel made by car, transit, walking, bicycling, carpooling, and other methods of travel. Each travel mode has different implications for health. Some implications are direct, such as the cost of traveling by that mode. Others are externalities, benefits or costs (to the individual or to society) that are not represented in the price or opportunity cost of the good or service. For instance, car crashes that occur as a result of driving impose a cost on society in terms of lost productivity, medical expenses, and such, but these costs are not fully reflected in the cost of driving; liability insurance is an attempt to correct for this but has only partial correlation with relative risk or the full range of external costs. In order to achieve the optimal outcome in terms of health, equity, environment, and economy, one consideration is whether the travel mode with the fewest externalities is also the most rational choice for any given trip – the choice with the lowest price and opportunity cost. These decisions may be a function of distance, land use at destination, ability, time and weather, reliability, trip chaining, travel companions, and other factors. Table 6 expresses the positive and negative externalities of each mode in terms of the major health impact categories assessed in this HIA.

**Table 6: Externalities of travel modes**

Mode	Safety	Access & Equity	Physical Activity	Environment	Civic/ Social
Private passenger motor vehicle/ Motorcycle	<ul style="list-style-type: none"> <li>• Some occupant protection</li> <li>• High injury/ fatality rate</li> <li>• High impact to other groups</li> </ul>	<ul style="list-style-type: none"> <li>• Unlimited schedule and route; high speed</li> <li>• High user cost</li> <li>• High congestion</li> <li>• High parking</li> </ul>	<ul style="list-style-type: none"> <li>• Mostly sedentary</li> <li>• Walk from parking</li> </ul>	<ul style="list-style-type: none"> <li>• High emissions per user mile</li> <li>• High noise</li> <li>• Moderate to high lifecycle</li> <li>• AFV partial offset</li> </ul>	<ul style="list-style-type: none"> <li>• Low to moderate interaction during use</li> </ul>
Commuter/ heavy/ light rail	<ul style="list-style-type: none"> <li>• Low injury/ fatality rate</li> <li>• Moderate impact to other groups</li> </ul>	<ul style="list-style-type: none"> <li>• Fixed schedule</li> <li>• Fixed guideway</li> <li>• Moderate to low user cost</li> <li>• Low congestion</li> <li>• No parking</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate to high activity level</li> </ul>	<ul style="list-style-type: none"> <li>• Low to moderate emissions per user mile</li> <li>• Moderate to high noise</li> <li>• AFV partial offset</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate to high interaction during use</li> </ul>
Bus	<ul style="list-style-type: none"> <li>• Low injury/ fatality rate</li> <li>• Moderate impact to other groups</li> </ul>	<ul style="list-style-type: none"> <li>• Fixed schedule</li> <li>• Semi-fixed route</li> <li>• Low user cost</li> <li>• Moderate congestion</li> <li>• No parking</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate to high activity level</li> </ul>	<ul style="list-style-type: none"> <li>• Low to moderate emissions per user mile</li> <li>• Moderate to high noise</li> <li>• AFV partial offset</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate to high interaction during use</li> </ul>
Bicycle	<ul style="list-style-type: none"> <li>• Moderate injury/ fatality rate</li> <li>• Low impact to other groups</li> </ul>	<ul style="list-style-type: none"> <li>• Unlimited schedule and route; moderate speed</li> <li>• Very low cost</li> <li>• Low congestion</li> <li>• Low parking</li> </ul>	<ul style="list-style-type: none"> <li>• High activity level</li> </ul>	<ul style="list-style-type: none"> <li>• Very low emissions per user mile</li> <li>• Very low noise</li> <li>• Low lifecycle</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate interaction during use</li> </ul>
Walk	<ul style="list-style-type: none"> <li>• Moderate injury/ fatality rate</li> <li>• Low impact to other groups</li> </ul>	<ul style="list-style-type: none"> <li>• Unlimited schedule and route; low speed</li> <li>• No cost</li> <li>• Low congestion</li> <li>• No parking</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate to high activity level</li> </ul>	<ul style="list-style-type: none"> <li>• Very low emissions per user mile</li> <li>• High noise</li> <li>• AFV partial offset</li> <li>• No lifecycle</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate to high interaction during use</li> </ul>
Freight truck	<ul style="list-style-type: none"> <li>• High impact to other groups</li> </ul>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• High emissions per freight mile</li> </ul>	<ul style="list-style-type: none"> <li>• Higher rates of unhealthy behavior (such as obesity, fatigue and increased crash risk for commercial drivers, see Anderson et al. 2012)</li> </ul>

Freight rail	• Moderate impact to other groups	• N/A	• N/A	• Moderate emissions per freight mile	• Unknown
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Prepared by: Center for Quality Growth and Regional Development

Mode share appears to be heavily influenced by the proportion and quality of right-of-way dedicated to each travel mode (automobile, bus and light rail, truck, bicycle, and pedestrian), or to the quality of services provided for transit. While general purpose lanes can be used by cars, trucks, buses, and bicycles, the inclusion of facilities intended exclusively for one of these modes can greatly modify the user behavior and utilization of the road. For instance, bicycle lanes or bus-only lanes may increase the safety and speed of travel in a corridor, and more people may choose these modes. Land use can also influence mode choice, as described earlier. Additionally, transportation operations and trends may influence choice; for instance, the prevalence of bicycle traffic may influence perceptions of bicycling as a safe and convenient travel mode.

Mode share can be measured in different ways, which may yield very different results. Proportion of travel by each mode can be expressed as a share of miles traveled, trips made, hours traveled, and more. Per-mile metrics are common, but may underrepresent the frequency or utility of bicycling and walking, which usually occur over much shorter distances. Per-trip metrics can be more useful for understanding health impacts, as they can convey the number of daily needs, including job access, which can be satisfied through modes that have more health benefits and fewer negative externalities. Other complications of mode share evaluation can result from trip chaining. For example, a trip in which someone drives to a parking garage near their office, walks to a coffee shop, and then walks to their office may simply get classified as a driving trip because that mode composed the majority of the travel time or distance. This classification may overlook the economic impact of the walking portion of the trip, and the essential role of the pedestrian infrastructure to complete the trip. Finally, the type or scale of the data may vary. Regional data for all trips, including many chained trips, can be obtained from the National Household Travel Survey; this survey is conducted approximately every eight years. Data for specific streets or cities may be collected by a local civic group or transportation department. Data from the U.S. Census Bureau only covers the trip to work.

Passenger cars and trucks contribute a unique level of mobility with higher maximum operating speeds than non-motorized travel, added cargo capacity, and freedom from the route or schedule restrictions of public transit, though still largely limited by the availability of public roads and parking facilities. However, Table 6 shows that many negative externalities can be attributed private motor vehicle travel: injuries and fatalities, air pollutant and toxics emissions, greenhouse gas emissions, sedentary behavior, unpredictable travel conditions and congestion, stress, noise, loss of social engagement, and negative economic pressure on governments, real estate, and households. Technological advances, such as alternative fuels and “intelligent” highway systems, have made inroads on some of these concerns but have not produced any wholesale solutions.

The present-day transportation system in most U.S. cities does not provide many viable travel options other than driving. Many public streets, including highways and major thoroughfares, lack even minimal walking or cycling facilities. Additionally, aesthetic and safety considerations due to street design and traffic operations discourage human presence. Zoning ordinances have mandated single use, non-nodal, low-intensity areas that cannot support quality transit and have little or no destinations within walking distance of homes or other origins. A great availability of convenient low cost parking options also discourages the use of transportation

modes other than driving. Finally, underinvestment in public transportation relative to road expenditures have resulted in limited route and schedule services. As a result, the negative health impacts associated with high levels of driving have become widespread.

In assessing Plan 2040, our goal was to identify the share of trips for which alternate travel modes could present a viable option when compared to driving. This scenario could only occur if the alternative mode is competitive with driving in cost, time, and convenience; this is made possible through policy, planning, and infrastructure modifications. These findings were placed in context with other healthy planning methods. In activity centers (see Centers entry, below), frequent intersections and access points combined with high demand often result in lower driving speeds and moderate congestion. Overall, though, the area may operate efficiently by carrying a significant share of traffic by foot, which is much less space intensive. Additionally, these conditions can allow bicycle traffic to complete trips through these areas in the same amount of time as a motor vehicle, but potentially with much greater capacity (approximately five to one). The historical solution to this has been to widen roads and increase intersection throughput for vehicles. However, these treatments can discourage foot and bicycle traffic by making street or lane crossings longer and worsening perceived traffic danger.

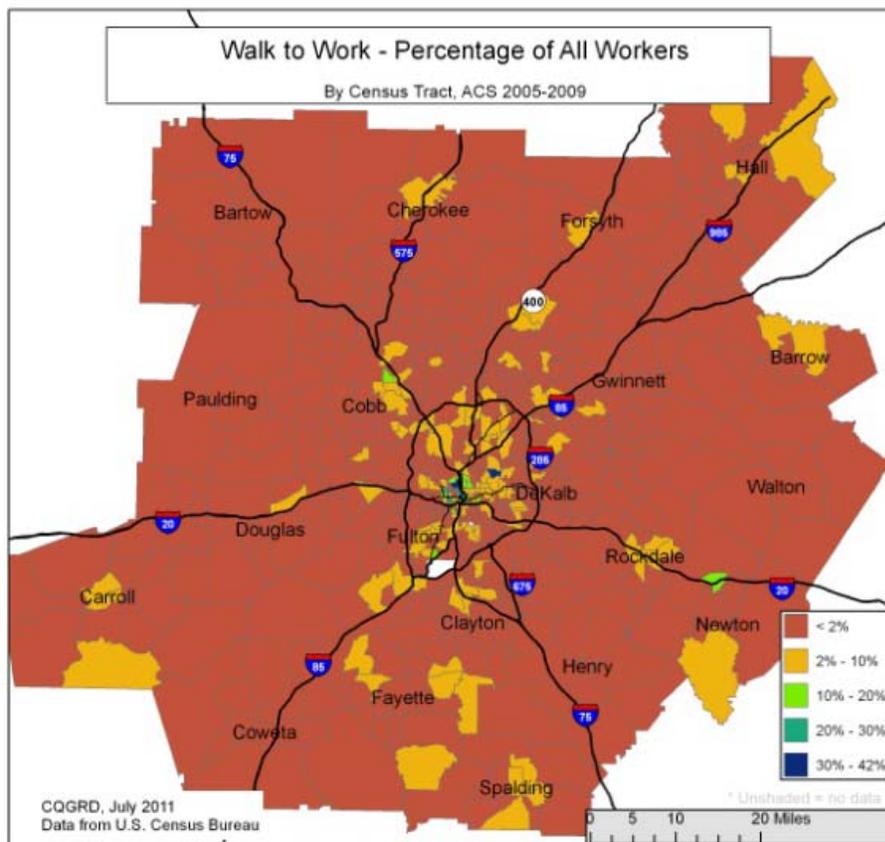
Surveys conducted by ARC and other parties (for instance, the Strategies for Metropolitan Atlanta's Regional Transportation and Air Quality (SMARTRAQ) study) have indicated that a significant amount of residents would prefer to live in neighborhoods with more alternatives to driving (Frank & Levine, 2007). Among suburban residents surveyed, about 1/3 stated they would prefer to live in a "smart growth" environment (if cost, safety, school quality was equivalent). . If alternatives were available, a larger proportion of trips under a half-mile could occur on foot, and a larger proportion of trips less than 3 miles could be bicycled, if bicycling conditions were improved. Finally, a larger proportion of trips between centers or along major corridors could be accomplished via transit, if reliable premium transit service were available. Some proportion of trips will always continue to be most suitable to private car travel due to schedule, distance, and land use, but by ensuring that the appropriate transportation facilities and services are available, diversifying mode share may provide reliable and convenient alternatives to traffic congestion at rush hour; increase access and reduce congestion in business districts where visitors can park, carpool, or take transit and then walk to numerous stores and offices; and avert increases in traffic volume in existing towns and neighborhoods. There can be an optimal mode choice for freight movement as well, such as rail for long distance and node-to-node (e.g. port to distribution center), road for last-mile, and small truck, low-speed vehicle, or bicycle courier in denser areas.

### **Plan 2040 Evaluation**

Recent data from the American Community Survey (ACS) from the U.S. Census Bureau and National Household Travel Surveys (NHTS) indicate that a significant number of trips are being made by foot, bicycle, or transit in the Atlanta region. For instance, the 2005-2009 ACS data indicated that over 30,000 trips to work are made by walking, as well as nearly 100,000 regular transit commuters, and several thousand bicycle commuters, while 2001 NHTS data indicated that each resident makes about 1.5 walking trips per week. In over half of regional Census tracts, at least 10% of commuters walk, bicycle, carpool, or take transit. However, the majority of trips are being made by private car, including 1.9 million commuters who drive alone. Additionally, 60% of NHTS respondents indicated that sidewalk conditions were a problem for them when they tried to walk. In ARC's 2001 Household Travel Survey, 5.7% of respondents routinely used transit to travel to work, 76.2% drove, and 3.9% walked or bicycled; out of all trips made on survey days, 4.6% were made on foot, 0.1% by bicycle and 2.1% on transit, 22.8% as a motor vehicle passenger, and 64.2% as a driver. Thus, regional travel is unevenly distributed across modes. Although most regions have an uneven distribution of

transportation modes, a shift towards a more even mode share would likely be beneficial from a public health perspective.

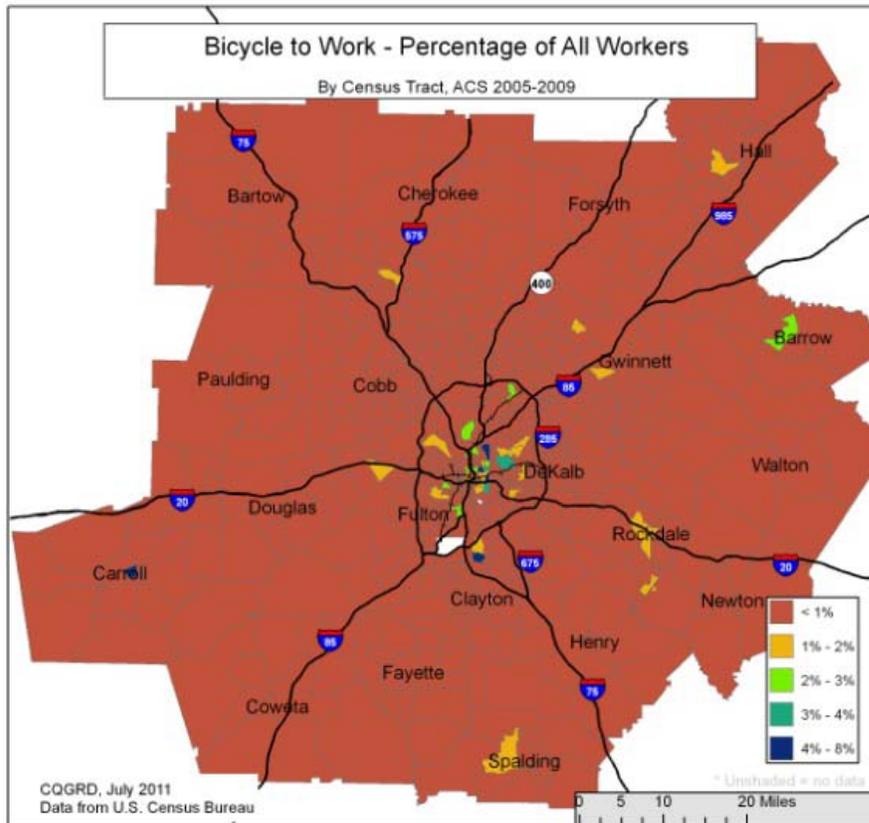
Although downtown Atlanta has the highest rates of walking to work, many core areas had moderate rates (2% - 10%, in orange) of walking to work. In several areas, rates of walking to work exceeded 30%. This indicates that walking is an important commute mode for the region, and that pedestrian infrastructure should be viewed not just as a question of latent demand, but also as an existing capacity need. It should be noted that these statistics only include workers whose entire commute consisted of walking; it does not address commutes that involved walking to transit or carpool services, or walking from a parking facility, nor does it address trips that are not travel to work.



**Figure 89: Walking commute mode share**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau – ACS 2005-2009.

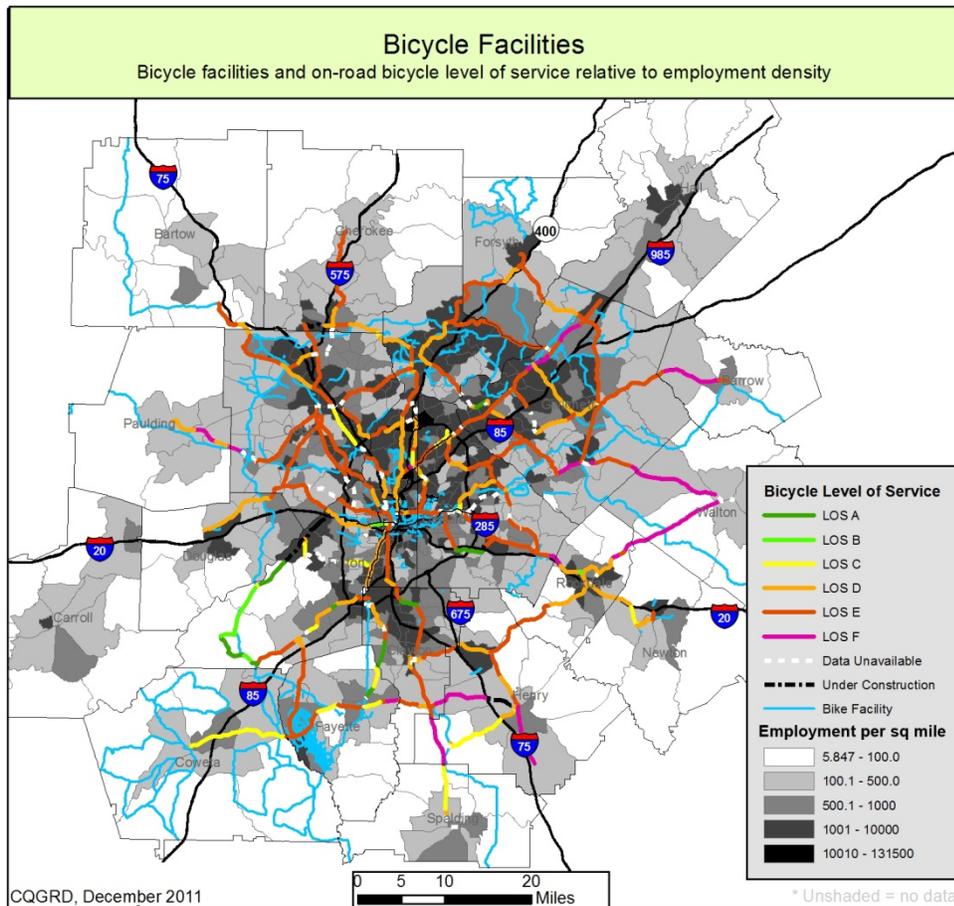
Although bicycle commuting is limited to a small number of Census tracts in the region, some locations did report up to 8% bicycle commute share. The highest rates could be found in the Buckhead, eastside, southwest, and northwest communities of Atlanta, western DeKalb County, northern Clayton County, and around Griffin, Conyers, Doraville, Winder, the Six Flags area, and several other points.



**Figure 90: Bicycling commute mode share**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau – ACS 2005-2009.

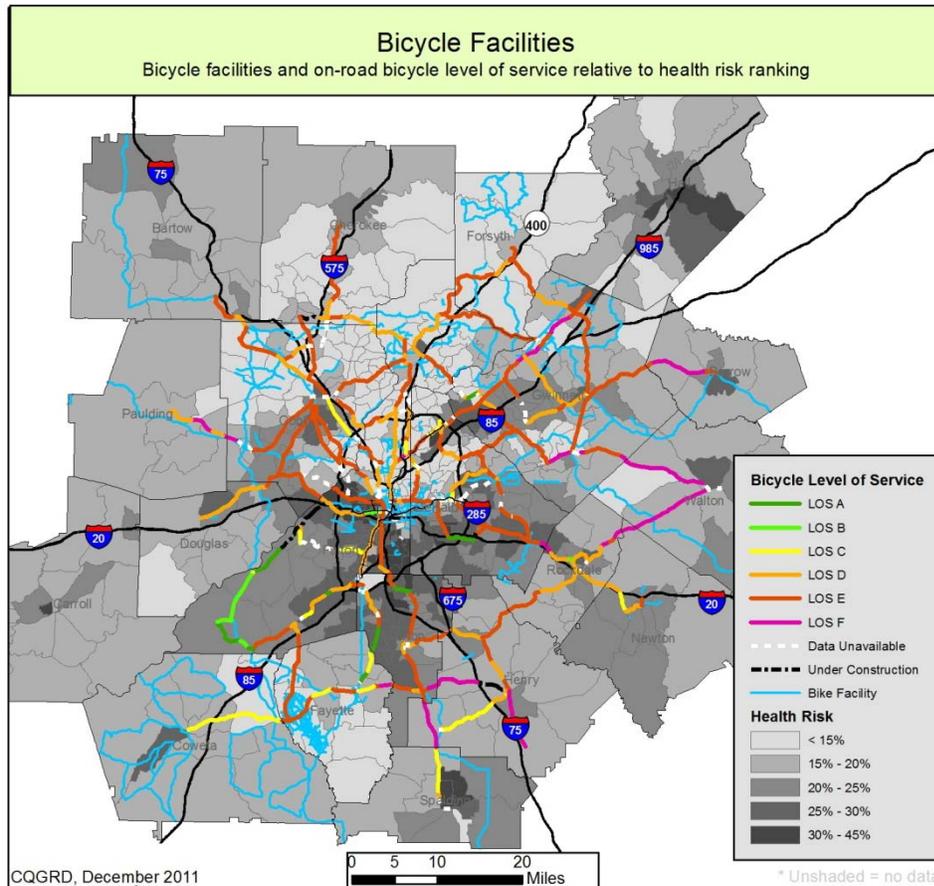
In order to achieve a major redistribution of mode share over the next 30 years, Plan 2040 would need to invest heavily in bicycle and pedestrian infrastructure, as well as continuing to foster walkable towns and neighborhoods. Pedestrian infrastructure inventories were not available for the region during this HIA, an important data need for the future. ARC had conducted a bicycle facility inventory and evaluated level of service on the relatively sparse regional bicycle network. The bicycle facility inventory includes bicycle lanes, small shared paths, golf cart paths, and signed state bicycle routes. As shown in Figure 91, the existing facilities provide access to certain employment centers while bypassing others. Facilities shown in red or pink have a failing level of service, while those in orange have poor level of service. Turquoise facilities are not on the regional network.



**Figure 91: Bicycle facilities relative to employment density**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau - ACS 2005-2009.

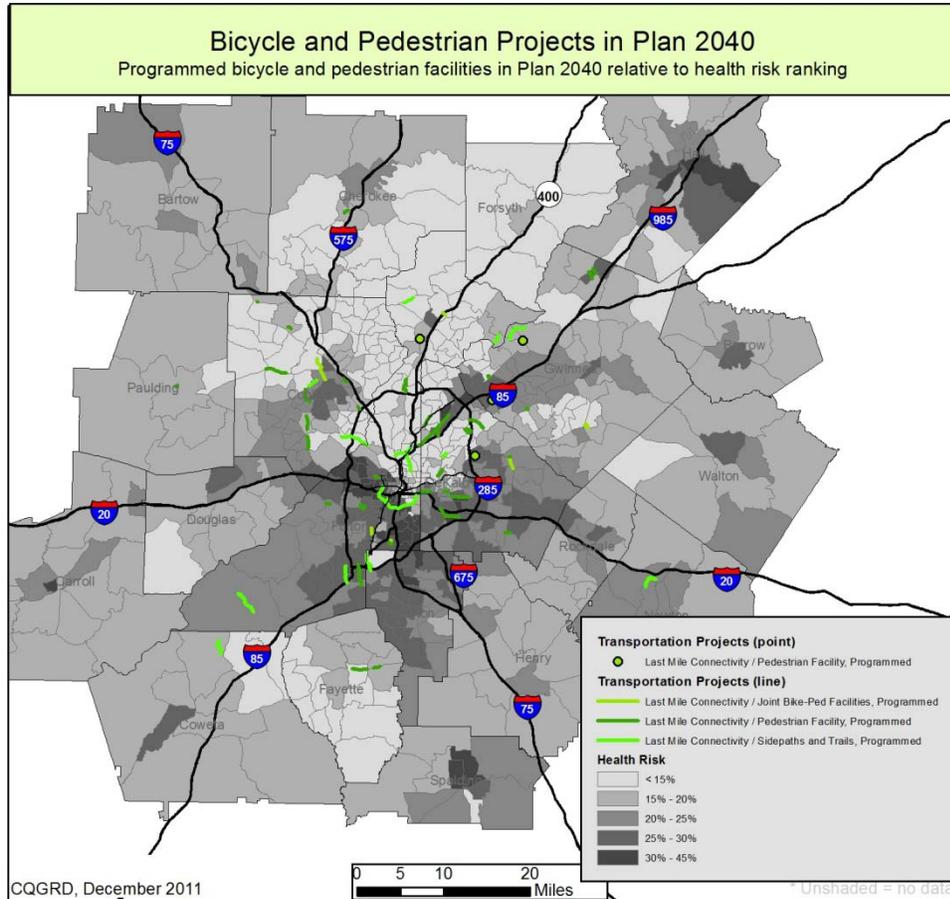
While routes and facilities have been planned through high health risk areas of the region, the quality and quantity of these facilities was relatively poor at the time of Plan 2040 development (Figure 92).



**Figure 92: Bicycle facilities relative to health risk ranking**

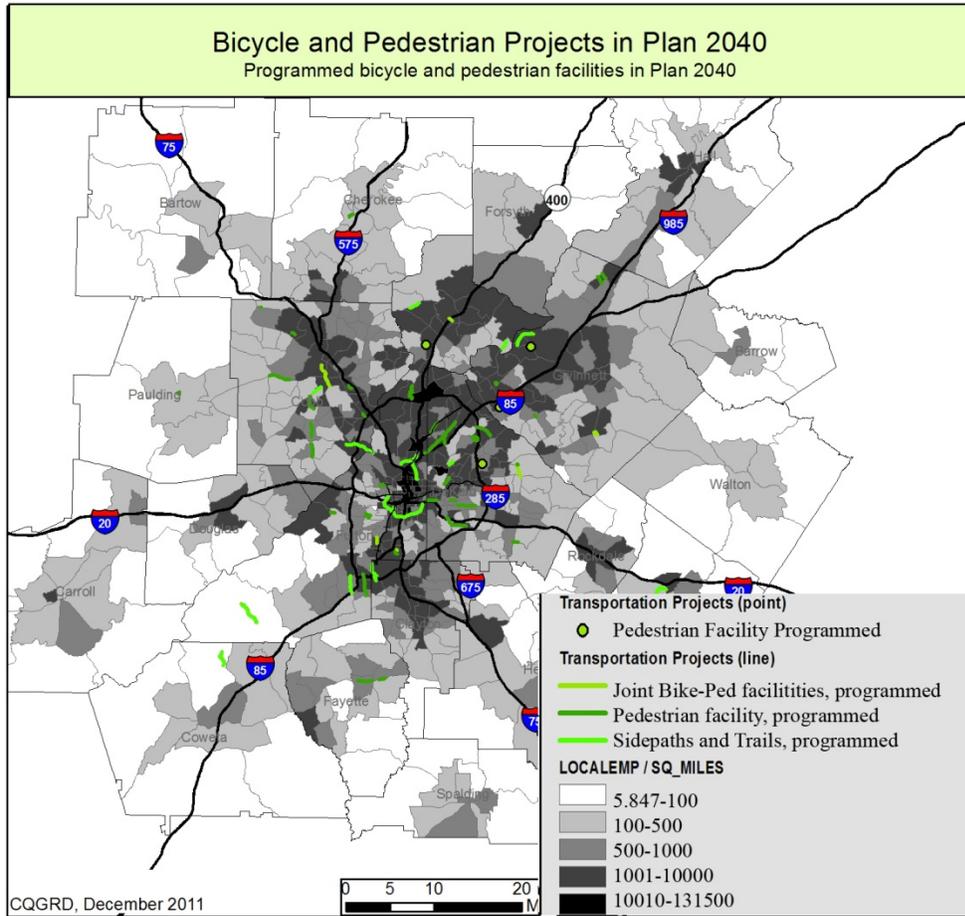
Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau – ACS 2005-2009.

Plan 2040 funded a relatively small amount of line-item bicycle and/or pedestrian projects during the first five years. The project list (and figure above) does not include roadway projects that included bicycle or pedestrian accommodations, and does not include lump-sum funding blocks, which were not programmed at the time of writing. The Atlanta Regional Commission also has a “Complete Streets” policy applicable to the funds the MPO has control over. Figure 93 depicts the programmed projects relative to community health risk ranking, while Figure 94 shows these projects in relation to employment destinations. Clear standards have yet to be fully developed for the funding of pedestrian and bicycle projects, although progress is being made at the regional and local level through the new regional thoroughfares guidelines and implementation of “Complete Streets” policies. However, improvements can be made in the future to the regional bicycle and pedestrian network as well as updates to local subdivision and zoning ordinances to support connectivity and pedestrian and bicycle facilities.



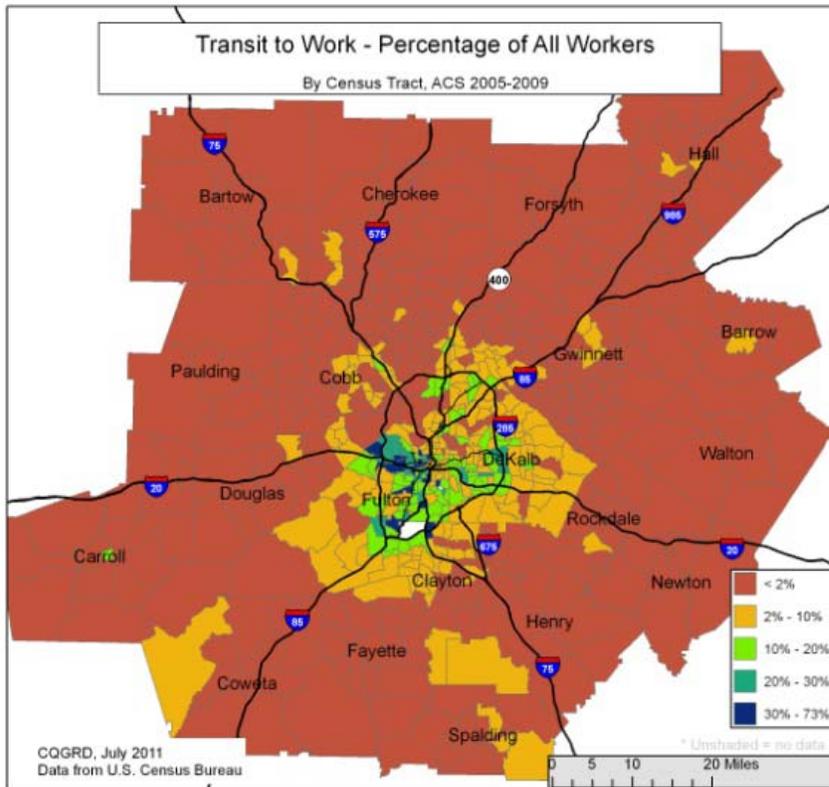
**Figure 93: Programmed bicycle and pedestrian projects relative to health risk**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau - ACS 2005-2009.



**Figure 94: Programmed bicycle and pedestrian projects relative to employment density**  
 Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau – ACS 2005-2009.

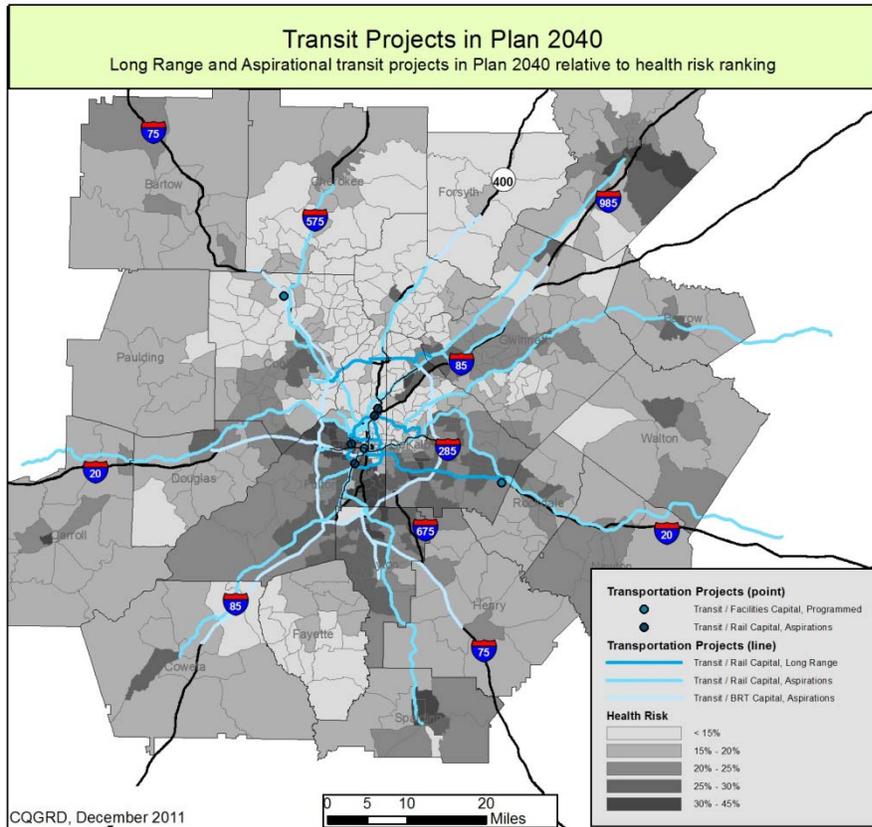
Of alternative transportation modes, transit had the highest percentage of commuters in the Atlanta area (Figure 95). The concentrations of transit commuters align with existing transit availability. The highest rates of transit commuting appears on the westside of Atlanta and in the East Point/College Park area, while a moderate amount of transit use appears in areas that offer commuter bus access.



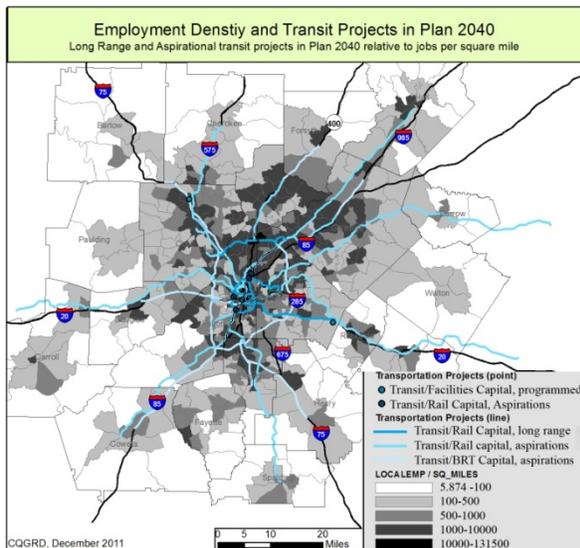
**Figure 95: Transit commute mode share**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau – ACS 2005-2009.

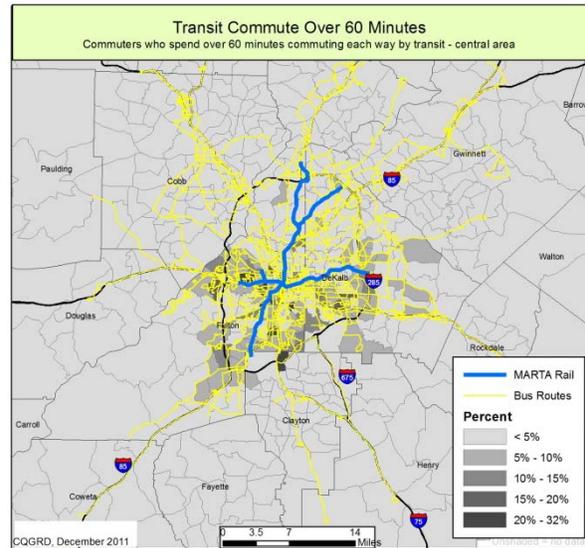
In order to achieve a major increase in mode share over the next 30 years, Plan 2040 would need to invest heavily in new transit routes as well as bicycle and pedestrian infrastructure for access to transit stops and stations. No new funding is available for transit operations other than the farebox revenue it might generate, making construction of new transit facilities of limited value. Federal and state funds come with many restrictions on their use, and relatively little of the programmed dollars are local; there are strict additional restrictions on ARC’s powers to coordinate regional governance and taxation. ARC has little control over these factors. The funded long range transit projects (dark green) would serve a small portion of the areas that were at risk for poor health and selected employment corridors. Access to other employment centers and to areas with long transit commute times would not be funded before 2040.



**Figure 96: Long Range and Aspirations transit projects in Plan 2040 relative to health risk ranking**  
 Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau – ACS 2005-2009.

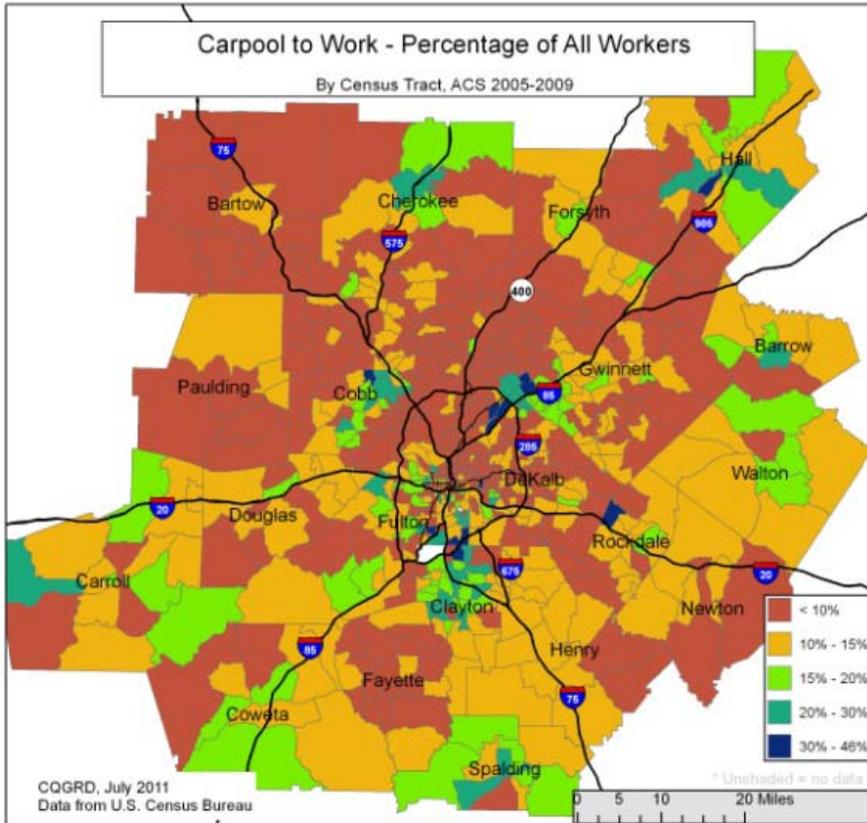


**Figure 97: Long Range and Aspirations transit projects by employment destinations**  
 Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau – ACS 2005-2009.



**Figure 98: Districts with transit commute over 60 minutes relative to location of rail transit**

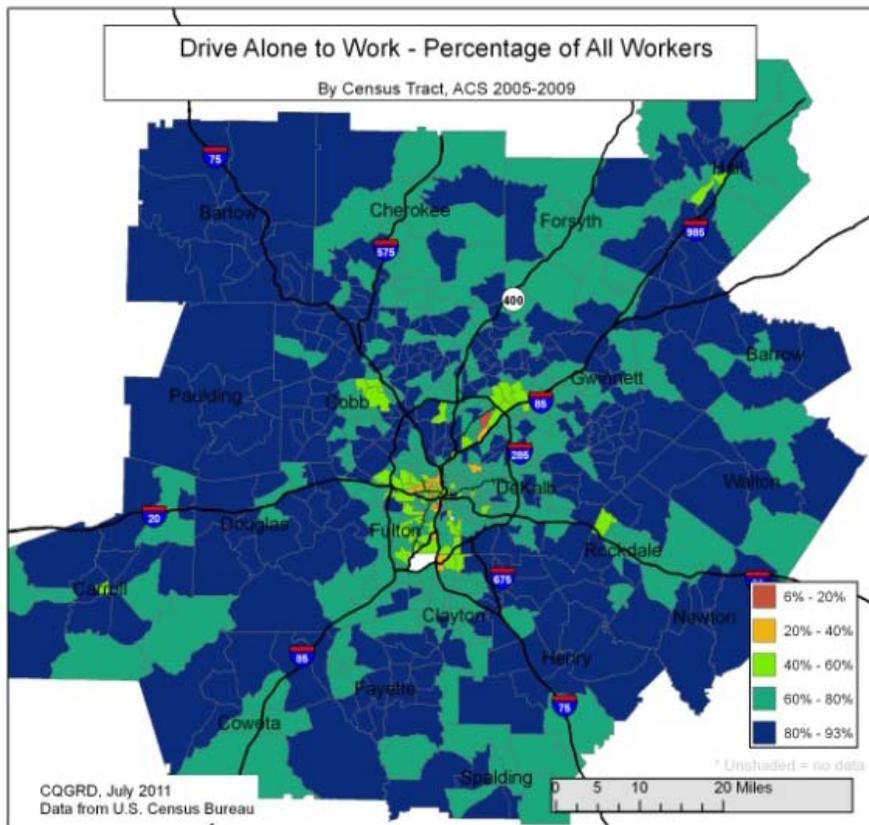
Carpooling is relatively widespread across the region, contributing at least 10% of travel to work in about half of all regional Census tracts (Figure 99). Carpool rates may indicate latent demand for transit services by workers who cannot or prefer not to drive alone and who do not have adequate travel alternatives. Commuters who live and work in more densely developed areas, such as town centers and regional employment corridors, may have more choices for finding a carpool partner.



**Figure 99: Carpool commute mode share**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau – ACS 2005-2009.

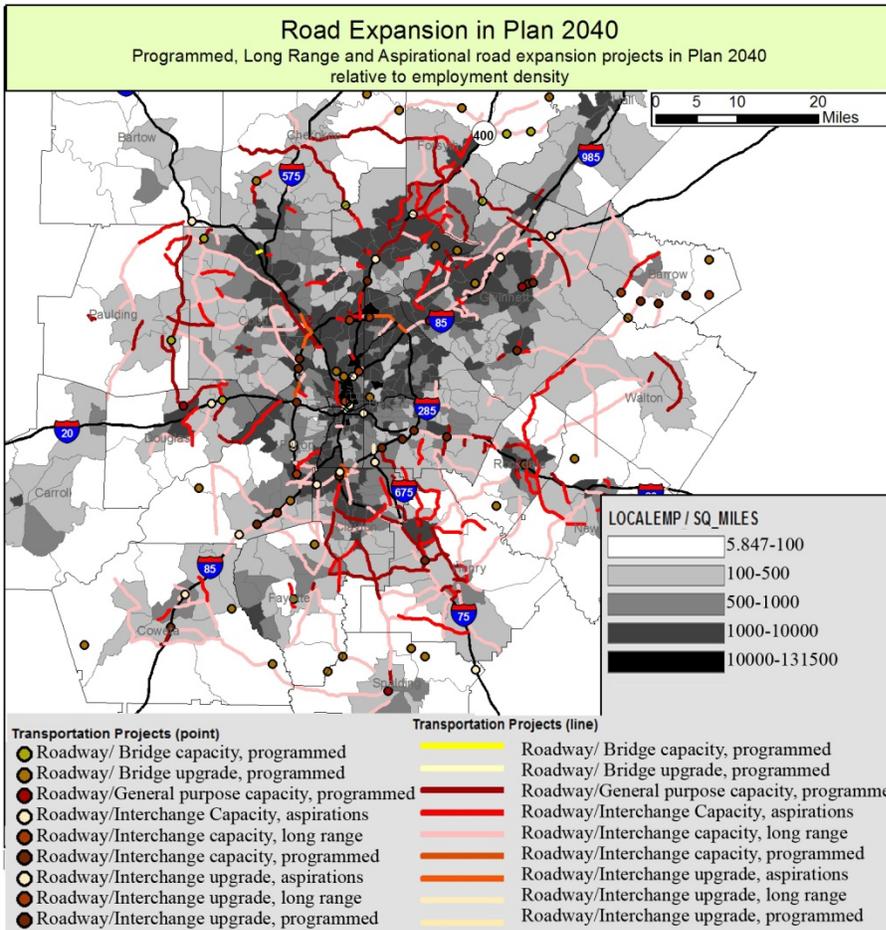
The majority of commuters in exurban areas and many suburban areas commute by driving alone (Figure 100). In large parts of the region, more than 80% of commuters drive to work alone. Due to the potential health issues associated with this mode, as described in Table 6, we asked whether these commuters would have more travel mode options under Plan 2040.



**Figure 100: Drive alone commute mode share in the Atlanta region**

Prepared by Center for Quality Growth and Regional Development. Data source: U.S. Census Bureau – ACS 2005-2009.

Figure 101 shows programmed, long range, and aspirational road expansion projects (road capacity, bridge capacity and upgrade, and interchange capacity and upgrade) in Plan 2040 relative to employment centers. It is important to note that capacity expansion would be likely improbable (due to right-of-way constraints) or cost-prohibitive in the majority of core urban areas. Currently programmed capacity expansion projects could be appropriately incorporated into the existing transportation and land use conditions in the mature urban and suburban districts and neighborhoods.

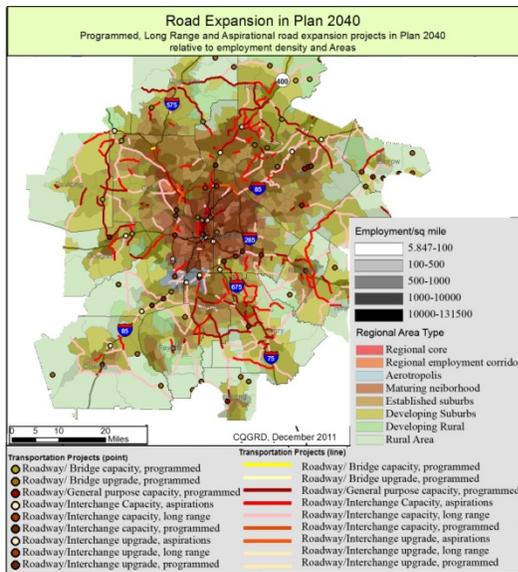


**Figure 101: Programmed, long range, and aspirational road expansion in Plan 2040**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau – ACS 2005-2009.

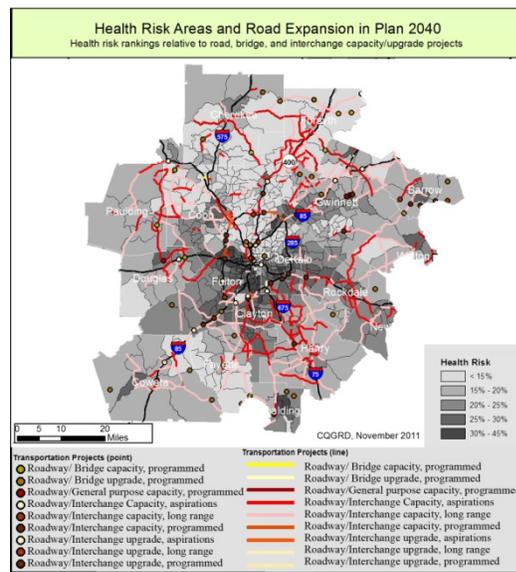
Mapped over the regional Area types identified in the Plan 2040 Regional Development Guide, it appears that many of the unfunded aspirational road capacity projects (pink), and at least one programmed road capacity project (dark red) would encroach on rural areas (Figure 102). Rural areas are shown in light green. There were few road expansion projects impacting areas of high health risk (Figure 103). Although the inclusion of rural encroaching projects on the aspirational list is potentially problematic (as they are retained for future consideration), the screening demonstrates that projects not connecting to centers or existing corridors were successfully removed for current funding consideration.

It is important to balance considerations such as mobility and access to services with preservation of rural areas and historical land-use character.



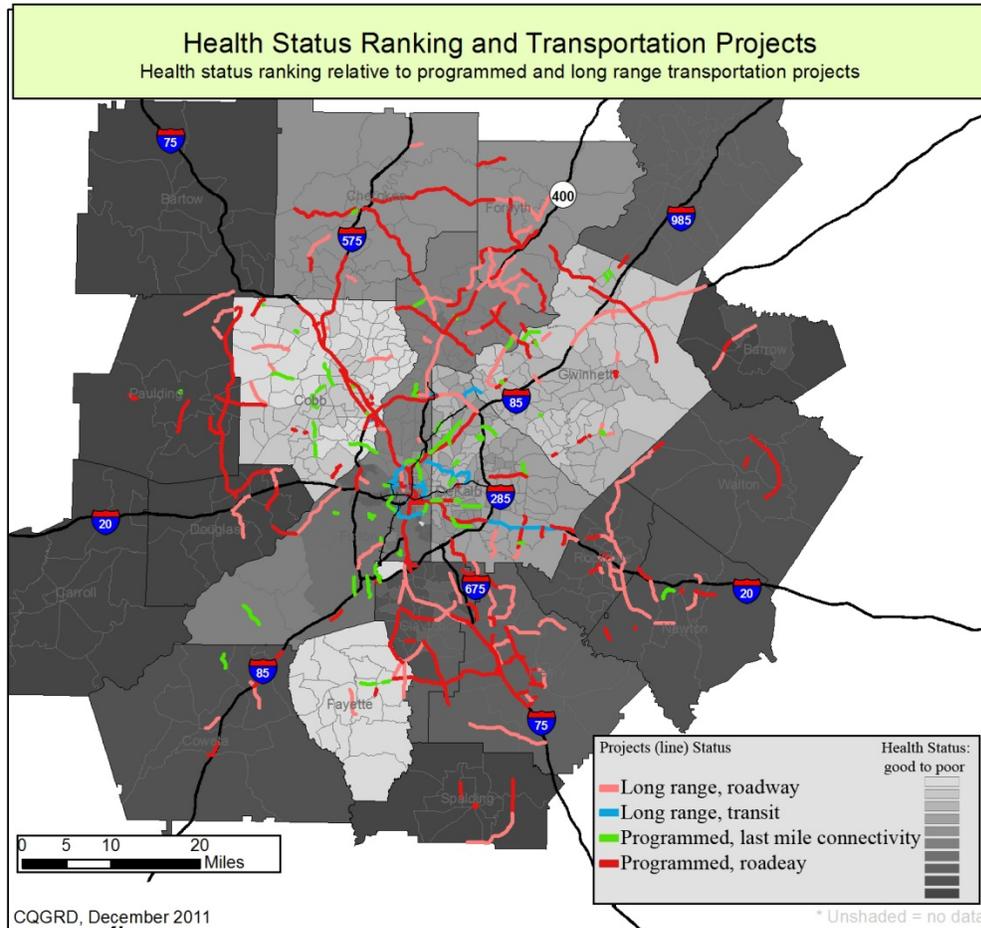
**Figure 102: Road expansion projects relative to Areas**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau – ACS 2005-2009.



**Figure 103: Road expansion projects relative to health risk**

Looking at overall health status (a combination of death rate and demographic risk factors), it appears that many of the areas with poor health status (darker gray) may continue to be at risk from lack of access to healthful transportation options in Plan 2040. In Figure 104, after excluding unfunded (Aspirations) projects, it appears that very few bicycle or pedestrian projects (green) are programmed in parts of the region with the poorest health status, and no transit projects (blue). Note that within the Plan 2040 project programming process, bicycle and pedestrian projects are funded during the TIP period with the remainder of “future funding” (and are usually funded with lump sum amounts that were not programmed at the time of this report). However, a fair number of programmed road projects (bright red) and long-range road projects (pale red) are committed in these areas. It is important to note that due to design decisions and federal policy, many roadway projects include bicycle/and or pedestrian facilities, although they may not be categorized as bicycle/pedestrian projects. The FHWA recommends that vision-oriented planning and regional collaboration that utilizes communication and collaboration strategies is a good strategy for long-term transportation management. The FHWA particularly cites the ARC’s “Aspirations Plan” as an exemplar of visionary regional transportation planning. However, funding realities determine the feasibility of implementation.



**Figure 104: Health status relative to programmed and long-range transportation projects**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau – ACS 2005-2009, Georgia Dept. of Public Health.

**Recommendations**

- Diversify Mode Share.** While any travel has some external impact on the community, non-motorized travel modes and public transport show significant improvements in terms of physical activity, safety, emissions, social interaction, and household travel cost, and to infrastructure and land use. It is the general recommendation of this report that transportation-related externalities should be included in the LRTP and TIP performance measures, as they are fundamental to achieving the overarching planning goals of health, safety, equity, and economic vitality.

  - Improve and/or encourage localized and regional data collection for walking, bicycling, carpooling, and transit ridership. ① ② ③ ⑧
  - Encourage the control of speed and conflict points to improve the pedestrian and bicycle environment. ① ② ③ ⑤
  - Design intersections to serve all types of users with an equal degree of priority and minimum delay. ② ③ ⑤
  - Develop more accurate ways to evaluate level of service for all travel modes and road users, and use them to increase and improve bicycle, pedestrian, and transit travel as appropriate to location (including lower-volume rural roads). ① ② ③ ⑤

- Encourage enhance access to transportation services and encourage reduction of roadway barriers such as infrequent pedestrian crossings or turn lanes that affect bus access to a bus stop. ①②③⑤
- Promote higher-density land use to increase the number of destinations in walking or bicycling distance. ①②④⑤
- Ensure that the entire roadway, including sidewalks and bicycle lanes, are adequately cleaned and maintained. ③④⑤
- Enhance street networks to improve accessibility and provide alternative routes (which will divert more traffic away from the highest-volume roadways) ①④⑤
- When feasible, minimize wide roadways (i.e. through lane width reductions or road diets when appropriate). ①④⑤
- Keep block lengths short and well-connected. ④⑤
- Create pedestrian-friendly environments: wide sidewalks, planting or furniture zones between the vehicle lanes and the sidewalk, benches, waste and recycling receptacles, shade trees, sidewalk-oriented building frontage and design, street and sidewalk lighting, and pleasant streetscape. ①②④⑤
- **Project selection should balance interests of the region and the local community.** Project selection should address questions of the proportion of carless households, people unable to drive due to age, or households with low income and high potential transportation costs, and areas lacking in transportation alternatives. Some census tracts with over 30% carless households, such as those in northwest City of Atlanta, have roadway capacity projects programmed or in the long range list, but no transit or non-motorized facilities. Some roadway projects may routinely include pedestrian and bicycle facilities. *Also see Transit, below.* ①②③
- **When feasible, evaluate all projects on equal grounds.** Compartmentalization of projects by type might result in a tendency toward comparing different project types equally based on regional goals and objectives. For instance, LCI investments may outperform capacity projects in terms of economic development, access, and air quality, but never have a chance to compete on those grounds. However, current modeling tools are a barrier to evaluating project costs and benefits across modal categories, taking externalities into consideration. Even where funding sources and eligibility of project types are fixed pursue performance and benefit-cost comparison across classifications in order to clarify the regional costs of being unable to pursue beneficial projects due to funding restrictions. ①②③
- Encourage state and local governments to identify where maintenance projects may incorporate bicycle and pedestrian accommodations (if not routine), in order to improve accessibility and reduce motor vehicle speeds.
- **Advocate for better planning and investment.** The regional planning process is where the costs and benefits of current transportation funding and scoring become apparent. With the recommended Performance Measures, page 204, ARC can determine whether current practices align with the region’s best interests. It is likely that the region needs significant changes in the federal and state transportation and regional governance legislation in order to allocate adequate dollars to pedestrian, bicycle, and transit projects, ensure adequate maintenance and operations, manage land use, and offer coordinated programs. ①②③④⑤
- **Guide the region’s development with long range transportation planning and targeted incentives.** Program investments should be guided by the development goals above and increase multimodal transportation options. Continue to make Funding decisions with a focus on equity (by geography, need, and income), investment in existing centers and corridors and with multimodal accommodations over the long range timeframe. Designate responsibility for managing development and transportation demand to local

jurisdictions with an emphasis on walkable neighborhoods, mixed-use neighborhood and town centers centered on planned and existing transportation corridors, and interconnected street networks that relieve pressure on arterials and shorten travel distances; prioritize investments in areas that are successfully implementing local elements of these plans. Implementation of this recommendation will continue current efforts by ARC, such as within its LCI program, and also by not targeting capacity projects for rural/undeveloped areas as identified on the UGPM, and by prioritizing projects identified in local Comprehensive Transportation Plans and multi-modal corridor studies. ① ② ③

## Safety and Design

### Discussion

Roadway design focuses on features that impact behavior and safety. It addresses speed limit and design speed for motor vehicles, number and width of general purpose lanes (in each direction), presence of medians, intersection design, turn lane and free-flow turn/merge lane usage, corner radii, signal phasing, quality of bicycle and pedestrian facilities, and more. A roadway will typically carry pedestrian and bicycle traffic, even if no facilities are provided for them. As described in earlier sections, road design is one of the major determining factors in the rate and severity of traffic crashes. Going beyond safety, road design can also influence economic vitality, travel time and distance, and mode share, through its influence on travel patterns and the subjective quality of the roadside environment.

The impact of traffic safety on the regional transportation system should not be underestimated. As discussed above, congestion has been the subject of considerable attention from politicians, media, and planning efforts, but a series of studies commissioned by the American Automobile Association (AAA) determined that traffic crashes are responsible for much larger costs to the region. The AAA study compares the costs of crashes to the costs of congestion on a per person level in the same urban areas used by the Texas Transportation Institute (TTI) in the annual Urban Mobility Report (UMR) 2010. Congestion costs were taken from the UMR. The costs of crashes were based on the Federal Highway Administration's (FHWA) comprehensive costs for traffic fatalities and injuries, which place a dollar value on 11 cost components of crashes: property damage; lost earnings; lost household production; medical costs; emergency services; travel delay; vocational rehabilitation; workplace costs; administrative costs; legal costs; and pain and lost quality of life. According to FHWA, in 2009 dollars, the cost of a single motor vehicle fatality is \$6,000,000. For the purpose of this study, the 2009 cost of an injury is estimated at \$126,000. In the "Very Large" city category (regions with more than 3 million residents), which included the Atlanta-Sandy Springs-Marietta MSA, the per capita costs of injury and fatality crashes was approximately double the per capita cost of congestion; in total, the cost of fatal crashes to the Atlanta region was \$2.9 billion, and injury crashes were responsible for \$7.8 billion of comprehensive costs. The sum of injury and fatality crashes thus cost the region \$10.8 billion, compared against \$2.5 billion in estimated congestion costs from the UMR. The Atlanta region had the second highest per capita crash costs out of 14 cities in the "Very Large" category - \$1,929 (Cambridge Systematics Inc., 2011).

To further support renewed emphasis on traffic safety, it is important to note that travel delay is included in the comprehensive costs of injurious and fatal crashes. Litman (2004) also noted that shifting vehicle travel from congested roads to less congested conditions tended to reduce crashes but increase crash severity. More lanes, higher speeds, and higher traffic volume on a road segment appear to increase crash rates, and possibly severity; absolute higher levels of congestion, all other factors being equal, appear to increase the rate of all

crashes but reduce the rate of crashes that result in injuries or deaths (Cambridge Systematics Inc., 2011). Additionally, the FHWA reports that there are two different types of congestion: recurring congestion due to daily traffic volume, and non-recurring congestion due to unique events such as weather, road construction and traffic crashes. According to the FHWA, one-quarter of non-recurring congestion is caused by crashes, meaning that improved safety could improve the overall predictability of travel. Alternatively, widening roads to accommodate peak capacity may be detrimental to safety, as the wider roadbed would encourage speeding during off-peak hours which constitute the majority of the day.

Redelmeier and Bayoumi (2010) found that each hour of driving corresponded with 20 minutes of reduced life expectancy due to the risk of crash, and that a 1 km/h increase in speed corresponded with an increase in lost time due to the higher risk of crash. Additionally, they concluded that crash rates could be significantly reduced with a small reduction in average travel speeds. Conventional wisdom has held that roads can be made safer for motor vehicles by moving fixed objects back from the roadside; widening travel lanes; and employing channelization, acceleration lanes, and grade separation at intersections, and these treatments have shown efficacy in the context of limited access highways. However, such designs have also been associated with increased driving speed and reduced driver attentiveness, and when they are used in other roadside settings, linked to increased crash severity, higher risk for pedestrians and cyclists, and a less suitable environment for local access (Dumbaugh, 2005; Dumbaugh & Rae, 2009; Noland, 2003). Recent research has also shown both that designing roads to over capacity encourages faster speeds and less safe driving and that the inclusion of non-traditional, context specific design elements that reduce vehicular speed and promote livability often actually enhances safety (Using Practical Design, 2010; Dumbaugh, 2005). Some studies have found a linear relationship between increased speeds and increased crash rates, as well as increased delay due to crash incidents, while other studies have only found an increase in severity (Ivan, Garrick, & Hanson, 2009; Redelmeier & Bayoumi, 2010). Speeding has traditionally been addressed through traffic enforcement, but some researchers have suggested that it is more effective to change the design speed of the road (Donnell, Himes, Mahoney, and Porter, 2009; Dumbaugh & Li, 2011). Prior studies have shown that changes to posted speed limits have only about a 1.5 mile per hour difference in average speed (Parker 1997).

The historic roadway design methods which strive to emphasize efficiency and safety of the system through these typical methods of widening, straightening, and removing fixed objects from the roadside, among others, often also have detrimental impacts on the environment and surrounding communities. By utilizing alternative flexible roadway design strategies, transportation design solutions can increase safety for all modes while avoiding these negative impacts. One such flexible method, Context Sensitive Solutions (CSS), also commonly known by the original name Context Sensitive Design (CSD), is a different approach to the conventional transportation-oriented decision-making and design processes. The CSS approach can be used to design and implement transportation projects that not only result in safe and efficient roadways, but ones that consider and preserve the total context of community values, including scenic, aesthetic, historic, and environmental resources. CQGRD has developed a report to guide implementation of CSS.

Where CSS is not used, some general principles can be established for suitable road design in an urban, suburban, or rural setting that balances land access and multimodal travel. Traffic calming practices are intended to reduce vehicle speeds; there are appropriate treatments for minor and major streets, and the treatments often improve the aesthetic appearance of the calmed area as well. Bunn, et al. (2003) conducted a meta-analysis on the effectiveness of area-wide traffic calming to prevent traffic injuries. They identified sixteen studies that used

controlled before/after or randomized controlled design to isolate the effects of generalized traffic calming techniques, such as road narrowing, diverters, or changes to road surface texture. The studies also measured the impact on road safety, indicated by the rate of all crashes, injury and fatality crashes, or fatalities. This meta-analysis found some variability in the results of the included studies, but concluded from the pooled results that a comprehensive traffic-calming initiative could reduce traffic-related injuries and deaths by 11%. The full palette of traffic calming options includes:

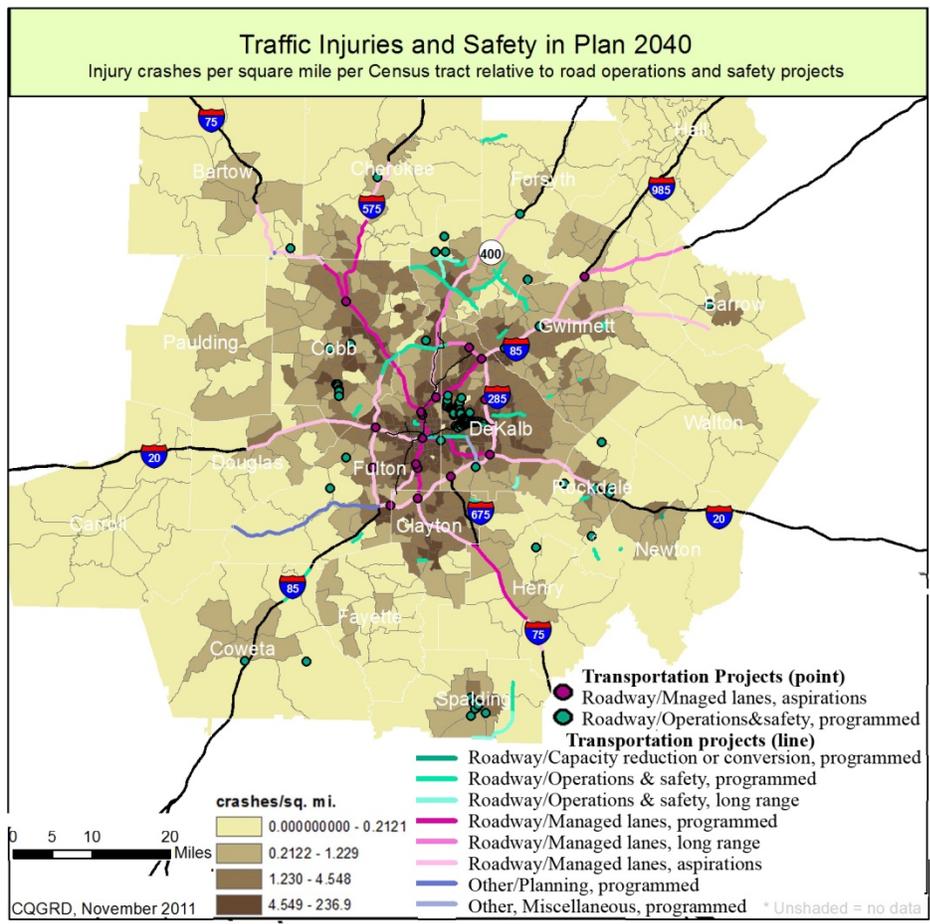
- Convert one-way street to two-way operation
- Road Diet: widen sidewalks/narrow streets or traffic lanes/reduce number of lanes/add bicycle lanes
- Bulb-outs and chokers
- Chicanes
- Roundabout or traffic circle
- Raised median
- Tighter corner radii (with truck/bus apron as needed)
- Diverters
- Road humps, speed tables, or speed cushions
- Colored or textured pavement
- For treatment details, see <http://www.pps.org/articles/livememtraffic/>

There are numerous opportunities for selected traffic calming elements on Atlanta roads, such as greater utilization of roundabouts. According to FHWA, roundabouts reduce fatal crashes by up to 91%, reduce injury crashes by 76%, and reduce all crashes by 35%. Roundabouts also reduce speeds and eliminate the most dangerous types of intersection crashes – head-on and t-bone crashes due to the interaction of through and turning vehicles. Good roundabout design requires vehicles to negotiate a small enough entry radius to slow their speed. Roundabouts can result in a longer crossing distance for pedestrians, but fewer potential conflicts. They can be difficult for less-experienced cyclists to navigate. Various treatments are available to improve operation for pedestrians or bicycle traffic, including for blind pedestrians. FHWA also reports that roundabouts can reduce congestion and also safely reduce delay at off-peak times. Single-lane roundabouts appear to be much safer than multilane ones, and offer significantly better performance for bicyclists and pedestrians. A mountable apron can be used to give larger vehicles extra space while maintaining a low design speed. Single lane roundabouts can accommodate up to 25,000 vehicles per day, depending on turning volume, and operates optimally for nearly 20,000 vehicles per day. Double lane roundabouts may accommodate up to 45,000 vehicles per day, depending on conditions. In some cases, installation of roundabouts along a corridor may facilitate a road diet, as the additional lanes are no longer needed for queuing at stop lights (Rodegerdts, Bansen, Tiesler, Knudsen, et al., 2010).

Mode share also factors in safety rates. Jacobson (2003) reviewed fourteen studies from locations in Europe and the U.S. in order to evaluate the rate collisions between motorists and pedestrians or motorists and bicyclists relative to pedestrian or cyclist traffic metrics. This crash rate decreased in places where more people were walking or bicycling. On average, a location that doubled its rate of walking could expect to see each pedestrian's risk of injury decrease by 66%. In theory, communities that see some driving trips replaced by walking or cycling trips could expect to see their overall traffic injury rates decline. As noted in the discussion of mode share, above, facilities and conditions must be conducive to travel by foot or bicycle in order for travelers to choose these modes. Improving the level of service for pedestrian and bicycle travel, especially in those locations identified in the latent demand analysis, could improve safety and mobility in these districts.

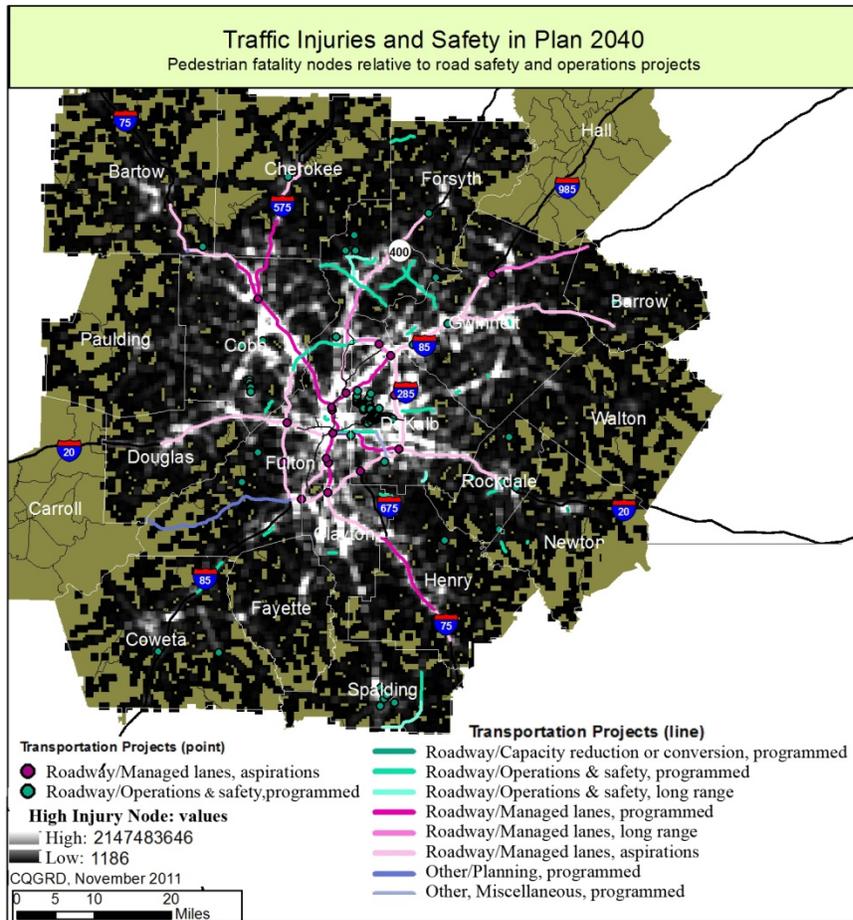
**Plan 2040 Evaluation**

In Figure 105, programmed and long range capacity reduction projects (darker green) and safety and operations projects (lighter green) show moderate correspondence with traffic injury density (crashes per square mile). Note that lump sum funding for Last Mile Connectivity and Operations/Safety projects were not yet allocated. Figure 106 shows that projects correspond with some areas of high crash prevalence, but that others – for instance, in central Cobb County and northern Clayton County – have not had any programmed or planned capacity reduction or operations and safety roadway projects (using the GDOT designation of “operations and safety” transportation project category). Additionally, note that smaller-scale operations or safety projects may not be included as line-item projects in the RPT due to the need to identify future needs on the local level.



**Figure 105: Traffic injury density and safety projects in Plan 2040**

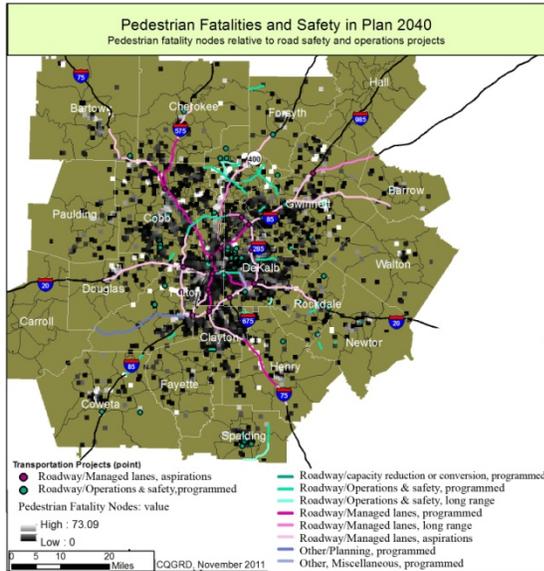
Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, Georgia Department of Transportation, U.S. Census Bureau – ACS 2005-2009.



**Figure 106: Traffic fatality concentrations and safety projects in Plan 2040**

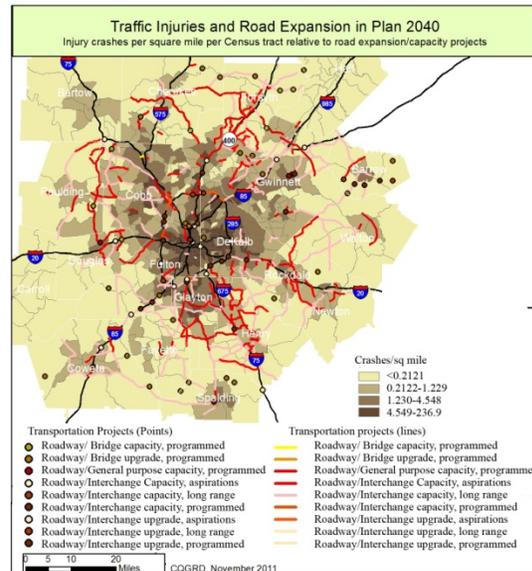
Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, Georgia Department of Transportation, U.S. Census Bureau – ACS 2005-2009.

Similarly, pedestrian and bicycle fatality concentrations in the Roswell Road, southwest Atlanta, and Cobb and Gwinnett County areas are not addressed, even in aspirational lists (Figure 107). Road capacity projects (Figure 108) require further examination to determine their potential impact on current and future safety.



**Figure 107: Pedestrian fatalities and safety in Plan 2040**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, Georgia Department of Transportation, U.S. Census Bureau – ACS 2005-2009.



**Figure 108: Traffic injury density and road expansion in Plan 2040**

**Recommendations**

- **Transportation programming must stipulate the use of best practices in accommodating multi-modal traffic.** The resulting infrastructure will need to serve the region for the next 30 years or more. In that time, we already anticipate that a larger percentage of the population will be unable to drive and that energy will become more costly and less available. The region’s citizenry could suffer a critical loss of access to jobs, goods, and community resources if viable alternatives to driving are not available; this burden will fall hardest on the most vulnerable populations. Project selection and design guidelines should define how the following resources will be used to create safe, convenient, environmental, multimodal roads: “Complete Streets: Best Policy and Implementation Best Practices”, Americans with Disabilities Act Accessibility Guidelines and draft Public Right of Way Accessibility Guidelines, universal design and crime prevention through environmental design (CPTED) principles, “Designing Walkable Urban Thoroughfares: A Context Sensitive Approach: An ITE Recommended Practice”, guidance from the Pedestrian and Bicycle Information Center and the Association of Pedestrian and Bicycle Professionals, Routine Accommodation policies from the Georgia Department of Transportation and the U.S. Department of Transportation, and American Association of State Highway and Transportation Officials (AASHTO) standards. Preserve bicycle and pedestrian facilities in the value engineering stage.

1 2 3 4 5

**Transportation investments should be coordinated with existing and future land use.** A significant percentage of walking and bicycling trips are currently made in conditions that are unsafe and have a failing level of service. Considerable demand for transit services and multimodal infrastructure goes unmet, reducing access to jobs and services. 1 2 3 4 5 7 8

- **Complete, multimodal facilities should be included in new developments.** Walking is the most common and easily accessible form of physical activity. It is also the activity available to the largest number of individuals, including vulnerable populations. Most walking occurs on local neighborhood streets. All development should include sidewalks on both sides of the street, except in rural areas with less than one unit per

five acres. There should be clear instructions for design, installation, and maintenance of sidewalk and streetscape. 2 3 4 5 6

- **Road projects must serve the local context as well as regional traffic.** There are inherent conflicts between mobility and access. Highly predictable transportation environments can be safe for high-speed mobility, but highly unpredictable transportation environments may be safer in a complex roadside context, because users behave more cautiously. The most dangerous settings may be those which appear controlled but actually carry uncontrolled movements, such as arterial roads designed for high-speed vehicular mobility. These roads feature wide marked lanes, turn lanes, and traffic signals, but in practice have many unpredictable vehicular and pedestrian movements, as consumers and workers try to access the adjacent businesses. Roads should serve their essential role in land access in terms of design speed, block length, and control. When access management strategies are used in road design, they should facilitate safe and convenient pedestrian travel without detours or excessive delays. Guidelines should be made clear for large programmatic funding buckets. For instance, local governments should be encouraged to assess traffic signal optimization so as not to result in excessive pedestrian delay (as calculated in the 2010 Highway Capacity Manual); preferably it will reduce pedestrian travel time as well. One way to accomplish this would be to use multimodal level of service (see page 162). 1 2 3 4 5
- Support the use of Context Sensitive Solutions as standard for all transportation projects. 1 2 3 4 5
- Use the new regional thoroughfares design guidelines. Ensure that features will not be dropped from projects during the design and construction phases. 1 2 3 4 5
- Design for low to moderate speed traffic flow on surface streets, including arterials, to improve safety and capacity, and to reduce stress. 2 3 4 5
- Pursue a denser network of smaller roads rather than a few very large arterials. 1 2 4 5
- Include the appropriate level of pedestrian and bicycle treatments for the next 30 years of development; assume that there will be significant non-motorized travel on urban and suburban road, and some non-motorized travel on rural roads. 1 2 3 4 5
- Standardize safe design principles: 2 3 4 5
  - Constrain vehicle speeds as appropriate to the road context (Litman, 2006). 2 3 4 5
  - Incorporate treatments to control conflict points, such as medians, alleys, traffic signals, and movement restrictions (Abdel-Aty & Keller, 2005). 2 4 5
  - Design roads to reduce rather than accommodate risky driving behavior. 2 3 4 5
  - Increase the share of bicycle facilities to reduce per-cyclist risk. 2 3 4 5
  - Increase the share and quality of pedestrian facilities to protect pedestrians from traffic, reduce individual risk, and minimize crime and fear of crime (Liu, Lu & Chen, 2008). 2 3 4 5
  - Provide sidewalks and frequent crosswalks to improve pedestrian safety (FHWA, 2004; US DOT, 2002; Miller, 2008). 2 3 4 5
  - Reduce corner radii where possible to minimize pedestrian exposure and reduce vehicle speed (Shankar, 2003). 2 3 4 5
  - Provide more transportation choices to reduce vehicle volume. 2 3 4 5
  - Create landscaped, tree-lined roads (Ernst, 2004). 2 3 4 5
  - Reduce roadside distractions such as billboards. 2 3 4 5
  - Improve street and roadside lighting, especially at conflict points (Mok, Landphair & Naderi, 2006; Dixon & Wolf, 2007; Wolf & Bratton, 2006). 2 3 4 5

- Review universal design standards and seek to implement road design that accommodates all users safely, regardless of their limitations. 2 3 4 5

## Transit

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; Moist, Bragg-Gresham, Pisoni, Saran, et al., 2008). One study in Atlanta found that labor participation rates increased in areas that had access to public transit (Sanchez, 1999; Adler & Newman, 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 & Newman, 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 & Evans, 2007; Fenton, 2005). Stokes, MacDonald, and Ridgeway (2008) developed a method for estimating the reduction in obesity-related health care costs relative to construction of a light rail line in Charlotte, NC. A study of the same light rail project, published in 2010, confirmed lower body mass index values for users of the rail line (MacDonald, Stokes, Cohen, Kofner, et al., 2010). A study in Salt Lake City, UT also found much lower rates of obesity, higher rates of community attachment and physical activity, and reduced car trips among new and existing transit users (Brown and Werner, 2008). A number of studies have also linked transit station proximity to higher residential and commercial property values, although the effect varies with the type of transit and the station area design (Debrezion, Pels, and Rietveld, 2007; FTA, 2000; Munoz-Raskin, 2010; Pagliara & Papa, 2011; TI, 2006; Weinstein & Clower, 1999). The Victoria Transport Policy Institute summarized the health effects of transit in a 2010 report (Litman, 2010).

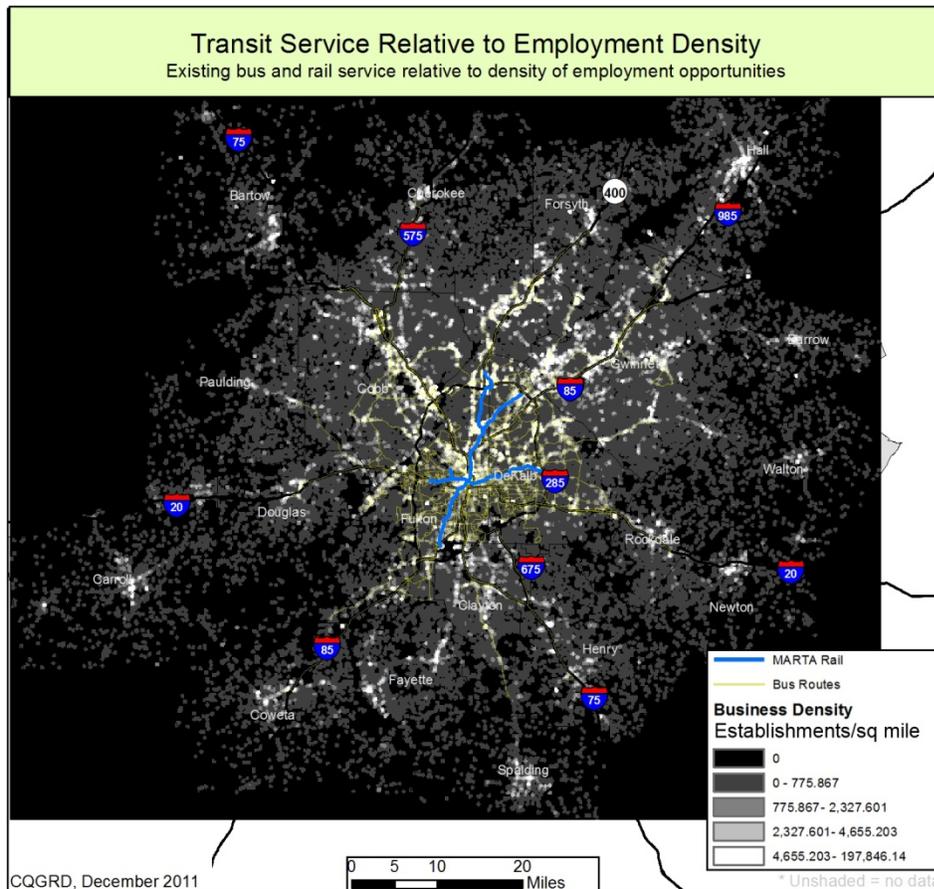
Land use around transit stations or corridors shows a strong link with ridership rates. Transit-oriented development, or TOD, exemplifies most of the traits of a health-promoting activity center – walkable, mixed-use, higher density, and offering affordable and accessible transportation options. Studies show that TOD can increase ridership and access, with variation according to the format of the TOD (Canepa, 2007). While a half-mile walking distance has often been assumed to calculate a transit station’s area of influence (or a quarter-mile for bus stops), actual assessment of station areas indicates that users will walk further than this, but that walking distance tolerance is strongly influenced by the availability of a quality pedestrian environment including pedestrian facilities and pedestrian-oriented land uses (Canepa, 2007; Guo, 2009; Werner, Brown, and Gallimore, 2010). Canepa (2007) suggested expanding the TOD area to at least 3,300 feet from the station; he also warned that major arterial roads and other barriers can significantly reduce the TOD area. Elderly transit users can be more susceptible to the quality and distance of their walking route (Borst, de Vries, Graham, van Dongen, et al., 2009). Parking can increase ridership, but in order to prevent interference with station-area-generated ridership, parking should be shared/public (rather than minimum parking requirements for each property), market priced, and not connected directly to the station; stores, offices, or residences should have first claim to the premium location immediately adjacent to the station. Employer policies such as subsidized parking or car stipends have been associated with lower rates of transit use, while flex time and transit stipends increase use. Bus service to a rail station also appears to increase ridership (Lund, Cervero, and Wilson, 2004).

Transit may be extended to areas that are already suited for service – higher density, walkable, mixed use activity hubs – or it can serve places that are underutilized or where land values have been declining in order to stimulate (and then benefit from) TOD-style redevelopment. Redevelopment may start years before transit service is constructed and operating, if real estate markets feel that the construction schedule will proceed reliably (Atkinson-Palombo and

Kuby, 2011; Filion and McSpurren, 2007). This casts transit planning as more than project development; rezoning and implementation of bicycle and pedestrian connections need to begin well in advance of transit infrastructure. Bus service varies in its impact on land use, ridership, and access based on the frequency of service, directness of trips provided, and reliability. The utility and operating efficiency of bus service appears to be greatly enhanced with higher levels of connectivity (allowing direct bus line corridors and direct walking routes to the bus corridor) and with higher-density mixed use zoning along the bus corridor (Cubukcu, 2008). Fixed guideway transit (commuter rail, heavy or light rail, streetcar, and some bus rapid transit systems) appear to have a much larger impact on land use (Atkinson-Palombo and Kuby, 2011). Transit mode selection appears to be highly context-based, depending on current and planned land use, purpose of the project, and availability of right-of-way.

### **Plan 2040 Evaluation**

The Metropolitan Atlanta Rapid Transit Authority (MARTA) forms the foundation of Atlanta's current transit network. MARTA is the nation's ninth largest rail/bus system, averaging 500,000 boardings 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. However, MARTA has faced a number of challenges: it is the largest system in the U.S. that does not receive state funding; MARTA is limited to operating in two counties, Fulton and DeKalb. The system also provides limited connections to other local systems serving jurisdictions outside this area, and it operates under legislative restrictions regarding its expenditures and jurisdiction. Areas outside the jurisdiction of MARTA are served by GRTA or other local transit systems. Many of its rail stations consist of large surface parking lots and relatively low density development, rather than transit-oriented development. The region is also served by the Georgia Regional Transit Authority (GRTA) Xpress commuter bus system, Gwinnett County Transit, Cobb Community Transit, and Cherokee Area Transportation System; Clayton County Transit recently ceased operation due to lack of funding. In its past, Atlanta was served by highly profitable streetcar lines and intercity passenger trains. However, many decades of heavily subsidized highway building and land use policies that were unfavorable to transit access have left the region with a limited rail transit network and a modest but uncoordinated collection of bus systems. Figure 109 shows existing transit service (rail and bus) against the full range of employment destinations in the region.



**Figure 109: Existing transit service relative to employment centers**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission & Claritas

The plan allocates \$1.24 billion dollars, or about 16%, of programmed funding on transit. However, only half a billion dollars is allocated to programmed transit expansion (7.4%). While the regional agency promotes transit as an important solution to quality of life, access, mobility, and sustainability in Atlanta, insufficient sources of operating funds severely constrains opportunities to significantly expand basic and premium transit. Transit receives about \$3.5 billion in programmed and long range expansion capital projects (20%). Note that many federal funding programs specify the mode of transportation or type of funding (capital, operations/maintenance) and thus, funding flexibility is often constrained. Proposed transit projects align moderately well with employment districts, but would still leave some disadvantaged areas underserved, even if all aspirational transit projects were constructed, as discussed on page 136.

Transit projects mostly connect through Places and LCI areas, while Station Communities are only defined along existing MARTA lines; Places descriptions contain some instructions for transit-oriented design (TOD). Facilitating quality pedestrian and bicycle access along transit corridors and at existing and proposed stations will be an important component of successful transit projects, as will shaping these places into transit-compatible communities. Some bicycle and pedestrian projects connect to transit projects (Figure 110). However, there are still untapped opportunities to support TOD through land use designation and bicycle and pedestrian programming in Plan 2040, working with local partners such as MARTA to move plans forward.

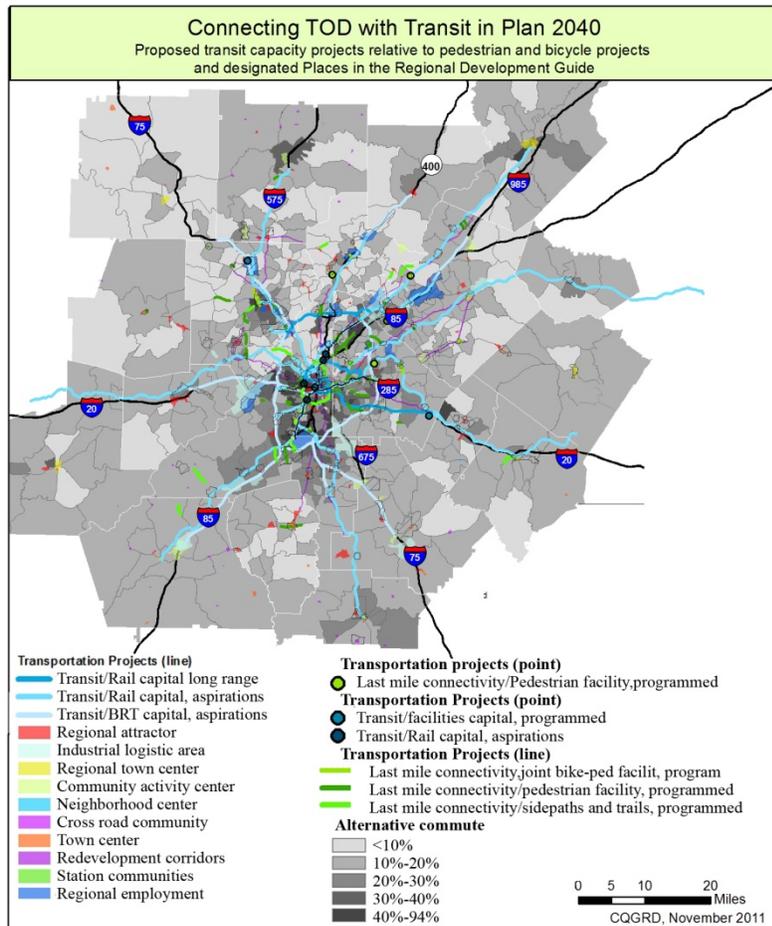


Figure 110: Connecting TOD with Transit

### Recommendations

- Aggressively pursue new sources of transit operating revenue, including congestion pricing, distance-based pricing, and taxation districts. ① ② ③ ④ ⑤
- Maximize implementation opportunities through strategic route and technology selection, but do not sacrifice quality, rider convenience, or the long-term effects of transit investments on land use. ① ② ③
- **Transit projects are likely to promote health.** Bus and train travel have much lower injury rates than other forms of ground transportation. Transit usage is associated with lower emissions and increased physical activity. It offers lower cost mobility and accessibility that can be used by children and people with impaired abilities. Based on population age and health, climate concerns, and the effect of energy prices, the Atlanta region cannot wait for transit services to come online. On corridors that are experiencing significant traffic volume or congestion and lack a premium transit alternative, seek to implement that transit service prior to increasing road capacity. Ensure that transit expansion prioritization considers the needs of areas with long transit travel times, high transportation costs, or few travel alternatives, as well as favorable land use and station area design. Determine whether each project serves existing demand (activity centers, areas of transit dependence, and high-volume corridors) or shapes future development patterns, and score it accordingly. In order to maximize transit benefits and return on investment: ① ② ③

- Area within half-mile of proposed station locations should have average block size less than 500 feet per face (less than 250,000 sq. feet block area), mixed-use zoning including some multistory, reduced parking, and pedestrian-friendly design, or be prepared for imminent redevelopment to these standards. ②④⑤
- Select fixed-guideway transit technology to maximize redevelopment at stations. ①②③④⑤⑦
- Utilize existing right-of-way, but only if it connects to activity centers; alignments along Interstate routes may be available but fail to service existing centers, while railroad and smaller thoroughfare corridors could reach more destinations. ①②③
- When transit projects are funded, support them with bicycle and pedestrian infrastructure funding which can be implemented in the years during which the transit is being developed. ①②③④⑤
- Maximize use and efficiency of existing transit services by implementing supportive land use and transportation design as described above. ①②③④⑤
- Consider future transit right-of-way in routine road maintenance, road construction, and land subdivision: concrete pad pullouts at major bus stops, preservation of median right-of-way, streamlined route alignments, and intersection enhancements such as dedicated signals, bypass lanes, or turnarounds. ①②③④⑤⑥

## Multimodal Level of Service

Optimal traffic conditions for automobiles has been defined using a “level of service” concept, in which the ideal level of service for many roadway facilities is considered to be 45 miles per hour at free-flow speeds. However, current analysis of road capacity and service do not account for travelers on other modes, which may have different needs and safety considerations. In order to expand traffic analysis to consider non-motorized transportation, recent research has devised “level of service” models for bicyclists, pedestrians, and transit which addresses the subjective experience of travelers as well as delay and ease of movement. Projects that improve LOS for motor vehicles can deteriorate LOS for pedestrians, bicycles, or transit. For instance, an intersection redesign or expansion that increases the continuous flow of motorized traffic through the intersection may result in longer wait times for pedestrian crossings, greater delay for transit vehicles to re-enter traffic flow after stopping for passengers, or increased conflicts between turning cars and pedestrian or bicycle traffic.

### The Subjective Travel Environment

One effect of car travel is that the passengers are partially buffered from immediate environmental conditions. Although the car occupants’ exposure to air pollution and injury may be worse, there is a perception that it represents a clean, safe environment. The motor vehicle occupant has greater control over climate, noise, and shelter. By contrast pedestrians, bicycle riders, motorbikes, and other unenclosed modes of travel are fully exposed to the immediate environment. They may be exposed to noise, heat and cold, wind, sun, rain, odors and other emissions, flooding, and actual or perceived threats from people, animals, and physical hazards. Some exposures are associated with negative health outcomes – heat stroke and heat exhaustion; injury; skin cancer, sunburn, and skin damage; respiratory disorders; hearing damage. Even when there is not a clear medical outcome from exposure to a harsh environment, it may result in discomfort or anxiety, which will discourage human activity unless absolutely necessary. As a result, pedestrian and bicycle facilities may be underutilized, and the investment in them may fail to generate the expected returns and benefits. Regardless of the potential for negative environmental conditions, there are many places with thriving

pedestrian usage where users are safe and comfortable, and able to enjoy the benefits of physical activity and social interaction from walking. These places serve as examples in which potential hazards have been largely mitigated through design. Facility and site design have a large effect on the microclimate, while aspects of land use and transportation planning have a more general effect on temperature and air quality. Pedestrian planning and design (and some bicycle planning) can also consider:

- Traffic noise in the pedestrian zone, which should allow conversation at normal voice levels.
- Shade and heat accumulation. The CDC reported that bicycling and walking were in the top five leading causes of heat illness for people over age 20; people over 55 are at much greater risk for heat illness than younger adults. Mature trees can provide shade and significant temperature reductions on the sidewalk and roadway; other vegetation can also reduce the local heat levels while paved surfaces can increase heat.



**Figure 111: Mature shade tree canopy to mitigate heat on the street and sidewalk**

- Wind contours. Studies have shown that buildings and roads can create wind “canyons” that create a negative human experience. Winds can be strong, blowing grit, papers, or signs around. Additionally, bicyclists can be significantly affected by wind, which can cause them to swerve unexpectedly or greatly reduce their speed.
- Lighting conditions at nighttime, which can differ from the amount of lighting on the roadway.
- Building enclosure and façade can convey whether adjacent land uses are pedestrian oriented. Large setbacks, parking facilities fronting the right-of-way, and blank façades reduce pedestrian comfort.

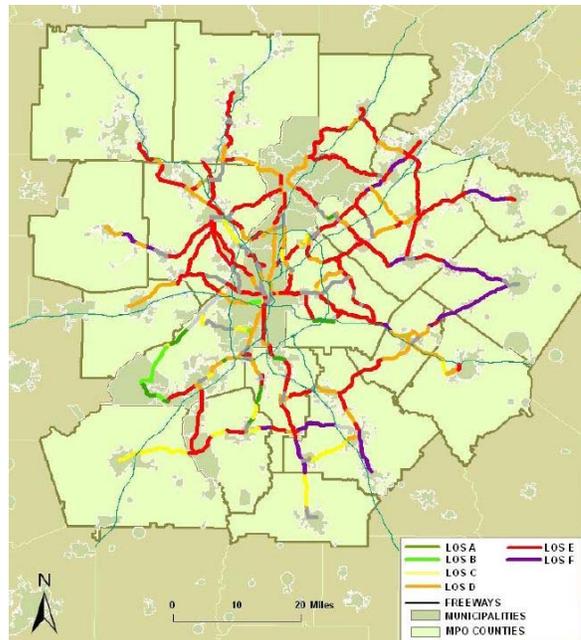
Pedestrian and bicycle level of service (LOS) assessments have evolved from simple capacity measurements to comprehensive evaluation criteria that address the convenience and comfort of users. Pedestrian level-of-service, as referenced in the Highway Capacity Manual 2000 edition, is determined by measuring or estimating either walking speed or pedestrian crowding. The crowding effect accounts for street furniture (e.g. benches, poles, meters, etc.),

landscaping, and building protrusions (e.g. sidewalk cafes). There is a different approach to determining pedestrian LOS that assumes street furniture, landscaping, interesting building facades and sidewalk cafes are generally appreciated by pedestrians; showing their appreciation by walking there more frequently. For instance, LOS methodology published in the Transportation Research Records (TRR) 1578 and 1773 by the Transportation Research Board of the National Academy of Sciences measures up to 11 criteria. This standard of pedestrian LOS uses roadway width, presence of sidewalks and intervening buffers, barriers within those buffers, traffic volume, motor vehicle speed, and on-street parking. Bicycle LOS utilizes street width, bike lane width and striping combinations, traffic volume, pavement surface condition, motor vehicle speed and type, and on-street parking. ARC has utilized this LOS approach in their bicycle and pedestrian planning, but has yet to conduct a comprehensive LOS assessment for all regional thoroughfares and LCI areas.

The Gainesville (Florida) Mobility Plan devised performance measures and a LOS rating system for bicycle and pedestrian facilities. Many current bicycle LOS methodologies measure space requirements and design features that would make roadways more likely to attract bicycle trips. The Gainesville bicycle LOS criteria included criteria assessing facilities provided, conflicts, speed, motor vehicle LOS, maintenance, and support for TDM (Dixon, 1996). Landis et al. conducted a study to create a model for pedestrian level-of-service, incorporating significant variables for pedestrian perceptions of safety (2001). The resulting model predicted pedestrian level of service as a function of lateral separation elements (i.e. sidewalks and buffers), vehicle volume and speed. Similarly, the Gainesville pedestrian LOS criteria assessed provision of pedestrian facilities, potential for conflicts, amenities, etc. These criteria were evaluated on a point-based system using various performance measures (i.e. presence of sidewalks, medians, bike lanes, etc.).

**Plan 2040 Evaluation**

The Atlanta Regional Commission has used pedestrian, bicycle, and transit LOS in the Atlanta region. ARC utilized bicycle and pedestrian LOS in their 2007 Atlanta Region Bicycle Transportation and Pedestrian Walkways Plan. Bicycle LOS was espoused for evaluating existing conditions and setting targets for a regional bicycle network, bicycle access to schools and activity centers, increasing transportation choices, and improving health; pedestrian LOS served the same objectives for the regional pedestrian network. The existing conditions assessment phase of this plan found that the average bicycle LOS on regional bicycle routes was “E”, or failing, which was worse than all but one of Atlanta’s peer cities (Sprinkle Consulting, 2007).



**Figure 112: Atlanta Regional Commission Bicycle Level of Service Map**

Prepared by Sprinkle Consulting Inc. for Atlanta Regional Commission.

ARC also participated in the “Field Test Results of the Multimodal Level of Service Analysis for Urban Streets” project prepared for the National Cooperative Highway Research Program (NCHRP) of the Transportation Research Board (Dowling et al., 2008). This project sought to refine consolidated LOS evaluation methods for automobile, transit, pedestrian, and bicycle along the same roadway segments, using selected cases. The Atlanta region participated, using Auburn Ave., 17<sup>th</sup> St., Buford Highway, Bullsboro Dr., and Cobb Parkway as its examples. The results and refined methodology can be found in the project report and associated Users Guide.

The ARC regional bicycle plan recommends bike lanes or parallel side paths on arterials that are within:

- ½-mile of schools
- 1 mile of major parks and greenways
- 1 mile of MARTA stations and premium transit operations service centers.

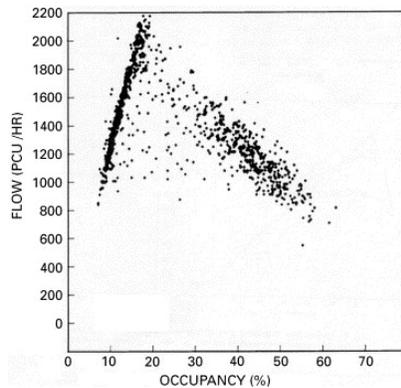
### **Recommendations**

- Continue to refine Multimodal Level of Service (MMLoS) measures to correspond with regional planning vision, goals, and objectives. 2 3
- Implement MMLoS evaluation on transportation projects. 1 2 3 4 5
- Use MMLoS objectives in plan-level performance measures. 1 2 3 4 5

## **Congestion**

### **Discussion**

Congestion has grown in recent decades, and continues to impose a host of economic and social costs on communities. As cited in the FHWA’s primer on congestion pricing, congestion in 2003 costs major metropolitan areas 3.7 billion hours of travel delay and 2.3 billion gallons of wasted fuel (FHWA, 2006). Thus, congestion can cause inconvenience, lost economic productivity and impact regional air quality and health through added emissions. However, some suggest that congestion is also an indicator of the economic success of cities, and is not a sign of the failure of a transportation system (Taylor, 2002; Taylor, 2003).



**Figure 113: Traffic flow and density data on a Canadian highway**

Prepared by Schadschneider, A. (2000). Statistical physics of traffic flow. *Physica A: Statistical Mechanics and its Applications*, 285(1-2), 101-120.

Traffic congestion often refers to conditions in which traffic density causes travel speeds to decrease and creates significant delays. It is commonly held that traffic flow operates on an “equilibrium” concept, in which users will shift to the faster transportation facility until every facility has an equal speed. For example, a roadway with few cars on it is considered in “free flow,” and increased traffic density will eventually lead to “at-capacity” condition, which is the last point at which the facility can add users without decreasing average speeds. If a roadway continues to add users past capacity, average speeds will decrease and the facility is said to be congested (see Figure 113). This theory has been supported by empirical results measuring traffic counts and speeds on freeway facilities (Rehborn, Klenov & Palmer, 2011). As congestion is primarily caused by the inability of facility capacity to meet rising travel demand, added capacity has often been proposed as a solution to congestion problems. Population growth and economic growth have been recognized as contributing factors to rising congestion and travel demand (Meyer, 1989).

However, due to the prohibitive cost of adding extra lanes, other mechanisms have been suggested to address the problem (FHWA, 2006). Beyond direct economic costs of adding roadway capacity, some research suggests that added capacity may actually increase travel demand by making expanded facilities more attractive. This theory of “induced demand” suggests that increasing capacity does increase demand and congestion, and has been supported by recent studies (Hansen & Huang, 1997; Surface Transportation Policy Project, 1998). Its premise is that users are willing to bear a certain amount of congestion (equating to lost time, or “opportunity cost”) during their trip, resulting in a constant level of congestion regardless of the number of lanes. However, the mechanism of induced demand is also linked to land-use decisions impacted by transportation investments (Cervero, 2001). The combination of past-year road investments and current operating speeds are thought to influence the amount of development added within a buffer zone of a freeway (Cervero, 2003). Alternatively, congestion may decrease if local development declines in rate or value. Expanding roads to accommodate more peak traffic may reduce their total efficiency or benefit, because trips shift from off-peak, reducing utilization of each lane-mile for greater periods of time while maintenance costs rise.

Given the weaknesses of strategies to “build your way out of congestion,” strategies such as encouraging alternative transportation, carpooling, and congestion or parking pricing are being utilized in order to reduce travel demand on congested transportation facilities. These “travel demand management” schemes have many indirect benefits as well, including air quality, infrastructure maintenance, economic and time savings, and social engagement. As shown in Figure 88, the vast majority of metro residents commute to work by driving alone. Given traffic congestion and long commute times, the time spent driving alone may lead to fewer opportunities for social interaction in one’s daily life. As described on page 125, social interaction, engagement and social capital are associated with indicators of community health.

As traffic congestion and associated air pollution are negative externalities of increasing travel, it is argued that the costs of congestion must be internalized into the market in order to reflect

the true costs to society of travel. Thus, some strategy of congestion pricing has been suggested as a remedy for traffic congestion, in order to reduce travel demand and increase efficiency on transportation facilities (closer to free-flow speeds). Revenues obtained from congestion pricing schemes could be allocated towards economic efficiency and equity investments: road construction, tax relief, and public transit improvement (Litman, 2005).

Potential benefits of congestion pricing schemes include revenues and decreased air pollution. Although results are mixed, congestion pricing may lead to reduction of pollutant exposure in areas with dense day-time population (Atkinson et al., 2009). A study of the High Occupancy-Toll (HOT) lane project on I-85 in northeastern Atlanta determined that pricing an existing High Occupancy Vehicle (HOV) lane for vehicles with two or more occupants would likely increase travel time reliability with negligible effects on vehicle emissions (Kall, Guensler, Rodgers, and Pandey, 2009). For the successful implementation of congestion pricing, a road user should pay a sum equal to the costs he imposes upon others (Ison, Rye, 2003). Conditions for perfect implementation include: external circumstances, making adequate time and resources available, actual availability of resources, valid theory of cause and effect, understanding and agreement on objectives, proper specification of tasks, perfect communication and coordination, demanding compliance (Gunn, 1978) argued by Ison & Rye (2003). Additionally, adequate supplemental transit options such as public transportation should be offered.

Some literature has argued that congestion pricing must be combined with other travel demand management (TDM) measures (such as park and ride, improvement of transit services) in order to be effective in reducing demand for auto travel, but TDM appears to have limited impact, especially in areas that are heavily congested and latent demand exists (Giuliano, 1992). Another option to reduce travel demand contributing to congestion is to expand capacity for other travel modes (i.e. transit) or increase the attractiveness of these transportation services. However, Duranton & Turner found that increases in road capacity or public transit services did not affect vehicle-kilometers traveled in the U.S., which points to congestion pricing as the most effective method of reducing congestion (2011).

Current transportation research documents a two-pronged debate on the impacts of roadway capacity expansion. The first involves the specific relationship between capacity expansion and induced increases and travel. The second is whether this induced travel demand provides net costs or benefits to society. In a research study on four states (Washington DC, Maryland, North Carolina and Virginia) by Fulton et al (2000), the results appear to corroborate the recently emerging “induced demand hypothesis”. This theory posits that short-term benefits of capacity expansion reduce the costs (time) of travel and increase mobility overall. However, over time, induced travel (demand) decreases these benefits. Induced travel effects result from road users’ behavioral reactions to capacity enhancements, resulting in increased total travel (Sharma and Mathew, 2011). Both short-run congestion effects as well as long-run land use/growth effects contribute to induced demand, suggesting that congestion management should be an integrative process that considers land use management as well.

Choi et al (2004) state that the expansion of roadway capacity is still considered the most desirable solution to alleviate congestion. However, they caution that the negative externalities of environmental pollution and noise are important costs that should be considered in the design process, despite being hard to quantify. They recommend that feasibility analysis for roadway expansion should involve an integration of demand modeling and noise modeling to accurately predict the costs and benefits of capacity expansion projects. Thomson (2008) reports that noise from street intersections that exceed 50-60 decibels are associated with annoyance and disturbed sleep, also potentially causing elevated blood pressure in the long term.

### Plan 2040 Evaluation

Plan 2040 adopts congestion mitigation as a performance measure, and implements general purpose capacity road and bridge projects, new roads, managed (priced) lane projects, transit projects, and bicycle or pedestrian capacity projects. Based on the analysis above, this assessment assumed that general capacity projects would not have any lasting impact on congestion or delay. Instead, we considered how the project list might affect access (travel time, travel distance, travel mode options, travel cost, and reliability of travel). The core questions regarding access impacts include which (if any) viable alternatives exist currently for the trip destination or corridor, whether managed lane projects affect existing or new capacity, whether increases in capacity for one mode could impact level of service for other modes (refer to the Level of Service section, page 162), application of pricing strategies (including toll revenue allocation), and potential long-term land use interactions. There are \$5 billion of programmed and long range managed lane projects in PLAN 2040, but some are implemented as new capacity. This may increase VMT while leaving existing lanes congested, which is likely to have a negative effect on air quality, safety, and physical activity, and could dedicate toll recovery to the construction of the new lanes.

### Recommendations

- **Traffic congestion should be approached by pricing existing High-Occupancy Vehicle lanes.** The latest studies suggest that congestion cannot be mitigated through capacity expansion. The health advantage to road pricing is that it can reduce congestion, one of the most concentrated sources of line emissions, while creating a funding source for alternative transportation options along the priced corridor. However, this effect is only achieved under certain conditions: existing lanes become priced in order to reduce the current amount of congestion, incoming funds support transit and non-motorized alternatives along the priced corridor, and the tolling technology does not create new congestion hotspots. ① ② ③
- **Increased access should be approached through strategic land use changes, connectivity, and multimodal level of service upgrades.** ② ④ ⑤ For example:
  - Localized congestion in a major retail district might be approached by creating shared parking facilities, increased parking prices, increased mix of uses, and improving the pedestrian facilities rather than expanding the road or intersection, in order to reduce the number of vehicle trips being made within the district. ② ④ ⑤
  - Congestion along a major corridor that currently has no transit service (or infrequent bus service) and poor bicycle and pedestrian LOS might be approached through new or enhanced transit service with dedicated right-of-way and upgraded bicycle and pedestrian facilities. Research suggests that congestion levels will maintain a constant level regardless of capacity, but the availability of alternative modes can provide a higher level of reliability with higher capacity. Additionally, these treatments may provide the same capacity in a smaller right-of-way, potentially preserving access to local destinations. ① ② ③ ④ ⑤
  - Projected future congestion in a developing rural area might be approached through conservation management to transfer development into areas with sufficient infrastructure. ② ④ ⑤
- Wherever feasible, alternative methods of congestion mitigation should be explored.
- Travel demand management through multimodal transportation systems and congestion pricing might provide long-term sustainable solutions as compared to increasing roadway supply through capacity expansion.

- An integrated approach of transportation and land use management can further reduce environmental impacts and increase relative social benefits (Fulton et al, 2000).

## Freight

### Discussion

Roadways, other transportation facilities, freight logistics, and industry can create “hot spots” of locally elevated air pollution levels, which may impact homes and schools and may inequitably impact some citizens more than others. Air pollution hot spots are linked to increased rates of asthma attack, premature and low birth weight babies, infant mortality, and other respiratory diseases. These sources also contribute to regional levels of five criteria pollutants (carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), coarse and fine particulate matter (PM), and sulfur dioxide (SO<sub>2</sub>)). Additionally, emissions of carbon dioxide and other greenhouse gases are linked to climate change which may affect health through impacts on agriculture, water supply, heat waves and tornadoes, and spread of tropical diseases. Diesel freight transport generates these pollutants as well as high levels of black carbon, sulfur dioxide, and some suspected carcinogens. However, freight rail generates significantly fewer emissions per ton-mile than freight trucking (You, Lee, Ritchie, Saphores, et al., 2010; Zhu, Hinds, Kim, Shen, et al., 2002).

Proximity to high-volume motor vehicle emission sources (highways, major roads, and congested areas) appears to significantly influence exposure (Corburn, 2007; Venkatram, Isakov, Seila, & Baldauf, 2009). 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, Wu, Ong, & Winer, 2006; Fischer, Hoek, van Reeuwijk, Briggs, et al., 2000).

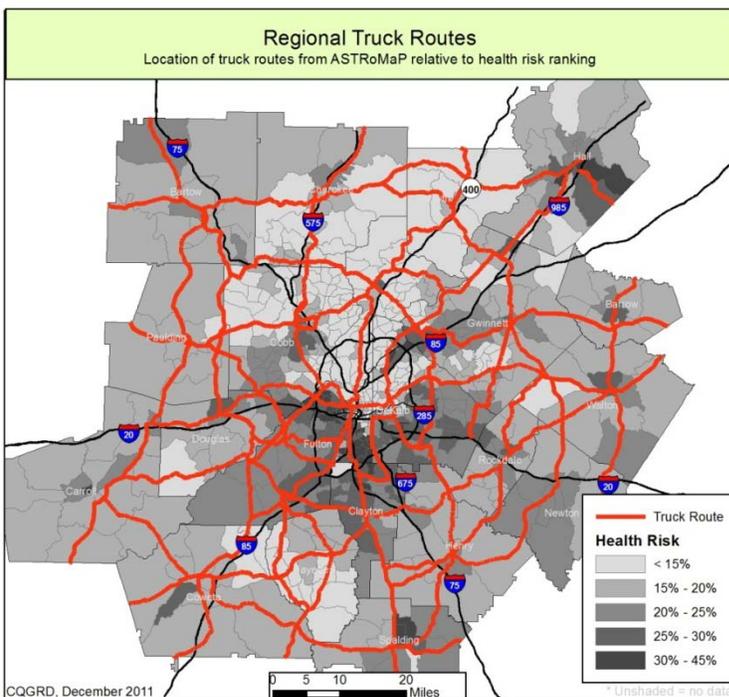
There are mitigation strategies for transportation-related air pollutant emissions. Van Houtte, Eisinger, and Niemeier (2008) found that freight truck operations affected their impact on air quality; stop-and-go traffic, high speeds, heavy loads, and hills contributed to a higher rate of emissions. They suggested routing trucks away from congested areas and hills, and limiting their weight and speed. Freight rail typically has lower emissions per ton of freight than trucking, and can be used to reduce roadway (line) emissions as well as the localized emissions around logistics hubs. A study of the Ports of Los Angeles and Long Beach in California concluded that relatively minute shifts from truck to rail – less than 1% of total movements – could produce 5% to 10% reductions in carbon monoxide, nitrogen oxides, particulate matter, and hydrocarbons (You, Lee, Ritchie, Saphores, et al., 2010). Reducing overall congestion is likely to reduce emissions as well, however research suggests that congestion maintains a static level on unpriced roads (Cervero and Hansen, 2002; Noland, 2001). Congestion pricing may reduce congestion (Duranton & Turner, 2008, Kall, Guensler, Rodgers, & Pandey, 2009). Providing pedestrian, bicycle, and transit alternatives may reduce localized emissions at destinations, and will at least improve mobility without increasing congestion. Air pollution from roadways (also known as line source emissions) decreases with

distance; exposure is most likely within 200 feet of a road carrying more than 50,000 vehicles per day, or within 100 feet of a road carrying 25,000-49,999 vehicles per day (significant amounts of truck traffic may change these criteria). Locating sensitive uses – residences, child care facilities and schools, and medical centers outside of these buffers can reduce health impacts (Brugge, Durant, & Rioux, 2007; Zhu, Hinds, Kim, Shen, et al., 2002).

Fuller, Bai, Eisinger, and Niemeier (2009) evaluated the effectiveness of sound barriers and vegetation adjacent to high-volume roadways for reducing exposure to pollutants at homes and other sites near the roadway. They found that sound walls did not reduce spread of pollutants, but that vegetation did. Their paper provides a table for selecting the most effective vegetation for pollutant reduction. It recommends hardy, long-lived evergreen conifer trees with dense leaf structure, and finds they are more effective when planted densely and as close to the emissions source as possible. Tree barriers may help reduce emissions from point sources, such as factories and warehouses, as well. Finally, bicycle riders and pedestrians appear to be highly susceptible to pollutants from high volume roadways (de Nazelle, Rodriguez, and Crawford-Brown, 2009). Freight routes should be separate from bicycle routes to the greatest extent possible, and vegetation should be planted along freight routes, including between the roadway and nearby sidewalks or non-motorized paths.

**Plan 2040 Evaluation**

There are places where freight routes pass through areas with current sensitive land uses, or areas which are zoned for future development which could include sensitive uses. This is particularly important where truck routes pass through environmental justice, health risk, or ETA communities (). There are many places where bicycle and pedestrian traffic does not have an alternative to routes that also carry heavy bus and truck traffic. CQGRD assisted ARC with their freight study in 2007. ARC does not have jurisdiction over freight rail projects or operations.



**Figure 114: Regional truck routes in relation to community health risk ranking**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau – ACS 2005-2009.

### Recommendations

- **Pursue alternative freight projects.** Freight movement by truck carries significant health concerns related to traffic safety, air pollution, noise, and working conditions. Some health impacts can be mitigated by shifting freight movement to rail, water, low-speed vehicle, and other modes. 2 3 4 5
- Modify ordinances so that sensitive uses are placed at least 100 or 200 meters from roads that carry heavy bus and truck traffic (depending on road volume and proportion of truck and bus traffic). 4 5
- Explore ways to reduce freight volume on bicycle routes. Increased connectivity (page 185) will increase the availability of alternate routes. 2 3 4 5
- Provide improved information to local jurisdictions to work with utilities (codes and initiatives) to increase the amount of roadside vegetation with proven air pollution mitigation effects. 2 3 4 5
- Give preference to truck routes that avoid congested areas and hills. Limit weight and speed in less preferable areas. 2 3
- Continue to develop programs to promote alternative fuels and clean diesel technology in regional truck and bus fleets. 2 3
- Develop programs to promote alternative distribution methods in congested areas, including transfer hubs, bicycle couriers, and electric delivery vehicles. 2 3 4 5
- Continue to pursue regional coordination of freight rail initiatives through collaboration with the Federal Railroad Administration, the Georgia Department of Transportation, and rail owners and operators. 2 3

## Land Use

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Land use refers to the function, design, and density of real property, excluding rights-of-way. Land may be used for homes, businesses, parkland, offices, utilities, farms, schools, and many others, or many combinations of these uses. Also considered are the way that buildings, other structures, parking areas, walkways and driveways, fences, and landscaping is arranged on the property, and the way that uses are arranged in relation to each other. Additionally, it considers the intensity of the uses – the number of homes or residents, businesses or employees, or other units of occupancy relative to units of land area such as acres or square miles. Land use addresses two components: the existing characterization of the property and the future options for usage as authorized by zoning and subdivision ordinances and related codes. Comprehensive plans and professional standards also place constraints on future development. Individuals, private developers, and occasionally public or non-profit agencies undertake construction or modifications, led by financing practices and trends in the real estate market.

Many land use planning and zoning departments consider it their mission to protect the health, safety, and welfare of their communities. These goals motivated the development of the earliest zoning regulations. However, this study finds that many recent trends in zoning and development, such as single-use zoning or street layout practices, are detrimental to public health. Additionally, we find few mechanisms for explicitly forecasting or evaluating the health impacts of development. Several key metrics are described below. Use of the Healthy Places Ordinance Audit and other tools begins on page 214; more information is available from CQGRD.

## Centers

### Discussion

Higher density development has been strongly linked with health and wellbeing through increased walking and cycling, increased access to goods and services, higher economic activity, lower infrastructure costs, lower crash rates, opportunities to reduce cost of living, and environmental conservation, as described above. However, these benefits are connected with a minimum density threshold, not simply an increase in average density across the region. Below that threshold, increases in density may actually result in longer travel times, less walkability, higher costs, and greater loss of undisturbed land – this is why some communities oppose any increase in allowable density. Additionally, the stated benefits are strongest where uses are clustered and mixed, where there is an identifiable community identity, and where increased density in one location allows other land to remain agricultural or minimally developed or to preserve existing neighborhoods. Therefore, this study recommends that regional planning should continue to encourage regional centers, town centers, and neighborhood/ village/ crossroads centers at naturally occurring sites, such as historic downtowns, shopping districts, and transportation hubs.

Zoning that places broad restrictions on density and use, and inflicts minimum parking requirements makes walkable, transit-served communities unattainable. It also drives up housing prices and the cost of living. Median transportation costs can grow from 5% of household income where travel alternatives exist, up to 20% in a car-dependent community, or up to 40% for low income households. Research links walkable neighborhoods, access to retail, and short commutes to better physical, mental, and social health. Higher density,

walkable nodes can also support a viable rail transit system, by increasing the number of homes and businesses that can locate within walking distance of potential station locations while reducing the total service area.

Favorable conditions for walking and transit begin around 8 dwelling units per acre, while some of the world's most highly-rated pedestrian and retail environments are encountered between 20 and 35 dwelling units per acre, assuming an average 2.5 residents per unit. Walking distance less than 1500 meters from home to a shopping center, post office, newsstand, school, or convenience store is associated with higher levels of physical activity. Distance to shopping, services, and employment is associated with better household access to everyday health needs. Proximity to commercial interests can facilitate increased physical activity, access, and economic vitality, but this effect is largely predicated on the presence of businesses that provide everyday shopping and service needs, such as a grocery store, bakery, greengrocer, laundry/ drycleaner, café, or drugstore. With appropriate mitigation of noise, traffic, and emissions, industrial activities can be included in walkable activity nodes. This improves access and physical activity for workers. Regardless of location, industrial sites can be made more suitable for access by foot, bicycle, or transit, and less undesirable as a neighbor.

If the net density of allowable uses were to be categorized as High (> 20 units per acre or >90 employees per acre), Medium (8-20 units per acre or 30-90 employees per acre), Low (1-8 units per acre or 6-30 employees per acre), and Rural (<1 unit per acre, rural, or agricultural), no more than a third of developable land should be in the Low category. High and Medium density qualify as walkable development, Low qualifies as unwalkable development, and Rural qualifies as conservation or agricultural land. Lot width in walkable development should accommodate 15 to 20 commercial entrances every 100 meters (328 feet) in commercial districts. This figure was derived from successful shopping districts in cities and towns across the world. It equates to a new storefront every 16 to 21 feet, or about every 5 seconds at normal walking speed. (Gehl, 2010). The largest center may be several miles across; smaller centers may be less than half a mile wide in total. Measurement of density in centers would necessarily be based on parcel data; even Census block group data might not be appropriately scaled.

A new round of studies are showing that new low density commercial development and new low density residential development in previously undeveloped areas cost the local jurisdiction considerably more in expenditures than they generate in tax revenue (Katz, 2011; Leeman, Ohm, & Rose, 2011). Mixed use, higher-density development in existing town centers generated tax returns several times higher per acre at lower infrastructure and service costs (Katz, 2011), while compact housing had about half the infrastructure costs of more scattered residences (James Duncan and Associates, Inc., et al., 1989). Centers that include food shopping tend to fare better than those that do not (Bromley & Thomas, 2002; MVA Consultancy, 2008).

Higher density development has acquired some negative connotations in the U.S., through the scarcity of good examples and prominence of bad examples, which include collections of skyscrapers that overwhelm the street scale (Figure 115), poorly managed transitions between areas of different densities (Figure 116), public housing high-rises (Figure 117), and unappealing design (Howley, 2009). Some of the comments received in the Plan 2040 and Health survey suggested that respondents feared that their existing residential neighborhood would become very dense.



**Figure 115: Looming skyscrapers**

Credit: Flickr/Herve Boinay;



**Figure 116: Skyscrapers built adjacent to historic townhomes**

Credit: Flickr/Herve Boinay;



**Figure 117: Lack of architectural detail and scale with surroundings**

Credit: Flickr/Zol87

On the other hand, many examples of well-designed density exist. These locations can command very high real estate values and prestige; they may even become destinations due to their walkability and character. Local examples include Savannah, GA, Glenwood Park in southeast Atlanta, or the historic parts of Midtown Atlanta. With good design of blocks, buildings, and landscaping, designating density nodes at locations that are currently underutilized or undervalued, such as strip commercial locations, could actually reduce development pressure on existing neighborhoods.



**Figure 118: 15.2 Units per acre**

Credit: Lincoln Institute of Land Policy.

**Figure 119: 21.8 units per acre**

Credit: Lincoln Institute of Land Policy.



**Figure 120: Urban transition zones**

Commercial developments, offices, and apartment homes can shield a single-family neighborhood from high traffic areas while bringing retail and transit service in walking distance. Credit: Lincoln Institute of Land Policy.



**Figure 121: Beacon Hill density**

Estimated density 33 people per acre/22 units per acre. Credit: Flickr/wallyg

Access is essential for low income households to be self-sufficient. This includes a number of factors such as car ownership and cost as determined by household budget priorities. It also includes full participation in employment and education opportunities, full access to the retail economy, and finally continued participation regardless of elderly or disabled status. Self-sufficiency also is desirable for the larger society in that it reduces reliance on welfare programs, paratransit programs, and other social services.

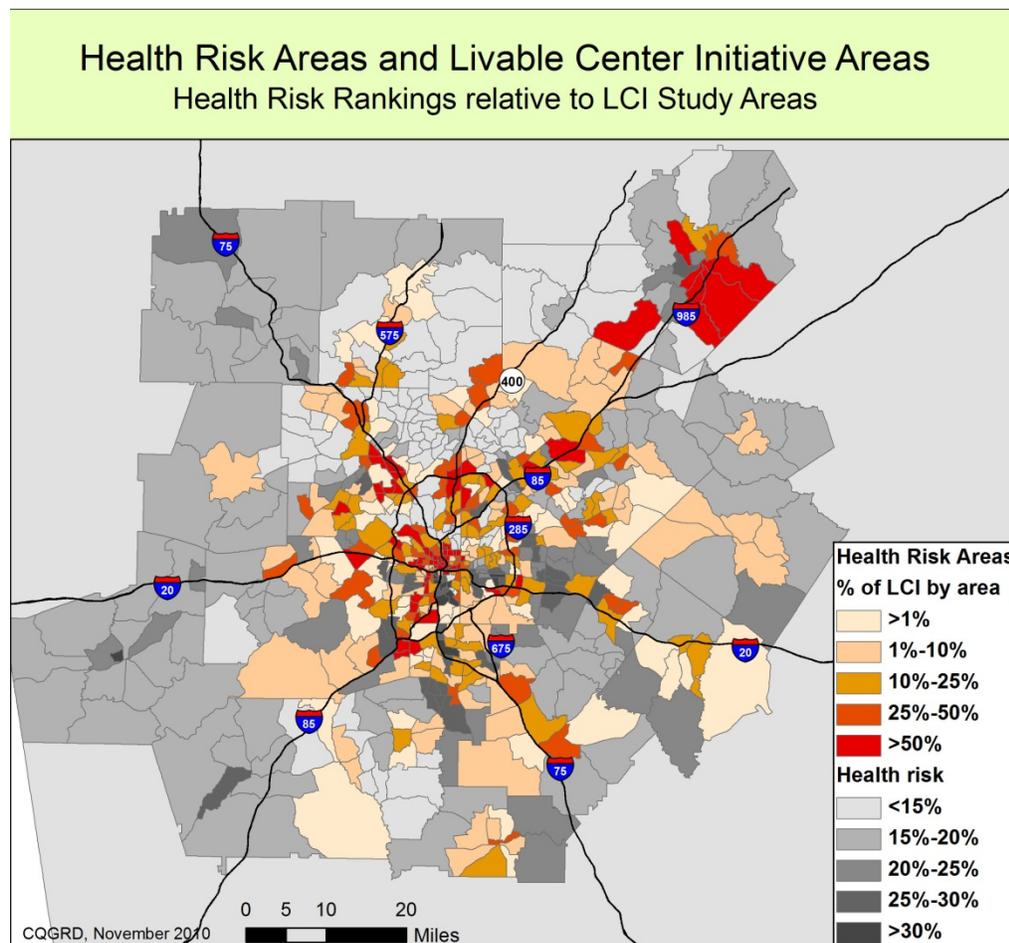
### **Plan 2040 Evaluation**

The Regional Development Guide (RDG) and Unified Growth Policy Map identify many types of centers: Regional Centers, Community Activity Centers, Regional Town Centers, Town Centers, Village Centers, and Crossroads Communities, as well as centers and corridors that are participating in the Livable Centers Initiative Program. The RDG effectively captures the wide range of forms that higher-density centers can take, from small villages to neighborhood business districts to the regional core. The Livable Centers Initiative has also helped to recast activity centers in the region.

The 2011 Livable Centers Initiative (LCI) Implementation Report found that LCI studies had influenced 88% of comprehensive plans, 64% of zoning codes, and 28% of policies for senior

and affordable housing. ARC's project criteria currently include implementation of the goals of the Lifelong Communities Initiative and is making progress toward policies for senior housing. About one-quarter of transportation projects in LCI areas were dropped or at risk. In the implementation report, the livability survey showed increases in walking and bicycling, which could mean an increase in physical activity and social interaction, and possibly a decrease in VMT. Also, the majority of respondents reported increased access to transit, retail and services, and more housing options. Nearly half thought that street life had increased, and two-thirds reported more participation in community activities (increase in social interaction). About one-third thought employment opportunities had increased (access to jobs).

The distribution of LCI zones is based on local initiative as well as eligible centers identified by the UGPM. This may result in geographic or demographic disparities in their distribution. Likely impacts of the LCI program include increased physical activity and civic engagement; reduced VMT resulting in reductions in injury and fatal crashes, emissions, household transportation costs; and reduced travel distance equating increases in access and productivity. In conclusion, the LCI program is likely creating a healthier environment for regional residents and workers, but the methodology could be updated relative to selection, implementation, and evaluation. Figure 122 shows the percentage of LCI study areas (by acreage) located in high health risk census tracts. The figure suggests that LCI districts are prevalent in health risk areas.



**Figure 122: Health risk and LCI areas**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau – ACS 2005-2009.

LCI in Plan 2040:

- The Regional Development Guide identified many types of activity nodes, or “Places”, which correspond with many of the characteristics that support good health – unique nodes where a range of residences, jobs, and services are concentrated in order to improve access to daily needs, reduce travel distance, support transportation alternatives, and create and support communities.
- Planning that emphasizes Places along with the existing Livable Centers Initiative (LCI) would likely promote health.
- Although outside the scope of Plan 2040, note that such plans may not become effectively enacted in the local jurisdictions’ code of ordinances (we offer tools to measure this).
- Additionally, some potential nodes were not designated as Places, and guidance on growth or conservation in areas not designated as Places might need to be strengthened.
- Also see the Livable Centers Initiative analysis, page 213.

Recommendations

- Contextually-appropriate density should be provided. Plans should identify underperforming areas and gaps in the urban fabric that are suitable for immediate infill or redevelopment, neighborhoods where any redevelopment occurs should be gradual, and natural conservation areas that should be preserved for agriculture, greenspace, or general conservation. Transportation corridors and centers should take the highest-density development, especially where quality transit is programmed. 1 2 4 5
- Create incentives to encourage that zoning and subdivision ordinances conform to recommendations regarding block size, connectivity, and street width. 2
- Create incentives to encourage that the full range of housing sizes, prices, and terms are permitted relative to regional household types, life phases, and incomes. 2 4 5
- Create incentives to encourage that parking regulations and pricing are appropriate. 2 4 5
- Include senior housing opportunities, including retirement and assisted care communities. 2 4 5
- Encourage environmental quality in buildings and transportation projects – promote use of EarthCraft standards, LEED and LEED-ND standards, Green Streets, and similar programs. 2 3 4 5
- Include civic buildings – such as courthouses, post offices, schools, churches, and community centers – in LCIs. 2 4 5
- Encourage accommodations for public and private gardens, farm stands, and farmers markets. 2 4 5
- Encourage medical centers and provide guidelines for design. 2 4 5
- Work with the Federal Highway Administration and GDOT to develop an expedited assessment process for small transportation projects that use LCI funding. 1 2 3
- Continue to explore funding opportunities such as Community Improvement Districts and Tax Allocation Districts as a way to build, operate, and maintain LCI enhancements. 2 4 5
- Develop incentives for property owners to contribute public enhancements, such as shuttle services, plazas, or streetscaping. 2 4 5
- Dampen development outside of LCI locations – explore a program to transfer development rights to LCI property, encourage local jurisdictions to preserve and

expand rural, agricultural, and estate zoning, and develop land conservation programs.

① ② ④ ⑤

- Use recommended health determinant indicators from the Plan 2040 HIA to evaluate the program's impact on health, safety, and welfare. ① ② ③
- Offer a mix of housing types and costs in proportion to local household income and life stage to reverse the concentration of poverty and accommodate all ages and family sizes in urban districts or neighborhoods. ② ④ ⑤
- Educate citizens about land use strategies. ②

Additional resources:

1. Visualizing Density Lower Density Catalog Images, 0.5–10.5 units per acre Julie Campoli and Alex S. MacLean © 2002 Lincoln Institute of Land Policy Working Paper
2. Measuring Density: Working Definitions for Residential Density and Building Intensity Ann Forsyth, Director Design Center for American Urban Landscape, Design Brief, Number 8/ July 2003 - November 2003

## Mix

### Discussion

Mix refers to a mix of land uses and occupancy. It includes communities that accommodate wide variation of demographic and socioeconomic identity in most residential neighborhoods and those that create space for stores and offices alongside residential areas. It also refers to communities that transition smoothly and incrementally between multifamily and single-family housing. These ideas can seem drastic relative to the tendency of today's zoning codes to strictly delineate land use into many different purposes of use and levels of intensity, and to apply them in large arrangements. Some jurisdictions have adopted mixed-use as a zoning district where they permit commercial, office, and higher-density residential uses, but this district rarely sees wide application. Although mixed-use districts are becoming more widely accepted, many citizens and policymakers passionately endorse narrow categories of residential zoning to control both traffic and property values. However, there is scant evidence to support these beliefs over time. Zoning that constrains use and establishes limits on floor area or square footage, number of bedrooms and bathrooms, number of units, height, and lot size (usually minimum thresholds and no maximum limits) actually appears to worsen traffic by reducing the number of destinations that can be accessed without driving. Floor area and square footage restrictions may also diminish the opportunity to build affordable housing, resulting in concentrations of lower income households in older housing stock, overcrowding, and potentially some homelessness, and potentially limiting the area in its ability to respond to changes in market demand.

Failure to provide housing of all types can have a range of consequences, from homelessness, to overcrowding, to departure by executives and entrepreneurs (potentially followed by their firms), to an inhospitable environment for today's demographics ('Millennials', young families, elderly), to declining property values, to pockets of concentrated poverty and associated ills. It can be a key factor in attracting and supporting successful businesses. It can also improve the viability of local medical providers, by avoiding the concentration of uninsured patients, Medicaid clients, and general health disparities. In addition to housing cost, the size and type of housing demanded by residents fluctuates based on each household's life phase, income and wealth, household size, cultural values, and other influences. Relatively even distribution of residences by age, income, household size, and lifephase can improve educational outcomes, reduce crime, and improve access to goods and services.

For instance, smaller single-level homes can provide housing for aging residents who wish to remain in their familiar neighborhood; their younger neighbors can assist with strenuous tasks while the older retired neighbors provide a watchful eye during work hours. At the same time, families with children may wish to live in higher-density housing where they can have a shorter commute to allow more family time, and more nearby amenities. Additionally, concentrated poverty has been associated with higher levels of crime, obesity, and economic and educational underattainment by children (Kelly, 2000; Ludwig, Sanbonmatsu, Gennetian, Adam, et al., 2011). High poverty neighborhoods are those with more than 10% of households living below the poverty line, according to the Department of Housing and Urban Development (HUD); extreme poverty neighborhoods have more than 40% of households in poverty. The Brookings Institution reports that the proportion of poor families living in high and extreme poverty Census tracts has increased since 2000; in the Atlanta region, the number of extreme poverty tracts has increased from 3 to 31, although the number of poor families living in extreme poverty areas has declined slightly and most of the decrease occurred within the Atlanta city limits (Kneebone, Nadeau, & Berube, 2011).

Additionally, having businesses located at appropriate nodes within walking distance of residences is linked to better access to jobs and services, and to increased physical activity, as described earlier. This can be implemented through more widespread use of mixed-use districts, through very detailed (e.g. block by block or parcel by parcel) application of zoning, or through the partial elimination of use-based zoning to be replaced with form-based codes or a community plan. By creating appropriate settings for community buildings (including libraries, city and county offices, schools, and community centers) in walking distance from many of the people they serve, mixed land use can foster civic engagement.

If property values rise sharply, housing affordability can become a serious issue. Affordable housing is defined as mortgage or rent expenses equal to less than 30 percent of a household's income. Housing affordability is not just an issue for poor families; the inability to find affordable housing can affect middle and upper income households as well, especially in areas with high housing costs. Where affordable housing is not available, more crowded living conditions may result. Crowded living conditions have also been associated with the transmission of respiratory infections, such as tuberculosis, and ear infections in children and even mold growth, as well as an increase in noise and lack of space for playing. In preliminary research, mold growth has also been linked with fatigue, depression, cerebral strokes, heart attacks, and hypertension. Lack of affordable housing can also impact a household's ability to pay for food or health care, and is linked to higher rates of homelessness (Lavin, Higgins, Metcalfe, & Jordan, 2006, Pollack, Egerter, Sadegh-Nobari, Dekker, et al., 2008). Foreclosure and strained housing affordability have been associated with higher rates of poor physical health, including chest pain, nausea, fatigue, and heart palpitations and severe psychological distress, including depression and anxiety (Cannuscio, Alley, Pagán, Soldo, et al., 2011).

For a homeowner, rising property values generally mean an increase in wealth and home equity, while falling values equate to an equally serious loss. Higher median area property values are associated with many advantages, including better city services, better schools, and well-maintained properties. However, an increase in the appraised value of a home, or business, will nearly always be followed by a proportional increase in annual property taxes for that parcel. Higher taxes are rarely welcome, although they do fund valuable public infrastructure and services. For homeowners with a fixed income, such as retirees, or experiencing difficulties with their mortgage payment due to a job loss or adjustable-rate increase, the additional expense of higher property taxes can have a significant impact on their risk of default and more generally on the household budget. For renters, their lease or rental terms may allow the cost of their rent to increase if the value or tax burden of the unit

increases, again impacting their other household expenditures and potentially causing them to relocate to less expensive housing. Finally, for someone newly seeking residence in the area, property values can determine which, if any, homes are available at their desired price range (high or low). Property values are strongly influenced by zoning regulations and other ordinances which often place restrictions on lot sizes, style and size of housing, presence of amenities, and proximity to desirable or undesirable land uses. However, this use of zoning may disadvantage some households relative to property values (for instance, by creating an artificial price floor for new homes, or limiting development scenarios in existing neighborhoods) (Green, 1999). Rental issues may also be mitigated with inclusive housing policies that disperse lower-income households rather than concentrating them in pockets of affordable, but possibly substandard, housing. The range of earnings provided by area businesses should serve as a guide for housing costs.

### **Plan 2040 Evaluation**

The region currently has dispersed employment patterns and extensive separation of residential, commercial, and business uses. The Plan 2040 Regional Development Guide promotes mixed use centers and corridors, and mixed land use to be applied where appropriate, and in appropriate scale, in neighborhoods and suburbs. Plan 2040 also promotes educational, institutional, and civic uses in neighborhoods and centers, as well as recreation. Housing options and housing affordability are encouraged in core, neighborhood, and suburb areas. The guide could go further in developing guidelines to identify neighborhood nodes and providing model ordinances for inclusionary housing, housing diversity, and land use diversity in nodes.

### **Recommendations**

- Offer specific ways that zoning ordinances can be updated to promote mixed use development in appropriate settings. 2 5
  - Develop guidelines to identify appropriate neighborhood nodes. 2
  - Provide model ordinances for land use diversity in nodes, including model mixed-use zoning at different scales, form-based coding, and others. 2
- Offer specific ways that zoning ordinances can be updated to mixed residential opportunity. 2 4 5
  - Index residential development policies to housing needs assessment. 2 4 5
  - Regulate appearance of residential property, rather than size or number of units. 4 5
  - Define affordable housing policies in districts with higher property values, especially around activity centers. 2
  - Adopt affordable housing policies 4 5
  - Provide ample and balanced opportunity for development of attached multi-family, attached single family, and detached single family development, with adjustments for housing needs assessment results and existing surpluses. 4 5
  - Set targets and incentivize larger attached single-family or multi-family units suitable for families with children. 2 4 5
  - Set targets and incentivize accessible units relative to expected elderly and disabled population, incentivize 'visitable' standards for all new homes. 2 4 5
  - Permit accessory dwelling units (ADUs), possibly with a community petition option in case of problem properties. This allows extra housing options for seniors and young adults in a supervised setting, while modestly increasing density to support better retail and transit services with minimal impact on the character of the neighborhood. 4 5

- Consider collector streets appropriate locations for small multifamily construction; transitional areas between neighborhoods and busy corridors or commercial centers can be an ideal location for apartments, condominiums, or townhomes. 2 4 5

## Parking

### Discussion

Parking policies have been studied as a question of land use, transportation, and economics. Any trip made by motor vehicle necessitates a place to store the vehicle while the purpose of the trip is being conducted. Parking may be on-street in the public right-of-way or off-street in a public or privately owned lot or structure on a developable parcel of land, and it may or may not involve a direct fee to the user. There is a cost associated with any parking facility, including its construction, maintenance, and the value of the land it occupies. The average parking stall is 300 square feet, with additional space for aisles if it is located in a parking lot. It has been estimated that about seven parking spaces are created for each motor vehicle, implying that a large percentage of parking spaces will be vacant at any given time. However, traffic patterns related to work hours, shopping trends, and such serve to generate high localized demand. Concerns over the impact of parking on residential neighborhoods and in illegal spaces have led to minimum off-street parking requirements in many jurisdictions.

Parking ordinances have been standardized across the U.S., but emerging research shows that these ordinances can have extensive, undesirable effects on economic vitality, transportation choices, and health. Requiring a minimum number of car parking spaces in relation to the volume of business effectively increases the cost of doing business for local merchants due to higher property and maintenance costs. The overall profitability of the land within the jurisdiction may decrease, as a significant percentage is used for non-revenue generating parking space, resulting in lower property and sales tax returns on per square foot and potentially increasing prices. This lost value generally cannot be recouped from priced parking, as the minimum requirements are designed to create an oversupply of parking. Opportunities for internal capture (customers visiting multiple businesses) are reduced, since most businesses take a proprietary stance towards the parking they provide, and thus require customers to return to their car and remove it from the lot before visiting adjacent businesses. However, shoppers are reluctant to make multiple stops due to the friction and lost time involved in each parking operation. The presence of parking facilities results in a loss of density and continuity of the business district. (Shoup, 2005)

Research has shown that small cities with the most expansive parking have experienced the most severe declines in their downtown districts, while cities with centralized parking and no parking requirements at the site level have been more successful (McCahill & Garrick, 2010). Centralized parking should not be a major expense for a city, as they should recoup their expenditures through parking fees (since supply will be more equal to demand) and higher tax revenue per acre from the business district. Priced parking tends to correspond with a reduction in traffic congestion and improvements in health, when the cost of parking is a factor in travelers' decision to walk, bicycle, or take transit to the business district rather than drive.

Research suggests that parking ordinances can have significant effects on economic vitality, transportation choices, and health. Businesses must incur additional expenses in buying property for parking, as well as the actual construction and maintenance. Minimum parking requirements have been associated with higher home prices, and with reducing the profitability of residential reuse of vacant buildings. This has the effect of reducing affordability and

reducing the density of residential and business floor area. In effect, this reduces the revenue-generating potential of developable land, and thus the potential tax revenue available for providing infrastructure and services to the area. Many cities tax parking facilities at a lower rate than other land uses, which appears to disincentivize their redevelopment regardless of the potential economic benefit to their district. As noted previously, density impacts walking rates and transit service viability, thus parking policies that reduce density may also reduce walking and availability of alternative transportation (Brockman & Fox, 2011).

In a business district, opportunities for internal capture (customers visiting multiple businesses) may be reduced, since most businesses take a proprietary stance towards the parking they provide, and thus require customers to return to their car and remove it from the lot before visiting adjacent businesses. However, shoppers are reluctant to make multiple stops due to the friction and lost time involved in each parking operation. Frequent disruption of storefronts or street enclosure due to parking facilities results in a simple loss of visual and psychological continuity of the business district which is associated with reduced foot travel. Intervention in parking supply is thought to have created abundance to the point that most parking cannot be priced. The cost of parking at their destination is a factor in travelers' decision to drive, walk, bicycle, or take transit on their trip, but the majority of motor vehicle trips in the U.S. end at a no-fee parking space. Higher prices reduce drive-alone trips and increase the use of alternate modes where available, choices which are associated with reductions in emissions and traffic congestion, and potential increases in physical activity. Studies have found that small cities with the most expansive parking minima have experienced the most severe declines in their downtown districts, while cities with centralized parking and no parking requirements at the site level have been more successful.

On-street parking is subsidized through road construction funds. It may add significantly to the cost of road construction, as it requires additional right-of-way, additional paving, and additional cleaning and maintenance. The additional 8 feet in width allocated to parking has been identified, in one city, to increase maintenance costs by \$1,000 per mile. Wider streets also have more stormwater runoff and increase crossing distance for pedestrians; on roads with underutilized parking lanes, the perception of extra space can contribute to speeding by motorists. On-street parking is intended to offer convenient supplemental stalls for short-term or unpredictable visits (stopping at the dry cleaners, visiting a friend's home) for which off-street parking is less suitable or unavailable. However, research suggests that free or underpriced on-street parking competes with off-street parking for long-term vehicle storage purposes (employees, third cars) and results in cruising for parking. Traffic analysis in downtown San Francisco determined that up to 30% of traffic volume was looking for on-street parking. Time restrictions and pricing by period of time have been implemented in many business or commercial areas in order to restore on-street parking to short-term use, but research and market studies have found that these prices are generally too low, and that the most effective pricing strategy adjusts the price monthly or even hourly in response to demand. Policies tend to target an 85% saturation rate. Calthrope and Proost (2006) report that time limits alone result in more time searching for an on-street parking space, adding to congestion; they suggested that market-rate off-street parking plus a small amount of on-street parking offered at the same rate had the best outcome. Arnott (2006) reported that parking garages would settle on an optimal price based partially on spatial distribution and facility cost (which is a function involving land value), and that priced on-street parking was necessary to capture the full benefit of parking garages and mass transit investments.

No published research was identified that specifically tested the health effects of parking regulations. There is fairly strong published research linking parking regulations to

intermediary causes that affect health, including the effect on density, mode choice, traffic volume, and economic productivity.

### **Plan 2040 Evaluation**

Plan 2040 recommends unspecified adjustments to minimum and maximum parking requirements in certain Areas and Places, without further detail.

### **Recommendations**

- Remove minimum parking requirements. Experts anticipate that developers will continue to build parking in order to meet their customers' expectations, but that they will adjust the amount of parking provided based on stall occupancy rates at their current holdings. Sample legislation is available if changes in parking supply begin to have a measurable impact on residential areas (Shoup, 2005). 4 5
- Change property assessment policies to value parking facilities and similar vacant land (excluding greenspace, agricultural parcels, etc.) at their highest potential value based on land use codes. The purpose is to allow the real estate market to set the price of space used for parking and to incentivize infill development or redevelopment in districts where land use is most intense. Consider earmarking the increased revenues to upgrade pedestrian and bicycle facilities, add bicycle parking, or enhance transit service to impacted areas. 4 5
- Where right-of-way is constrained and considering the local roadway and land use context, allocate space to create standard bicycle and pedestrian facilities before considering whether to install a parking lane. Set preference to discontinuous segments of back-in angled parking on one side of the street rather than parallel parking on both sides, with narrower street segments between parking segments. This should improve safety for bicycle and pedestrian traffic. 1 2 3 4 5
- Introduce variable, market-based pricing for on-street parking in higher-intensity and commercial areas. There are several models being developed around the U.S. Some protections might be developed for residential streets within walking distance, as above. Consider earmarking any increased revenues to upgrade pedestrian and bicycle facilities, add bicycle parking, or enhance transit service to impacted areas. 4 5
- Align other policies for a complete parking strategy. Permit shared/public parking facilities, including structures in commercial, office, mixed-use, and multifamily districts, and shared parking yards or lots in any district. Authorize and incentivize ways to make parking costs more visible to travelers, such as cashout of employer-subsidized parking and unbundling parking spaces from housing cost in multifamily residential properties. Ramp down subsidized parking for government employees. Further mitigate potential health impacts of parking through site design and building codes. 1 2 4 5 6
- Develop comprehensive guidelines for context-appropriate parking policies and ordinances. 2 4 5

## **Conservation**

### **Discussion**

Unimproved land also has value to the region, and particularly to the health of Atlanta-area residents. Whether serving as recreational space, places to preserve native habitat, or farmland to support demand for locally-grown food, conserved land can have a significant positive impact on physical activity, mental wellness, nutrition, and environmental and ecological quality. To make the most of an activity center-oriented development pattern, some

development activities should be transferred from non-center to center areas. Rural development (fewer than one residence per every 5 acres) may be appropriate in some settings. Millage rates, environmental protection ordinances, and support for local farmers markets may facilitate land conservation practices.

### **Plan 2040 Evaluation**

The plan identifies rural areas and greenspace, but does not define land conservation targets.

### **Recommendations**

- Work with local jurisdictions to define the boundaries of the areas that are best suited for increased development intensity, development expansion, preservation, or reclamation (conversion from development back to agriculture or greenspace), based on infrastructure, soil quality and other ecological factors, and spatial distribution. ① ② ④ ⑤
- Include conservation corridors into the region's core, to create wildlife corridors, potential greenways, and access to greenspace and urban agriculture for residents of the core counties. ① ② ③ ④ ⑤
- Utilize financing mechanisms such as "Redfields to Greenfields" to optimize the use of underperforming properties in areas that are less suited for sustainable development. ④ ⑤ ⑥
- Work with local jurisdictions to utilize conservation bonuses, density bonuses, and transfer of development rights in order to achieve conservation targets. ① ② ③ ④ ⑤

## Land Use – Transportation Interaction

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The objective of transportation and land use planning is to coordinate them in a way that supports mobility, access, equity, health, economic productivity, ecological quality, and quality of life. These are not mutually exclusive outcomes. Performance measures can be assigned to each. Projects can be ranked by performance, and they can also influence future planning and development. Atkinson-Palombo and Kubly (2007) report that planned transit projects can impact land use decisions before the project is implemented. The effect is strongest when overlay zoning is used at planned station locations. Target zoning uses Transit Oriented Development, which is walkable and cyclable, mixed use, small blocks, and connected street networks, which other studies link to higher rates of physical activity and access. Advance development can generate new tax revenue. Including transit projects in long-term transportation planning, even if funding questions remain unanswered, could result in positive results in land development, unless funding remains uncommitted and projects uncompleted, shaking the public's faith in transit planning.

There is compelling evidence that poverty, race, ethnicity, disability, age, and urban or rural setting are correlated with persistent and expanding health disparities among U.S. populations. The pursuit of good health requires safe and convenient access to a source of steady income, goods and services, and a wholesome environment. However, nearly one-third of Americans do not drive due to disability, age, financial constraint, or other personal circumstances. The majority is located in metropolitan areas, but even in rural areas about 14 percent of trips are made by those without access to a car (FHWA, 2001). These Americans live in an automobile-oriented society without access to an automobile and are therefore both socially and economically disadvantaged. Their access to goods and services and their inclusion in the larger society are dependent on greater accessibility in the transportation system. The impending increase in the proportion of elderly Americans, constituting 20 percent of the population, will only add to this dependency. Without roadway system design and funding priorities that accommodate their travel needs, these individuals and their families often have limited access to jobs, hospitals, supermarkets, and more. Their level of access is also affected by land use patterns that have been formed by decades of automobile-oriented road planning and engineering.

Major roads and highways have turned into barriers as they become more difficult to cross by foot or by vehicle. Homes and stores have tried to withdraw from heavy motor vehicle traffic through use of the cul-de-sac and large setbacks from the edge of the street, reducing overall connectivity. Limited street connectivity forces use of a few heavily used, congested roadways, exposing travelers to greater risk from air pollution and car crashes. Cities have given over large tracts of valuable—and taxable—land to pavement for roads and parking that have depleted “Main Street,” drained the tax base, and created sprawling regions where businesses are dwarfed by their parking lots and roadways are often barren and dangerous. Designing for automobile use on every trip, no matter how short, has evolved into a self-reinforcing spiral of decentralizing communities, expanding pavement, and increasing per capita vehicle miles traveled (VMT). This trend has created many of the issues contributing to poor health outcomes.

### Connectivity

#### Discussion

The street network can be seen as the inverse of development patterns – as land is allocated for development (or conservation), the street network is what remains. Like other land use and

transportation practices, street layout practices have evolved over time. In past centuries, streets grew from human living and walking patterns, or were planned along geometrical patterns, typically a grid. In the mid-twentieth century, however, American street and land development planning shifted toward long, looping residential streets that make few connections within the neighborhood and even fewer connections to external streets; short cul-de-sacs fill in the layout with the minimum amount of connectivity. This response appears to be partly in reaction to unchecked growth in automobile traffic, combined with new home financing policies implemented by the federal government. At the time, in the 1930s, the Federal Housing Authority (FHA) explicitly advised against a gridiron street network, alleyways, and high connectivity, describing these designs as “monotonous” and “unsafe”, and emphasizing the fact that fewer streets left more land for development. The FHA policies also began to specify minimum road widths, lot sizes, and block lengths, and to discourage narrow lots, four-way intersections, through streets, and sharp corners. Recent studies suggest that these changes have had negative effects on congestion, traffic crash rates, access, and physical activity rates, as well as travel times (including for emergency response vehicles). Nonetheless, these recommendations were extremely influential due to the role of FHA in real estate financing. FHA recommended street layout practices were implemented in nearly every new residential development until the 1980s (Marshall & Garrick, 2010).

### Plan 2040 Evaluation

The RDG emphasizes connected street networks in its Areas and Places guidelines. New roads scored very well in the transportation benefit-cost analysis. However, the benefit-cost analysis does include consideration of induced demand effects. It is important to note that ARC does have a program in place (the Comprehensive Transportation Planning program) to foster coordination with local governments, integrated transportation/land use planning and multimodal planning that feeds into the RTP process.

### Recommendations

- **Connectivity must be restored.** Connected street networks shorten travel distances, making active transportation more feasible. They provide alternate routes which can reduce exposure to injury and air pollution, by allowing users to avoid busy roads. Retrofit existing cul-de-sac developments in established suburbs with nonmotorized access points to adjacent developments. For developing areas, the design of all newly proposed projects should include complete connectivity and multi-mode transportation options. 2 3 4 5
- **Expand capacity by completing the road and transit network; avoid widening roads.** Prioritize new streets (2 or 4 lane cross sections) over road widening (2 to 4 or 4 to 6 lanes) projects; this can reduce travel distances. Research suggests that capacity gains for new lanes are marginal if there are two or more travel lanes in each travel direction. Options may include enhanced transit service, pedestrian-friendly access management, alternatives for new parallel/bypass streets, traffic controls that reduce queuing, or improved local interparcel and pedestrian circulation. 1 2 3 4 5

## Access Management

### Discussion

Access management refers to the regulation of interchanges, intersections, driveways, and median openings on a roadway. Prohibiting turns or prohibiting certain users from part of or the entire road can improve operations. For instance, a left turn may be restricted to buses only, one leg of an intersection might be closed to pedestrians, or the quantity and placement of driveways along the roadway may be restricted. In doing so, conflicts between road users

are reduced sometimes at the expense of freedom of movement. The right balance of access management can improve safety and level of service (LOS) for all road users.

### **Plan 2040 Evaluation**

The RDG suggests some access management in its Areas and Places guidelines, with limited description.

### **Recommendations**

- The number of high-volume access points for motor vehicles should be tightly restricted. This will make the sidewalk area safer and more conducive to walking. Vehicular access to parking lots, or drive-throughs where they are permitted, will ideally occur only once per block or less. In order to achieve this, parking and other motor vehicle facilities will necessarily be aggregated and shared. When separate facilities exist, they might be connected by an alley or passthrough. 2 3 4 5

# Healthy Planning Methods

Regional planning for healthier communities must consider unique issues related to certain populations, such as elderly citizens, children, people with disabilities, socio-economically and historically disadvantaged groups, and ethnic subcultures. Our analysis identified spatial and logistical dynamics related to each of these populations, as described previously, and found evidence of severe health disparities. According to projections in Plan 2040, the region will see large increases in minority, aging and dependent populations. Improving access, affordability, and transportation options and preventing inequitable distribution of environmental hazards appear to be the primary factors in reducing health and socio-economic disparities.

Public support for healthy, livable places is growing as well. Recent data shows demographic, economic, technological, and cultural trends converging in favor of healthy development. The “Millennial” generation is seeking shorter commutes, social interaction, and urban amenities, while the aging Baby Boomer generation is seeking quiet, compact, mixed-use neighborhoods where they can continue to access basic services when their driving abilities decline. Instability in fuel prices has simultaneously made shorter travel distances and transportation alternatives more attractive, and may have contributed to some foreclosures in outlying exurban developments; some analysts have theorized that economic difficulties are driving new interest in experiences and interpersonal relationships. Mobile communications, social networking, media, scrutiny of public spending programs, and widespread concerns about personal health and environmental pollution could all favor investment in health-promoting land use and transportation (Leinberger, 2008; Tombari, 2005).

There are few examples of healthy regional planning, but this report should provide the initial guidance ARC will need to begin integrating evidence-based practices in their routine operations. CQGRD, local public health departments, local planning jurisdictions, and some consulting firms are becoming increasingly equipped to provide technical assistance in HIA and similar initiatives. Additionally, some national or external organizations are pursuing HIA and healthy places planning, adding the list of available resources. For instance, the Nashville metropolitan government has conducted HIA in their transportation plan, the Chicago region’s Metropolitan Planning Council is conducting HIA training, and the American Planning Association supports an online HIA training module.

Most importantly, planning for a healthy region requires a strategic commitment from the entire organization, its governing bodies, and its partners. One component of this commitment involves the ability to express the value of a healthy region. In addition to the ethical motivation to save lives and reduce suffering, there also appear to be enormous corresponding gains in regional economic productivity and revenue, and reduced long-term expenditures for public services and infrastructure. This represents an excellent potential return on investment to planning agencies and other public agencies within the region.

Plan 2040 was founded on goals and objectives that included health explicitly and in indirect ways (economy, environment). However, the process of translating these objectives into performance measures, programs, policies, and project funding requires further development. The methodology and planning metrics currently available to ARC could be improved in order to more fully evaluate planning scenarios for their effect on health and quality of life. Additionally, a legacy project list may not always reconcile with current objectives and modeling tools. When assessing transportation alternatives to mitigate congestion, it is important to consider air quality and health impacts, and explore alternative methods of travel demand management where feasible. Additionally, capacity expansion or roadway improvements should integrate

multimodal transportation options and safe access in order to help mitigate potential negative impacts in a context-sensitive manner.

## Planning Framework

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As a long-range regional plan, Plan 2040 may affect as many as 8 million residents and countless visitors to the Atlanta region for the next 30 years. Additionally, this plan is the region's opportunity to prepare for increasing diversities in the 20-county region. These include diversity of urban form and function present in the built environment – ranging from dense urban settlements to successive rings of suburbs to sparsely populated rural and ex-urban areas and demographic diversity by race/ethnicity, age, income, and health status, to name a few. The long term health, sustainability, and prosperity of the region will likely be influenced by Plan 2040. There is a notable opportunity to use health impact assessment to address the listed health issues for the entire Atlanta region. Further, transportation planning is a federally-mandated activity of Metropolitan Planning Organizations, which exist for every region with a population greater than 50,000. A successful, replicable HIA framework for regional transportation planning could be adopted for metropolitan areas nationwide, and could guide future regional planning efforts.

As this report has suggested so far, evidence-based regional planning may need to deviate in large and small ways from customary planning practices. Primarily, it must be:

- context based
- flexible, working from a wide palette of solutions
- accountable to both small and large-scale conditions
- innovative and adaptable, to readily adopt new solutions
- sensitive to the needs of unique vulnerable populations

### Plan 2040 Framework

The regional plan consisted of multiple tools for assessment, planning, and implementation. These included a regional Vision including goals and objectives based on public input and sustainability principles; Findings of the regional assessment; a Regional Development Guide and corresponding map; a Regional Resource Plan for natural and cultural assets; a Conformity Determination Report to study regional compliance with National Ambient Air Quality Standards (NAAQS); Implementation Plans for ARC's strategic, local, and regional partners; and a Regional Transportation Plan which determines the policies, programs, and projects through 2040, including a list of funded projects in the six-year (2012-2017) Transportation Improvement Program.

### Regional Assessment

Plan 2040 began with an assessment phase that evaluated regional trends in relation to sustainability. Although the economic downturn was expected to have an impact on long term demographic and employment trends, ARC's forecasts still showed significant growth in the region. The population is projected to grow from 4.9 million in 2010 to 8.2 million by 2040. The elderly population is expected to constitute a much larger segment, equating 1.6 million residents over age 65 in 2040 – and changing patterns of work and travel. ARC anticipates new growth to be split between the five core counties and the rest of the region, resulting in both urban redevelopment and suburban expansion. They reported that the majority of multifamily development and transit service was in the core counties, although demand for these amenities was present throughout the region. More than half of the households in the region had two members or fewer and household size was projected to decrease. The region has a significant share of the southeastern economy, but is now experiencing lower growth in economic activity than other cities in the southeast. Job growth has shifted from high-wage positions in outer parts of the region to lower-wage jobs in the core, but since 2005 nearly all

employment gains have been lost due to the recession. Between 2010 and 2040, the number of jobs in the region is forecast to increase from about 2.6 million to 4.5 million. There was a water management council for the region, but no coordinated management of land conservation. The Regional Assessment produced the following findings:

- Urban expansion is occurring in a way that detracts from access and quality of life
- Water supply and quality are uncertain for the future
- Region experiences perceived and actual negatives of peak traffic delays
- Significant changes in age and ethnic/racial identity of population are expected
- Current housing supply may differ greatly from future demand
- The region has few areas that offer alternatives to driving
- Development patterns are in flux; natural resources and existing communities are under development pressure
- The region and its funding partners have decreased financial capacity to pay for transportation maintenance, operations, and new infrastructure
- Current levels of regional cooperation may limit its ability to respond to opportunities or challenges in a coordinated manner

While thorough in the areas of economy, population, and environment, we find that this assessment lacks analysis of certain items that we consider essential to a healthy, livable and economically stable region. This phase of the regional plan is when health data should be collected and any trends forecast. Additionally, disparities in income, education, employment, and health status should be mapped. It is also recommended to include some analysis of business access and local circulation from the perspective of land use in addition to transportation. Finally, a more comprehensive ecological assessment could be included, including brownfield remediation and sustainable building and energy initiatives. Our analysis would add the following findings:

- Chronic disease and injury are endangering the region's productivity
- Business growth and employment faces restrictions on access to viable markets
- Economic and health disparities limit participation in the regional economy
- Fundamental lack of multimodal capacity limits the success of road and transit investments
- The economic downturn represents challenges and opportunities to rethink building practices for affordability and efficiency
- Brownfields and locally-unwanted land uses depress redevelopment in many areas

*The plan's vision, goals, objectives, and principles align closely with healthy places planning.*

Plan 2040 Vision Statement:

*Visionary leadership for sustainable growth by balancing environmental responsibility, economic growth and social needs while maximizing benefits to all.*

Plan 2040 Goals:

*Goal #1: Lead as the Global Gateway to the South*

*Goal #2: Encourage Healthy Communities*

*Goal #3: Expand Access to Community Resources*

Plan 2040 Objectives:

- *Increase mobility options for people and goods.*
- *Foster a healthy, educated, well trained, safe, and secure population.*
- *Promote places to live with easy access to jobs and services.*
- *Improve energy efficiency while preserving the region's environment.*
- *Identify innovative approaches to economic recovery and long-term prosperity.*

Plan 2040 Principles:

*Increase mobility options for people and goods by*

- *Assuring the preservation, maintenance and operation of the existing multimodal transportation system.*
- *Continuing to implement cost effective improvements such as sidewalks, multi-use trails, bicycle lanes, and roadway operational upgrades to expand transportation alternatives, improve safety, and maximize existing assets.*
- *Maintaining industrial and freight land uses at strategic locations with efficient access and mobility.*
- *Maintaining and expanding infrastructure to support air and rail travel and transport.*
- *Strategically targeting roadway capacity improvements to serve regionally significant corridors and centers.*

*Foster a healthy, educated, well trained, safe and secure population by*

- *Building communities that encourage healthy lifestyles and active living for all ages, with provisions for healthcare, education, recreation, cultural arts and entertainment opportunities.*
- *Promoting a regional community that embraces diversity – age, ethnicity, and lifestyle – as its strength.*
- *Promoting access to quality schools, career training, and technology literacy to provide a workforce that can support economic opportunity.*
- *Promoting public safety efforts to create vibrant and safe 24-hour communities.*

*Promote places to live with easy access to jobs and services by*

- *Building compact development in existing communities with integrated land uses that will minimize travel distances and support walking, cycling and transit.*
- *Increasing housing, services, and employment opportunities around transit stations.*
- *Providing a range of housing choices to accommodate households of all income levels, sizes and needs and to ensure that workers in the community have the option to live there.*
- *Protecting the character and integrity of existing neighborhoods, while also meeting the needs of the community.*

*Improve energy efficiency while preserving the region's environment by*

- *Conserving and protecting environmentally-sensitive areas and increasing the amount and connectivity of greenspace.*
- *Continuing to enhance stewardship of water resources throughout the region.*
- *Promoting energy-efficient land development and infrastructure investments that foster the sustainable use of resources and minimize impacts to air quality.*
- *Encouraging appropriate infill, redevelopment and adaptive reuse of the built environment to maintain the regional footprint and optimize the use of existing investments.*

*Identify innovative approaches to economic recovery and long term prosperity by*

- *Focusing financial resources and public investments in existing communities.*
- *Establishing a region-wide economic and growth management strategy that includes federal, state, regional and local agencies, as well as non-governmental partners.*
- *Enhancing and diversifying economic development activities to include sectors like life sciences, logistics and transportation, agribusiness, energy and environmental technology, healthcare and eldercare, aerospace technology and entertainment and media production.*
- *Leveraging the diversity of the region – our people, places and opportunities – to continue to attract business and residents.*

Relative to the health and planning evidence detailed in previous chapters, we find that the vision, goals, and objectives support healthy planning, but that certain elements are missing from the principles. For instance, reducing household transportation costs, reducing energy costs, reducing VMT and diversifying mode share, balancing future tax revenue and expenditure through land use, reducing disparities, and protecting agricultural productivity all pose significant contributions to the stated goals and objectives. We recommend revising “Promote places to live with easy access to jobs and services” with “Promote affordable places to live with easy access to jobs and services”.

### **Peer Cities**

In preparation for Plan 2040, ARC hired consultants to conduct a review of recent regional planning efforts by five peer agencies – Denver Regional Council of Governments (Denver), Delaware Valley Regional Planning Commission (Philadelphia), the Metropolitan Council (Minneapolis-St. Paul), the North Central Texas Council of Governments (Dallas-Ft. Worth), and the Association of Bay Area Governments and Metropolitan Transportation Commission (San Francisco). In examining this review, we found several items of note. One finding was that several of these peer agencies designate conservation zones intended to preserve natural and agricultural land; some of them use urban growth boundaries and limited expansion zones in

order to support this conservation. Another finding was that one other agency uses measurable objectives in order to evaluate their plan.

*The San Francisco region has developed health-related performance targets for regional transportation planning.*

Since that review, the San Francisco region's Metropolitan Transportation Commission (MTC) has introduced "Transportation Project Performance Assessment" which utilizes ten adopted targets, including health-related targets, in evaluating transportation projects over \$50 million, or classes of projects for those that cost less than \$50 million. More information about this process can be found at <http://apps.mtc.ca.gov/events/agendaView.akt?p=1763> (Agenda item 2). Projects are evaluated on the adopted targets of

1. CO<sub>2</sub> emissions reduction
2. Adequate housing
3. Particulate matter emissions reductions
  - a. PM<sub>2.5</sub> emissions reduction
  - b. PM<sub>10</sub> emissions reduction
  - c. PM emissions reduction in CARE communities
4. Injury and fatality collision reduction
5. Increase in minutes of active transportation (walking/biking)
6. Open space and agricultural preservation
7. Decrease in low-income expenditures on transportation
8. Economic vitality
9. Mode share/VMT
  - a. Decrease in per-trip non-auto travel time or increase in non-auto mode share
  - b. VMT reduction
10. State of good repair

### **Implementation Program**

The Implementation Program is ARC's tool for putting its plans, programs, and policies into action. Although it is the regional agency for the Atlanta area, ARC has limited authority, especially regarding land use and related ordinances. Thus in Plan 2040, ARC assigns internal strategies and responsibilities for partnering with outside agencies – including state agencies, city and county governments, universities, and civic organizations – to fulfill the plan's commitments. In the associated document, ARC proposes to develop additional regional performance measures in 2011. The program includes a five year work program, including tasks and funding, for each ARC division (Aging Services, Environmental Planning, Government Services, Land Use, Research/GIS, Transportation Demand Management, Transportation Planning, and Workforce Development). The program also lists a new potential area of work, "Support greater health strategies linking biking and pedestrian facilities, programs to support health, etc."

With limited authority over local policies and ordinances, we find that the implementation strategy and local government implementation plans are an important step towards enacting the entirety of Plan 2040. As our assessment in the Evidence and Planning Evidence reveals, land use and many other elements of infrastructure and operations determine the impact and utility of transportation investments. The Implementation Program includes training, guidance, programming, incentives, and funding to promote implementation of plan elements by local jurisdictions in the region.

**Implementation Program Recommendations**

## Increase mobility options for people and goods

- Task the Aging Services Division with developing clear guidelines for land use and transportation practices that facilitate access and mobility of senior citizens regardless of their ability level; support continued refinement of universal design best practices and the Lifelong Communities initiative. ① ②
- Task the Environmental Planning Division with assessing the impact of transportation investments and trends on air quality hotspots, water quality and supply, land contamination, and natural resources, and with developing a role for greenspace as a significant element of the non-motorized transportation system. ① ②
- Encourage the Government Services Division with promoting traffic law compliance (e.g., through education (?)) to reduce traffic incidents that contribute to congestion. ① ②
- Increase funding support for the Land Use Division to assist local governments with access management, TOD, and walkable development; task the division with developing more robust methods of identifying activity nodes and conservation areas. ① ②
- Specify that Transportation Demand Management should favor programs and projects that are correlated with better health (e.g., commuter bus/vanpool stations that facilitate TOD and bicycle and pedestrian access rather than a simple park-and-ride design). ① ②
- Allocate funding for the Land Use Division to assign specifically to LCI support; utilize recommendations in this report to update project selection criteria; task this division with pursuing a comprehensive update to regional freight planning including intermodal and alternative fuel/alternative mode; continue to prioritize testing and development of multimodal demand modeling. ① ②
- Task Workforce Development with promoting local vocational and university programs that will prepare future transportation planners, engineers, and construction workers for implementing the transportation vision of Plan 2040, and with collecting job creation data for transportation investments. ① ②

## Foster a healthy, educated, well trained, safe and secure population

- Encourage and expand the Aging Services Division's Lifelong Communities initiative with addressing health and safety needs of seniors in all activities, including development of a review process for planning and project compliance; include local and state health departments in outreach. ① ②
- Task the Environmental Planning Division with assessing access to greenspace and presence of environmental contaminants in air, water, and soil. ① ②
- Provide the Government Services Division with funding to initiate school siting analysis. ① ②
- Task the Land Use Division with implementing usage of the HIA and its recommendations in addition to exploring options for use, and provide support for the entire five-year work plan; ensure that equity is a cornerstone of sustainability initiatives; charge this division with fostering improved quantity and design of public spaces. ① ②
- Ensure that Research and GIS obtain health data and receive training on its use. ① ②
- Assign Transportation Demand Management with mitigating concerns about personal security and safety related to walking, bicycling, and riding transit. ① ②
- Ensure that the Transportation Planning Division incorporates a multimodal perspective on traffic safety; explore options to increase regional funding for transit operations and for bicycle and pedestrian infrastructure; utilize Context Sensitive

Solutions and evidence-based design for safer roadway designs; allocate funding to implementation of the HIA results. ① ②

Promote places to live with easy access to jobs and services

- Task the Aging Services Division to cultivate relationships with all local health districts; support continued refinement of universal design best practices. ① ②
- Task the Government Services Division with promoting governmental and social services to be sited in activity nodes accessible by transit. ① ②
- Help the Land Use Division succeed in its other activities by providing funds to evaluate changes in access to jobs and services; task the division with addressing access for lower income households and communities. ① ②
- Ensure that Research and GIS utilize health data in benchmarking and strategic planning. ① ②
- Task the Transportation Planning Division with prioritizing bicycle and pedestrian investments in and transit access to designated activity nodes. ① ②

Improve energy efficiency while preserving the region’s environment

- Task the Environmental Planning Division with initiating guidelines for building codes, land use, renewable energy sources, hardscaping, and landscaping/tree conservation related to efficient use of energy and water; provide funding for this division to collect data, track usage, and forecast trends. ① ②
- Task the Government Services Division with coordinating sustainable energy production and distribution in the region, and with promoting the adoption of location-efficient mortgages, LEED, EarthCraft and other standards by local governments and businesses. ① ②
- Task the Land Use Division with developing guidelines, in conjunction with the US Environmental Protection Agency and the Georgia Environmental Planning Division, for brownfield redevelopment and eco-industrial operations. ① ②
- Charge Research and GIS with identifying environmental risk areas due to air, soil, or water contamination and establishing the most aggressive achievable reduction targets. ① ②
- Task Workforce Development with promoting “green jobs” training programs. ① ②

Identify innovative approaches to economic recovery and long term prosperity

- Task the Aging Services Division with assessing land use and transportation impacts on cost of living, foreclosure risk, and housing options for the elderly. ① ②
- Task the Environmental Planning Division with calculating economic value of natural resources and environmental quality. ① ②
- Task the Land Use Division with studying impact of land use on household budget, economy, public expenditures, and tax revenue, and identifying land use practices that attract employers and skilled workers; provide sufficient funding for a complete study of best practices in sustainable development codes and practices. ① ②
- Charge Research and GIS with identifying places or populations that require additional assistance to achieve stability and prosperity, and with identifying places or development patterns with a low likelihood of recovery and sustainable prosperity. ① ②
- Do not rely on roadway expansion to increase economic productivity; task the Transportation Planning Division with incorporating recommended analytical tools to identify transportation projects of all types with the best economic benefits including those from health-based productivity and expenses. ① ②

**Regional Resource Plan**

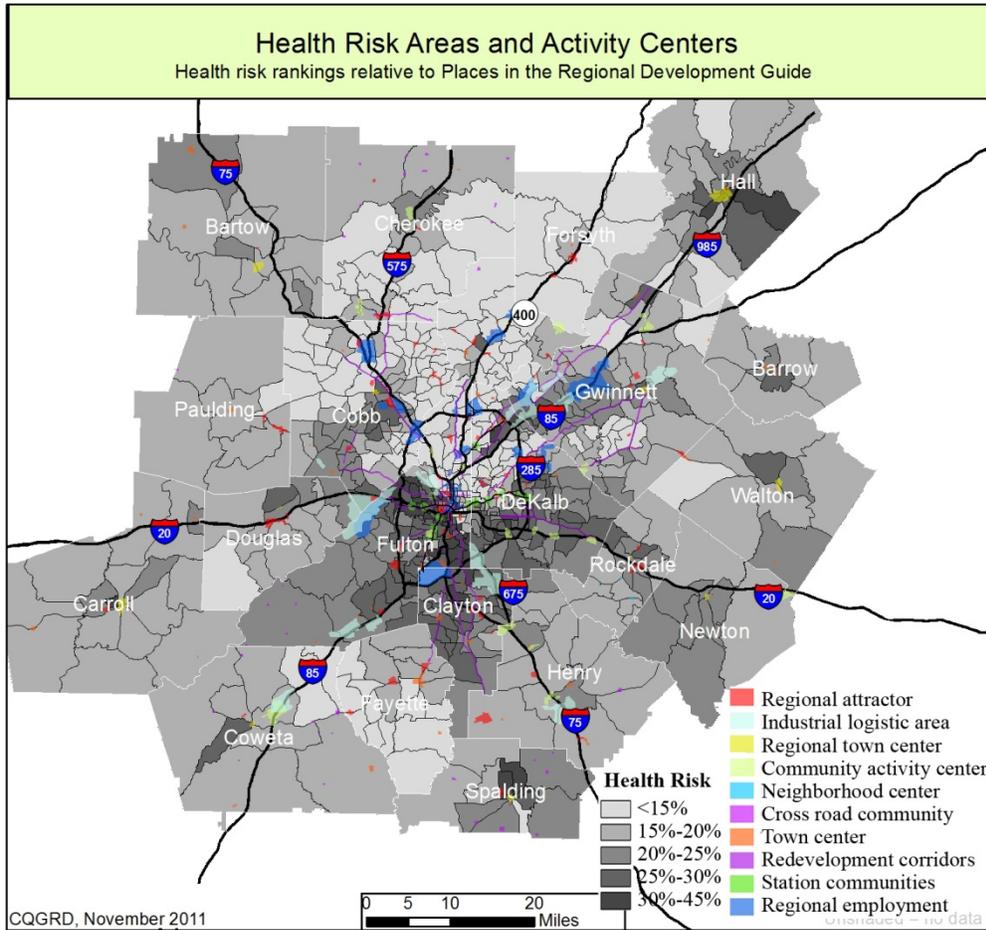
This plan identifies regionally significant areas of conservation, recreational value, agricultural, and scenic value, as well as historic and cultural resources. These resources were identified through nomination from local jurisdictions or through GIS and other data sources. Each resource was assigned by its value to the region, and vulnerable or endangered resources were identified. The resulting map highlights large areas of wetlands, as well as rivers, major parks, greenway trails, historic sites, and active agricultural districts, and provides development guidelines for them. We find that this plan, if implemented throughout the region, could be a successful strategy to preserve and protect significant resources, while potentially improving citizens' access to these resources.

## ***Development & Land Use Planning***

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The Regional Development Guide (RDG) incorporates existing land use and future land use plans into a cohesive regional scheme based on the predominant character or function of a location. The RDG creates a classification system of “Areas” (larger stretches of land) and “Places” (smaller distinct centers), identified by such factors as residential density, job density, presence of regionally-significant amenities, and trends in housing and demographics. Areas include Region Core, Regional Employment Corridors, Maturing Neighborhoods, Established Suburbs, Developing Suburbs, Developing Rural, Rural/Undeveloped Areas, and Airport Investment Areas; Places include Regional Centers, Community Activity Centers, Regional Town Centers, Town Centers, Village Centers, Crossroads Communities, Major Retail Districts, Recreation Districts, University Districts, Wellness Districts, Industrial/Logistics Areas, and Station Communities, overlaid with Regionally Important Resources and Redevelopment Corridors. In the RDG, each Area and Place type had implementation priorities established by plan objective, which included transportation, land use, and programming. Each Area type received a description of the associated transportation implementation priorities in the transportation plan. The RDG can be used in conjunction with the Unified Growth Policy Map (UGPM) which incorporates local plans.

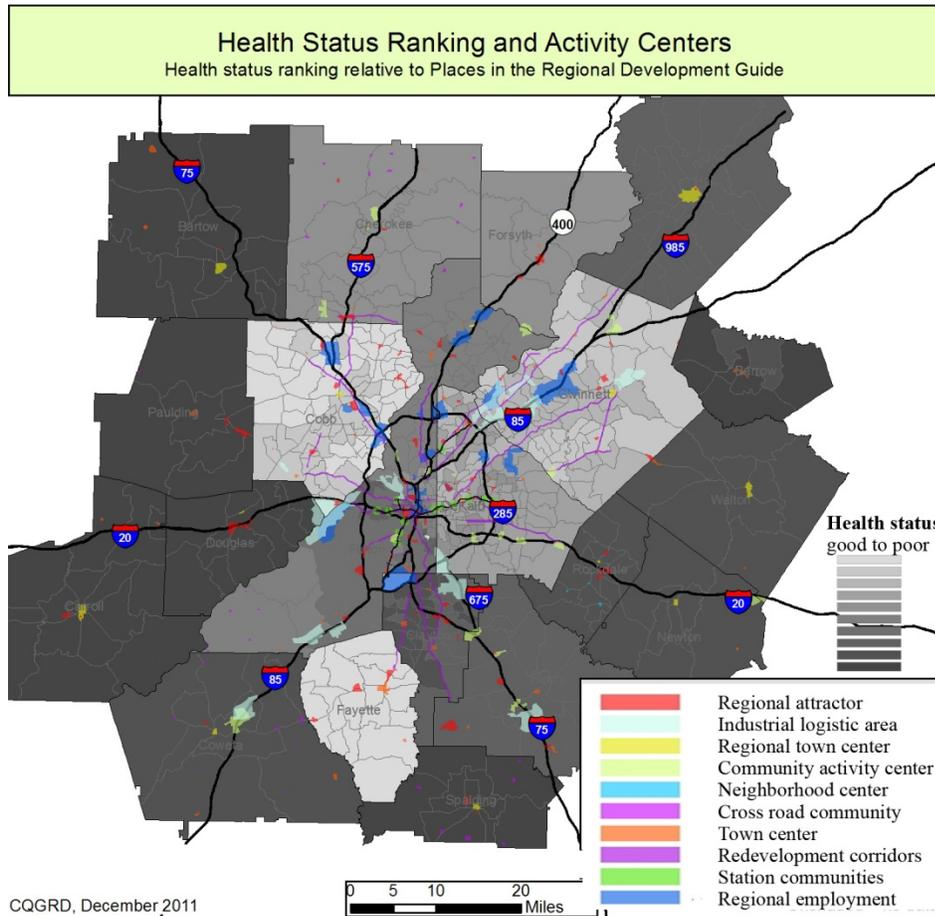
Due to the large amount of information in the RDG, this assessment will not address each entry specifically. The assessment will consider overarching qualities and concerns. Generally, the priorities expressed for the Areas and Places are closely aligned with healthful community design. Housing choices, connectivity, transit provisions, access to jobs or grocery stores, bicycle and pedestrian amenities, and preservation of greenspace are all referenced in the locations where these items would be appropriate. Designating and zoning for Places in health risk areas could support improved health status for residents of these areas. Figure 123 shows the relationship of Places to health risk ranking. Places seemed to be relatively evenly dispersed through high-risk communities, except a possible shortage of employment centers.



**Figure 123: Health risk and activity centers**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission, U.S. Census Bureau - ACS 2005-2009.

Figure 124 indicates that areas with poor health status (dark gray) may be less likely to have extensive activity centers, or employment corridors.



**Figure 124: Health status and activity centers**

Prepared by Center for Quality Growth and Regional Development. Data sources: Atlanta Regional Commission; U.S. Census Bureau – ACS 2005-2009; Georgia Dept. of Public Health.

Several issues remain to be addressed in the RDG.

- Regional Employment Corridors also contain a significant amount of multi-family housing – this could improve access to jobs, services, and transit, but it could also result in unhealthy living conditions near high-volume roadways or without adequate amenities for families. Implementation priorities should describe the appropriate way to integrate residential developments into these areas. These corridors also experience unusually high crash injury rates, including pedestrian crashes, so road safety and walkable design should be a priority. Note that we identified high employment along many major roadway corridors which Plan 2040 does not include in this category. 2 4 5
- See the CQGRD report on Health Impact Assessment of the Atlanta Aerotropolis Brownfield Development for additional recommendations regarding the Airport Investment Areas. 2
- Many Maturing Neighborhoods already feature 8 or more units per acre and include some duplexes and small multifamily units. Additionally, there are likely to be some smaller maturing neighborhoods in older cities in the region, which are not included in the area as shown and could benefit from higher residential density over time. 2 4 5

- Established Suburbs may currently be between one and five units per acre, but outside walking or cycling distance from activity centers, it is recommended to discourage additional densification, and even to promote a gradual reduction of density and an increase in conservation areas. Otherwise, the implementation priorities do emphasize critical measures, such as the need for increased street connectivity, expanded civic capacity, aging-in-place options, wider mix of uses, and repurposing of underutilized parking lots. ②④⑤
- The principles for Established Suburbs are also true in Developing Suburbs, with an even greater emphasis on conservation, which the RDG captures. Traffic safety is also extremely important in these areas, whose residents often average more daily miles of travel at relatively higher speeds, and who suffer more traffic deaths. A strong emphasis on nodal development – at crossroads or villages and around historic town centers – with very low density development (less than one unit per five acres) and conservation in remaining areas is recommended. Higher-intensity mixed-use business districts at activity centers could help reduce commute distances and improve economic opportunities in these areas. ②④⑤
- The Developing Rural category is ambiguous – are these rural areas at risk for overdevelopment, or areas that are being selected for future expansion in order to relieve development pressure on Rural Areas? Either way, the use of Transfer of Development Rights (TDR) under implementation priorities is likely to be a successful strategy, especially if it can be used at a regional scale rather than restricted to stay within each city or county. Additionally, although rural populations are small and not encouraged to grow, these areas may have lower-income households with insufficient access to retail and public services; improved service provision should be a priority under objective 2. ②④⑤⑦
- **“Places” appear to be an extremely effective policy for creating healthy, livable communities.** These locations should be prioritized for premium transit service, bicycle and pedestrian access from surrounding communities (their “bike shed” or “walk shed”), a gradual conversion to market-based parking policies, and a wide mix of uses. Even in Crossroads Communities and Village Centers, a modest amount of vertical mixed use (one or two floors of apartments above stores) could be highly appropriate, and densities might approach 20 units per acre for a few blocks. ①②④⑤
- While most of the recreational venues in Recreation Districts would be freestanding, the immediate uses in these districts could support fairly high intensity mixed use development in order to maximize the health benefits of access to these resources and capture of their full economic potential. For instance, bicycle networks should be prioritized along with pedestrian and transit options, while parking requirements should be eliminated and replaced with managed parking. ②④⑤
- The mobility priorities of University and Wellness Districts are well considered. These districts might need a stronger emphasis on transitional land use between major institutional facilities and residential areas, as well as long-term expansion plans. ②
- We endorse access management as a key priority along Redevelopment Corridors, as long as such treatments balance the mobility and access needs of all travel modes. We also encourage a greater emphasis on road safety in these places. Conversion to market-based parking rather than parking requirements could contribute to an enormous value capture on underutilized property and improved interparcel access. ②③
- See the CQGRD report on Health Impact Assessment of the Atlanta Aerotropolis Brownfield Development for additional recommendations regarding ecologically and developmentally compatible industrial areas, which can incorporate multimodal access, connectivity, and some mix of uses. ②

- Nearly all Areas and Places need further emphasis on equitable development, to address connectivity and parking requirement modifications, and to endorse appropriate types of agricultural activity and natural preserves. ①②
- Future programming by the Land Use Division should develop visual references for development options in different types of Places, in addition to their plans to formulate model development codes. ②
- One thing that the RDG and the UGPM could further clarify is a vision for future growth versus conservation areas. Although the RDG does specify which Areas and Places should undertake Growth Preparedness, it would be extremely valuable to provide a map of proposed growth and no-growth areas. This might require further collaboration from local jurisdictions and their constituents. ①②④⑤⑦

## ***Transportation Program and Project Selection***

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As described in the “Mode Share” section, we expect that health, equity, and economic development will be maximized if a larger percentage of trips in the region can be made by transit, walking, or bicycling. This includes longer trips as well as local ones. Additionally, we have found that the optimal proportion of travel modes in a given area can be heavily dependent on land use context. This leads to three major principles of transportation project prioritization for the Atlanta region:

1. Federal and state planning objectives require that certain elements including safety, economic development, and freight movement be considered in the process. However, the regional development guide and the Unified Growth Policy Map, based on local planning processes and regional demand, to the greatest extent possible, should be the leading determinant of transportation investment, in terms of both location of projects and type of projects.
2. Where inadequate infrastructure or services exist for a particular mode relative to land use-based latent demand assessments, projects that address those needs should be prioritized.
3. Behind all project design and selection should be a policy to “do no harm” to the greatest extent possible– to avoid projects that would create new safety hazards, based on the safety findings above, or new impediments to multimodal access, and to alleviate existing problem areas as identified in our analysis.

### **Plan 2040 Regional Transportation Plan Performance Framework**

The Plan 2040 RTP utilized a multi-step decision framework. This framework was developed as a tool to help organize and guide various steps of the transportation plan development process. This framework utilizes four “key decision points” (KDP). Each KDP defines a step in the process where resource allocation decisions are informed by technical or policy evaluation and highlight which steps are supported by performance assessment (Figure 125. ).

At KDP1, an inventory was taken from the existing RTP. The projects that emerged from this inventory as recommended for further consideration were subsequently the subject of regional studies and plans. This included locally adopted plans. Through this process a universe of potential projects to fund for the financially constrained RTP was developed. Discrete projects are largely ignored at this step. Program areas are first defined and performance trendlines are developed for each, to define the general relationship between performance and funding levels. Once these trendlines were developed, they were used to define any optimal levels of funding, or any points of diminishing return between funding and performance. This step is intended to be a critical first link between stated plan policy (goals/objectives) and actual plan development, in its impact on policy discussion related to plan development. For PLAN 2040, the KDP1 analysis and corresponding policy discussion focused largely on the system preservation program and needs, allowing ARC for the first time to establish system maintenance funding levels based on need, as opposed to historic plan expenditures.

In KDP2, projects were compared against the UGPM and critical ARC study recommendations and state policies (excluding preservation and programming). Inconsistent projects were filtered out of consideration for funding unless they demonstrated an immediate safety need or had significant sunk cost; e.g., right of way acquisition underway.

In KDP3, road and transit expansion projects were evaluated with performance criteria which are linked to broader PLAN 2040 objectives. Project evaluation was conducted within road and transit capacity programs, to compare projects of similar type, given the limitations of current

tools to effectively compare a spectrum of benefits across programs. This is not the point in the process where the benefits of a road or transit (or other) project on a corridor are compared to one another. That step occurs much earlier through plan and project studies, AAs, etc. At KDP 3, the projects have already been defined and are now competing for funding. A benefit-cost analysis is also completed for each project. Costs include the cost to build, operate and maintain the project for both roads and transit. Benefits include the monetized value of fuel cost, delay cost, reduction in criteria pollutants, and reduction in GHG emissions for road projects. For transit projects, benefits were equated to project points from the quantitative project evaluation. Projects were then assigned to Tiers based on their performance and benefit-cost to identify projects with positive performance impact and high benefit-cost ratios.

At KDP4 high performing projects were mapped for each program. Complimentary investments were identified and selected, in terms of compliments to one another and compliments to environmental justice, LCI, UGPM areas.

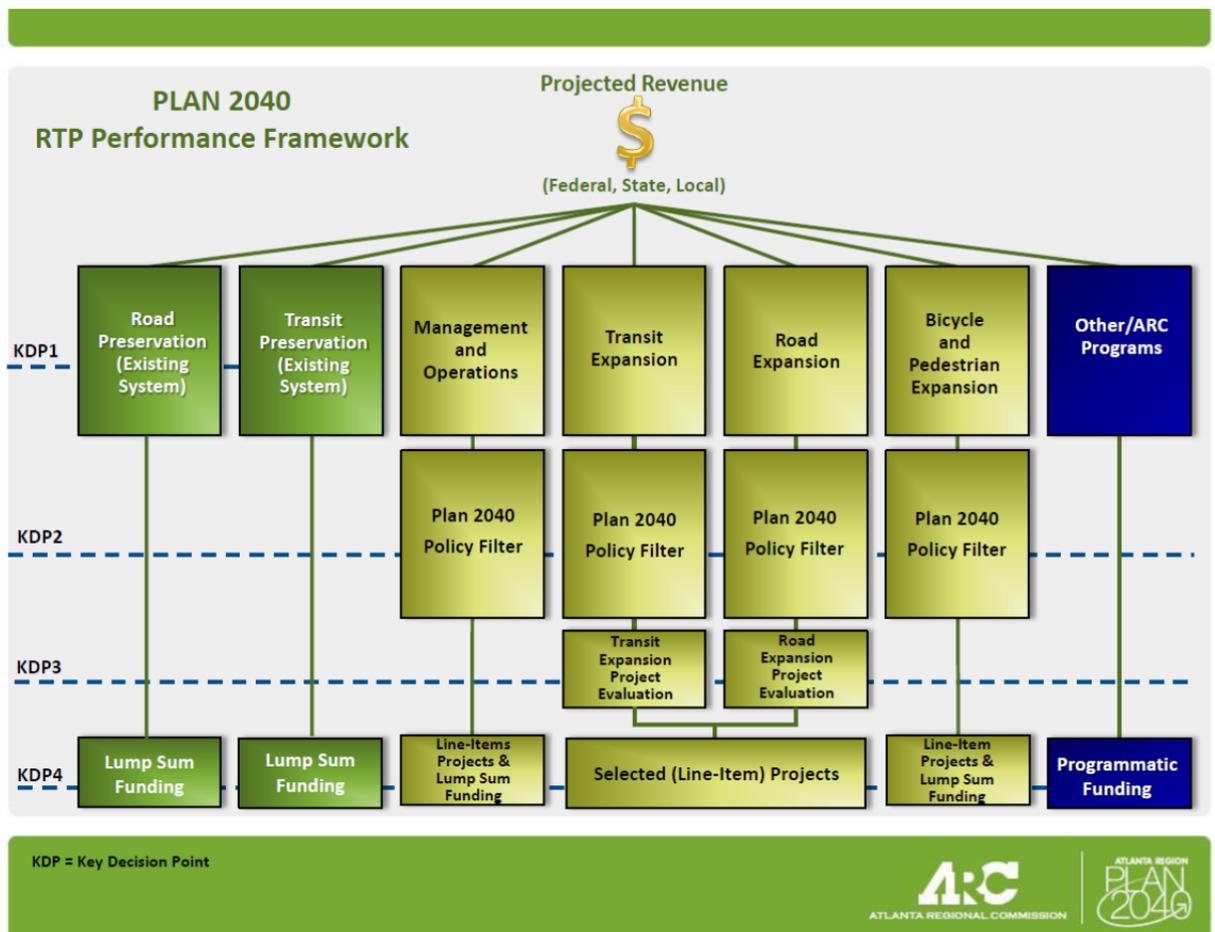


Figure 125: RTP Performance Framework

**Measuring Plan Performance**

Effective project selection will be guided by measurable objectives that support the plan’s overall vision, goals, and objectives, and which allow projects of very different types to be compared quantitatively against each other. The limited amount of funding available for project implementation increases the importance of this phase. Plan 2040 did use quantitative

Performance Measures to compare project and plan scenarios. However, we find that these measures are unable to capture the entirety of Plan 2040 vision and goals, including some which could be detrimental to health. The stated objectives are approximated for measurement with six transportation planning concepts, called “Emphasis Areas”. Figure 126 clarifies the relationship between the objectives and the six emphasis areas:

- Mobility
- Connections and Access
- Safety
- Economic Growth
- Community/Environment
- State of Good Repair

RTP Emphasis Area	Plan 2040 Objectives				
	Mobility Options for People and Goods	Healthy, Educated, Well Trained, Safe and Secure Population	Residential Choice in Locations Accessible to Jobs and Services	Energy and Resource Efficiency while Preserving Region’s Environmental and Critical Assets	Innovative Approaches to Economic Recovery and Long-Term Prosperity
Mobility	X				X
Connections and Access	X	X	X		X
Safety		X			
Economic Growth		X	X		X
Community/Environment		X	X	X	
State of Good Repair				X	

Figure 126: Objectives and emphasis areas

We find that the evaluation measures (shown in Table 7) could be enhanced to develop a transportation plan that will create health, economic stability, livability, and sustainability. Our recommendations to change or add measures follow. The listed items can be used as plan-level performance measures or discrete indicators to be explored by each division throughout the planning and implementation process. Note that certain measures have a land use element as well as transportation, which we consider necessary for comprehensive performance evaluation.

Table 7: Plan-Level Performance Measures used in Plan 2040

RTP Emphasis Area	Plan-Level Measure	(A) Description (B) Data Source
Mobility	Average Commute Time	(A) Average travel time by auto and transit for HBW trip per commuter.
Connections/Access	Activity/Employment Center Travel Shed	(A) Average number of workers reaching major activity/employment centers within 45-minute (autos and transit).

<b>Safety</b>	Injury/Fatal Crash Rate	(A) Number of injury and fatal crashes per 100M VMT.
<b>Economic Growth</b>	Jobs and Growth	(A) Change in GDP and jobs for the region resulting from travel time (delay) savings. (A) Peak-Hour Freeway Speed: Managed lanes, HOV versus General Purpose.
	Cost Savings	(A) Annual congestion cost savings.
<b>Community/Environment</b>	Emissions	(A) NOx, VOC, PM2.5, and GHG.
<b>State of Good Repair</b>	Roadway and Transit Condition	(A) Percent pavement, bridge, and transit infrastructure in good condition.

#### Recommended Plan-Level Performance Measures or Indicators

- Supplement “Number of injury and fatal crashes per 100M VMT” with an additional measure of “Number of injury and fatal crashes per 100K residents.” *The additional metric gives a more accurate picture of the actual risk ratio faced by residents, and supports efforts to reduce injury rates regardless of future increases or decreases in VMT.*
- Supplement “Average travel time by auto and transit for HBW trip” with “Average travel distance for HBW trip”, with a goal of reducing this metric.
- Supplement “Average number of workers reaching major activity/employment centers within 45-minute (autos and transit).” with “Percent of HH within 3 miles (network distance) of major or minor activity center/LCI” and “Ratio of housing to jobs within 5 miles (network distance) of major employment areas”
- Supplement “Percent pavement, bridge, and transit infrastructure in good condition.” with “Percent of roads identified in pedestrian/bike heat methods with pedestrian and/or bike facility.” and “Percent of sidewalk and path in good condition.”
- Replace “Annual congestion cost savings” with “Annual health savings,” which will include congestion cost savings and other peak travel metrics as components,
- Add “Reduction in per capita VMT”, “Percent of trips made by walking or bicycling”, and “Percent of trips made by transit”,
- Add “Percent of peak and off-peak trips for which transit is available” and “Discrepancy between transit and automobile travel times”; Target equivalent transit travel times between major activity centers and within regional core and employment corridors.
- Supplement “Peak-Hour Freeway Speed: Managed lanes, HOV versus General Purpose” with “Consistency of travel time at peak and at off peak, all modes”
- Supplement “NO<sub>x</sub>, VOC, PM<sub>2.5</sub>, and GHG” with “Trees and vegetation cover in right-of way”, “Impervious surface land coverage”, and “Percent of freight movement by rail”.
- Supplement “Percent pavement, bridge, and transit infrastructure in good condition” with “Percent of sidewalks and paths in good condition”, “Percent of sidewalk coverage in latent walking demand sites”, and “Percent of bicycle facility coverage in latent bicycle demand sites”.
- For stronger results, repeat calculations for vulnerable population and environmental justice areas

## The Decision-Making Process

Moving through the decision-making framework, KDP1 determines funding priorities among seven categories: road preservation, transit preservation, management and operations, transit expansion, road expansion, bicycle and pedestrian expansion, and other/ARC programs. However, even these fundamental decisions may have implications for health, safety,

economic opportunity, and other key outcomes. Setting levels of investment in these categories may not allow the shifts in mode share or reinvestment in existing developed areas that are needed to see the largest gains in active transportation, air quality, and access to jobs and services.

In KDP2, a project compilation list is generated from local, regional, and state plans. In order to more fully integrate health and equity objectives into project programming, work with local partners to include these considerations early on, as part of project identification.

Additionally, it is not clear how each of the review criteria will be weighed against the others. Road and transit preservation projects and programming are not judged against these criteria, which may result in a failure to identify and prioritize projects or programs which would be highly compatible with the UGPM, safety, or other forms of guidance. However, ARC already plans and funds projects such as “road diets” in roadway corridors to address UGPM criteria. ARC should continue to identify settings where the existing transportation infrastructure could be downsized to improve multimodal travel and reduce future maintenance costs, such as areas with unfinished, abandoned residential developments or aging retail sites with little probability of future fiscal viability, or urbanized areas where VMT is declining.

Road and transit expansion projects are evaluated in KDP3. Finally, KDP3 plans to use existing tools and methods, but it is important to acknowledge the constraints of these legacy analytical methods. Because they were developed around transportation planning goals of the past, they may not be suitable for meeting PLAN 2040 objectives.

In KDP4, the project list will be further constrained according to project sponsor priorities, regional equity, and project readiness. Waiting this long in the selection process to address questions of equity may not leave enough options for ensuring equitable outcomes, spatially or demographically. Sponsor priorities and readiness status may both have the potential to skew the project list away from innovative and health-promoting but non-traditional projects, such as those that would facilitate active transportation. The results from KDP3 are used again in KDP4, but it is not clear whether this only applies to the road and transit expansion projects that were actually reviewed in KDP3 and thus might favor them. At this stage, the project list is also brought to stakeholders, officials, and agencies for review. This only allows stakeholders to comment after major decisions have been made, not on each decision. The cumulative list of selected projects is then evaluated, but no benchmarks or performance measures are included to ensure that the cumulative list accomplishes PLAN 2040 objectives. Although the Plan 2040 process is constrained by available financial resources (and potential future economic and political change), an inclusion of measurements to guide fulfillment of regional objectives would likely bolster positive health impacts for the region.

Other questions about the decision process included whether we should be able to give lower preference to projects in Developing Suburbs, and should we be able to select against expansion projects that do not serve a defined center. For safety projects, evaluation must include specificity of lanes, width, speed, land use, existing and latent demand for bike/ped; factor by volume but not necessarily peak volume, as this may miss off-peak issues; high crash rates supports road calming/diet not expansion. Vehicle Hours of Delay was not found to be a valid type of project impact by our analysis. Although congestion relief is an important community priority, a more appropriate metric might be delay per person rather than delay per vehicle. Economic growth should be factored by travel cost of driving; and projects should not negatively impact the character or functionality of activity centers, and should not negatively impact communities by creating conditions for speeding during off-peak times. However project

evaluation should be based on volume of bike or pedestrian traffic, absence of alternate routes, adjacent land use, character/sense of place; also distance traveled.

Benefit-cost (B/C) analysis was used in KDP3, but only for road and transit expansion projects. The methodology was different for the two categories. Fuel cost is included in the road analysis, but not the full cost of driving. There are no lost land costs (for instance, economic value or tax revenue), and not all health costs (for instance, lost productivity) or environmental costs are included. Studies and recent projects suggest that reduced worker productivity plus employer health care costs due to unhealthy living could constitute a very large percentage of the cost of doing business. A 2007 study reported on several firms that had saved hundreds of millions of dollars in reduced health care costs and reduced absenteeism through strategies to improve employee health. The productivity savings were about four times larger than direct medical expenses (Loeppke, Taitel, Richling, Parry, et al., 2007). Meanwhile, a city in Mississippi received a 15% discount on their health insurance premiums in response to their employee health initiatives, allowing them to offer cost-of-living raises despite the economic downturn (Bailey, 2011). The potential business savings in a region of 2.5 million employees would be massive, and could exceed other economic productivity inputs, such as those associated with travel delay.

Also in the benefit-cost analysis, fuel savings calculations showed a decrease in fuel efficiency at high speeds, which is aligned with research which suggests the best fuel efficiency is found between 25 and 55 miles per hour (West, McGill, Hodgson, Sluder, et al., 1999). However, the findings of these calculations and their impacts on the benefit-cost analysis should be clarified, since currently higher speeds appear to be favored. Additionally, we recommend running scenarios with potential changes in fuel cost through 2040. In emissions measurement, it is especially important to compare TDM against road expansion projects and to factor induced demand. In the methodology used, new streets scored well, which is consistent with other studies. Road widening tended to have very low B/C scores and relatively low safety scores. We recommend that project selection establish a minimum benefit-cost or performance score and reallocate funding if the amount of funds exceeds the value of the high-scoring projects

### Recommendations

- **Capitalize on good objectives.** The guidelines for development types are conducive to creating healthy communities but needs a stronger commitment, clearer design and policy details, quantifiable metrics, and better coordination from the transportation project list. ① ②
- Apply metrics directly to the objectives, without the intermediary Emphasis Areas. Work with subject matter experts to incorporate valid measurements and criteria for the objectives. Identify how conflicts between objectives, should they occur, will be resolved. ① ②
- Consider externalities in cost-benefit analysis to consider the full costs of transportation programming decisions and potential health impact. Pursue new analytical tools that are compatible with stated goals and objectives; partner with subject matter experts to access tools and methods outside of conventional transportation planning. ① ② ③
- Rank all projects on their performance and benefit-cost results, and select the best performing projects regardless of their classification, excluding low-scoring projects. Some grouping may be utilized if the results are heavily skewed, for instance on a geographic basis. ① ② ③

- Clarify studies and ARC board policy used to set the policy filter. Determine weighting of the various filter components; consider the challenges of UGPM scope; include an option for negative growth or attrition; consider if legacy projects still qualify. ①②
- Consider equity, from a spatial and population-based perspective, at the beginning of the process and develop a procedure to consider equity through each decision point. ①②⑦
- **“Plan Level Performance Measures” do not adequately measure pedestrian access, bicycle access, transportation cost, multimodal access for children and seniors, transportation costs, or other important health impacts.** The performance measures rely on traditional metrics, such as car and transit travel time, crash rates, regional emissions modeling, and driving speed. Impact on community and environment was measured as regional emissions. While the metrics that were used can be elements of a healthy, thriving region, the thesis of this report is that other key measures are essential to the overall quality of life, social justice, and economic productivity of the region. Metrics suggested throughout this report should be used in performance evaluation. ①②③
- **Fully consider Plan 2040 objectives (including health) in investment decisions.** This analysis has identified potential positive and negative impact that would likely result from roadway, transit and bicycle/pedestrian transportation projects. Given the constraints of funding sources and the cost differentials between various transportation modes, investment in bicycle/pedestrian and transit projects should be increased where feasible. Analysis and evidence from public health literature indicates that increasing bicycle, pedestrian and transit access may realize significant health benefits. ①②③
- **Evaluate projects carefully using suggested metrics, and conduct a rapid or intermediate project-level health impact assessment if needed.** Bicycle, pedestrian, and transit projects are likely to promote health. Safety and road reduction projects are likely to improve health when context-sensitive, especially if they are implemented in areas with high crash rates. Road pricing may improve health, primarily on existing lanes. New roads may have better health impact and benefit-cost ratio than expanding existing roads. In the present and for the foreseeable future, the Atlanta region is generally automobile-dependent. However, road capacity projects appear likely to negatively impact health unless they maintain a contextually-appropriate balance between access and mobility, and provide robust pedestrian and bicycle facilities. All transportation projects should be evaluated to ensure that they increase connectivity, reduce barriers, and create short routes with multiple route options for pedestrians and cyclists. All road projects should meet the best practices for multimodal facilities as described above. Pedestrian connections should be implemented where street connections are abandoned. ①②③④⑤⑧

## Developing a Healthy Planning Framework

### Collaborating with Local and State Public Health Departments

The initial challenge to introducing health outcomes into the regional planning process is to understand the health problems of interest, the sources of data about them, and the planning and programmatic elements that affect them. This subject matter expertise already exists in health agencies, which tend to be very receptive to new working relationships. As awareness has grown about links between the built environment and public health, these agencies are interested in creating healthy places for their constituents to live and work. At initiation, agency liaisons may need to learn new terminology or concepts, but fortunately there are many training and technical assistance options for cultivating formal and informal working relationships between public health and planning organizations. The basic elements of this relationship should include: data sharing, regular meetings to plan and prioritize activities, workshops to build inter-organizational capacity, and regular presentations to directors. 2 8

### Measuring Health Determinants

Some of the potential health metrics that were identified in this HIA could not be appraised due to a lack of data. For instance, lack of a complete sidewalk inventory on regionally-significant roads constrains potential walkability analysis. Table 8 lists some of these potential data. Gathering this data would provide expanded opportunities for analysis to achieve Plan 2040 objectives. 2 8

**Table 8: Proposed Health Determinant Data Elements**

Section	Data Elements
<p>Safety and security Core concepts: Injury related deaths &amp; disabilities; impact of perceived risk on healthful behaviors Analysis:</p> <ul style="list-style-type: none"> <li>Exposure to crash risk: crash rate by residence, crash rate by location</li> <li>Crime and intentional injury: violent crime and homicide rates</li> </ul>	<ul style="list-style-type: none"> <li>Aggressive driving data</li> <li>Traffic violation data</li> <li>Crime data controlled for demographic profile</li> <li>Emergency response rates</li> <li>Violent crime data</li> <li>Perceived safety of RSTS transportation facilities and communities</li> </ul>
<p>Access to jobs, housing, services, and goods Core concepts: Interrelationship between economic status and health (productivity, cost of healthy food and housing, access to health care, mental health, children/opportunity, crime); relationship between household and regional economy (unemployment, cost of services); determinants of household budget (income, benefits, cost of living &amp; economic choices) Analysis:</p> <ul style="list-style-type: none"> <li>Travel time and cost to work</li> <li>Congestion and demand</li> <li>Job or school access relative to travel mode</li> <li>Residential locations available by travel mode</li> </ul>	<ul style="list-style-type: none"> <li>Health-related quality of life data</li> <li>Household transportation costs</li> <li>Utilization rates of public services</li> <li>Unemployment distribution controlled for geographic and demographic correlates</li> <li>Consumption of fruits and vegetables controlled for demographic profile</li> <li>Delivery or utilization of mobile services</li> <li>Centricity</li> <li>Utilization of child care services</li> <li>Voter turnout</li> <li>Property values and commercial rents</li> <li>Ratio of diagnosis to death vs. treatment</li> <li>Primary care home rates</li> <li>Travel time to grocery, medical facility,</li> </ul>

<ul style="list-style-type: none"> <li>• Travel time and cost to healthy food sources (relative to unhealthy/costly food sources)</li> <li>• Concentration of poverty</li> <li>• Economic impacts of access</li> </ul>	<p>church/community center</p>
<p>Active living Core concepts: Role of physical activity in various diseases/leading causes of death; challenges of intentional physical activity programs; recommended vs. actual physical activity rates Analysis:</p> <ul style="list-style-type: none"> <li>• Walking, bicycling, other active travel as viable mode options for trips (including as portion of trip)</li> <li>• Perceived and actual safety of walking or bicycling</li> <li>• Level of service for bicycle or for pedestrian (Bruce Landis, see Decatur LDS, Atlanta Aerotropolis, TRR, see ARC's bicycle and pedestrian plan)</li> <li>• Distribution of recreational facilities</li> </ul>	<ul style="list-style-type: none"> <li>• Pedestrian mode share in region</li> <li>• Pedestrian mode share in local area</li> <li>• Pedestrian facilities</li> <li>• Detailed land use</li> <li>• Passenger counts from transit providers</li> <li>• Pedestrian Level of Service on all RSTS</li> <li>• Bicycle mode share in region</li> <li>• Bicycle mode share in local area</li> <li>• Bicycle facilities</li> <li>• Bicycle Level of Service on all RSTS</li> <li>• Obesity and overweight rates</li> <li>• Obstructive (ischemic) heart disease</li> <li>• Hypertension and hypertensive heart disease</li> <li>• Stroke</li> <li>• Breast, colon, and prostate cancer</li> <li>• Diabetes diagnosis</li> </ul>
<p>Environmental quality Core concepts: Contribution of environmental hazards to disease, precautionary principle; conservation/control vs. remediation; economics of environmental quality Analysis:</p> <ul style="list-style-type: none"> <li>• Exposure to nature</li> <li>• Air pollution</li> <li>• Noise</li> <li>• Water and soil pollution</li> <li>• Urban climate</li> <li>• Global climate change</li> <li>• Environmental justice</li> </ul>	<ul style="list-style-type: none"> <li>• Vehicle mode share</li> <li>• Rates of trip generation</li> <li>• Changes in vehicle miles traveled (VMT)</li> <li>• Motor fuel purchases</li> <li>• Land cover (e.g. vegetative)</li> <li>• Local pollution levels</li> <li>• Full list of contamination sources such as landfills, industrial activities</li> <li>• Environmental monitoring data of such uses Planning and regulation guidelines for lot size, FAR, energy efficiency</li> <li>• Energy consumption</li> <li>• Asthma, respiratory, cardiovascular hospitalizations, heat-related hospitalizations</li> </ul>
<p>Public life &amp; social connection Core concepts: definitions of health including emotional well-being and ability to change environment Analysis:</p> <ul style="list-style-type: none"> <li>• Social capital</li> <li>• Civic participation</li> <li>• Mental illness</li> </ul>	<ul style="list-style-type: none"> <li>• Mental health data</li> <li>• Data on volunteering/participation in activities</li> </ul>
<ul style="list-style-type: none"> <li>• Performance measures</li> <li>• Mode share</li> </ul>	<ul style="list-style-type: none"> <li>• Regional vehicle miles traveled (VMT)</li> <li>• Local average daily traffic</li> </ul>

### **Engaging Stakeholder Advisory Groups**

ARC already engages in robust public outreach, including the use of citizen advisory groups representing various classes of stakeholders. ARC and its staff also have a history of collaboration with other agencies, researchers, and advocacy organizations. In order to foster healthy regional planning, these relationships will be important, and could be enhanced to include a wider range of health experts and public health issues. 2 7 8

### **Prioritizing Health**

As discussed in prior sections, Plan 2040 included health in its goals and objectives, but needed additional tools to ensure that these goals were reflected at each step of the planning and project selection process. ARC can use its relationships with health agencies and stakeholders, as well as the growing number of examples around the U.S., to ensure that a comprehensive set of metrics representing health determinants is used to create a healthy, evidence-based regional strategy. 1 2 3

### **Using Best Practices**

Several health impact assessments of regional or large-area planning are summarized on page 35. Additionally, other metropolitan planning agencies have been working to integrate health into their plans. Nashville-Davidson County and the Nashville Area Metropolitan Planning Organization have prioritized walking and bicycling infrastructure in order to increase physical activity and improve regional mobility and productivity; their current plan allocates 25% of transportation funding to these projects. San Francisco's Metropolitan Transportation Council and Association of Bay Area Governments introduced health metrics in their Plan Bay Area Project Performance Assessment (currently under final review). In their benefit/cost analysis, benefits include travel time; emissions (CO<sub>2</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, ROG, NO<sub>x</sub>); health costs due to level of physical activity; collisions causing injuries, fatalities, or property damage; direct user costs (vehicle operating/ownership); and noise, while costs include capital expenditures and net operating & maintenance expenditures. Their overall performance targets include CO<sub>2</sub> emissions reduction; adequate housing; particulate matter reductions (PM<sub>2.5</sub> emissions reduction, PM<sub>10</sub> emissions reduction, PM emissions reduction in environmental justice communities); injury and fatality collision reduction; increase in minutes of active transportation (walking/biking); open space and agricultural preservation; decrease in low-income expenditures on transportation; economic vitality; mode distribution (decrease in per-trip non-auto travel time or increase in non-auto mode share, VMT reduction); and state of good repair. These metrics are applied to all uncommitted projects, across project categories, and are intended to create a "level playing field" for project comparisons. They are complemented with equity goals that include an emphasis on housing and transportation affordability, elimination of concentrated poverty and displacement, and travel time for non-work purposes. 1 2 3

## Programs

### Livable Centers Initiative

The Livable Centers Initiative (LCI) is one of ARC's primary land use focused programs, and it is categorically the most popular. The LCI was conceived when the ARC Board adopted policies in the Regional Transportation Plan (RTP) proposal in May 1999 to provide funding for investment studies and transportation projects located in activity and town centers in the region. LCI gives individual communities the opportunity to apply for the resources necessary to create plans that link transportation improvements with land use development strategies, and thus improve the quality of life for residents. Then, after the plan has been created, the communities are eligible to apply for funds to implement specific transportation projects. It also serves to encourage a combination of inventive yet careful local level planning. It allows for a great deal of community involvement and location specific development. LCI was even given the 2008 National Award for Smart Growth for the program's "innovative approach to development that expands economic opportunity and protects public health and the environment." (ARC, 2007) The Livable Centers Initiative program provides both planning and transportation infrastructure funding to government jurisdictions and provides planning funds to non-profit organizations in the 18-county Atlanta Metropolitan Planning Organization (MPO) boundaries (includes all of 13 counties and portions of 5 additional counties).

LCI is currently the product of partnerships between ARC and the Georgia DOT, FHWA, local governments, non-profit organizations, business, and residents in the Atlanta region. The committee that selects studies for funding each year includes organizations such as the Urban Land Institute, Trust for Historic Preservation, Georgia Conservancy, and the Center for the New Urbanism, among others. Partnerships are also sought during the implementation of completed LCI plans.

#### LCI Application and Site Selection process

The LCI program is open for funding to government jurisdictions and non-profit organizations in the 18-county Atlanta Metropolitan Planning Organization (MPO) boundaries (includes all of 13 counties and portions of 5 additional counties). In order for a jurisdiction to be considered for an LCI award, it must maintain Qualified Local Government (QLG) status (as designated under the Georgia Planning Act), or show progress toward reinstating QLG status through the Georgia Department of Community Affairs (DCA). The LCI study must also be located in a qualified study area: a town center, activity center, or corridor, or an emerging regional center or corridor.

The fundamental concepts the LCI study areas follow include connecting homes, retail shops, entertainment, and offices; enhancing streetscapes and sidewalks; emphasizing the pedestrian; improving access to transit and other transportation options; and expanding housing options.

The program promotes studies that will:

- 1) Encourage a diversity of residential neighborhoods, employment, shopping and recreation choices at the activity center and town center level; housing should be given strong focus to create mixed-income neighborhoods and support the concept of "aging in place";
- 2) Provide access to a range of travel modes including transit, roadways, walking and biking to enable access to all uses within the study area; and,

- 3) Develop an outreach process that promotes the involvement of all stakeholders (including those not often involved in such planning efforts).

ARC's innovative Livable Centers Initiative (LCI) has been used to reduce traffic congestion, boost economic development, and improve quality of life. It also supports many characteristics of healthful community design. Active transportation: mixed use, higher density, and traditional interconnected street network, combined with pedestrian and bicycle amenities. Access to jobs and housing: a wider range of housing choices, creation of concentrated employment centers, small business opportunities, and better transit access. Access to goods and services: stores and small offices are located in walking distance from homes and transit. Reduce motor vehicle mileage and volume: shorter distances to destinations, and walking, bicycling, and transit are more competitive with driving in terms of convenience, cost, and comfort. Restore civic life: create public spaces, revitalize town centers, facilitate neighborhoods. Preserve environmental quality: concentrate more development in a defined district to reduce pressure on undeveloped land.

The LCI 2007 Implementation Report included a Livability Analysis, which surveyed the perceptions and experiences of LCI users. 66 percent of the study communities reported that they agree or strongly agree that there are more opportunities to walk or bike in the LCI area. 62 percent responded in agreement that bike and/or pedestrian activity has increased. However, respondents mostly disagreed that bicycling or walking had become safer, or that public transit options had improved. A 2008 study conducted by a research assistant at CQGRD determined that LCI objectives correspond closely with healthy places characteristics. The "centers and corridors" planning orientation promotes density, mixed use, traditional street network, bicycle and pedestrian infrastructure, and transit oriented development. These principles are linked to healthful design that is likely to:

- Increase multimodal and active travel: increase physical activity and civic engagement
- Reduce VMT: reduce injury/fatal crashes, emissions, household transportation costs
- Reduce distance: increase access and productivity, may increase congestion but still decrease total travel time

## **Recommendations**

In order to capture more health benefits from the LCI program:

- Operationalize HIA and healthy community design in LCI studies. ① ②
- Ensure that the full range of housing sizes, prices, and terms are permitted relative to regional household types, life phases, and incomes within contracts between ARC and the local LCI sponsor. ② ④ ⑤
- Continue to explore using rigorous assessment to ensure that transportation investments are appropriate to the LCI vision, and that these areas receive some level of priority in funding disbursement. ① ② ③
- Include senior housing opportunities, including retirement and assisted care communities within contracts between ARC and the local LCI sponsor. ② ④ ⑤
- Encourage environmental quality in buildings and transportation projects – promote use of EarthCraft standards, LEED and LEED-ND standards, Green Streets, and similar programs. ② ④ ⑤
- Continue to encourage zoning that conforms to recommendations regarding block size, connectivity, and street width through incentives. ② ④ ⑤
- Encourage accommodations for public and private gardens, farm stands, and farmers markets. ② ④ ⑤

- Encourage parking regulations and pricing that are appropriate through incentives. 2 4 5
- Work with the Federal Highway Administration and GDOT to develop an expedited assessment process for small transportation projects that use LCI funding. 2
- Continue to encourage funding opportunities such as Community Improvement Districts and Tax Allocation Districts as a way to build, operate, and maintain LCI enhancements. 2
- Develop incentives for property owners to contribute public enhancements, such as shuttle services, plazas, or streetscaping. 2 4 5
- Dampen development outside of LCI locations – explore a program to transfer development rights to LCI property, encourage local jurisdictions to preserve and expand rural, agricultural, and estate zoning, and develop land conservation programs. 2 4 5
- Evaluate LCI recipients for their implementation of healthy zoning ordinances (as guided by CQGRD’s Healthy Places Ordinance Audit or San Francisco’s Healthy Development Measurement Tool), for their ability to provide access to daily needs (such as grocery stores and medical offices), and for the degree of equitable development. 1 2

## Lifelong Communities strategies and solutions

Lifelong Communities (LLC) has established the following objectives for the region to accommodate its aging residents:

- Promote Housing and Transportation Options:
  - Integrate older adults into local land use and community planning processes
  - Develop policy to promote housing options for older adults
  - Develop housing and housing programs for older adults
  - Include older adults in planning for and construction of new transportation projects
  - Improve capacity of older drivers
  - Improve public transit to serve the needs of older drivers
  - Improve existing social service transportation systems
  - Eliminate the need for older adults to drive
- Encourage Healthy Lifestyles:
  - Improve access to preventative healthcare and basic services
  - Keep older adults active and engaged
  - Educate older adults on critical health issues
  - Improve capacity of local health system to serve growing older adult population
- Provide Access to Services and Resources:
  - Educate older adults and caregivers about services early and often
  - Improve linkages among community based service providers

We find that these objectives capture the major land use and transportation issues for senior citizens, as well as for other residents that might experience mobility issues. We emphasize that these features of the built environment address multimodal transportation and livable centers, and thus connect to the Livable Centers Initiative. However, we find that Plan 2040 should go further to address the development of places suitable for aging. In particular:

- Increase share of multimodal funding in project list (pedestrian and transit capital, and transit operations), and ensure that projects are being conducted for areas projected to have a significant elderly population. 1 2 7
- Aggressively pursue LCI development. 2 4 5

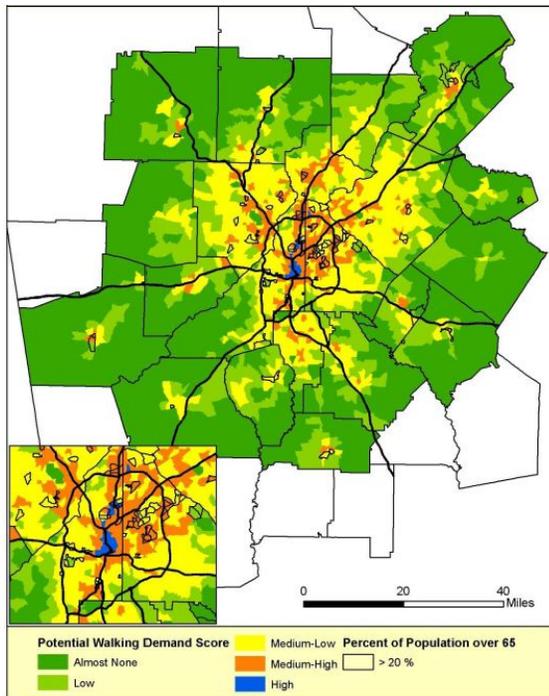
- Address senior housing and access needs in LCI and other plans and zoning. 2 4 5
- Address non-work trips more widely in transportation planning. 2
- Work with local jurisdictions to significantly increase the number of homes with one no-step entrance and one ground floor bathroom with a 36" doorway. 2 4 5

## Bicycle and Pedestrian Planning

Good bicycle and pedestrian accommodations stood out as an important element for improving physical activity, safety, social interaction, environmental quality, and access. However, creating safe and appealing options to walk or ride a bicycle can be much more complex than installing a sidewalk, crosswalk, or bicycle lane. The selected facilities must be appropriate to the land use context, motor vehicle traffic, and pedestrian or bicycle traffic. In some cases, additional road treatments must be provided to ensure that the design will operate safely for all users. With the constrained amount of transportation funding available, prioritizing projects is an important task as well. Planning exercises must consider capacity issues (improving travel for current pedestrians and cyclists, or enabling untaken trips) as well as travel demand management or trip substitution (providing a competitive pedestrian and/or bicycle alternative to driving, see below). Either way, it is important to provide a high level of service as described on page 162.

ARC currently prioritizes segments of their bicycle network based on existing bicycling conditions; potential bicycle travel demand; public input; severity of congestion; relative level of bicycle-friendly policies enacted by jurisdictions requesting assistance with a given project; whether or not a segment passes through an LCI site or a Station Community, and (unit) facility construction cost. They will also consider segments on the Regionally Significant Thoroughfare System (RSTS) that are a priority bicycle route on a local plan. The current bicycle network could see some expansion in order to reach more activity centers. ARC has also explored the use of Latent Demand Scores (LDS).

LDS is a GIS based analysis which was applied to determine latent, or potential, demand for bicycling and walking on the existing road network in the study area. LDS uses a gravity model designed to rank road segments based on their proximity to different types of major attractors and the probability that someone will walk or bike a certain distance to those different types of attractors. To calculate the score, researchers first identify the existing land uses in the study area. The land uses are then assigned a standardized trip generation rate based on the attractiveness of the destination, using the Institute of Transportation Engineers' *Trip Generation Manual* (6<sup>th</sup> Edition, 2003). These trip generation rates represent the decision to travel for a given purpose. Once the average number of trips is calculated for each land use, the uses can be categorized into broad groups. Next, employee counts for retail and non-retail business locations are obtained from available commercial sources, which are used to identify activity clusters. The employee activity nodes can be spatially located using GIS within the study area along with the land use nodes categorized into the following primary categories: school, work, recreation, or shopping. The number and type of destinations within walking or bicycling distance of each road segment is calculated, giving each segment a weight based on the number of trips potentially generated along it. These scores are factored for the overall propensity to walk or to bicycle to a destination within that distance, based on studies in the Atlanta region.



**Figure 127: Potential Walking Demand Score (ARC, 2010)**

Prepared by Atlanta Regional Commission.

LDS has often been used in prioritizing pedestrian and bicycle facilities or routes, and CQGRD has successfully used this process in the Atlanta area. However, LDS does not perform as desired at the regional scale. It does not scale up well to the regional level due to the discontinuity of land uses and the overriding interest in longer-distance, multi-jurisdictional travel. The granularity of the data tends to be insufficient, and the distances of interest too great. However, funding for regionally-significant pedestrian facilities is important for a cohesive multimodal transportation network. Additional data collection regarding current levels of bicycle and pedestrian traffic will be required in future planning efforts. LDS techniques should be used within LCI, activity center, and corridor studies, but supplementary methods may be more effective at the regional scale: 2 4 5

- The San Francisco Department of Public Health Pedestrian Injury Forecasting Model operates using roadway, parcel, and Census tract data to identify potential hazard areas. CQGRD did not apply this or other ranking methods due to insufficient data. The methodology can be found at <http://www.sfpbes.org/elements/24-elements/tools/108-pedestrian-injury-model> and CQGRD can provide the accompanying research article.
- For bicycle planning, the Bicycle Heat Model used in Montgomery County, Maryland adapts LDS concepts for local and regional bicycle trips. The heat map uses 11 factors to estimate demand for bicycle transportation at the census block group level. See [http://www.montgomeryplanning.org/transportation/bikeways/bicycle\\_demand\\_map.shtm#method](http://www.montgomeryplanning.org/transportation/bikeways/bicycle_demand_map.shtm#method).

Table 9: Bicycle Heat Model

FACTOR	RATIONALE	WEIGHT	DATA SOURCE
<b>Residential Density</b>	<i>Most trips start or end at a home or job making residential and employment clusters the major indications of the demand for bike travel.</i>	0 to 30 points	Parcel Data or Census
<b>Employment Density</b>		0 to 30 points	Economic Data (e.g. Claritas)
<b>Through Trip Demand</b>	<i>While other factors capture the demand for bicycle facilities in major activity centers, this factor captures the desire to travel between activity centers.</i>	0 to 15 points	Planning Dept GIS
<b>Proximity to Rail Station</b>	<i>Cycling is a solution to the "last mile" problem, the distance between one's home or work and a mass transit stop, especially.</i>	0 to 30 points	Transit GIS
<b>Proximity to Bus Route</b>		0 to 3 points	Transit GIS
<b>Proximity to Retail Centers</b>	<i>Those major destinations generate demand for people to cycle. Community facilities may include libraries, parks, recreation centers, and other civic buildings.</i>	0 to 3 point	Planning Dept GIS
<b>Proximity to Community Facilities</b>		0 to 1 point	Planning Dept GIS
<b>Proximity to Elementary Schools</b>	<i>Students that live close to a public school are more likely to bicycle, because school bus service is typically only provided to high school students living more than two miles from school, middle school students living more than 1.5 miles from school, and elementary school students living more than one mile from school.</i>	0 to 3 points	Planning Dept GIS
<b>Proximity to Middle Schools</b>		0 to 3 points	Planning Dept GIS
<b>Proximity to High Schools</b>		0 to 3 points	Planning Dept GIS
<b>Proximity to Universities</b>	<i>College students tend to bicycle more than any other group. Many students lack cars; others do not wish to pay for limited parking.</i>	0 to 3 points	Planning Dept GIS

- For pedestrian planning, we have proposed a “pedestrian heat” prioritization model. To use the measurements, road segments and pedestrian-specific facilities will take a score on each of the above factors or remain null. Any scored segment should be entered into the regional pedestrian network. The sum of the scores indicates overall priority of pedestrian facilities. Be sure to acquire or conduct an inventory of existing facilities. Facilities should include, at minimum, 5’ sidewalks, 4’ planting/ furniture/ utility zone, crosswalks at all intersection legs including major driveways, and lighting. If traffic volume is over 25,000 vehicles per day, it should include crossing medians and other traffic management treatments. Areas around schools and other places where children are expected may require enhanced street crossing aids. Areas with high elderly or immigrant populations will require special considerations regarding signs, crossing aids, signal timing, etc.

**Pedestrian Heat Prioritization Categories:**

- 1) Pedestrian mobility and access along regionally-significant roadways (.25 mile airline buffer)
  - a) Current land use intensity (residential density, employment density, commercial density) – 25%

- b) Current mix of land use (at least two of following within .25 miles: residential, office/institutional, commercial) – 15%
  - c) Lack of alternate route (no continuous parallel road or path within .125 mile) – 10%
  - d) Future intensity (zoning) – 10%
  - e) Future mix – 10%
  - f) Community reliance (percentage of carless households, percentage of households in bottom income quintile) – 10%
  - g) Severity of chronic disease associated with lack of access to goods or settings for physical activity (top 10% for age-adjusted hypertension, hypertensive heart disease, ischemic heart disease, stroke, diabetes) – 10%
  - h) Total traffic volume – 10%
- 2) Pedestrian access to transit stations
- a) .5 mile network buffer around stations of existing high-capacity/intensity transit lines with widely spaced stops (MARTA heavy rail, express bus or vanpool service)
  - b) .5 mile network buffer around proposed high-intensity transit stations (BRT, commuter rail)
  - c) Cumulative score where more than one station is proximate
  - d) Optional – factor by ridership unless inadequate pedestrian infrastructure is suspected of impacting ridership
- 3) Pedestrian access along transit corridors
- a) .25 mile airline buffer along frequent-stop transit lines (bus routes, streetcar lines)
  - b) Facilities for travel along, to, and across the corridor
  - c) Optional – factor by ridership unless inadequate pedestrian infrastructure is suspected of impacting ridership
- 4) Pedestrian access to significant facilities
- a) .5 and 1 mile network buffer around major destinations or facilities: airports, stadiums/arenas, parks, shopping centers, town centers, employment centers, colleges/universities, LCIs
  - b) .5 and 1 mile network buffer around schools
  - c) Cumulative score where more than one destination is proximate
- 5) Pedestrian risk zones
- a) Roads with high rate of pedestrian injury or fatality
- 6) Livable Centers
- a) Any regionally-significant road in the boundaries of an LCI or similar local designation (City of Atlanta SPI)

**Additional considerations for pedestrian heat prioritization:**

Places that may require a new road or a pedestrian path or bridge.

- 1) Gaps and barriers
- a) Areas of high pedestrian access rates as defined in items 1a, 1b, 1d, 1e, 1f not served by any regionally significant roadway or pedestrian facility, and where the road network is largely discontinuous
  - b) Areas of high pedestrian access rates as defined in items 1a, 1b, 1d, 1e, 1f in which a transportation facility that does not serve pedestrians is located, such as a railroad, waterway, or limited access highway

## Travel Demand Management

Travel Demand Management, or TDM, can refer to initiatives which shift trips away from over-utilized transportation resources. In the Atlanta region, it generally refers to shifting rush hour drive-alone trips to carpooling, vanpooling, transit, walking, bicycling, telecommuting, or working alternate hours. Some TDM initiatives may have a greater impact on health than others. For instance, replacing a driving commute with a bicycle commute or a commute by walking to the train would likely see a large increase in physical activity and large reduction in emissions; replacing a driving commute with a shorter drive to a park-and-ride lot and then a bus trip would have a smaller impact on emissions, a smaller impact on capacity, and no impact on physical activity. We recommend a TDM program selection process that favors more healthful forms of transportation and land use. For instance, vanpool and commuter bus stops in activity centers could increase non-motorized access for nearby residents; a parking facility in the center might increase traffic but could also revitalize local businesses with foot traffic. Similarly, safe bicycle and pedestrian routes to existing park-and-ride lots could increase this mode share, and potentially reduce the need for more motor vehicle capacity. ① ② ③

## Reducing Regional Health Disparities

The region cannot achieve its best level of health and productivity if health disparities persist for some of its members. In addition to efforts by local health departments and other agencies, the regional planning process must ensure that benefits and potential risks from development, zoning, special uses, and transportation projects are distributed equitably amongst the population. Additionally, ARC is encouraged to pursue a strategy to further mitigate or minimize harms in health disparity areas, and to target these areas with additional programming as appropriate. For instance, areas with many low-income households, high joblessness, and low levels of car ownership might receive additional transit and last mile connectivity projects to improve access to regional employment opportunities, or might receive technical assistance in developing an employment-oriented activity center. Road projects in areas with low car ownership are likely to have additional design considerations to ensure that residents have safe crossings at transit stops (for instance, at least every 600 feet or at each intersection along bus routes).

### Recommendations

- Land use plans should ensure an adequate amount of quality housing can be created in walkable, transit accessible places for lower-income and aging households. ②
- Transportation funding distribution should be generally representative of transportation demand, with accommodations for latent demand. For instance, if about 10% of households in the region are currently carless, then at least 10% of transportation funding in the TIP should be allocated to providing pedestrian and bicycle access to employment and commercial destinations, neighborhoods, and transit stops; if the percentage of non-drivers could total 20%, 30%, or more in 2040 (including children, a larger elderly population, and the slowly-increasing number of people with disabilities) then that proportion of long-range funding may be required to provide adequate access by non-motorized modes to transit stops and daily needs, in addition to adequate transit capital and operations dollars to service this percentage of the regional population. ② ③ ⑦
- Equitable target areas and other forms of equity or environmental justice assessment should include health risk factors. ② ③

# Conclusion

## Summary

The Atlanta region is facing many health challenges, but planning, guidance, and leadership from the Atlanta Regional Commission and its partners is positioned to guide the region to a healthier future. Plan 2040 began to establish goals and strategies for such a transformation. However, healthy regional planning will require updates to many standard practices, from data collection and analysis, to planning and performance measurement, to project evaluation. This report offers extensive guidance for new methods and policies, and technical assistance will continue to be available (see Next Steps, below). The key recommendations to be considered are:

- Design and development
  - Diversify mode share
  - Increase connectivity
  - Increase centeredness and conserve land outside of centers
  - Design transportation facilities with greater consideration of land use, land access, and multimodal travel
  - Reduce or mitigate land use-transportation conflicts
- Planning methods
  - Include a wide range of health indicators in performance measures and data analysis
  - Standardize project ranking
  - Collaborate with organizations that represent health interests
  - Establish priorities around health
  - Reduce disparities
  - Use HIA
- Programs and implementation
  - Ensure that program goals are fully represented in plans and projects
  - Include health metrics
  - Aim for excellence

## Next Steps

A Health Impact Assessment does not truly conclude until the project, plan, or process it addresses is completed. During that time, the HIA team may make repeated presentations to the decision-makers and various stakeholder groups, advise decision-makers on effectively implementing the HIA recommendations, and evaluate the implementation and resulting health outcomes. In the case of the Plan 2040 HIA, CQGRD has presented recommendations that apply not only to the implementation of the plan itself, but also extensive recommendations that apply to the planning process as conducted by ARC and the policies of external agencies that govern the process. These recommendations will stand not just to the year 2040, but for the entire future of regional planning in the Atlanta metropolitan area.

CQGRD proposes to partner with ARC in order to provide technical assistance to support healthy regional planning. Such partnership could include training for ARC staff, presentations to ARC boards and leadership, presentations to ARC constituents and stakeholders, collaboration on development and testing of new models or performance measures, and evaluation of planning outcomes. While a limited amount of presentation, guidance, and evaluation has been incorporated into the Center's

planned activities, more extensive initiatives could be funded by ARC, other agencies, or interested foundations.

In order to fully implement healthy planning, ARC and its partners will need to advocate for policy changes from the U.S. Federal Highway Administration, U.S. Federal Transit Administration, Georgia Department of Transportation, and Georgia Department of Community affairs. With the recent adoption of transportation reauthorization (MAP-21), new performance based planning requirements will impact regulations and processes for project development and selection. These new policy regulations may impact the implementation of some recommendations of this HIA.

Some changes may have to be initiated or approved by the legislative bodies that govern these agencies. In particular, ARC might request:

- Changes in transportation funding formulas to allow greater flexibility between modes
- Changes in transportation policy to support use of evidence-based performance measures that foster health and sustainability
- Changes in transportation funding formulas to offer favorable local match rates based on performance score rather than mode
- Changes in planning policy to allow greater coordination of interjurisdictional land use planning
- Changes in planning policy to allow greater incentivization of land use-transportation coordination

This HIA applied the best available health and planning research to understand the likely causes of current health challenges and anticipate the impact of the proposed plans and projects. However, there are some unavoidable limitations of this activity. Unforeseen economic or demographic trends may affect the regional environment or population, research and best practices may continue to evolve, and anticipated plan-level or categorical impacts may be different at the project level due to variations in the setting or the impacted population. Additionally, the scope of the regional plan did not allow in-depth assessment of each project or planning element. Health impact assessment methodology could be extremely useful, at a rapid or intermediate scale, on specific transportation projects, developments of regional impact, city and county comprehensive planning and ordinance updates, and other plans and programs such as water management, greenspace, workforce development, or commute options. Additionally, ARC could enable healthy planning with specific changes in the data that the agency collects or accesses, and introduction of performance measures related to these metrics.

## Evaluation

The effectiveness of the Atlanta Regional Plan 2040 Health Impact Assessment was not evaluated during the HIA process. Rather, evaluation was proposed in the following format:

- Following completion of the report, CQGRD will invite product and process evaluation review from the Health Impact Project, other HIA practitioners, and HIA participants. However, CQGRD may not have the objectivity to conduct its own evaluation. Review is invited in accordance with standard HIA review methodology, such as that found in *A review package for Health Impact Assessment reports of development projects*. As described by Bekker, Putters, and van der Grinten (2005), this portion of evaluation may include:
  - Product (quality of the report):
    - Validity of predictions
    - Argumentation

- Readability and understandability
  - Process: (Preparation (screening, scoping), research (appraisal, assessment, analysis); report; evaluation; follow up):
    - Systematic plan of action on problem formulation, data collection, analysis and making inferences
    - Equal attention to all stages of the process
    - Communication plan throughout HIA process: interactions with project planners and key decision-makers
- In 2013, CQGRD staff and students will research, write, and submit a paper that analyzes the Plan 2040 HIA process. The paper will specifically address ways to evaluate the utility of specialized appraisal tools in developing HIA assessment and recommendations. It will also consider their effectiveness as a communication tool with decision-makers.
- In 2013, CQGRD staff and students will research, write, and submit a paper regarding the near-term impact of the HIA. The paper will consider participation rates during the ongoing dissemination process, awareness of the HIA and its recommendations by decision-makers, and actual and proposed changes to Plan 2040 and to the recurrent regional planning process, local ordinances, and other relevant policies and plans (pending policy discussion among internal stakeholders). Some of this information will be available through the monitoring program, below. In addition, researchers may use interviews, plan review, or media review. Priority recommendations will be given additional attention for their potential implementation.

## Monitoring

Once the HIA findings and recommendations have been disseminated to stakeholders, it is the responsibility of the HIA team to observe how the HIA is used by stakeholders. Action on HIA recommendations cannot be undertaken by the HIA team; rather, the evidence, analysis, and guidance are intended to encourage decision-makers to act on the recommendations that are relevant to them. Additionally, community members and organizations may choose to advocate for implementation of certain recommendations.

Many of the recommendations regarding Plan 2040 and the regional planning process can be implemented by ARC divisions, or by its board and executive committees. However, there are also recommendations that ARC can only advocate. Implementation of recommended changes to zoning and subdivision codes and other ordinances would require action by cities and counties in the region. Some recommendations regarding transportation planning and design would also require action by city or county planning and public works departments. Finally, some of the recommendations regarding transportation funding allocation, project evaluation and status, and other major policy issues depend on action by the U.S. Congress, Federal Highway Administration, Federal Transit Administration, Georgia General Assembly, Georgia Department of Transportation, and the Georgia Department of Community Affairs.

CQGRD will be interested in observing whether any of these activities occur, and supporting the HIA report as necessary. Activities of interest will occur during annual plan amendments from 2012 until the start of the next long-term regional plan, during the Transportation Implementation Program from 2012-2017, and during the development of the next long-term regional plan, as well as ongoing or recurring planning and policy changes at local, state, and federal levels. Monitoring activities will be conducted through regular communication with ARC and review of state and federal actions.

# Appendices

# Appendix A: References

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# Appendix B: Plan 2040 Public Comment Submission

## Health Impact Assessment of PLAN 2040: Comment on the draft plan

### What is Health Impact Assessment (HIA)?

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”. 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.

### Health Impact Assessment and PLAN 2040

Health is not merely the absence of illness, but complete physical, mental, and social wellness. Good health is prevalent in communities where healthy choices are easy and affordable. Land use and transportation can have unintended effects on health, quality of life, and economic wellbeing in ways that have not been captured in conventional planning practices. The way that we envision, plan and build our region can help promote active lifestyles, improve traffic safety and air quality, and promote economic and social connectivity. These factors play a role in seven of the ten leading causes of death as well as significant percentage of injury, illness, and disability in our region. Healthy and safe community environments include those with affordable, sustainable, and economically vital neighborhoods, clean air and water, and accessible places for an aging and diverse population. PLAN 2040, the long-term regional comprehensive plan being prepared for the Atlanta region by the Atlanta Regional Commission (ARC), represents an unprecedented opportunity to influence the long term health, sustainability, and prosperity of the region.

Considering metro Atlanta resident’s health and quality of life in regional land use and transportation planning will allow us to reverse unacceptably high rates of disability and death due to obesity, injury, pollution, and persistent socio-economic disparities. The following commentary provides an overview into how health should be addressed in PLAN 2040’s performance measures. This comment will be supported by a final study, available after PLAN 2040 is completed, with a full report of the analytical methodology and process improvement strategies for healthy comprehensive regional planning. Some of the recommendations that result from this health impact analysis diverge significantly from conventional objectives. Where possible, supporting evidence is provided from transportation and economic research to demonstrate that the recommended changes will not have a negative effect on standard planning objectives, such as mobility, access, or property values, metrics which do also support good health.

The Atlanta Regional Commission has already embraced health as an essential element of a thriving and productive region. The stated goals and objectives of PLAN 2040<sup>1</sup> contain these elements:

Goals:

1. Lead as the global gateway to the South.
2. Encourage healthy communities.
3. Expand access to community resources.

Objectives:

1. Increase mobility options for people and goods.
2. Foster a healthy, educated, well-trained, safe and secure population.
3. Promote residential choices in locations that are accessible to jobs and services.
4. Improve energy and resource efficiency, while preserving the region’s environment and critical assets.
5. Identify innovative approaches to economic recovery and long-term prosperity.

Below is a brief explanation of potential health impacts, and discussion of the development, transportation policy, and transportation project elements which should be considered based on these impacts.



### Injuries and Safety

Over 5000 lives were lost due to car crashes in the Atlanta region between 1999 and 2007, not to mention hundreds of thousands of serious injuries. Pedestrians and bicycle riders are over-represented in traffic fatalities. The majority of serious crashes are preventable, with changes to speed and volume of motor vehicle traffic, the design of streets, and the amount of time and distance traveled in the region. High-quality pedestrian and bicycle facilities on all major roads, connected networks of side streets, lower design speeds, streetscaping, and mixed use development reduce the rate of serious crashes. Intentional injuries due to crime and violence are reduced in communities where there are more trees, where neighbors are acquainted, where citizens informally patrol the street from windows and sidewalks, and where people can get to work even if they don't have a car.<sup>2</sup> Fears of traffic or crime also impact travel choices and property values. Urban design can create safer spaces with robust bicycle and pedestrian infrastructure, pavement and roadside design elements that discourage speeding, and homes and businesses that engage with the public right-of-way to create a lively and continuously-monitored space.

### Access, Mode, and Distance

The region has limited housing choices near major employment centers, resulting in long commute distances, traffic congestion, and higher "vehicle miles traveled" (VMT). Housing is separated from retail centers as well, increasing the time and money households devote to daily transportation, and reducing access to jobs and services. Travel distance affects access to nutritious food, medicine, and health care, especially for the elderly, children, persons with disabilities, and households with limited time or mobility. Zoning that places broad restrictions on density and use, and inflicts minimum parking requirements makes walkable, transit-served communities unattainable. It also drives up housing prices and the cost of living. Median transportation costs can grow from 5% of household income where travel alternatives exist, up to 20% in a car-dependent community, or up to 40% for low income households.<sup>3</sup> Crime and mental illness tend to be more prevalent in areas lacking access to economic opportunity.<sup>4</sup> Research links walkable neighborhoods, access to retail, and short commutes to better physical, mental, and social health.<sup>5</sup>

### Physical Activity

The Atlanta region is facing an epidemic: sedentary lives. Physical activity has been engineered out of daily life, and simple activities like walking to school or to the store have become the exception. Sidewalks, convenient crosswalks, bicycle lanes, traffic calming measures, mixed-use zoning, and connected street networks facilitate active transportation and save lives: heart disease, stroke, diabetes, certain cancers, and mental disorders are all linked to a lack of physical activity.<sup>4, 6</sup> However, these design elements are lacking in many parts of the region. More than 25% of metro Atlanta residents are obese<sup>7</sup>, which increases their medical costs and nearly doubles their risk of premature death. The key elements needed for an active community are highly mixed land uses, short connected blocks, and high-quality infrastructure for pedestrian and bicycle traffic.

### Air Quality

Regional air quality in metro Atlanta has shown improvement, although national ambient air quality standards (NAAQS) are still exceeded each year. The regional picture fails to convey the full public health issues related to air quality, however. Roadways, other transportation facilities, freight logistics, and industry can create "hot spots" of locally elevated air pollution levels, which may impact homes and schools and may inequitably impact some citizens more than others.<sup>4</sup> These hot spots are linked to increased rates of asthma attack, premature and low birth weight babies, infant mortality, and other respiratory diseases.

### Public Access

Many essential social and economic activities take place in public or semi-public spaces. People must leave their private homes in order to interact in society. In streets, parks, and businesses they meet their neighbors, learn, shop, and even engage in political expression. Additionally, these settings provide access to unique public resources such as recreational areas, libraries, and social services. However, communities are struggling to come together as nearly all of their public space is used for motor vehicle movement, most travel in the public realm is made isolated in a private car, and there is insufficient space to congregate.<sup>8</sup> Individuals who are not well integrated into the social, political and economic networks, those with low social capital, are shown to be at increased risk for poor physical and mental health.

<b>Development, the Regional Development Guide, and the Unified Growth Policy Map</b>
<b>Capitalize on good objectives.</b> The guidelines for development types are conducive to creating healthy communities but needs a stronger commitment, clearer design and policy details, quantifiable metrics, and better coordination from the transportation project list.
<b>Land use diversity must be maximized.</b> Mixed use zoning can improve access to goods, increase safety by promoting a variety of activities at different times of the day and night, and improve walkability. Any areas located in the maturing neighborhoods, established suburbs, developing suburbs, and developing rural areas as described in the Development Guide should reflect this neighborhood street activity preference.
<b>Connectivity must be restored.</b> Connected street networks shorten travel distances, making active transportation more feasible. They provide alternate routes which can reduce exposure to injury and air pollution, by allowing users to avoid busy roads. Retrofit existing cul-de-sac developments in established suburbs with nonmotorized access points to adjacent developments. For developing areas, the design of all newly proposed projects should include complete connectivity and multi-mode transportation options.
<b>Contextually-appropriate density must be selected.</b> Plans should identify underperforming areas and gaps in the urban fabric that are suitable for immediate infill or redevelopment, neighborhoods where any redevelopment occurs should be gradual, and natural conservation areas that should be preserved for agriculture, greenspace, or general conservation. Transportation corridors and centers should take the highest-density development, especially where quality transit is programmed.
<b>Complete, multimodal facilities must be included in new developments.</b> Walking is the most common and easily accessible form of physical activity. It is also the activity available to the largest number of individuals, including vulnerable populations. Most walking occurs on local neighborhood streets. All development should include sidewalks on both sides of the street, except in rural areas with fewer than one unit per five acres. There should be clear instructions for design, installation, and maintenance of sidewalk and streetscape.
<b>Remove parking requirements.</b> Nearly all parking requirements should be lifted to allow actual demand to drive supply and cost. Minimum parking requirements lower density by allocating a certain portion of every property to motor vehicle storage, rather than usable space. They also increase the price of homes, apartments, and retail or office space. Parking can impact VMT, as the availability of free parking is one of the factors that influences travel mode choice. Leaving parking supply to the market will allow infill development, reduce business operating costs and prices, and increase the supply of affordable housing.
<b>Transportation Program Analysis and Project Selection</b>
<b>“Plan Level Performance Measures” do not adequately address pedestrian access, bicycle access, transportation cost, multimodal access for children and seniors, transportation costs, or the other health impacts described here excluding crash rates.</b> The performance measures rely on traditional metrics, such as car and transit travel time, crash rates, regional emissions modeling and the controversial travel time index. Impact on community and environment was measured entirely by regional emissions, and interests of the community and the natural environment are not always compatible. While the metrics that were used act as elements of a healthy, thriving region, the thesis of this report is that other key measures are essential to the overall quality of life, social justice, and economic productivity of the region. Metrics suggested here should be used in performance evaluation.
<b>Project selection should balance interests of the region and the local community.</b> Project selection should address questions of the proportion of carless households, people unable to drive due to age, or households with low income and high potential transportation costs, and areas lacking in transportation alternatives. Some census tracts with over 30% carless households, such as those in northwest City of Atlanta, have roadway capacity projects programmed or in the long range list, but no transit or non-motorized facilities.
<b>Transportation programming must stipulate the use of best practices in accommodating multi-modal traffic.</b> The resulting infrastructure will need to serve the region for the next 30 years or more. In that time, we already anticipate that a larger percentage of the population will be unable to drive and that energy will become more costly and less available. The region’s citizenry could suffer a critical loss of access to jobs, goods, and community resources if viable alternatives to driving are not available; this burden will fall hardest on the most vulnerable populations. Project selection and design guidelines should define how the following resources will be used to create safe, convenient multimodal roads: “Complete Streets: Best Policy and Implementation Best Practices”, Americans with Disabilities Act Accessibility Guidelines and draft Public Right of Way Accessibility Guidelines, universal design and crime prevention through environmental design (CPTED) principles, “Designing Walkable Urban Thoroughfares: A Context Sensitive Approach: An ITE Recommended Practice”, guidance from the Pedestrian and Bicycle Information Center and the Association of Pedestrian and Bicycle Professionals, Routine Accommodation policies from the Georgia Department of Transportation



and the U.S. Department of Transportation, and American Association of State Highway and Transportation Officials (AASHTO) standards. Preserve bicycle and pedestrian facilities in the value engineering stage.

**Transportation investments should be coordinated with existing and future land use.** A significant percentage of walking and bicycling trips are currently made in conditions that are unsafe and have a failing level of service. Considerable demand for transit services and multimodal infrastructure goes unmet, reducing access to jobs and services. Bicycle and pedestrian infrastructure should be addressed as latent and existing demand, not just travel demand management. PLAN 2040 references the 2007 Atlanta Region Bicycle Transportation & Pedestrian Walkways Plan, Concept 3 transit plan, and Livable Centers Initiative (LCI), but devotes a relatively modest percentage of funding to complete these plans.

**Transit projects are likely to promote health.** Bus and train travel have much lower injury rates than other forms of ground transportation. Transit usage is associated with lower emissions and increased physical activity. It offers lower cost mobility and accessibility that can be used by children and people with impaired abilities. Based our population age and health, climate concerns, and the effect of energy prices, the Atlanta region cannot wait for transit services to come online. Transit projects in the Long Range category should be substituted for road capacity projects along the same corridor in the TIP. Ensure that transit expansion targets all parts of the region with long transit travel times, high transportation costs, or few travel alternatives.

**Evaluate all projects on equal grounds.** Compartmentalization of projects by type might result in a tendency toward a lack of consideration for all travel modes and land use as being interrelated. For instance, LCI investments may outperform capacity projects in terms of economic development, access, and air quality, but never have a chance to compete on those grounds. Maintenance projects should also be filtered.

**Guide the region's development with long range transportation planning.** Rather than reacting to existing or projected motor vehicle congestion or volume, program investments that will promote the development goals above and increase multimodal transportation options. Fund investments equitably (by geography, need, and income), progressively (starting from existing centers and corridors), and with complete mode accommodations over the long range timeframe. Designate responsibility for managing development and transportation demand to local jurisdictions with an emphasis on walkable neighborhoods, mixed-use neighborhood and town centers centered on planned and existing transportation corridors, and interconnected street networks that relieve pressure on arterials and shorten travel distances.

**Transportation Project List**

**Realign investment with objectives identified by PLAN 2040.** The PLAN 2040 outreach process garnered opposition to roadway expansion, and support for healthy communities. This analysis has identified harms that would likely result from projects that increase VMT, and potential benefits from projects that increase access to transit, bicycle, and pedestrian options. However, the draft project list allocates about 82% of programmed funding allocation and about 68% of long-range spending to new road capacity (priced or unpriced), and only 2% for bicycle and pedestrian projects (plus some programming). The proportion of highway maintenance to pedestrian facility maintenance is similarly skewed. There are no Long Range or Aspirations bicycle or pedestrian projects, which limits comprehensive planning and development. Seven percent of programmed and 30% of long range investments are allocated to transit. These proportions result in extensive missed opportunities for added physical activity, safety, and access, and for VMT reduction. Expenditures for transit and bicycle/pedestrian infrastructure should each exceed that for roads.

**Expand capacity by completing the road and transit network, not widening roads.** Replace road widening (2 to 4 or 4 to 6 lanes) projects with new streets (0 to 2 or 0 to 4 lanes) projects; this can reduce travel distances. Research suggests that capacity gains for new lanes are marginal if there are two or more travel lanes in each travel direction. Where widening is proposed, put funds toward transit while studying each proposal for alternatives using pedestrian-friendly access management, alternatives for new parallel/bypass streets, traffic controls that reduce queuing, or improved local interparcel and pedestrian circulation.

**Road projects must serve the local context as well as regional traffic.** There are inherent conflicts between mobility and access. Highly predictable transportation environments can be safe for high-speed mobility, but highly unpredictable transportation environments may be safer in a complex roadside context, because users behave more cautiously. The most dangerous settings may be those which appear controlled but actually carry uncontrolled movements, such as arterial roads designed for high-speed vehicular mobility. These roads feature wide marked lanes, turn lanes, and traffic signals, but in practice have many unpredictable vehicular and pedestrian movements, as consumers and workers try to access the adjacent businesses. Roads should serve their essential role in land access in terms of design speed, block length, and control. When access management strategies are used in road design, they should facilitate safe and convenient pedestrian travel without detours or excessive delays. Guidelines should be made clear for large programmatic funding buckets. For instance, how will traffic signal optimization affect pedestrian trips?



**Traffic congestion should be approached by pricing existing lanes.** The latest studies suggest that congestion cannot be mitigated through capacity expansion. The health advantage to road pricing is that it can reduce congestion, one of the most concentrated sources of line emissions, while creating a funding source for alternative transportation options along the priced corridor. However, this effect is only achieved under certain conditions: existing lanes become priced in order to reduce the current amount of congestion, incoming funds are spent on transit and non-motorized projects, and the tolling technology does not create new congestion hotspots. There are \$5 billion of programmed and long range managed lane projects in PLAN 2040, but they are implemented as new capacity which will leave existing lanes congested and may dedicate toll recovery to the construction of the new lanes. While this may create some additional high-speed motor vehicle travel, it is likely to have a negative effect on air quality, safety, and physical activity.

**Pursue alternative freight projects.** Freight movement by truck carries significant health concerns related to traffic safety, air pollution, noise, and working conditions. Some health impacts can be mitigated by shifting freight movement to rail, water, low-speed vehicle, and other modes. There are no freight rail projects.

**Evaluate each project on health terms.** Road projects will likely negatively impact health unless they maintain a contextually-appropriate balance between access and movement, and provide robust pedestrian and bicycle facilities. All transportation projects should be evaluated to ensure that they increase connectivity, reduce barriers, and create short routes with multiple route options for pedestrians and cyclists. All road projects should meet the best practices for multimodal facilities as described above. Pedestrian connections must be implemented where street connections are abandoned.

*Example: The new interchange of State Route 92 and US Route 78 is lacking complete multimodal facilities. The concept drawing may have sidewalks, but does not depict crosswalks, bicycle lanes, planting zones, or any other pedestrian amenities. At 10 lanes wide in some places, this road would need a pedestrian island in the median and other enhanced crossing treatments. Additionally, pedestrian access and mobility may be impaired by noise barriers and disconnection of side streets. This project is adjacent to two elementary schools for which Douglasville has initiated walk-to-school programs, runs within blocks of downtown Douglasville, and passes through an area with a relatively high proportion of carless households. It will also serve as an important railroad crossing location for bicycle and pedestrian traffic.*

*Example: During the I-285 Top End study, local stakeholders noted that there were no direct alternate routes to the highway, which eliminated the option of walking or bicycling and forced them to drive on I-285, even for short local trips. Traffic analysis confirmed that local traffic, not through capacity, was the source of congestion. A shortage of places to cross I-285, except at exit locations, exacerbated congestion, crash rates, and travel distance. Proposed "collector-distributor" lanes should be designed as two-way frontage roads with sidewalks, appropriate bicycle facilities, and access to abutting properties to support multimodal local travel and reduce travel distance.*

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<sup>1</sup> Atlanta Regional Commission PLAN 2040 website. <http://atlantaregional.com/transportation/plan-2040/plan2040>

<sup>2</sup> Sarah Goodell and Claudia H. Williams. *The Synthesis Project, Policy Brief No. 11* | The Robert Wood Johnson Foundation | The built environment and physical activity: What is the relationship? 2007

<sup>3</sup> Todd Litman. *Evaluating Transportation Economic Development Impacts: Understanding How Transport Policy and Planning Decisions Affect Employment, Incomes, Productivity, Competitiveness, Property Values and Tax Revenues*. Victoria Transport Policy Institute. 2010

<sup>4</sup> Shireen Malekafzali (Ed.) *Healthy, Equitable Transportation Policy: Recommendations and Research*. PolicyLink/ Prevention Institute/ Convergence Partnership

<sup>5</sup> Arlene Renalds, Tracey H. Smith, and Patty J. Hale. A Systematic Review of Built Environment and Health. *Family & Community Health*, 33(1), 68-78. 2010

<sup>6</sup> National Center for Chronic Disease Prevention and Health Promotion. *The Power of Prevention: Chronic disease . . . the public health challenge of the 21st century*. 2009

<sup>7</sup> National Center for Chronic Disease Prevention and Health Promotion. Behavioral Risk Factor Surveillance System – SMART: BRFSS City and County Data. 2009 - Atlanta-Sandy Springs-Marietta, GA Metropolitan Statistical Area. <http://apps.nccd.cdc.gov/BRFSS-SMART/MMSARiskChart.asp?yr=2009&MMSA=5&cat=OB&qkey=4409&grp=0>

<sup>8</sup> Jan Gehl. *Cities for People*. New York: Island Press. 2011

