

# nashvillenext

## **VISION, TRENDS & STRATEGY**

### **APRIL REVIEW DRAFT**

This is the review draft of Volume I of NashvilleNext. It provides a vision for Nashville's future based on the participation of thousands of Nashvillians. It also includes key trends shaping Nashville's future, tools to implement the plan, and key strategies for achieving the community's vision.

We appreciate that you are giving time to reviewing this work. These actions are the result of three years of effort on NashvilleNext, combining public visioning and community engagement with topical experts to create a plan for Nashville and Davidson County over the next 25 years.

#### **Comments**

The public review period is during April 2015. We are eager to hear your thoughts on the plan. Here's how to provide input:

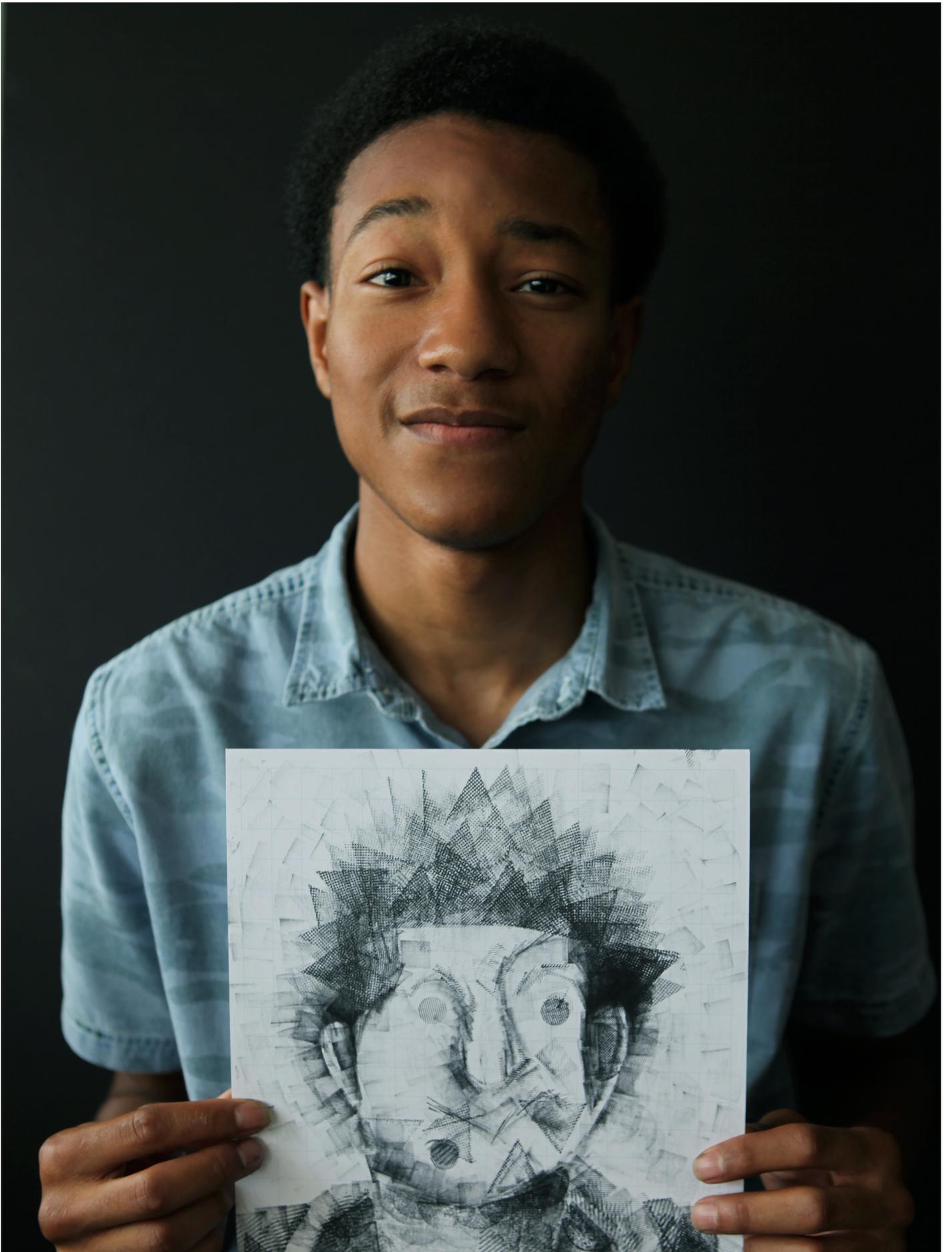
- » Online: [www.NashvilleNext.net](http://www.NashvilleNext.net)
- » Email: [info@nashvillenext.net](mailto:info@nashvillenext.net)
- » At public meetings
  - » April 18: Tennessee State University (Downtown Campus), 10am - 1:30 pm
  - » April 20: 5 - 7pm at both the North Nashville Police Precinct and the Edmondson Pike Branch Library
  - » April 27: 5 - 7pm at both the Madison Police Precinct and the Bellevue Branch Library
- » Phone: 615-862-NEXT (615-862-6398)
- » Mail: Metro Nashville Planning Department, P.O. Box 196300, Nashville TN 37219-6300

We ask that you include contact information with your comments. We also request that you be as specific as possible in your requests. Referring to a specific page or section is greatly appreciated.

#### **Next steps**

The most up to date information is always available at [www.NashvilleNext.net](http://www.NashvilleNext.net). Here is our tentative adoption schedule:

- » Mid-May: Post static draft of plan in advance of public hearing
- » June 10: First public hearing at Planning Commission (tentative; special date)
- » June 15: Second public hearing at Planning Commission (tentative; special date)



# TRENDS & ISSUES

The only given in preparing for the future is that it is uncertain. Trends that seem unstoppable succumb to new technologies, national and international economic change, and simple unexpected changes in taste. Planning relies on the best available information about the future, to prepare for what seems likely.

Some of the trends that follow – such as changes in the number of people of a particular age – are as certain as trends get. Some are recent trends in lifestyle preferences that are more tenuous. Nevertheless, these trends point to a different future for Nashville from its recent past.

## **Tomorrow's leaders**

### **How planning the city impacts our children and youth**

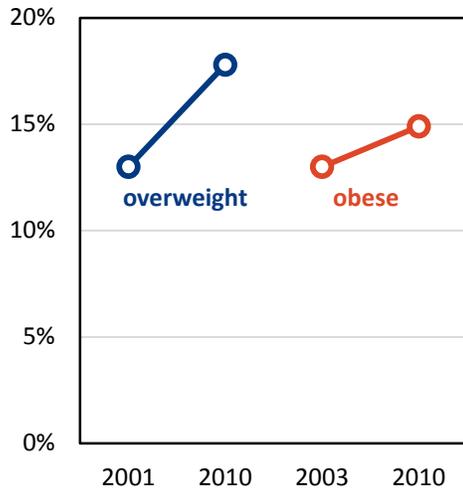
A long-range plan is part of the legacy handed down from the current generation to the next. It is one of our tools for considering the pressing issues of today and to grapple with the kind of place we want to leave our children as they become stewards of Nashville.

That legacy includes the conditions for children today that shape their future. Nashville today will leave an indelible mark on its children. Will they grow up feeling safe and secure in their neighborhoods? Will they receive an education which prepares them for life as adults? Will they be ready to work, ready to raise families, and ready to lead their communities? Will they begin life healthy and well, with enough food and opportunities to run and play?

Our built and natural environment, our transportation system, and our housing market all shape children's lives. Children are the most susceptible to health problems created by a built environment that does not support healthy lifestyles. With no other way to get around Nashville on their own, young people can only range as far as the built environment allows them. Lack of sidewalks and places to go limit how much exercise youth get in their daily lives. Proximity to schools, with safe routes to and fro, is especially important. Concerns with violence in neighborhoods and

## Obesity in Nashville teens

The percentage of teenagers who are overweight or obese has increased dramatically in the last decade.



Source: Centers for Disease Control Behavioral Risk Factors Surveillance Survey (2001, 2003, 2010)

parks can also drive parents to keep children inside. While adults can opt out of their immediate surroundings by driving to another part of the city, children must rely on others to get around.<sup>1</sup>

Because of pull factors like screen time and push factors of like high traffic neighborhood streets, the number of active children is too low. Lack of time, money, or availability means many children do not eat healthy meals. As a result, the proportion of children who are overweight or obese has increased over the past decade. This can lead to a lifetime of health problems, including diabetes.<sup>2</sup>

## Among Nashville children...

Many factors combine to make it more difficult for children to stay physically active: unwalkable neighborhoods, hectic schedules, more options for screen time at home, among others.

**78%** do not engage in one hour of physical activity every day

**33%** watch three hours or more television each day

**15%** do not feel safe in a public location such as their neighborhood or a park

Our school system also has lasting consequences for our children. Children receive education and training at school, but they also learn how to navigate the social world. At their best, our schools lift students up and help them unlock their potential and find their passion. At their worst, schools struggle with families overwhelmed by the effects of concentrated poverty, homelessness, or language barriers. Looking ahead 25 years frames this challenge starkly. The communities in Nashville that will grow the most are those who are struggling the most academically.

Managing the school system and recommending curricula is outside of NashvilleNext's purview. But how the city grows and provides housing, jobs, and recreation to children and families affects whether children come to school ready to learn. Achieving integrated schools is difficult when our neighborhoods are not. Providing high quality education is challenging when 31% of children live in poverty.<sup>3</sup> Offering choices among school options is misleading if children and families lack the transportation to get there. Many of the issues addressed by NashvilleNext shape educational opportunities for children or how easy it is to be healthy or safe.

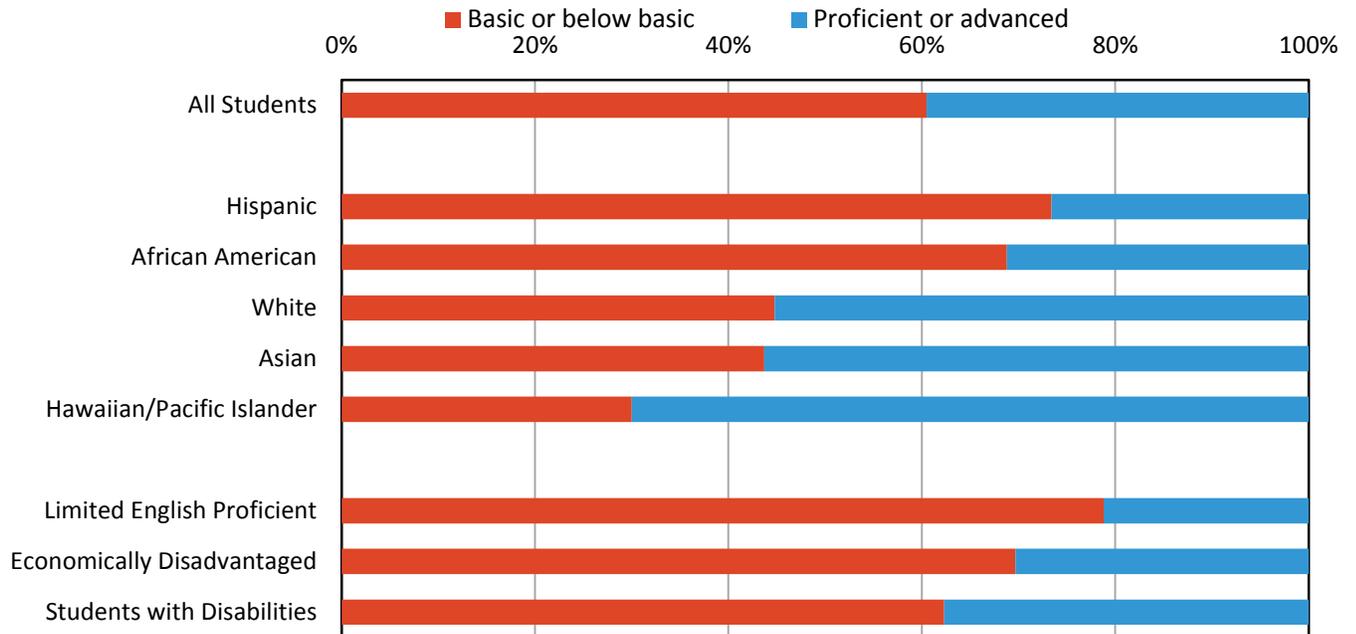
1 Sources: Child & Youth Master Plan Youth Survey (2010)

2 Sources: Schlundt, D.G.; Hargreaves, M.K.; and McClellan, L. *Geographic Clustering of Obesity, Diabetes, and Hypertension in Nashville, Tennessee*. *J. Ambul Care Management*. 2006 Apr-Jun. 29(2):125-32. <http://www.ncbi.nlm.nih.gov/pubmed/16552321>

3 Sources: American Community Survey (2013; 1-year estimate), table DP03.

## Grade 3 Achievement for Reading / Language Arts

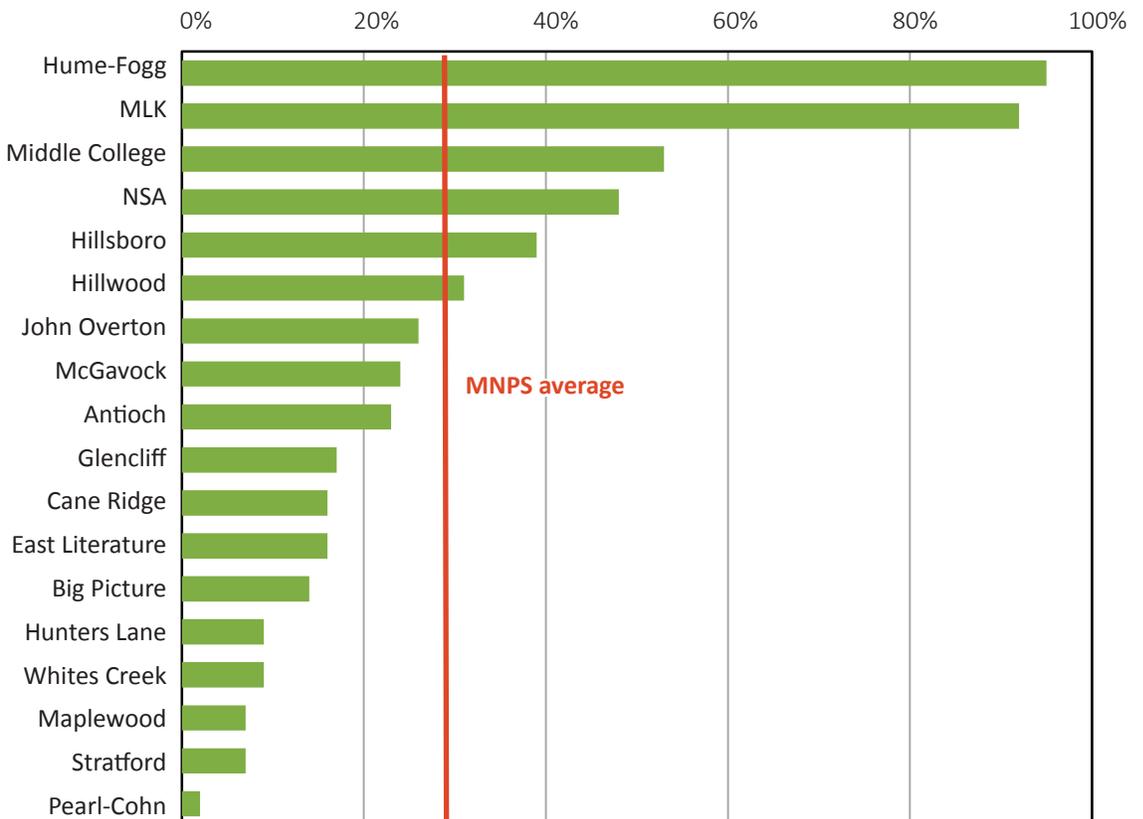
After third grade is when students stop learning to read and begin reading to learn.



Source: Tennessee Department of Education (2012); Annie E. Casey Foundation (<http://www.aecf.org/resources/early-warning-why-reading-by-the-end-of-third-grade-matters/>)

## 21 on the ACT

Percentage of students at each Nashville public high school achieving this indicator of success at college (2012)



Source: Tennessee Department of Education (2012)

More fundamentally, children and youth should be engaged in shaping the future of Nashville. In one survey of Nashville youth, 94% felt that youth had unique and important insights. Many youth are eager to shape the future for themselves, their families, and their communities. At the same time, many also lack the opportunities and the role models necessary to do so. That same survey reported that one-third of youth lacked an adult in their life they could talk to about their problems. More than 80 percent felt that Nashville does not do a good job of supporting the positive development of youth aged 11 to 21.<sup>4</sup>

These issues run deeper than zoning and capital improvements. But the decisions we make as we prepare for the future shapes the world our children face today and in the future.

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4 *Child & Youth Master Plan Youth Survey (2010)*

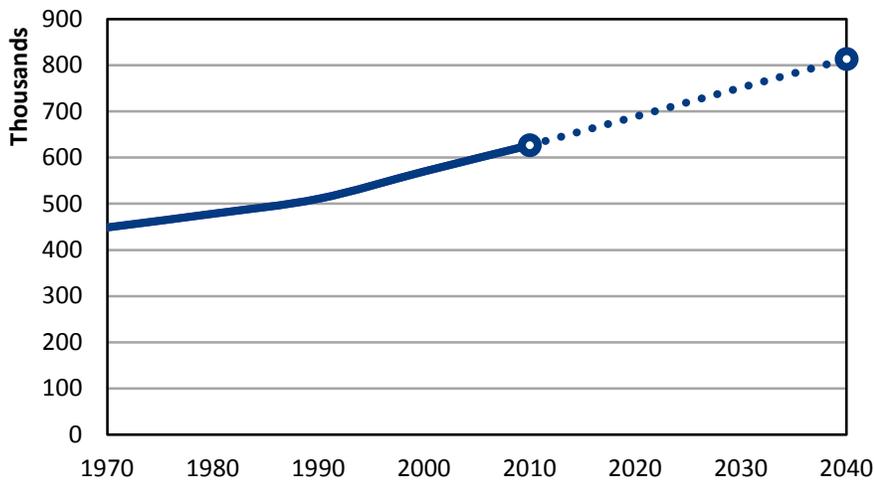
## Changing demographics

Population growth and changing age, race, and ethnicity demographics are changing Nashville’s housing market and community needs

Nashville is growing and expects to continue adding people and jobs at a rapid pace. Over the next 25 years, we expect Davidson County to add 186,000 residents and 326,000 jobs.

### Nashville population, past and future

This chart shows Davidson county’s historical population (solid blue line), along with our projected growth from 2010 to 2040 (dotted line).



Source: U.S. Census (1970 - 2010); Woods & Poole (2020 - 2040)

Population grows for two primary reasons. *Natural increase* is population growth due to more births than deaths. Natural increase happens because of higher fertility rates or when people live longer. *Migration* reflects how many people move into and out of a city over time. These population projections are based on economic trends in Nashville and across the county, along with historical fertility, mortality, and migration rates, extending through 2040.

As we grow, we are also changing demographically. Most of these changes are part of national trends, playing out in Nashville.<sup>5</sup> One such trend is the changing racial and ethnic make-up of Nashville residents. By 2040, we expect to have no majority race or ethnicity. Without conscientious efforts to bridge communication gaps and understand the concerns and needs of

<sup>5</sup> Source: Nelson, A. (2013). *Reshaping Metropolitan America: Development Trends and Opportunities to 2030*. Washington, D.C.: Island Press.

## Race and ethnic diversity

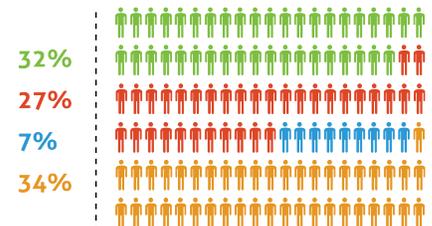
### 1980



### 2010



### 2040



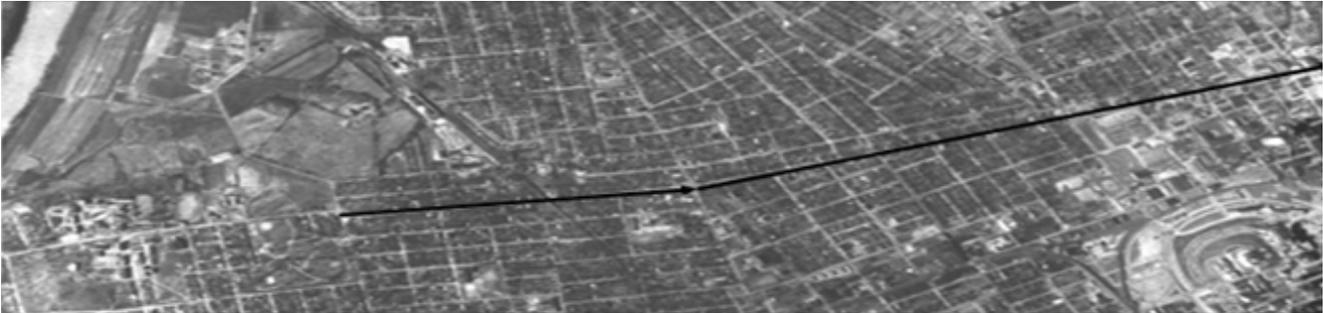
- White (non-Hispanic)
- Black (non-Hispanic)
- Other
- Hispanic (any race)

new and old neighbors, diversity can also intensify conflict over neighborhood, civic, and workplace changes.

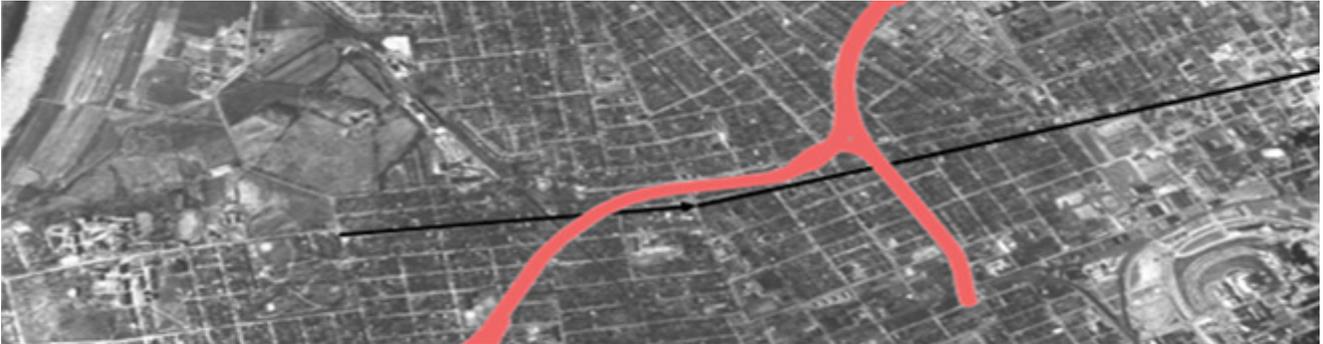
Historically, African-American and Hispanic Nashvillians have lower homeownership rates and worse health outcomes. They live in lower performing school zones and have lower graduation rates. These outcomes are partly the result of past policy choices depriving minorities of due process of law and growth and development decisions that placed onerous burdens on minority communities. These policies were not unique to Nashville; many were put in place by the United States government or the State of Tennessee. Throughout the twentieth century, Nashville also underinvested in minority neighborhoods. It relocated their residents to put in I-40 and urban renewal projects. Black Nashvillians were restricted from parts of the housing market, including subsidies for homeownership.

Despite improvement and some ethnically integrated neighborhoods, Nashville still has neighborhoods that are not diverse, made up almost entirely of one race or ethnicity. Nashville (as of the 2010 Census). In addition to showing very different patterns of density throughout the county, they show a stark level of segregation in most neighborhoods.

**Jefferson Street, North Nashville 1950**



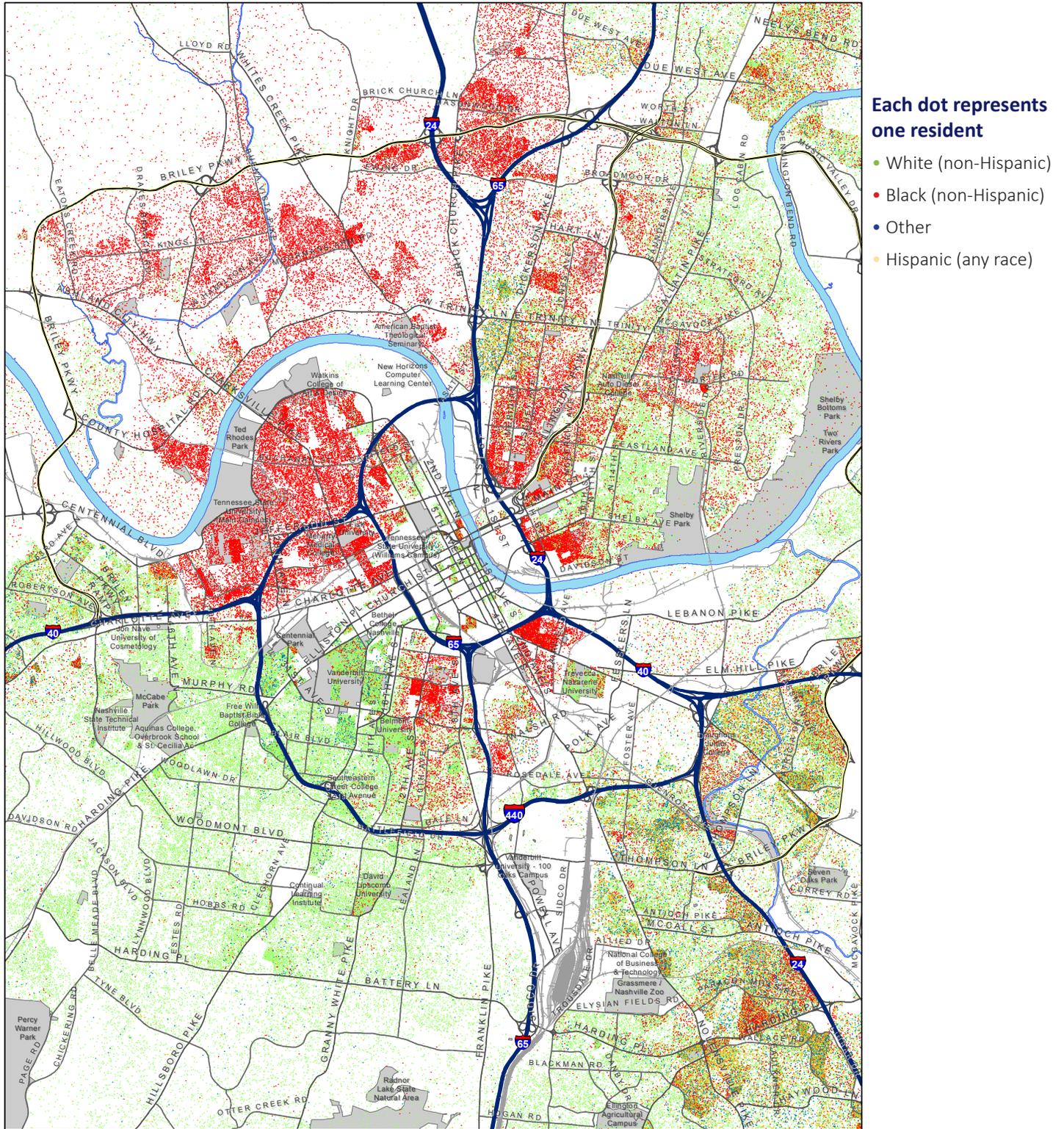
**Jefferson Street with I-40 Overlays**



*Racial Healing Project 2011 MPHD*

## Race and ethnicity dot maps

Compare the red dots (African American residents) north of Charlotte and east of Gallatin with the green dots (white residents) to the south and east.



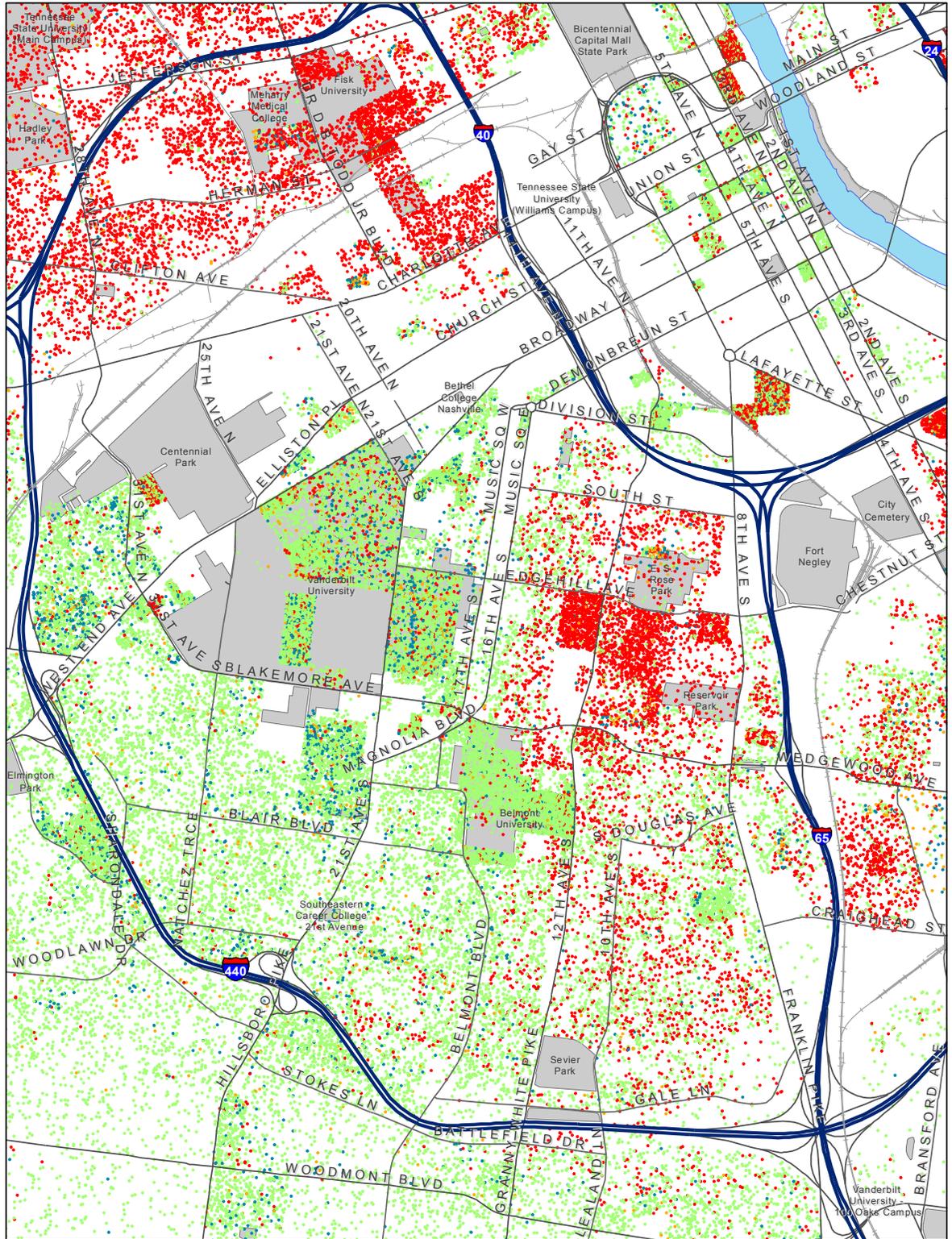
Source: U.S. Census (2010); dots are model results to approximate the location of individuals.

## Race and ethnicity dot maps (Green Hills / Midtown community planning area)

Below, the portion of the Green Hills-Midtown Community Planning Area north of I-440 shows a clear dividing line along 12<sup>th</sup> Avenue South and Wedgewood Avenue, as well as the increased density and diversity of residents close to Vanderbilt.

Each dot represents one resident

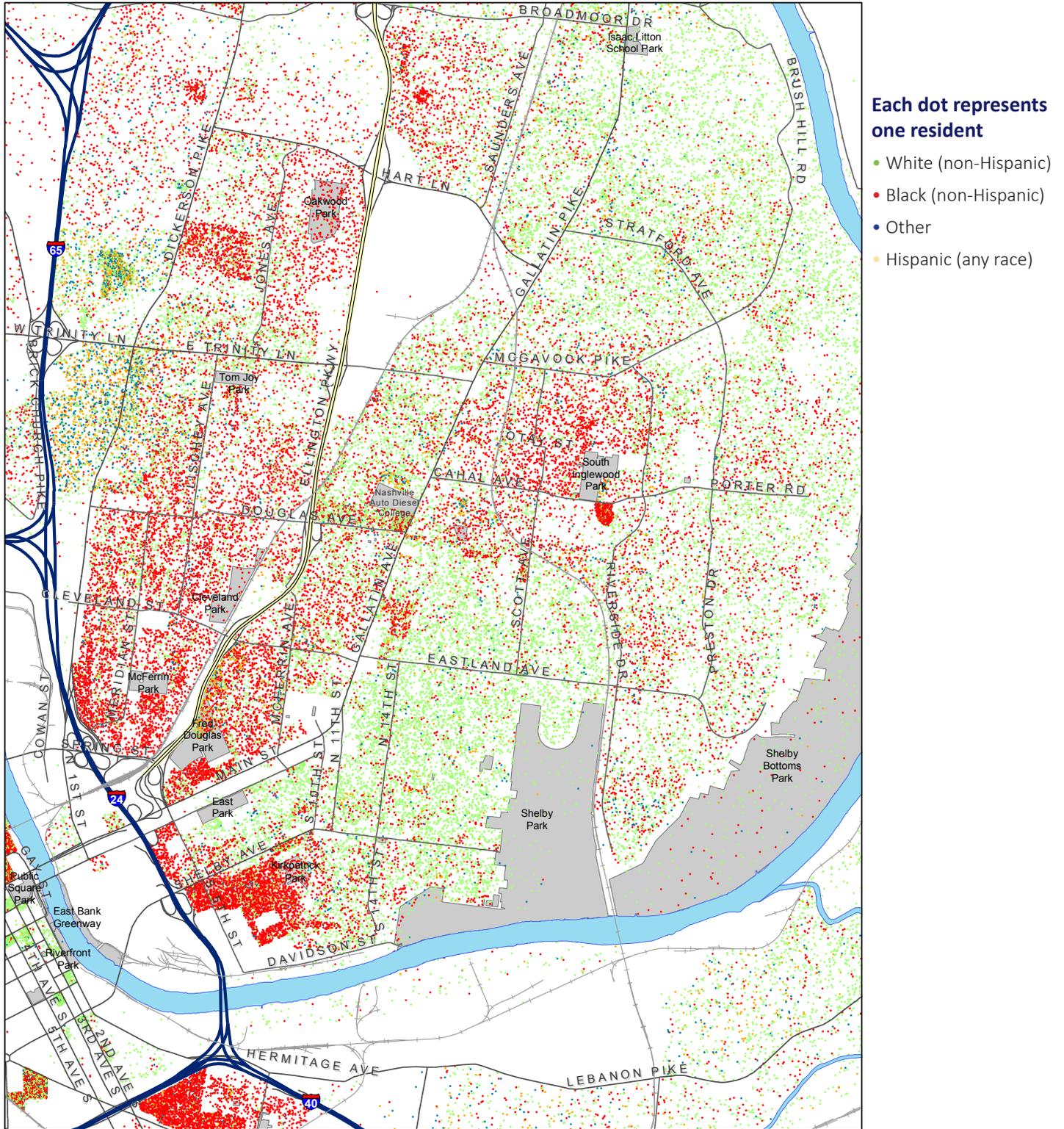
- White (non-Hispanic)
- Black (non-Hispanic)
- Other
- Hispanic (any race)



Source: U.S. Census (2010); dots are model results to approximate the location of individuals.

## Race and ethnicity dot maps (East Nashville community planning area)

East Nashville shows a similar dividing line along Gallatin Pike.



Source: U.S. Census (2010); dots are model results to approximate the location of individuals.

Another challenge to opportunity in Nashville is the spread of concentrated poverty. Poverty is concentrated where more than 30% of residents in a neighborhood have incomes below the poverty line. The percentage of residents living in these neighborhoods has grown slightly, from 5.8 percent in 1970 to 6.3 percent in 2010. As troubling, more neighborhoods are now considered high-poverty (16 Census tracts in 1970, up to 32 Census tracts in 2010). All Census tracts that were high-poverty in 1970 were still high-poverty in 2010, though fewer of their residents were poor. However, 18 Census tracts (home to 22,000 residents living in poverty) were added

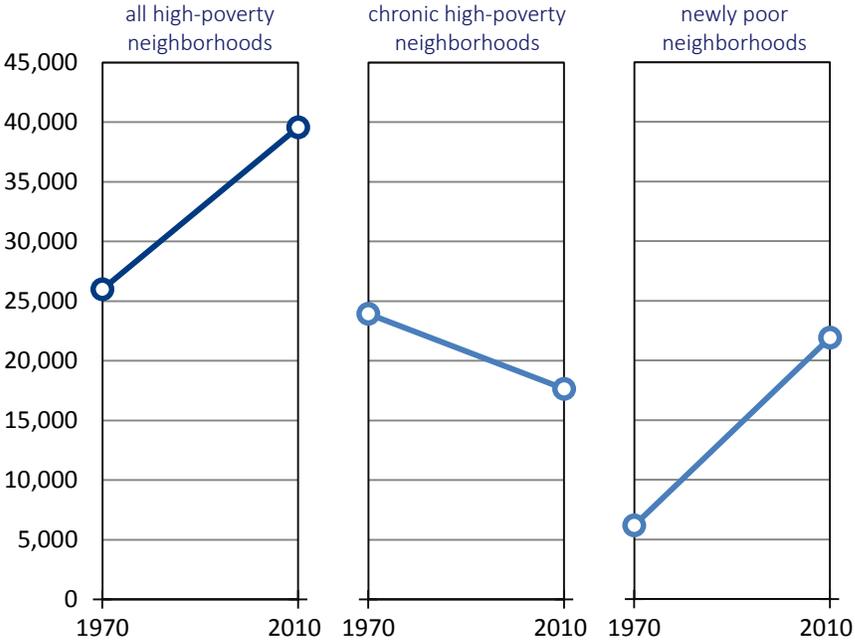
**Number of people living in poverty, in...**

**High-poverty neighborhoods** are Census tracts where more than 30% of residents live in poverty (16 tracts in 1970; 32 tracts in 2010).

**Chronic high-poverty neighborhoods** are Census tracts that were high-poverty in 1970 and 2010 (14 Census tracts).

**Newly poor neighborhoods** are Census tracts that were not high-poverty in 1970, but were high-poverty in 2010 (18 tracts).

Source: City Observatory using U.S. Census data

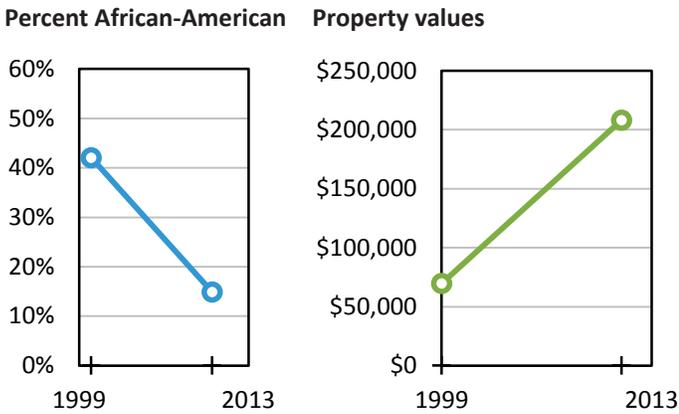


The decline in the number of people living in poverty in high poverty Census tracts supports current concerns that in-town neighborhoods are gentrifying, even if it is not yet widespread enough to shift an entire tract below the high-poverty threshold. Some neighborhoods close to downtown have seen increased private investment and rising property values. As property values and rents rise, the community may change as well, particularly when higher income (typically white) residents take the place of lower income (typically black) residents. For those who receive an unexpectedly large sum for a long-time home, this can be a boon. Many of those forced out, however, have trouble finding new homes in convenient locations. Increasingly, cheaper housing is located at the edge of the county, away from transit, jobs, and services. Those who stay feel an acute loss as old neighbors move away, new neighbors cause friction, and new business replace beloved neighborhood spots. 12South and Wedgewood/Houston have both seen increases in property values and declines in their black populations.

Through NashvilleNext, Nashvillians have shown a commitment to improving opportunities for all Nashvillians. To achieve this, NashvilleNext offers actions that address these historically inequitable outcomes.

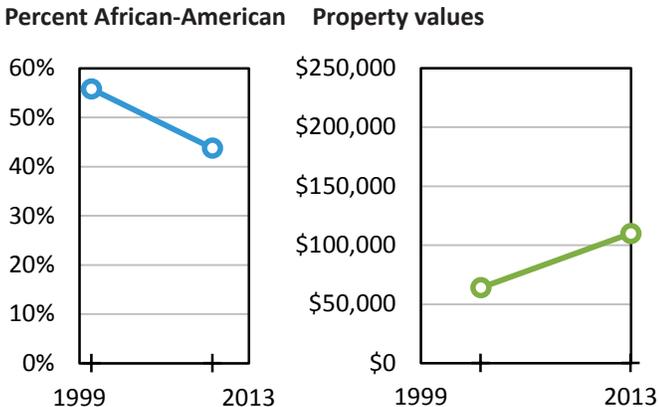
**Change in 12South**

Change in percentage of 12South residents who are African-American, compared with change in property values over similar time periods.

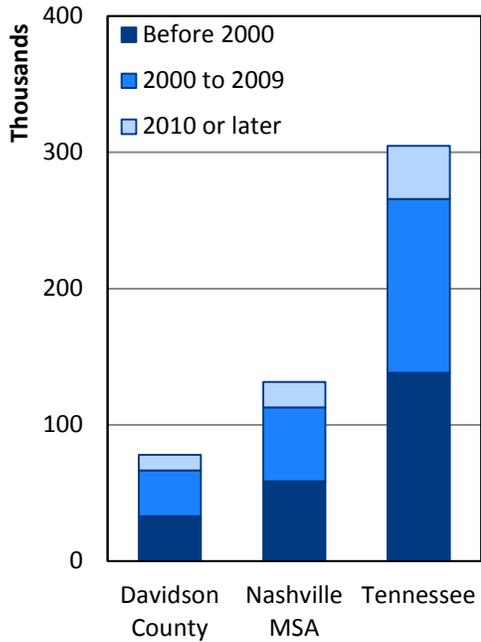


**Change in Wedgewood/Houston**

Change in percentage of Wedgewood/Houston residents who are African-American, compared with change in property values over similar time periods.



## Number of foreign-born residents in Nashville, the MSA, and Tennessee



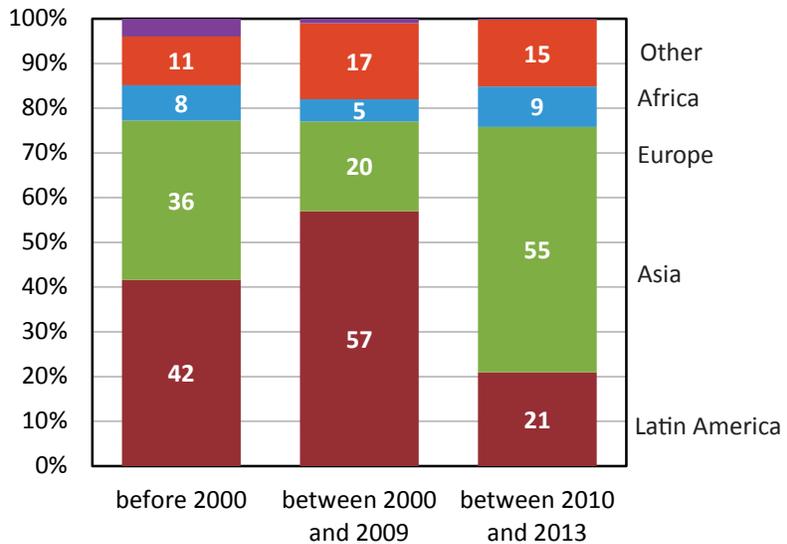
Source: American Community Survey (2013, 1-year estimate, table S0502)

Another facet of our increasing diversity is the continued growth in Nashville’s international immigrants. Between 2000 and 2012, Tennessee had the third fastest growing foreign-born population in the country. Davidson County has shown a similar rate of growth. This pace of growth has been startling to some communities that are now home to significant immigrant communities. However, immigrants lend Nashville diversity, bringing new ideas and perspectives to our community and economy.

Since 2000, Nashville has worked to better integrate foreign born people into our community. In particular, Nashville has launched, joined, or supported immigrant-focused initiatives, such as:

- » The Welcoming Tennessee Initiative
- » New Americans Advisory Council
- » MyCity Academy

## Origin of foreign-born residents in Nashville



Source: American Community Survey (2013, 1-year estimate, table B05007)

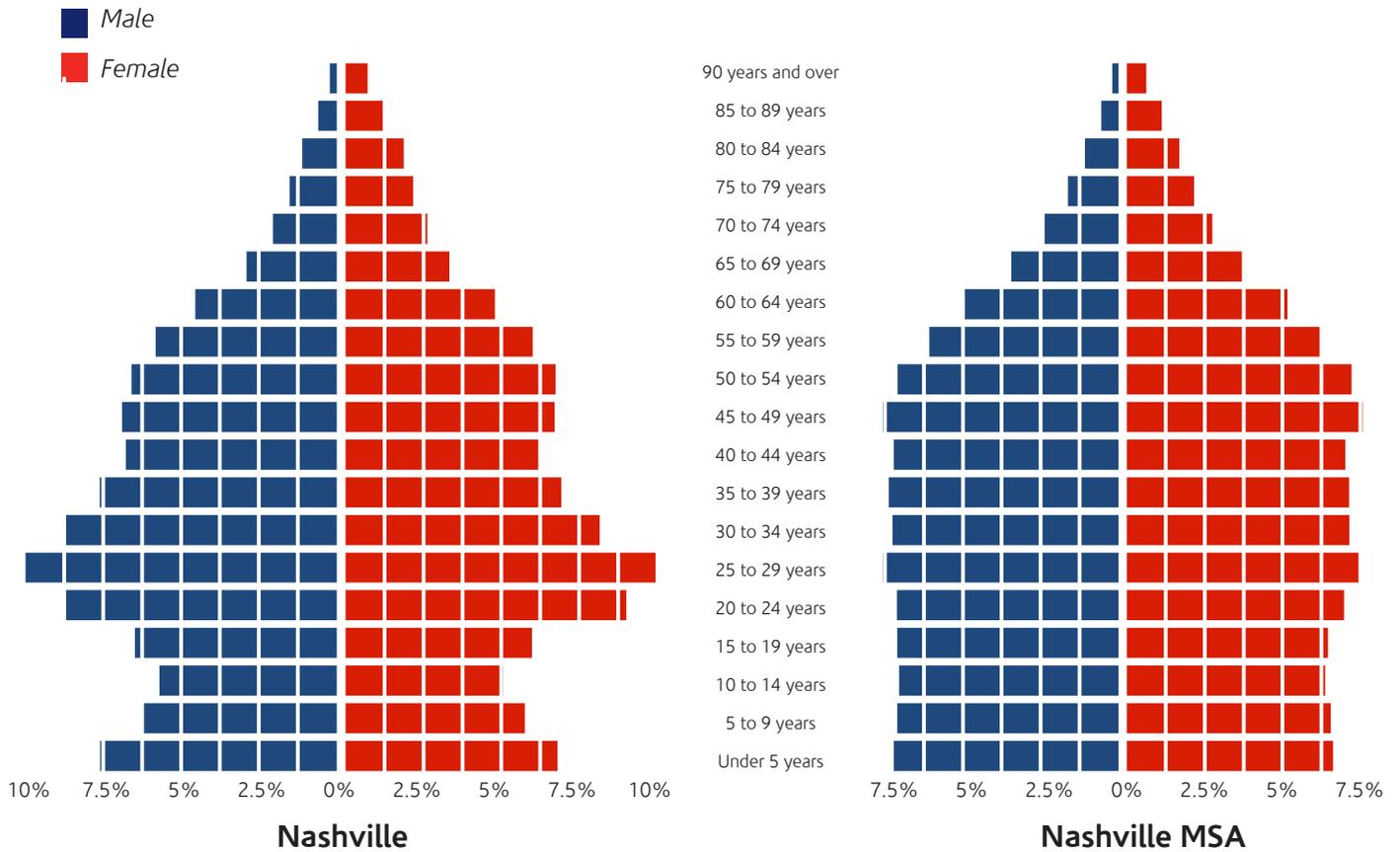
Another way that we're changing demographically is how old we are. Lifecycle effects reflect differences in community needs based on the age of residents. These are slow-moving, long-lasting trends that shape many aspects of Nashville. For example, how much housing people need or want, where it is, and what kind of housing it is all differ by age. Some aspects of this include whether a person:

- » Is in school or working?
- » Has children, and whether they are young or old?
- » Is able to get around independently, by car or on foot

Because each generation has a different number of people, these lifecycle effects can create major swings in the housing market. The market tries to meet demand for different types and locations of housing by adding new homes in high-demand areas.

### Population of Nashville and Middle Tennessee by Age and Gender

Notice Nashville's lopsided education system. Fewer elementary and high school students, but a massive number of college-age people

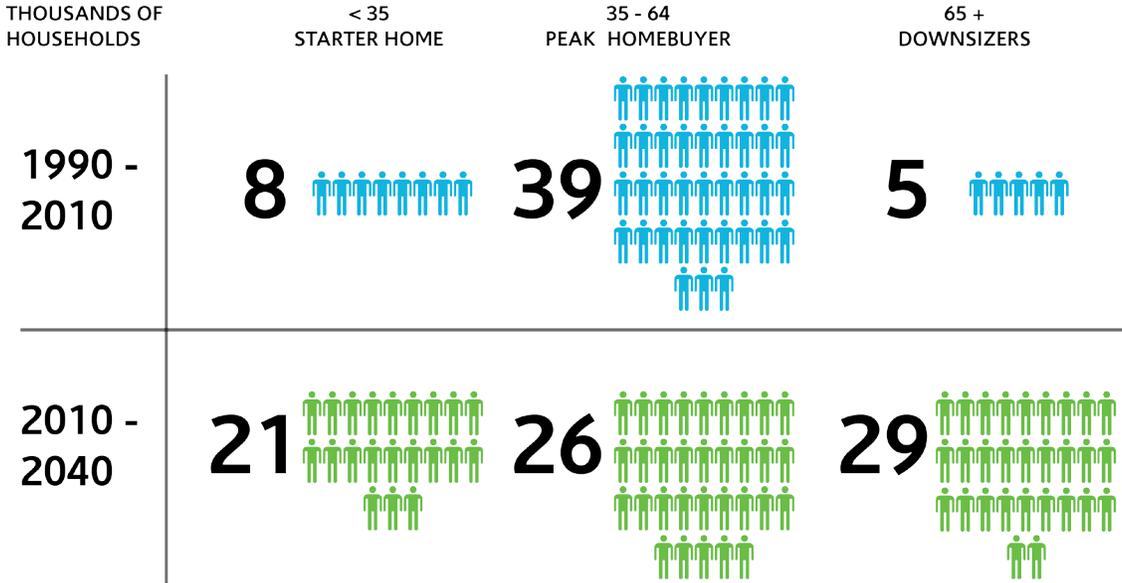


Source: U.S. Census, 2010, chart Q1.

Over the last two decades, households at the peak of their homebuying age were the largest source of growth in Nashville. Changes to the built environment reflected that; we built many single family homes and duplexes, especially to the southeast.

Over the next twenty-five years, however, we expect to see more people in their “starter home” years and more downsizers. These younger households and retiring seniors are both looking for smaller, more urban homes with walkable amenities.

Some of the effect of these changing tastes in housing can be seen now in survey data. Research for NashvilleNext combined multiple surveys to create this composite index of housing type preferences, based on size and type of household (people living alone, people living without children, and households with children). Unsurprisingly, families with children continue to prefer single-family homes. However, households with only one person and those without children desire different housing options. Importantly, these two groups will be the largest source of Nashville’s growth over the next 25 years.<sup>6</sup>

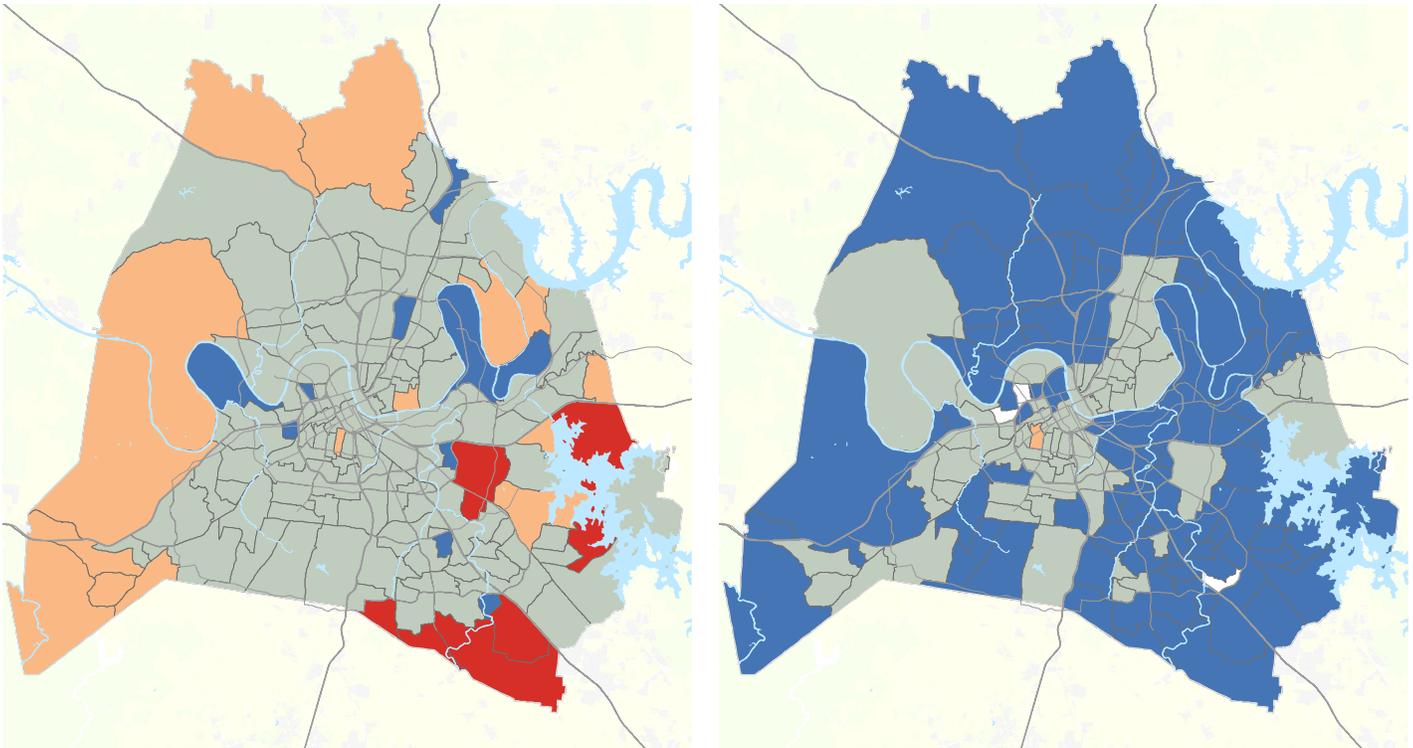


<sup>6</sup> Source: Nelson, A. (2013). *Greater Nashville: Trends, Preferences and Opportunities 2010 to 2025 and to 2040*.

### Change in land values, 1997 to 2001 and 2009 to 2013

These changes in demographics and housing demand are already beginning to appear in development patterns. Compare changes in land values from 1997 to 2001 (left map) with changes from 2009 to 2013 (right map). From 1997 to 2001, increases in land value were concentrated to the southeast, reflecting the conversion of vacant land to (primarily) one- and two-family subdivisions.

From 2009 – 2013, increases in land value were focused in and near downtown, reflecting increasing demand for existing urban neighborhoods.



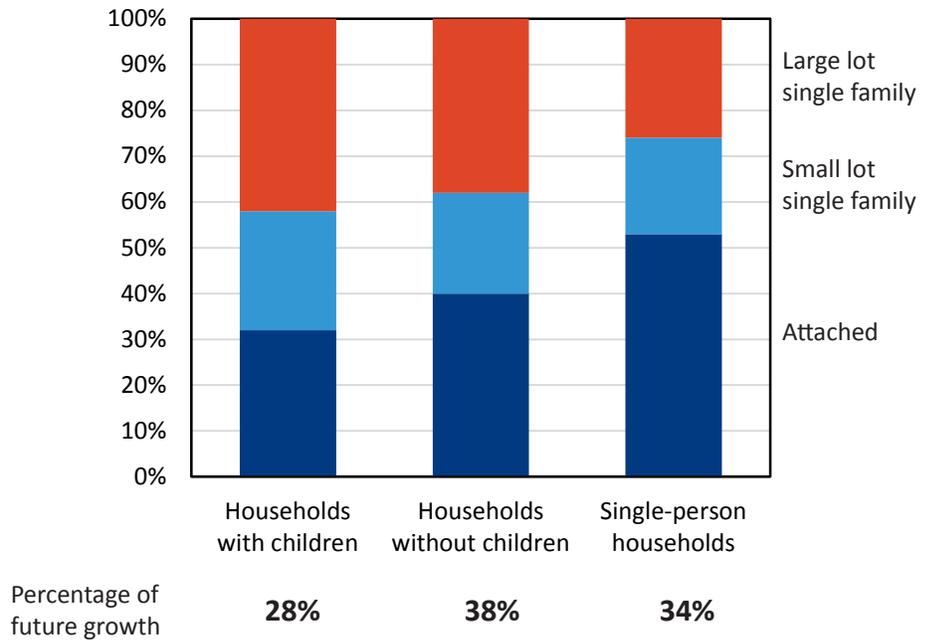
Source: Metro Nashville Assessor

#### Legend

- 29% to no change
- no change to 52%
- 52% to 95%
- 95% to 210%

## Housing type preferences by household type in 2040

The fastest growing kinds of households over the next 25 years prefer small-lot single family and attached homes.



Source: Nelson, A. (2013). *Greater Nashville: Trends, Preferences and Opportunities 2010 to 2025 and to 2040*.

These demographic effects are amplified by several other trends:

- » Tighter lending markets (though it is unclear whether this is a short-term change or a long-term trend)
- » Younger households forming families later in life
- » Recent college graduates have the greatest level of college debt in US history
- » Fluctuating gas prices (that are generally higher than during the late twentieth century)
- » Increasing number of black and Hispanic households, who historically have lower rates of homeownership (partly due to national programs and trends that could change over time)
- » Smaller household size (49% of new households over the next 25 years will be people living alone)
- » Declining crime rates, particularly in older neighborhoods.<sup>7</sup>

Together, these trends point toward a future where demand for walkable neighborhoods outstrips the supply of those neighborhoods.

<sup>7</sup> Source: Nelson, A. (2013). *Greater Nashville: Trends, Preferences and Opportunities 2010 to 2025 and to 2040*.

## Housing

Changes to the housing market are making Nashville less affordable, particularly for renters and lower-income households.

Providing residents with different housing options is important beyond simple matters of taste. Smaller units with less land allow people with varying needs and tastes to make different trade-offs. For example, as seniors age, some may see a lawn or garden as a hobby, while others see it as a burden to keep up. More diverse housing gives seniors the choice of how to live without having to leave their communities. Some families may trade closeness to shops or downtown for larger lots, while others forego a yard to be able to walk to school. Letting the market provide different kinds of homes gives Nashvillians greater ability to live the lives they want. Meanwhile, these choices always come with a price tag attached. Households with fewer resources find themselves with fewer and fewer options to choose among.

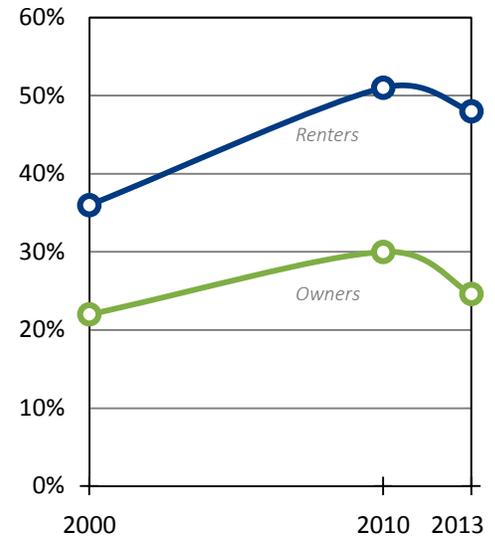
Affordability is a rising concern among Nashvillians. It has consistently been a priority throughout NashvilleNext. The number of households burdened by high home costs (defined as spending 30% or more of gross income on rent or mortgage) has increased over the past ten years. Declining affordability has affected both renters and owners. Worse, 16% of households were severely cost burdened (spending more than 50% on rent or mortgage).

The cost of a home is only one factor in Nashville’s affordability. Homes are more or less efficient in how they use utilities, such as water, electricity, or natural gas. For low-income households, inefficient homes can force families to choose between health and comfort and paying their bills.

Transportation costs also contribute to unaffordability. Car ownership provides Nashvillians flexibility in getting to jobs, schools, retail, and services. However, time spent in traffic and a lack of alternatives force many households into owning one or more cars. For low income households, the shift of low and middle wage work out of the urban core (where it was well-served by transit) to surrounding counties, where jobs are only accessible by car can increase the burden that transportation costs impose. Middle and higher income households seeking a larger home and yard find neighborhoods far from work and daily needs, increasing their transportation costs.

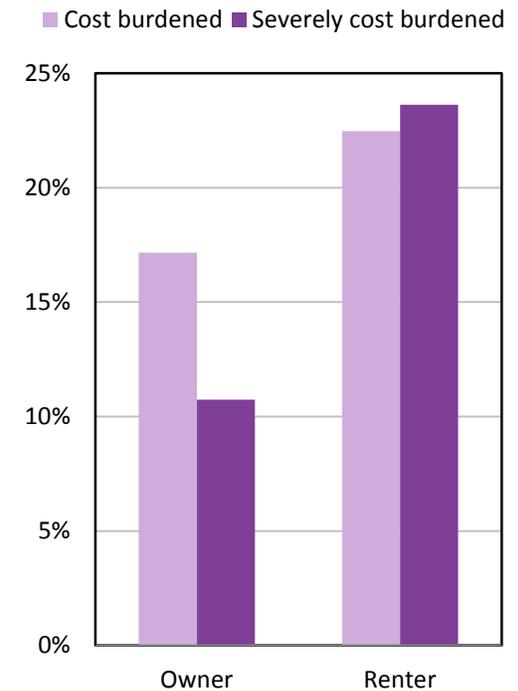
Housing can be a boost or a hindrance to physical and mental health and

**Cost burdened households, 2000 to 2013**



Source: U.S. Census (2000); American Community Survey (2013 1-year estimate, table B25106)

**Severity of cost burden by owners and renters**

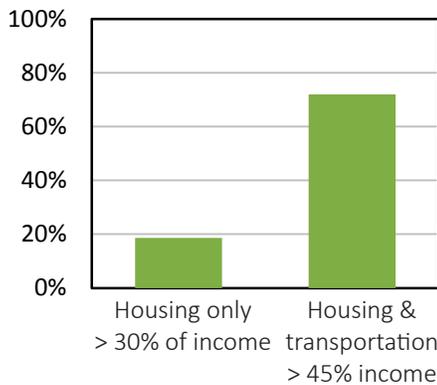


Source: U.S. Housing and Urban Development, Comprehensive Housing Affordability Strategy Data, Housing Cost Burden Overview (using American Community Survey, 2007 - 2011, 5-year estimate)

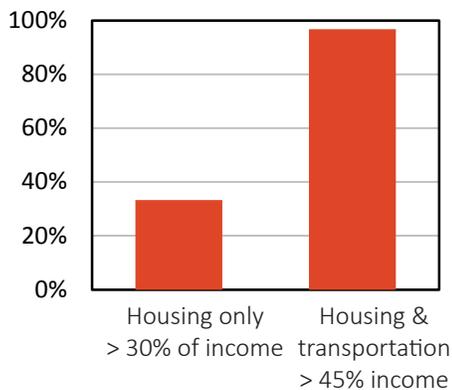
### Transportation and household affordability

What percentage of people in Davidson County who would be considered cost-burdened based only on housing costs (over 30% of income) compared with housing and transportation costs together (over 45% of income).

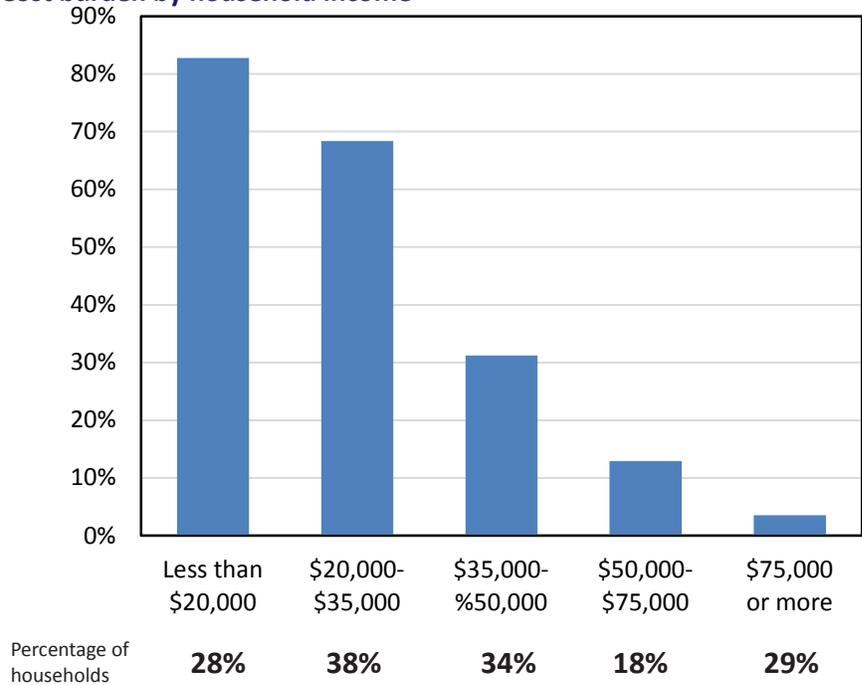
If everyone in county earned the region's median income:



If everyone in county earned 80% of the median income:



### Cost burden by household income



Source: American Community Survey (2013 1-year estimate, table B25106)

to a community's livability. Housing supports good health when it is affordable, clean, and well-built; includes natural greenery; and is part of a neighborhood that supports active living. Housing like this also may foster supportive relationships, restoration, and respite from the world outside. On the other hand, unhealthy and unsafe homes are the culprit of many preventable diseases, injuries, disabilities and deaths. Excessive heat and cold, humidity, mold, and chemical toxins like radon and lead all take a toll on human health. When housing options are limited and affordable housing cannot be found, people often resort to living in overcrowded and unhealthy homes, transitional homes, or emergency shelters.

Housing also plays a large role in the health and wellbeing of people with disabilities. The availability of housing options that can accommodate special needs affects the city's livability. Alzheimer's patients, for example, fare better in small-scale housing that supplies little stimulation and can accommodate physical wandering. Physical handicaps also bring housing concerns. For example, large living spaces and bathrooms are necessary for people in wheelchairs. "Universal design" means designing places to accommodate people with disabilities. Doing so improves safety and convenience for everyone, including small children.

## Neighborhoods, character, and infill

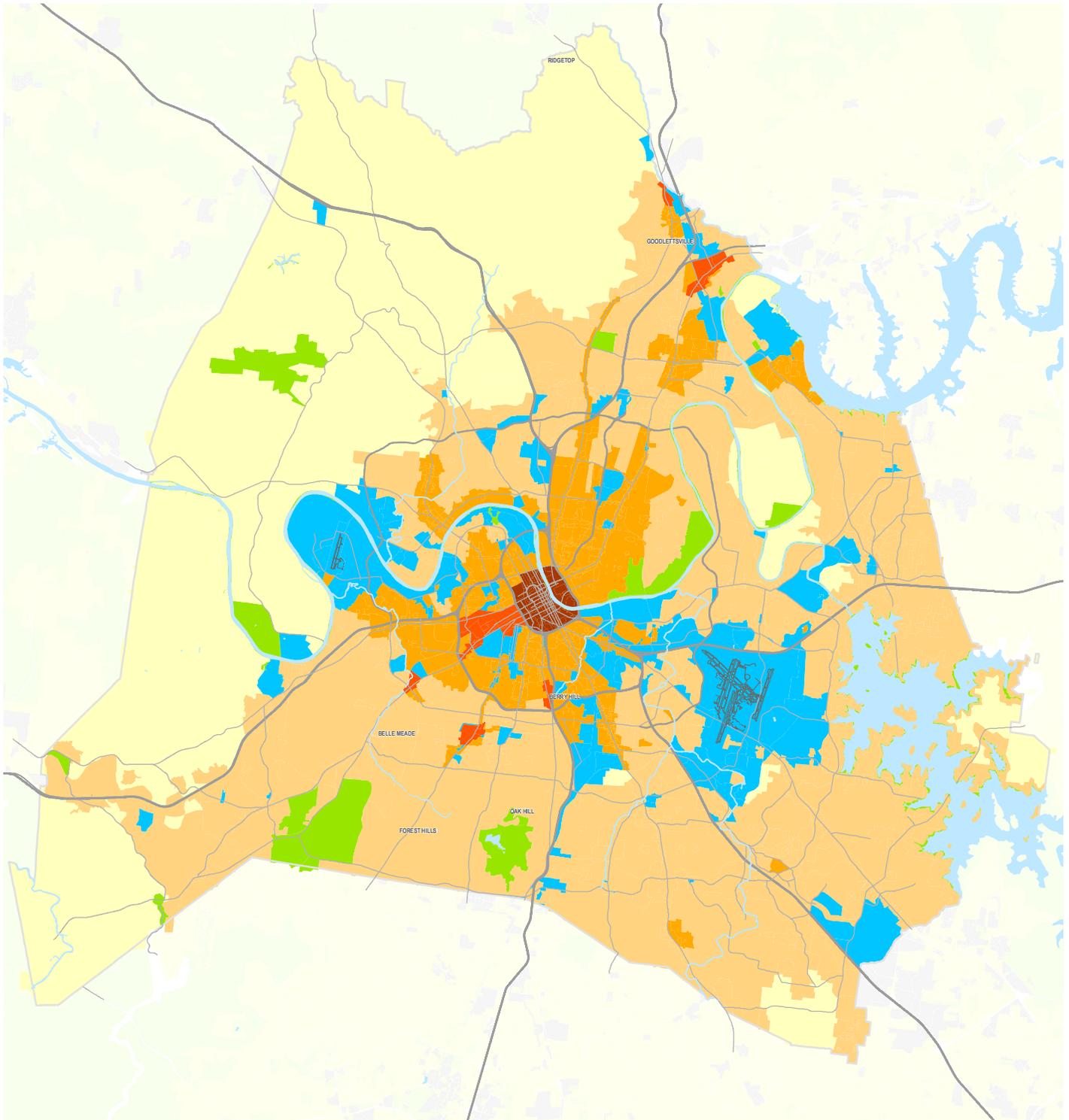
**Many residents are concerned when infill development is out of character with the rest of the neighborhood.**

Nashville includes many different kinds of places, with very different characters. Character is the overall pattern of land uses and intensities, ranging from natural, undisturbed areas, to rural areas, to suburban neighborhoods and shopping centers, to urban neighborhoods, to downtown. Accommodating new housing, services, and jobs, and improving health and livability requires either matching changes to fit the character of the area or carefully and intentionally changing the character of key locations.

The map below shows the different character areas of Nashville. These character areas are called “transects.” Transects are used to recognize that the character of Nashville/Davidson County varies from the most natural and rural to downtown. By acknowledging these different character areas, we can create land use policies, zoning, subdivisions, and other development tools to preserve the diverse character of Nashville/Davidson County.

These transect areas reflect how intensely land is used, how buildings relate to streets and open space, and how neighborhoods are laid out. Transect zones guide land use tools to reinforce the desired character of each part of the county. All development elements—such as the placement and scale of buildings, the type of streets, presence and width of sidewalks, lighting, parks, and landscaping—should reinforce the character of the area.

## The Transect: Character areas in Davidson County



### Transect zones



## The Transect: Characteristics of three transect zones

Rural	Suburban	Urban
<b>Example areas</b>		
Bells Bend, Joelton, Linton, Neelys Bend, Scottsboro, Union Hill, Whites Bend, Whites Creek	Antioch, Bellevue, Bordeaux, Charlotte Park, Cane Ridge, CrieveCrieve Hall, Donelson, Glenclyff, Glengarry, Green Hills, Hadley Park, Hermitage, Hillwood, Inglewood, Oakland Acres, Priest Lake, Rayon City, Rosebank, West Meade, Una-Antioch	12South, Belmont-Hillsboro, Buena Vista, Chestnut Hill, Cleveland Park, Eastwood, Edgehill, Germantown, Greenwood, Hope Gardens, Hillsboro-West End, Historic Buena Vista, Lenox Village, Lockeland Springs, McFerrin Park, Old Hickory Village, The Nations, Sylvan Park, Sylvan Heights.
<b>Neighborhood characteristics</b>		
Sparsely developed with agricultural and low density residential uses	Moderately developed with primarily residential, but other uses are present, often separated from residential areas	Designed with carefully integrated mixture of housing and mix of commercial, employment, entertainment and other uses
<b>Residential</b>		
Common housing types include single-family and two-family; very low density	Most common housing types include single-family and two-family, but townhomes and manor homes are also found; also found are apartments but they are usually separated from one- and two-family homes; low to moderate density	Multiple housing types, single-family, two-family, townhomes, stacked flats, alley houses; moderate to high density
Housing generally located on very large lots with deep, varying setbacks and wide spacing that honors environmental features	Housing generally located on large lots with moderate setbacks, although some new developments may have shallower setbacks	Housing generally located on smaller lots with shallower setbacks and minimal spacing between homes
<b>Open space</b>		
Open space generally passive, utilizing natural vegetation and landscape with few, if any, additional amenities	Fewer public parks because open space and park activities provided via large yards in classic suburban; in newer developments with smaller yards, open space provided within each development	More formal to accommodate active recreational uses, with passive uses appearing as plazas, courtyards and squares
May also include privately-held land trust and conservation easements	Existing trees and vegetation are integrated into site design to preserve green space and dense foliage	Variety of types, ranging from ball fields and playgrounds to picnic areas and urban gardens
Greenways link rural centers and open space	Public open spaces generally larger to serve larger area	Open space often incorporated into centers

## The Transect: Character areas in Davidson County

Rural	Suburban	Urban
<b>Centers</b>		
<p>Smaller, main street areas and village centers with smaller scale and intensity, usually limited to civic uses and daily convenience commercial</p>	<p>Larger, concentrated areas of commercial, employment, entertainment and civic uses with some residential uses that serve immediate neighborhood, community, or region. May be pedestrian friendly internally or with connections to corridors.</p>	<p>Pedestrian-friendly areas of commercial, residential, employment, entertainment and civic uses that serve immediate neighborhood or community</p>
<p>Generally located at intersection of two prominent rural roads</p>	<p>Generally located at prominent intersections along edge of several neighborhoods, although smaller neighborhood-scaled centers may exist</p>	<p>Generally located at prominent intersections; varies in scale from larger centers to small neighborhood centers</p>
<b>Corridors</b>		
<p>Corridors designed to not overwhelm natural landscape; often built to follow natural topography; shoulders and ditches/swales are present, not curbs or sidewalks</p>	<p>Corridors act as throughways, moving people to and from outer areas into more densely populated urban areas; curbs, gutters and sidewalks are present</p>	<p>Corridors may decrease in width, but because of denser population, additional modes of travel are provided by sidewalks, bikeways, and transit</p>
<p>Buildings are clustered near corridor intersections in towns and hamlets</p>	<p>Land uses are best centered at intersections but are also found in a linear fashion along corridors</p>	<p>Mix of uses exist with buildings placed and oriented so that they address the street</p>
<p>Along corridors land uses limited to residential and agricultural. Development is often removed from view with deep setbacks</p>	<p>Land uses adjoining corridors range from residential to commercial uses with deeper setbacks to accommodate landscaping; some areas are built closer to the street</p>	<p>Corridors may contain all higher density residential or a mix of uses</p>
<p>Limited road network; limited travel options, mostly vehicles</p>	<p>Moderate street connectivity; pedestrian and biking opportunities; limited transit options</p>	<p>Street grid usually more complete, people have multiple routes and corridors begin to function as destinations; multiple modes of travel options</p>

The change in high-demand neighborhoods discussed above also has implications for neighborhood character. The map below shows the location of infill development since 2007. Many of the red dots are small lots rebuilt with larger homes or larger lots divided into two or more smaller lots with large homes.

East Nashville, Green Hills, West Nashville, and neighborhoods within the I-440 loop all show striking amounts of infill development, with small parcels in ones, twos, and threes redeveloping to a much higher intensity (more homes, larger homes, or both). Sometimes new development is welcomed by existing residents, but often it is controversial. For existing residents, new homes in their neighborhoods can trigger a number of concerns, including:

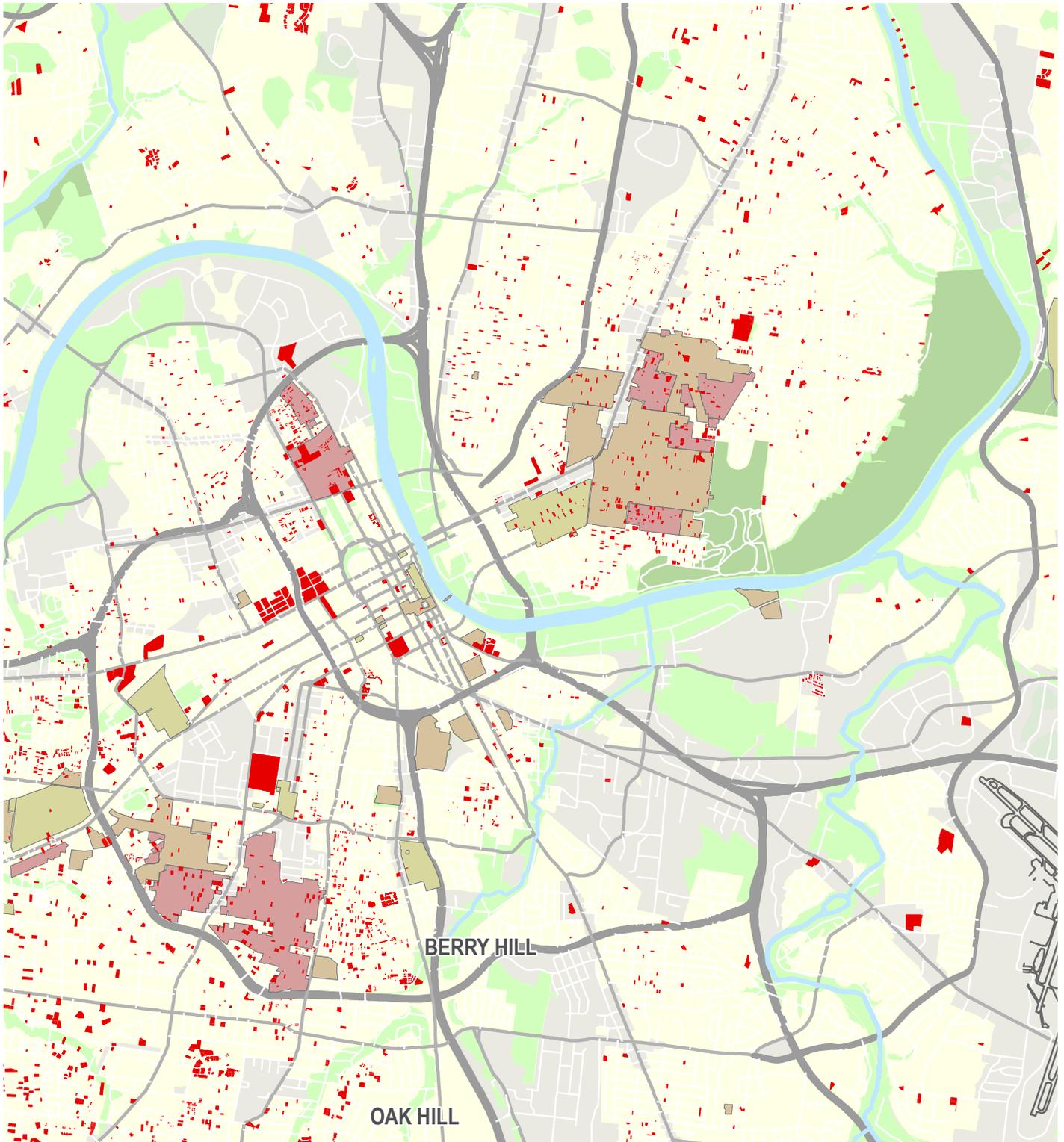
- » the price, whether it is too low or too high
- » the character, height and bulk compared to surrounding homes and the impact that additional height and bulk has on existing neighbors
- » the sufficiency of infrastructure, usually related to stormwater runoff, erosion, transit, sidewalks, and parking

New development in urban areas is typically higher end, and in many cases, existing lower and middle income residents feel squeezed out.

These neighborhoods are increasingly turning to tools such as historic districts, conservation districts, urban design overlays, or contextual overlays to protect the character of their neighborhoods or limit teardowns, yet these tools may not be appropriate and may not work in all situations. In particular, because these tools focus only on preserving the existing built environment, they have limited ability to promote affordability.

## Infill development in the urban core (2007 - 2015)

Infill development includes new subdivisions and building permits in in-town neighborhoods.



 Infill development (January 2007 - January 2015)

Effective date

 1990s or earlier

 2000 - 2007

 2008 - 2015

## Safety

The challenges of public safety in Nashville are also changing. Similar to education, the activities of police, fire, and other safety personnel are outside of the scope of NashvilleNext. Nevertheless, the form and character of the built environment shape how safe the city is in a number of ways.

For police, crimes occur when a perpetrator has access to a victim. For many crimes, access is a function of the built environment:

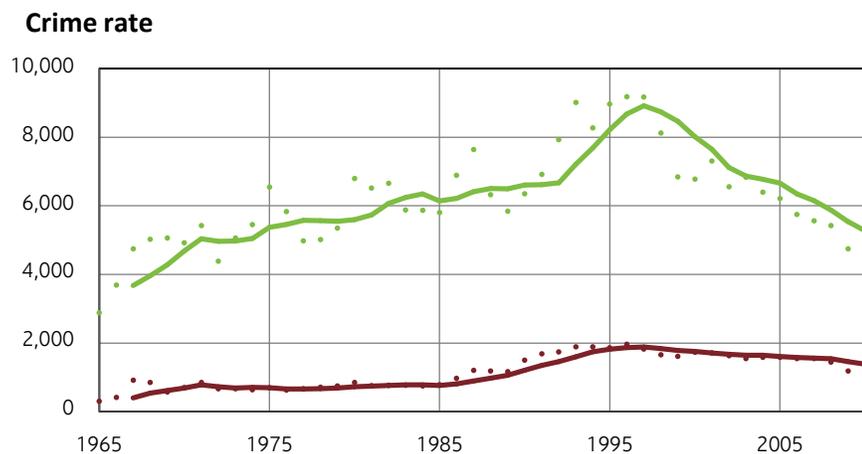
- » Can a criminal gain access to homes without being seen?
- » Are the places that people walk well-lit at night, and do they have blind spots where criminals can hide?
- » Are public places visible to bystanders?
- » Are there large parking lots, particularly those without lighting?

For fire, the age and quality of buildings contributes to the prevalence and location of fires, as well as the kinds of uses that occur within buildings.

The built environment, and especially the street network, also shapes response times. Because they drive, walk, or bike away from their stations, police response times are less affected. For the fire department, however, the street network plays a major role in response times. A well-connected grid network, with many ways of getting between a fire station and an emergency, allows one station to serve a wider area. A suburban street pattern, with many cul-de-sacs and only a few major roads that connect

### Davidson County crime rate

Violent and property crimes per 100,000 residents have both declined since their peaks in the 1990s.



Source: Metro Nashville Police Department

different parts of an area, or rural areas with few homes and buildings spread across a large area require either longer response times or more stations.

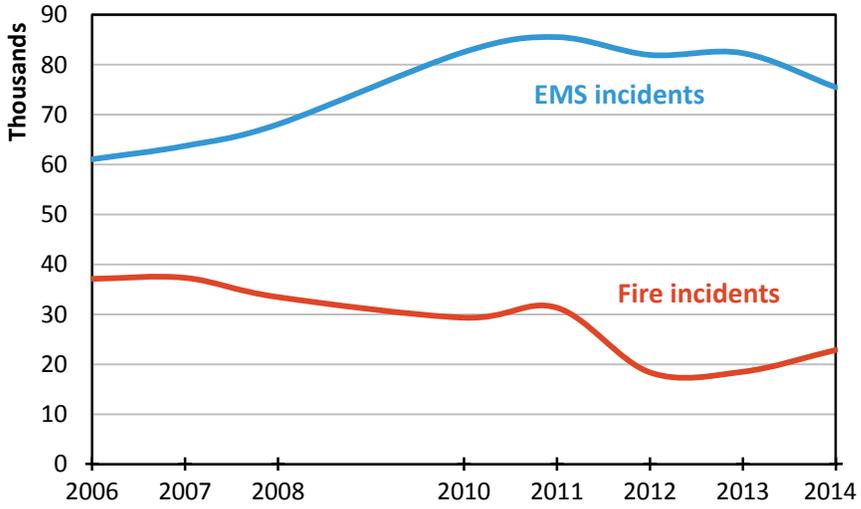
The Police Department and Fire Department both face long-term trends that impact their day to day activities. For the police, the sharp decline in crime is especially noteworthy and welcome. This drop, two decades long at this point, set the stage for the demographic trends discussed above. Without it, it is difficult to imagine that the demographic pressure for smaller, more urban homes would be at the level it is.

The Fire Department, on the other hand, faces two different trends. The return to the city poses response and logistical challenges, as a growing population in crowded urban areas could require more emergency response trips in congested roads. Meanwhile, as redevelopment occurs, older buildings built to out of date fire standards are often replaced by newer, modern buildings that are less prone to fire hazards. However, as taller buildings become more common beyond downtown, the Fire Department must locate more ladder trucks nearby to deal with potential high-rise fires.

Second, the aging population means a continued shift in workload. Currently, two-thirds of the Fire Department calls are for medical emergencies, while only about one-third are for fire suppression or alarms. As Baby Boomers continue to age, this trend will likely continue.

**Type of calls to the Fire Department, 2006 - 2014**

Two-thirds of the calls to the Fire Department are for medical emergencies.



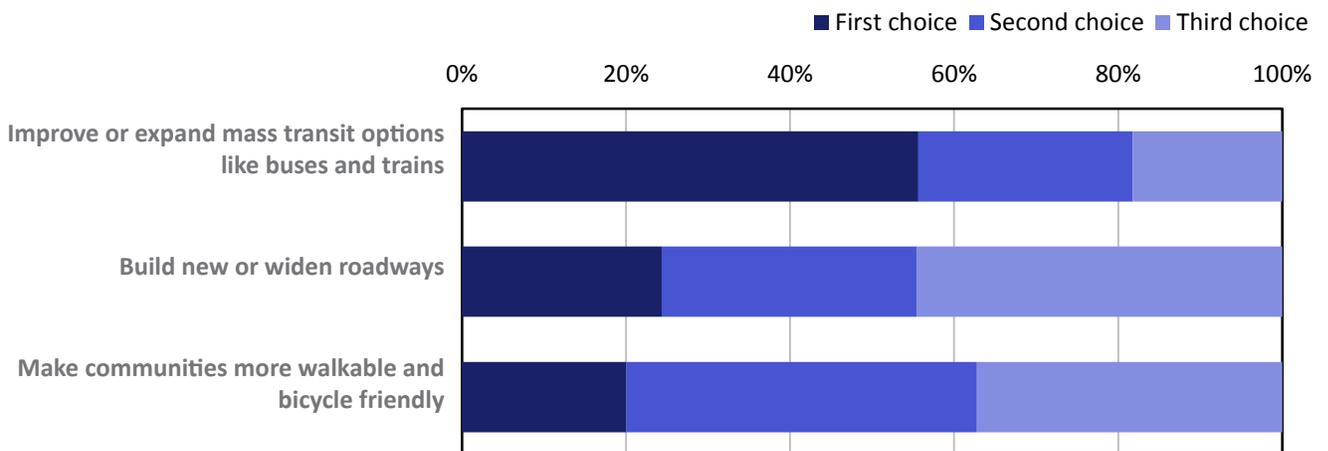
Source: Metro Nashville Fire Department

## Transportation

As in any growing city, traffic, congestion, and transportation access are critical concerns for Nashville today and as it grows. Congestion and lack of transportation options affect many quality of life and economic issues.

### Preferences for improving transportation

If you had to decide on an overall strategy for improving transportation in Middle Tennessee, which of the following would be your first priority, second, and third priority:



Source: Nashville Issues Survey (2012)

### Roads

Most Nashvillians drive most of the time. Ninety percent of trips in the U.S. take place in a car. Like river transportation and trains before them, cars have fundamentally shaped Nashville and the lives of Nashvillians.

Since World War II, Nashville has been built around a series of smaller, local roads, feeding into major streets, including those that are part of the state and federal highway system, with limited access interstates carrying the heaviest traffic. Changing the character of these roads—widening them or narrowing them, or changing the balance of users that they accommodate, such as by adding bike lanes—is straightforward to engineer but requires close coordination of multiple Metro, State, and Federal agencies, as well as engagement with property and business owners, drivers, riders, and other stakeholders. Nevertheless, creating an efficient transportation system requires actively responding to the challenges of congestion, urban infill, air pollution and greenhouse gas emissions, and changing tastes for transportation modes.

**Counties with the most driving rates had the highest levels of obesity. Each hour in a car every day raised the likelihood of obesity by six percent.**

*American Journal of Preventive Medicine, 2004*

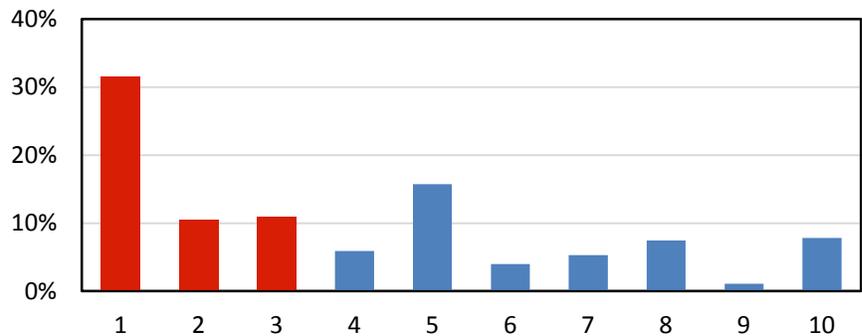
With few major new roads planned, the task shifts in two ways. Simply maintaining an expansive road network will be critical. In some areas, particularly in still growing suburban areas, crucial connections between parts of the road network still need to be made. In other areas, roads may be widened to accommodate current or future traffic.

In urban areas, the task becomes more difficult. With little appetite for the controversy or expense of widening urban roads, we must focus on using existing right of way as efficiently as possible, recognizing the diversity of uses and users of each street. Reorganizing our major corridors to better accommodate the choices Nashvillians are asking for can help manage congestion without widening roads.

As Nashville ages, more people will be unable or reluctant to drive. That increase in aging seniors (20% of the population) is in addition to the population with a disability that limits their ability to drive, as well as 25% of people who will be under the age of 18. Ten percent of households earn below the poverty line, for whom private auto ownership is a financial burden. Additionally, younger adults are waiting longer to get drivers licenses (the number of people aged 14-34 without a driver's license increased from 21% in 2000 to 26% in 2010).

**Most Nashvillians find it difficult to get around without driving a car**

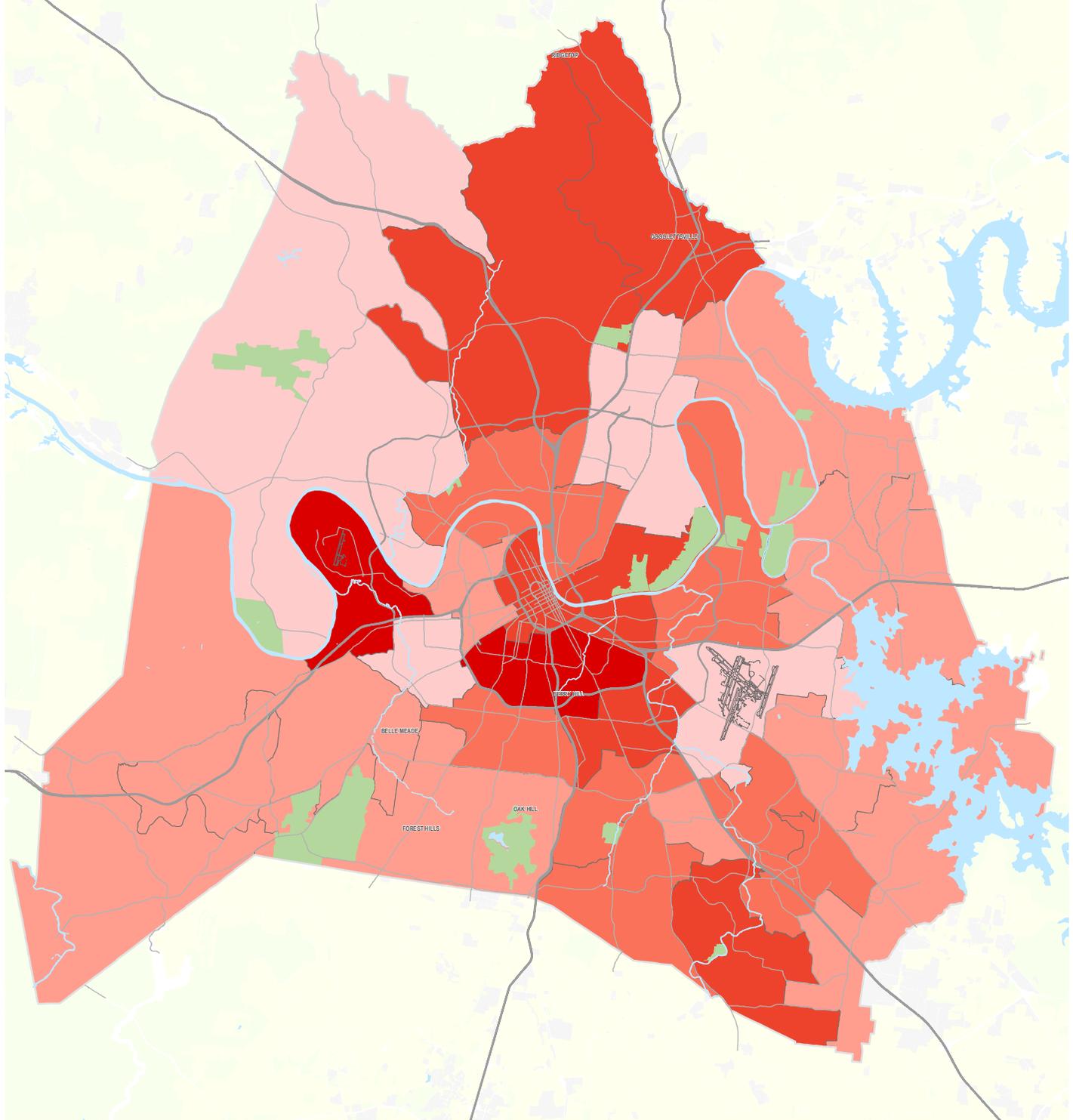
“On a scale of one to ten, where one is very difficult and ten is very easy, how easy for you is it to get around Nashville without driving a car?”



Source: Nashville Issues Survey (2012)

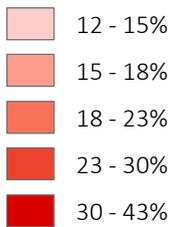
Among Nashvillians who can drive, many will find it more and more unaffordable. Gas prices are fluctuating but now seem to be generally higher than in most of the second half of the twentieth century. We are also more

# Non-single occupancy vehicle share of commutes to work, by Council District



## 2011 Council Districts

Non single occupancy vehicle share of commute to work



aware of the contribution of transportation to the cost of housing. When homes are separated from jobs, schools, shopping, and other daily needs, the cost associated with daily travel escalates.

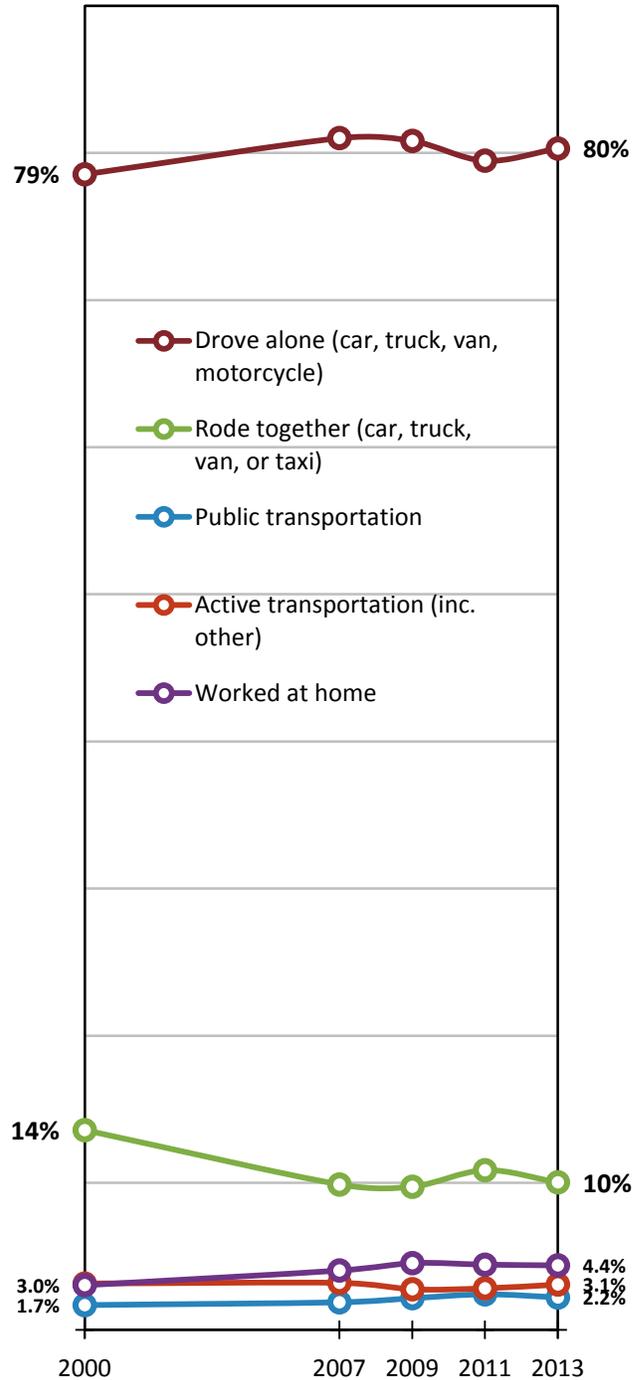
With large areas devoted to moving or storing cars, and with more time spent traveling, few Nashvillians get enough regular physical activity to stay healthy.

These changes are reflected in Nashville and Davidson County residents' behavior, as daily vehicle miles traveled—the total amount of driving that happens within Davidson County—has leveled off over the past ten years. During that same time, transit ridership has grown rapidly.

As the same time, federal and state funding for transportation is declining. Nashville rights-of-way — the publicly accessible land in between private properties, which typically includes streets, sidewalks, alleys, greenways, and the similar infrastructure — is difficult and expensive to expand, especially in high-demand areas, where property values are higher. It's more and more environmentally difficult and expensive to acquire land and buildings to expand roads. Therefore, we have to use our existing rights of way more efficiently.

Currently, responsibility for planning and managing Nashville's transportation network is split among multiple departments and agencies. Within Metro, the Planning Department is responsible for managing public rights-of-way, while Public Works is responsible for constructing and maintaining public facilities within those rights-of-way, except for state highways, which are managed by the Tennessee Department of Transportation. Transit and transit stops are the responsibility of the Metro Transit Authority, although sidewalks and other ways to get to those transit stops are the responsibility of Public Works. In addition, the Metropolitan Planning Organization (MPO) coordinates regional transportation investments through planning and distributing state and

**Means of transportation to work, 2000 - 2013**



Source: U.S. Census (2000); American Community Survey (2007, 2009, 2011, 2013 1-year estimates)

federal investments. Each agency has a set of primary concerns it responds to. For example, Public Works and MTA are most closely attuned to the needs and concerns of current road users (drivers and transit users, primarily), while the Planning Department and the MPO consider long-range trends and community needs and desires.

Other agencies play a role as well. Metro Water Services builds and maintains stormwater and sewer infrastructure that keeps roads clear and safe during storms. Nashville Electric Service maintains utility poles (which may carry electricity, cable, telephone, and other utilities) in the public right of way. Coordination between the various state, local, public, and private entities involved in any segment of road must be extensive to provide a high level of service to Nashvillians.

*A new approach to transit*

These concerns are not new. In response, Nashville has been working on a new approach to transit. Nashville MTA, working with the Metropolitan Planning Organization, has introduced new transit types to add capacity and reliability to its local bus system.

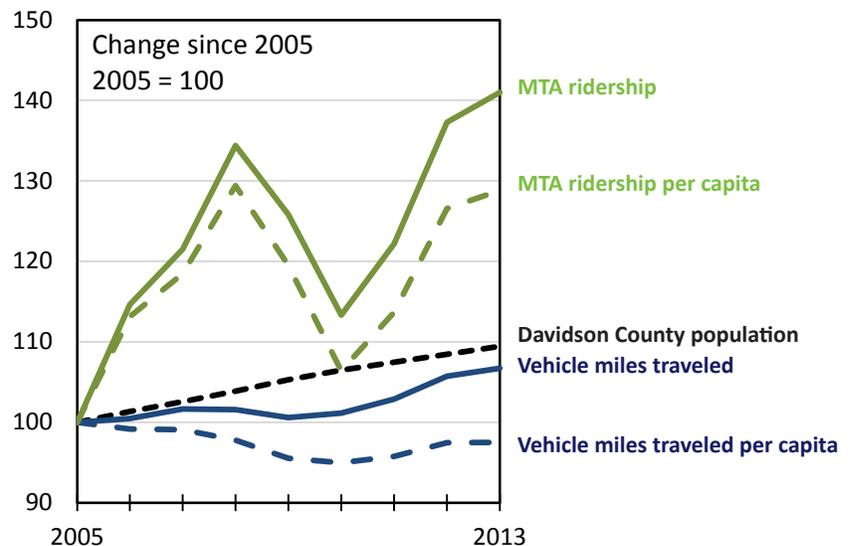
- » Music City Star, which was Nashville’s first new mode since the creation of Nashville’s contemporary bus system. The Star runs commuter service on existing heavy rail lines from Downtown’s waterfront to Wilson County in the east.
- » Local express services currently serves Gallatin and Murfreesboro Pikes, with expansions to Charlotte and Nolensville Pikes planned. Local express service, also called BRT Lite, shifts bus service toward higher capacity, more reliable service by spacing stops further apart and investing in signal prioritization. These routes also feature more prominent bus stations. Service is still constrained, however, by being mixed with auto traffic.
- » Transit running outside of traffic: the next step in creating a more robust transit system. This can take the form of bus rapid transit, in which buses run in dedicated lanes, or as light rail service.

**Change in driving and transit use, 2005 - 2013**

This chart shows the change in vehicle miles traveled (total and per person) and transit use (total and per person) since 2005. 2005 is shown as 100, with changes since then relative to 100.

The number of miles traveled by vehicles in Davidson County has risen slightly since 2005 due to population growth. The number of miles driven by each county resident has declined slightly.

Meanwhile, transit ridership has increased in total numbers and per county resident.



Source: Metropolitan Transit Authority; Tennessee Department of Transportation; American Community Survey.

Each of these steps moves Nashville toward a system of more frequent and reliable transit service. This has implications for other aspects of the design of MTA's system, including stop spacing and, payment systems.

Transit service and land use patterns typically evolve together. Denser, more intense land uses support a higher level of transit service. Greater transit service in turn allows higher development intensities. In addition to buses running more frequently, higher transit service can also include increasing amounts of fixed infrastructure. This can be as simple as upgrading from a bus stop indicated by a sign only to a bus stop that includes a bench, shelter, lighting, and a time table. It includes signal prioritization, where the bus can communicate to stop lights to receive priority in order to maintain timeliness. At the high end, fixed infrastructure includes dedicated lanes (for bus rapid transit) or routes completely separated from traffic (as in light or heavy rail).

As the scale of these investments increases, the importance of aligning where Nashville spends its money to where it gets the greatest return (in increased ridership) becomes increasingly important. This goes beyond transit investments on their own, and seeing how broader investments (or lack thereof) support or limit transit ridership. For example, lack of sidewalks from residential areas to transit stops or stations limits riders. Providing pedestrian connections is an important part of a complete transit-supportive neighborhood.

### **Examples of how transit routes can evolve along a corridor over time**

Local Bus Service-> Local Express Bus Service (BRT Lite) with Transit Signal Priority & Queue Jump Lanes-> Dedicated Arterial BRT Lanes

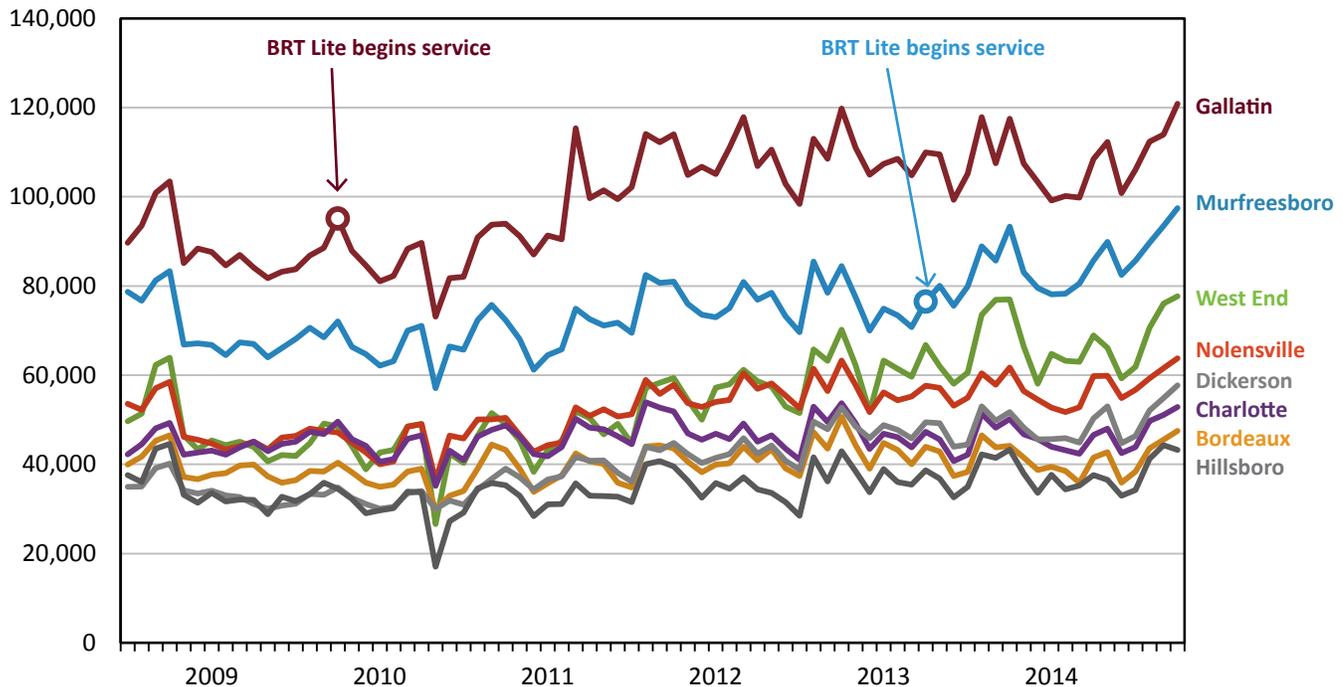
Commuter Bus Service (Relax & Ride)-> BRT on Shoulder-> Dedicated BRT Expressway-> Light Rail

### Factors and approaches to providing and improving transit service

The level of transit service provided throughout a system depends on a number of factors that affect individual lines, stops, and stations. These factors affect the frequency and reliability of service, as well as when routes are run throughout the day.

Technology	Type of route	Transit stops	Vehicle types	Infrastructure	Service frequency	Hours of operation
Electronic Fares	Commuter Bus	Park and Ride	Van	Mixed Traffic	1 Hour	Weekday
Bus Tracker	Local Bus	Lots	Minibus	Queue Jump	30 Minutes	Morning & Evening
Apps	Express Bus	Signed Stops	Bus	Lanes	15-20 Minutes	Commutes
Arrival & Departure Times	Bus Rapid Transit	Benches	Commuter Bus	Bus On Shoulder	7-10 Minutes	Weekdays and Weekends
Transit Signal Priority	Light Rail	Shelters	Articulated Bus	Mix of In-Traffic & Dedicated Lanes		Late Nights
	Heavy Rail	Stations	Light Rail Vehicle	Dedicated Lanes		
	Commuter Rail		Diesel Multiple Unit	Dedicated Bus Only		
			Heavy Rail Vehicle			

### Monthly MTA ridership on select corridors



Source: Metro Transit Authority

### *Walking and biking*

Providing transportation options and making a city more walkable is good for the health of its citizens and their quality of life. The built environment plays a key role in the decisions people make on whether to walk, to bike, to ride public transit, or to drive their own cars. What makes a place more walkable? A combination of direct routes (typically through an interconnected street grid pattern which allows for an abundance of intersections) with appropriate facilities (like sidewalks), higher population density, and greater mixed land use creates areas with housing, employment, recreation, services and shopping all within walking distance.

Walkability's two primary parts – places to walk to and features that make walking safe and pleasant – both change based on context (urban, suburban, rural). Rural areas have fewer and smaller walkable districts, as well as fewer sidewalks. However, these areas also have less traffic and more opportunities to walk across open spaces. Urban neighborhoods, on the other hand, have the most vehicle traffic, as well as the most places to walk to, whether it is a school, café, or to visit neighbors down the street. Some suburban neighborhoods have low enough traffic that shared space along the street is appropriate. Increasingly, however, appropriately placed and sized sidewalks are needed, especially to and in commercial areas.

The average Nashville commuter spends 45 minutes in traffic each day during peak travel periods. Urban sprawl has led to longer commute distances, making cars the most practical means of transportation. All this car travel is stressing us mentally, physically and environmentally. People who drive 9,000 to 18,000 miles in a year are 75 percent more likely to have neck and back pain than those who drive 3,000 miles or fewer annually. In 2009, the average Middle Tennessee driver traveled 15,000 miles.

Transportation is a major contributor to air pollution. In the Nashville area, an excess 18,652,000 gallons of fuel was consumed in 2012 because of congestion-related delays. Living near major roadways has been shown to be detrimental to health, particularly lung health. The health impact includes causing or exacerbating chronic respiratory illness, asthma, impaired lung function, and cancer and heart disease.

**Nashville ranks 7th worst in the nation in the amount of carbon dioxide produced because of congestion-related delays.**

*Texas Transportation Institute. 2012 Urban Mobility Report*

Nashvillians have consistently asked for more and better areas to walk in. Sidewalks and walkability are common requests to Councilmembers when reviewing the capital improvements budget, and during Community Plan updates.

Sidewalks are only one part of making walking safe and inviting. Safe intersection design including street width and crossings, including ramps for people with walking difficulties or strollers, are also important. Generally, making sidewalks safe for children and people disabilities ensures they are safe for everyone. Street trees and furniture and appropriate placement between buildings, sidewalks, landscaping, and roads can make walking pleasant.

The pattern of streets and blocks is also important to how walkable an area is. Nashville's neighborhoods built before the 1940s typically were built to a rough grid pattern, with small lots and square or rectangular blocks. Most of these neighborhoods were built with sidewalks, and markets, schools, and libraries nearby. Many of them had streetcar service, allowing them easy access to downtown.

After World War II, as automobile ownership spread through more households, new and rebuilt neighborhoods of ranch homes on large non-sewered lots were built in communities like Madison, Bordeaux, Donelson, Goodlettsville, Green Hills, and Bellevue. Because they were built expecting their new residents to primarily drive, roads were redesigned to spread out traffic. and Shifting from a compact development pattern to one more spread out, with short and long term effects. As these neighborhoods were being built, larger lots with a more extensive road network meant that traditional urban infrastructure like sidewalks, curbs, and gutters were abandoned in favor of drainage ditches. In the long-term, this means that much of Nashville has been on the assumption that everyone can and will drive, in a way that discourages walking. That, in turn, has contributed to many of the health and environmental issues Nashville is facing today.

**43 percent of people with safe places to walk within 10 minutes of home met recommended activity levels.**

**Only 27 percent of those without safe places to walk were active enough.**

*American Journal of Public Health, 2003*

Retrofitting these areas, even to achieve residents' desires for increased walkability, is expensive and disruptive.

Places that allow walking to be a part of people's daily routines make it more likely that people will exercise enough each day (at least 30 minutes for adults and 60 minutes for children). Street design impacts the safety and ease of walking and biking, which impacts the amount of walking and biking that residents will do. A grid pattern enables the most direct route to destinations as well as travel options. Designated bike lanes for bikers and sidewalks with convenient crosswalks for pedestrians appeal to walkers and bikers. The width of the street and the time given by a traffic light to cross the street may determine whether children, the elderly, or the infirm can safely cross the street. Streets with multiple lanes are less safe. People choose to walk when they can walk safely, using a direct route, to destinations nearby.

A half hour per day of brisk walking provides a long list of benefits, including improved blood circulation and cholesterol levels; reduced risk of heart disease and stroke; decreased bone loss; and increased energy and muscle strength. Daily exercise also helps prevent weight gain; releases tension, stress and anxiety; improves depression; promotes better sleep; and may delay or prevent chronic illnesses.

Aside from encouraging fitness, walkable streets give residents the benefit of more social cohesion. Residents of walkable neighborhoods are more likely to know their neighbors, to trust others, to be politically active and to participate in social activities. Ramps, depressed curbs, wide doorways, and easy access to transit routes make it possible for seniors and disabled residents to participate fully in the community, engage in physical activity, talk with neighbors, and access health care and social services.

Bicycling has grown in popularity over the past ten years, particularly as bike-friendly infrastructure has been added. Nashville's bike routes have grown and diversified, adding greenways, bike lanes, and signs for shared lanes to increase the safety of cycling. More recently, the addition of bicycle sharing services (first with Nashville Green Bikes, which introduced bike sharing in parks, and then with BCycle in many more areas) allow more riders, and more casual riders, to use bikes for short distances in walkable, bikeable neighborhoods.

## Sidewalks in Nashville

Nashville has 1,076 miles of sidewalks, up from 752 when the first Strategic Plan for Sidewalks and Bikeways was completed in 2002.

For the 2002 Plan, Public Works studied Nashville's 752 miles of sidewalks, and found a large number of problems:

- » Only 0.5% of sidewalk blocks were free of problems (Problems included damage, steepness, lack of ramps, and obstructions)
- » Only 9.4% of sidewalk ramps were ADA compliant

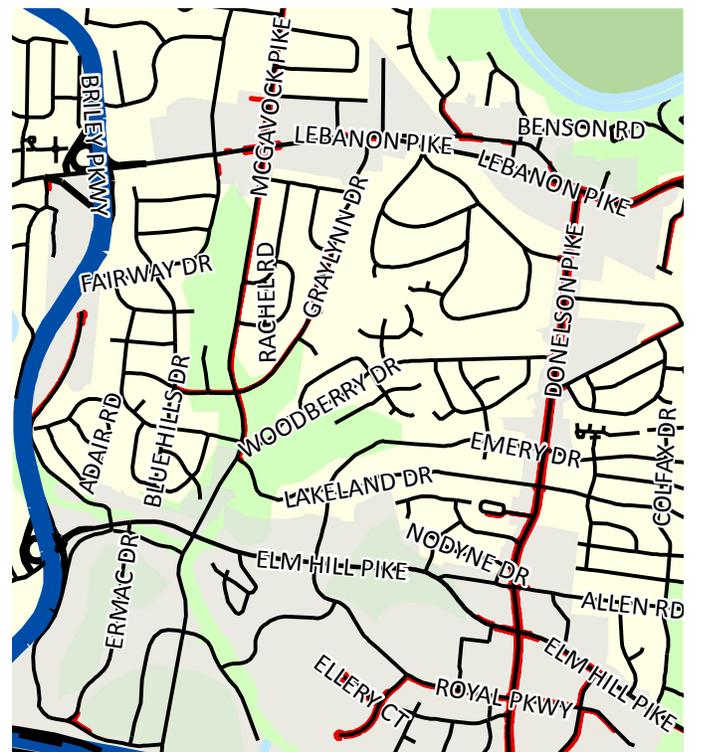
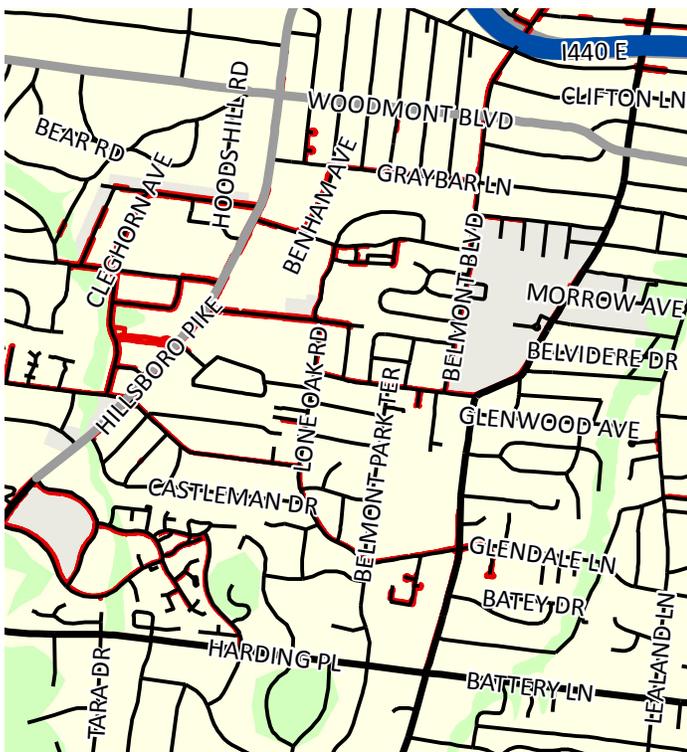
### Sidewalks and block patterns in walkable neighborhoods built before World War II

Red lines show streets with sidewalks.



### Sidewalks and block patterns in drivable neighborhoods built after World War II

Red lines show streets with sidewalks.



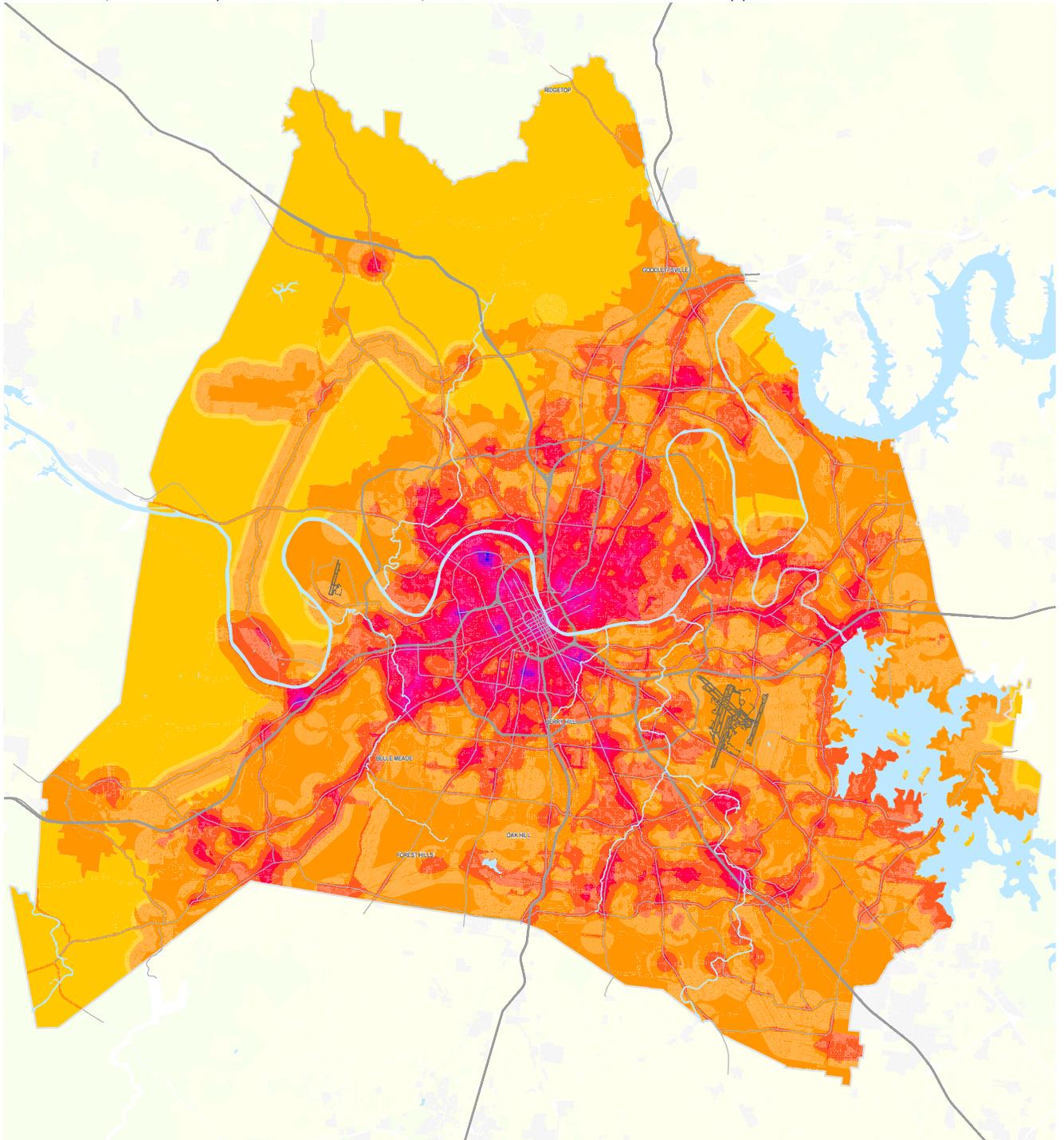
Historically, the expansion of Nashville’s bikeway network has been coordinated to coincide with regularly scheduled street maintenance and repaving. Over the years, this process has dramatically increased active mobility in many areas of Nashville. Nashville has been investing in active transportation infrastructure since the adoption of its Strategic Plan for Sidewalks and Bikeways in 2003, the city now commits resources to innovative infrastructure projects that go above and beyond traditional bicycle accommodation. For example, the city celebrated the grand opening of Tennessee’s first protected bike lane on the 28-31st Avenue Connector in October of 2012 as well as the creation of the state’s first bike box on Church Street in August of 2014. The city has also begun applying buffered bike lanes instead of standard painted bike lanes as the default treatment whenever sufficient right of way allows. This policy has resulted in 9.6 new miles of buffered bike lanes since 2012. The 11th Avenue Complete Streets project, currently under construction, will connect a vibrant mixed use neighborhood with an urban greenway using a grade separated cycle track.

**Neighborhoods built to support bicycling have seen a boom. Since 2000, the percentage of residents of Council District 18 cycling to work increased from less than 1% to 3.4%.**

*Source: U.S. Census (2000); American Community Survey (2009-2013, 5-year estimate).*

## Pedestrian Generator Index

This map shows which parts of the county have the most potentially walkable destinations. Because it was developed to help prioritize new and replacement sidewalks, it reflects only the destination and route, and not whether sidewalks are currently present .



Pedestrian Generator Index



## Parks and greenspace

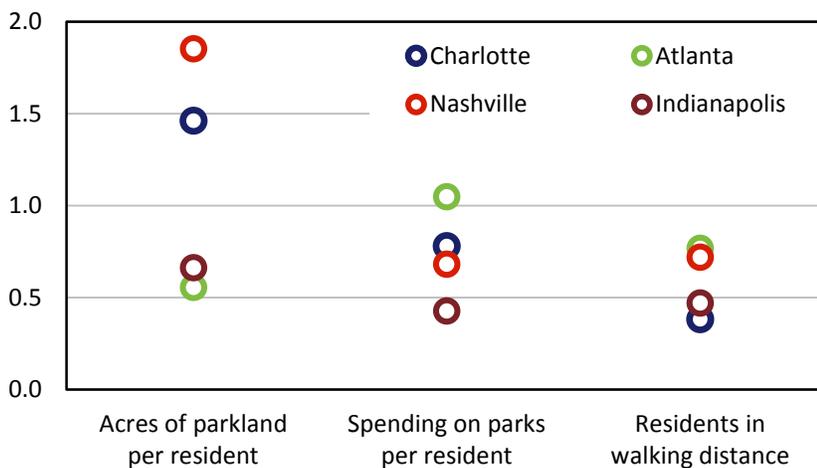
Access to green space supports physical and mental well-being, but not all densely settled parts of the County have access.

Forests, agricultural areas, greenways, large landscaped areas, city parks, and ballfields are all considered part of our green network, and all afford people living near them with both calm respite and a place to recreate, provide gathering places, offer shade and protection from the sun on a hot sunny day, and provide a filter for pollutants in our air and water. Greenery increases the quality of life and adds years to the quantity of life. In addition to its aesthetic benefits, green settings have been shown to decrease fear and anger and increase mental alertness and cognitive performance.

Living close to green space and having access to a garden is correlated with lower levels of stress, anxiety, depression, and obesity, and, especially among the elderly, more positive perceived general health. Green common spaces lead to stronger social ties, and when new parks open, neighbors are more likely to interact, take pride in their community and form local improvement groups.<sup>8</sup>

The health effects of green space are very pronounced. Benefits come not just from being in natural surroundings, but also from just looking at natural settings. Similarly, being able to see a few trees or a little landscaping from the office desk has been shown to enhance feelings of satisfaction and restoration. Parks facilitate a physically active lifestyle for people who

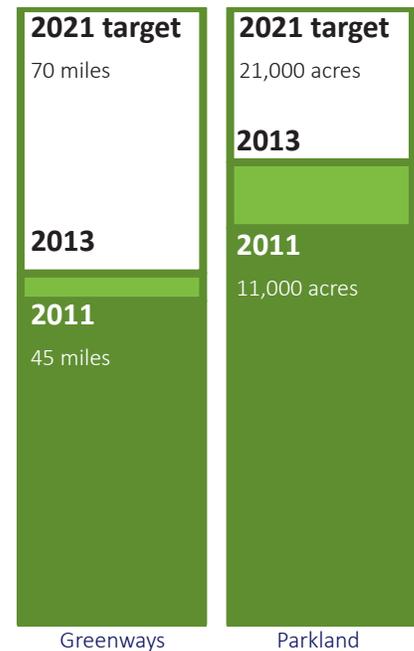
### Nashville parkland compared with peer cities and the national average



Source: Trust for Public Land, ParkScore report (2012)

### Progress toward open space goals

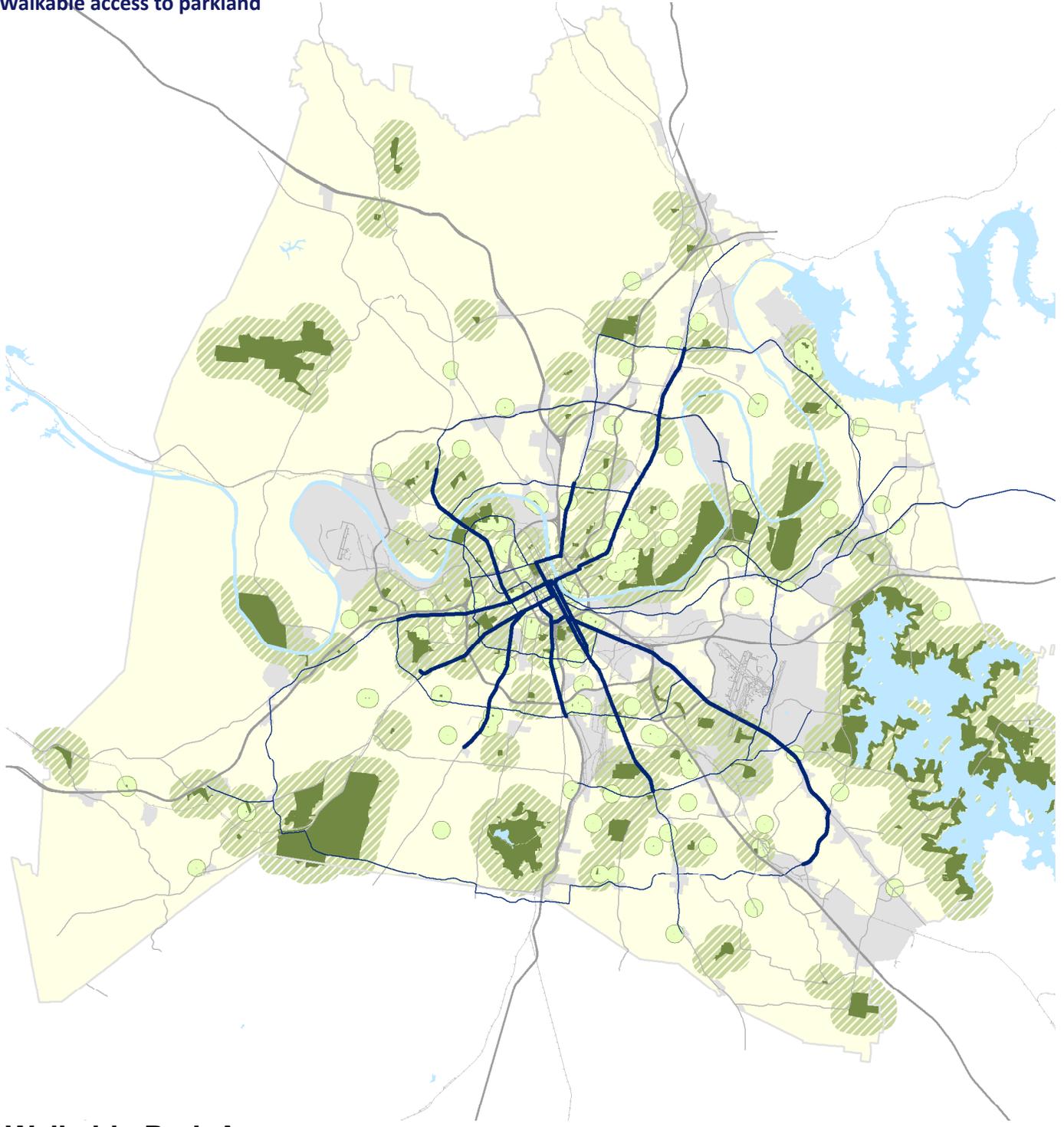
The 2011 Open Space Master Plan set ambitious goals for conservation, parkland, and greenways. Metro is already pursuing those goals.



Source: Metro Parks & Greenways

<sup>8</sup> Healthy and Livable Communities White Paper, NashvilleNext

**Walkable access to parkland**

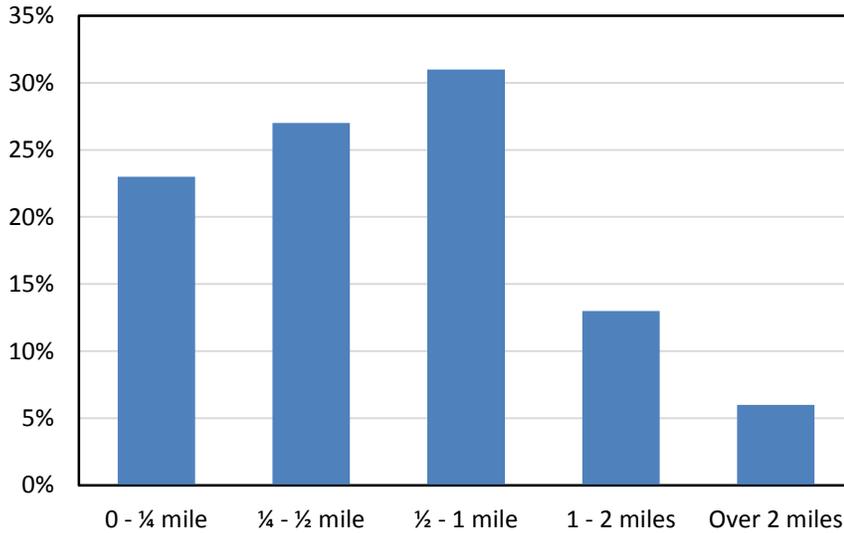


**Walkable Park Access**

-  All Parks
-  1/4 Mile Access to Mini Parks
-  1/2 Mile Access to Neighborhood, Community, and Regional Parks

### Percentage of park users by distance between park and home

People who visit a park are more likely to live within one mile of the park.



Source: "Park Use and Physical Activity in a Sample of Public Parks in the City of Los Angeles." Cohen, Deborah et al. RAND Technical Report (2006)

live near them. In fact, most people who use public parks live within a mile of them. However, access to parks and greenspace is not evenly shared throughout the county.

Greenspace is also important to Middle Tennessee’s other inhabitants – the thousands of other animals and plant species. Natural habitats are critical for the species unique to the Cumberland River watershed. In Davidson County, 41 plant or animal species are considered threatened or endangered by either the State of Tennessee or the United States Environmental Protection Agency. Another 26 species are identified by the State as in need of special attention or management.

### Species listed as threatened, endangered, or needing special attention

Type of species	Number
Flowering Plant	41
Bird	7
Fish	6
Mollusc	6
Plant Community	3
Amphibian	2
Heron Rookery	1
Insect	1

## Food access

**Diet is critical to good health, but land use and transportation can limit residents' healthy options.**

Failure to eat a healthy diet over time takes a toll on quality, productivity, and length of life; increases health care spending; and lowers school test scores. In turn, all of these can reduce local economic vitality. Today, some of the leading causes of death in our country are due to excess body weight. More than a third of American adults and 17 percent of children and adolescents are obese. It is a need for a more thoughtful food system that allows all people to conveniently access fresh, healthy foods at an affordable price.

Obesity increases the risk of type 2 diabetes by as much as 34 times. Diabetes complications, especially when left untreated, include blindness, kidney failure, heart disease and poor blood circulation that can lead to limb amputations. Along with diabetes, imbalanced eating increases the risk of heart disease, high blood pressure, stroke, and some cancers.

Personal choices have the biggest impact on health. However, land use and transportation decisions shape what options for healthy food are available. This is especially true when transportation costs (in time or money) are added to the cost of the food. Supermarkets generally have a wider selection of fresh produce and lower prices than corner or convenience stores. Living in close proximity to a grocery store compared with living in close proximity to convenience stores and fast food outlets can affect the choices we make and the health outcomes of the neighborhood. Researchers find that as grocery store access decreases – regardless of education and income – obesity increases.

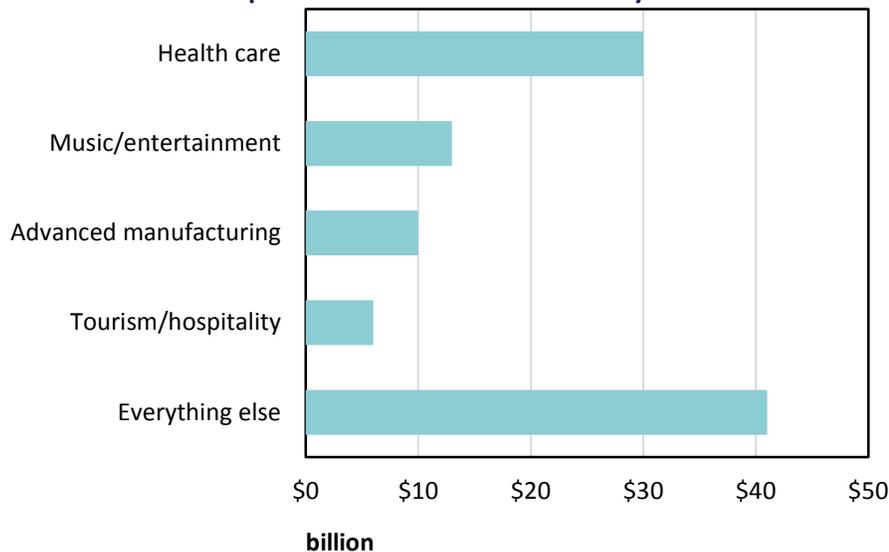
Low-income and minority neighborhoods tend to have poor access to healthy foods. They have fewer supermarkets on average, and a higher density of fast food restaurants and convenience stores that offer a small selection of healthy foods at higher prices. Compounding the problem is that there is less vehicle ownership among residents in these communities, making it difficult for residents to shop outside of their neighborhoods. People who do own a car have less money to spend on food when they have to travel farther to access healthy food.

## Economy

Nashville's well-rounded economy is booming, but addressing workforce shortages and skills gaps is critical to remaining competitive in the future.

In 2014, the economy of Nashville and Middle Tennessee reached the \$100 billion mark, making it the 34<sup>th</sup> largest metro economy in the country. One of the strengths of Middle Tennessee's economy is its diversity. Initially rooted in trade (as a major port along the Cumberland River) and state government, the region's economy now boasts substantial jobs across all major sectors. This diversity allows it to perform well and offer opportunities for growth during economic downturns.

### Four sectors make up more than half of the economy of Middle Tennessee



Source: Nashville Area Chamber of Commerce

Similarly, the largest sectors by number of employees are government, health care and social assistance, retail, accommodation and food service.

Nashville is the center of a broader regional economy, connecting as many as 15 different counties. Though we have a smaller share of the region's economy than in the past, Nashville still has the largest share of the region's jobs (generally higher-skill and higher-paying jobs) and plays a unique role. Public policy decisions and public and private investment should enhance Nashville's role as the vibrant, urban center of commerce, government, entertainment and culture for the region.

## Foreign investment

Five percent of Nashvillians work for foreign-owned companies. Though a small share of workers, foreign investment represents a larger share of compensation, productivity growth, and corporate research and development.

Foreign investment also links Nashville with the global spread of new knowledge, technology, and ideas, all critical to Nashville's growth as a creative, entrepreneurial economy.

Source: Brookings Institute, *FDI in U.S. Metro Areas*, online report.

## A statewide leader

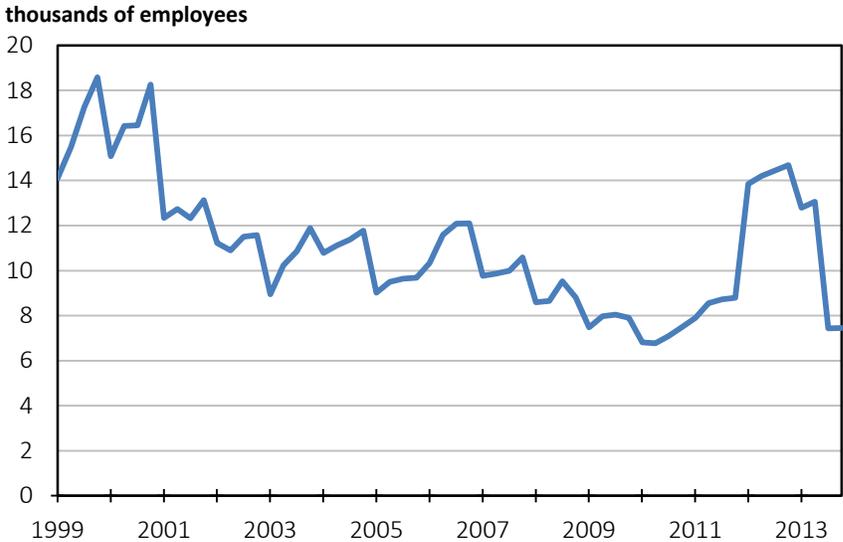
Middle Tennessee outperforms the state on several measures. The Nashville MSA ranks number 1 in the state in:

- » Population & growth
- » Gross domestic product
- » Employment & wage growth
- » Educational attainment
- » Undergraduate & graduate enrollment
- » University research & development
- » State tax revenue
- » Per capita income

One of Nashville’s most important competitive advantages is its knowledge-based, creative economy. This strength is seen in the many sectors and businesses in Nashville that are leaders in their fields. This strength is also seen in the creative and entrepreneurial spirit of Nashville, which creates a space for ingenuity and innovation. In the last ten years, a number of outlets, incubators, and spaces have started that support the diversity of small business start-ups and innovators. The Entrepreneur Center, for example, connects new entrepreneurs with mentors, resources, and education to help establish their businesses. Similarly, Tennessee State University’s Business Incubation Center helps smaller, lower-tech businesses grow, while the Center for Non-Profit Management assists non-profits. Nashville has also seen a proliferation in co-working spaces that can be rented for short periods of time. Some of these workspaces are art or design focused, with recording space or sound-proof booths, while others provide platforms for technology development or meetings rooms for collaboration. This expanding support system allows entrepreneurs to develop their businesses while developing business skills and maintaining low overhead.

**Empoyees at Nashville start-ups (1999 - 2014)**

Start-ups include all firms that have existed for less than two years.



Source: U.S. Census, Quarterly Workforce Indicators

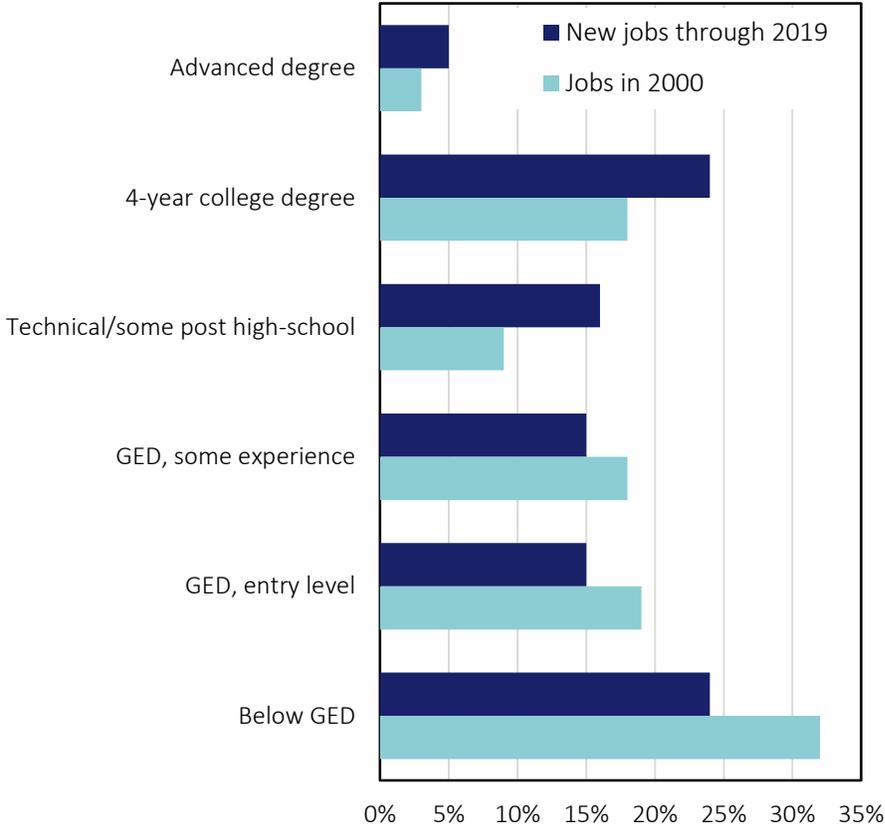
Across Davidson County, personal income per person is rising as the overall level of educational attainment in the County has risen. However, compared with most of its suburbs, Nashville has a larger portion of the population living in poverty, a much larger foreign-born population, an older population, and a large share of population with lower levels of educational attainment. Meanwhile, the higher-paying jobs attractive to Nashville and the region increasingly require additional education. The resulting skills gap is a challenge for:

- » Employers who need to fill jobs,
- » Employees looking to well-paying jobs who do not yet qualify for jobs seeing the most growth, and
- » The region, as it works to encourage companies to expand, start up, or relocate here.

The fastest growing occupations in the next decade will require a broad array of skills and backgrounds. The largest block of hiring will be for jobs requiring little skill or training, such as retail or warehouse jobs. However, the share of these jobs will decline. In contrast, occupations with the largest growth and with the highest pay through the coming decade will require substantial post-secondary education, skills and experience (such as technicians or information technology workers), many requiring skills in science, technology, engineering and math. In education and workforce development, these are collectively called STEM. Focusing on them within K-12 and post-secondary education is an attempt to better prepare the United States and its students and workers to be competitive globally. In addition, many experts and organizations advise that art and design also be incorporated into STEM curriculum around the country (expanding the acronym to STEAM).

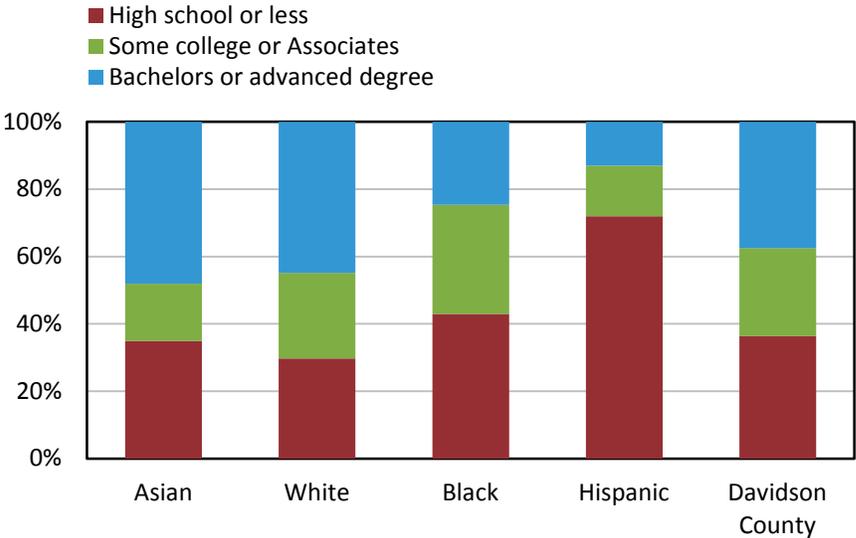
Nashville's community colleges, business sector, and workforce development agencies are already working to achieve balance between the high-skill and low-skill workforce needs at a time of simultaneous industry realignments, economic recovery, rapid technological change and major demographic changes. Managing this skills gap will likely require multiple approaches at once.

**Changing skill or educational requirements for jobs in 2000 compared with 2019**



Source: Chamber Workforce Study

**Educational attainment by race & ethnicity**



Source: American Community Survey, 2011 - 2013 (3-year estimate)

The first approach is to develop home-grown talent. Individuals with more education, skills, and experience have more opportunities for better-paying jobs. Connecting our residents to educational and employment opportunities improves their quality of life. It also bolsters Nashville's economy. Sometimes, lack of job openings, college offerings, or skills limits what a worker can achieve. Other barriers, such as lack of physical access and transportation, language, citizenship, disability, affordable childcare, or soft skills can also limit a worker's access to jobs or education. Providing strong PK-12 educational options to everyone, along with flexible, lifelong learning opportunities is crucial.

Another source of future talent is people who move to Nashville, seeking work. These people bring skills and experience acquired elsewhere, expanding Nashville's pool of expertise. Similarly, one of Nashville's greatest assets are students who are drawn to Middle Tennessee's colleges and universities, 60% of whom stay after graduation.

#### *Local businesses, small businesses, and entrepreneurs*

Some, typically older, communities in Nashville are anchored by retail and commercial districts of different sizes and forms. These districts are critical for a complete neighborhood. They provide vital retail services, such as grocery stores, pharmacies, and banks; amenities like bars or cafes; public services like libraries and health clinics; and public spaces along sidewalks and in parks. At their best, access to a complete neighborhood creates places that people desire and where they invest their time, energy and resources. They enhance the character of their surrounding communities, and offer community members places to meet and build relationships.

**56% of Nashvillians report that having locally owned businesses nearby is a high priority to an ideal community for them.**

*Community issues survey (2012)*

**13% of Nashville households earn income through self-employment; that accounts for one-third of all such households in the region**

*Source: Census of Non-Employer Work*

**More than 25% of Nashvillians lacked adequate access to banks, and relied on alternate financial services.**

*Source: 2013 FDIC National Survey of Unbanked and Underbanked Households*

**Restaurant-led revitalization**

The revitalization of Nashville’s neighborhoods reflects changes in workplaces as well. While the homes in inner-ring neighborhoods become denser, yet also house fewer people, the commercial and employment areas are changing as well, in response to a different set of national and international trends. Major employment sites – either offices, medical, education, or industrial jobs – are located further away from neighborhoods, in places like Downtown, Midtown, Green Hills, or low density industrial land. Additionally, with more shopping done at supermarkets, big box stores, or online, neighborhood retail is shifting to services. This takes many forms, including personal services like barbers, salons, or spas; small-scale fitness facilities like gyms or yoga studios; or small gifts shops. Nashville’s booming restaurant scene exemplifies the trend. Nothing heralds a neighborhood’s shift to higher income households like new restaurants, typically featuring innovative cuisine, mixing of cuisines, or local produce. In recent years, new restaurants respond to available, cheap land and changing neighborhood demographics. However, they also intensify those shifts, by introducing more people to a neighborhood and signaling that a shift is underway.

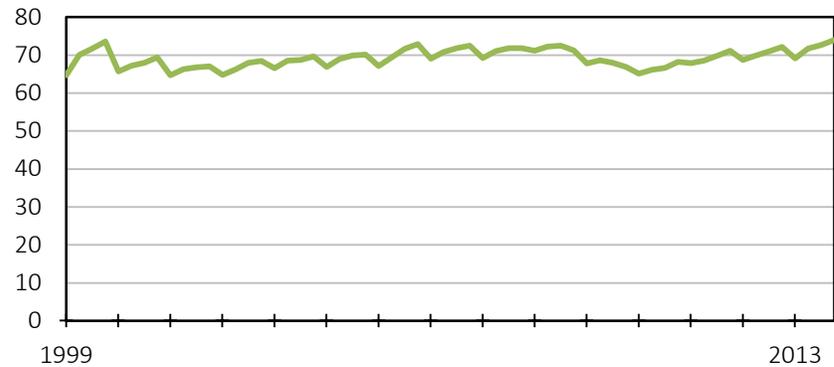
However, the potential for a complete neighborhood does not exist:

- » When store fronts are vacant and residents lack access to goods and services,
- » When they have large parking lots and an inhospitable public realm, often lacking shade or sidewalks,
- » When they are separated from homes, forcing all but the closest or most desperate to drive to meet daily needs,
- » When cheap construction means that the lifespan of commercial buildings is only 20 or 30 years, or
- » When unwanted businesses pollute, are bad neighbors, prey on customers with no other options, or drive down property values.

**Employees of small businesses**

Fifty employees or fewer

thousands of employees

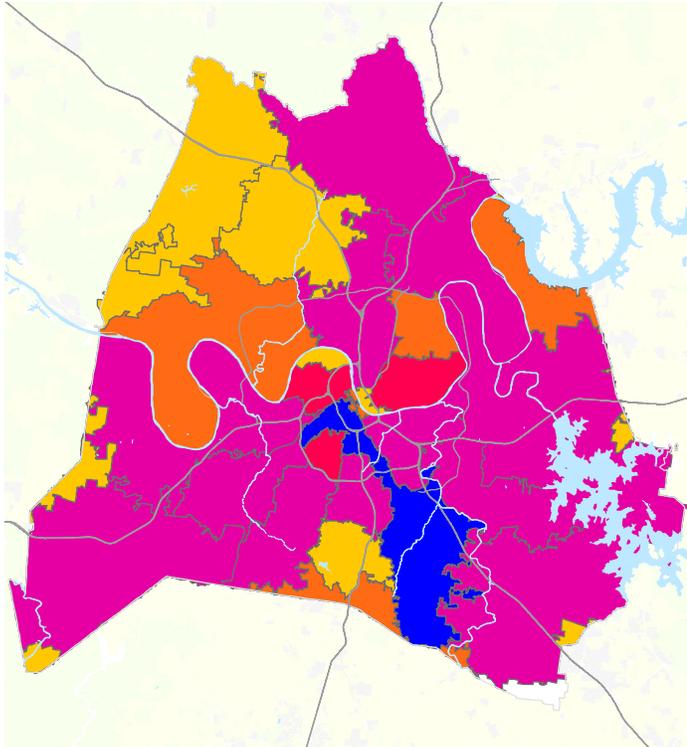


*Source: U.S. Census, Quarterly Workforce Indicators*

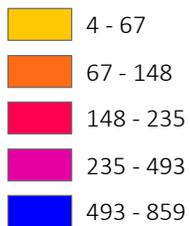
The small and local businesses that populate these districts are a vital part of Nashville’s economy. Annually, they employ more than 150,000 jobs over the last decade, and account for about 20% of payroll for Nashville workers. These businesses are also important to immigrants finding a place in Nashville. While immigrants make up only 9% of the county’s population, they run 29% of Nashville’s “Main Street” businesses (defined as retail, food services and accommodation, and neighborhood services such as nail salons, beauty shops, and gas stations). This brings immigrants into Nashville’s middle class, while also providing community support for more recent arrivals.

However, not all parts of Nashville are equally well-served by retail and

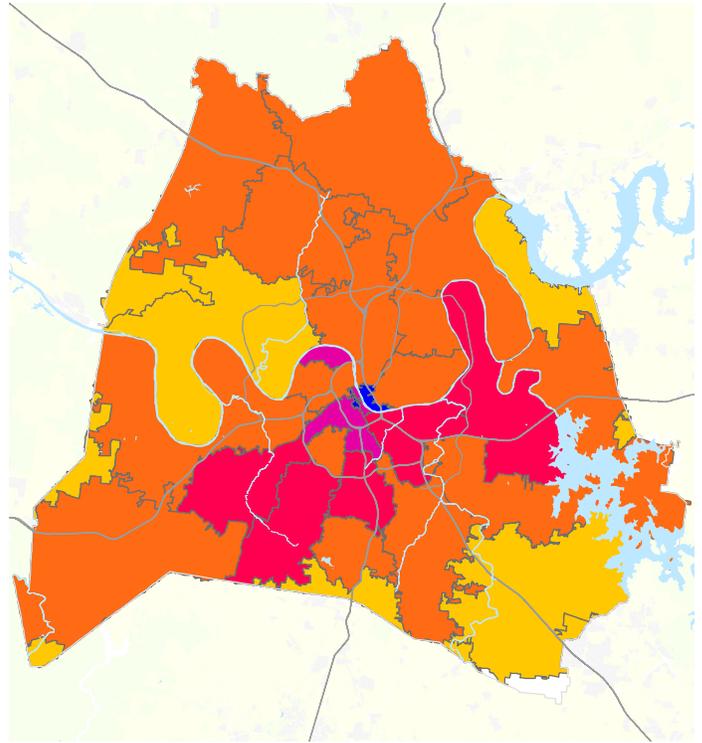
**Count of retail establishments in each zipcode**



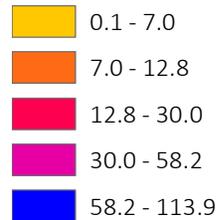
Number of retail establishments



**Retail establishments per 1,000 residents in each zipcode.**



Retail establishments per 1,000 residents



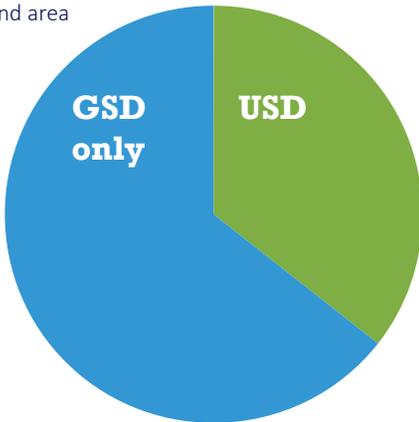
services. The two maps below show the number of retail establishments reporting sales tax receipts to the Tennessee Department of Revenue.

This is not just a matter of having quirky mom-and-pop shops around. Retail access plays a role in the healthiness of communities. Partly, this is about the social fabric of neighborhoods. But it also has direct health impacts. The relationship of neighborhood design, walkability, and health has been discussed above. Retail access also shapes the food deserts discussed above, drawing a direct line between retail districts and health and quality of life.

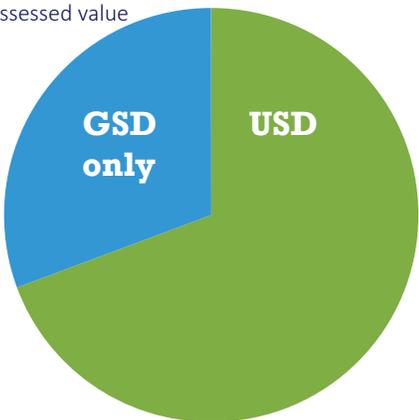
## The Urban Services District and the General Services District



Land area



Assessed value



## Managing the city's finances

In 2014, the government of Metro Nashville operated as a \$1.8 billion dollar entity. Half of Metro's revenues come from property taxes. The next largest sources of revenue in 2014 were the local portion of sales taxes (18%) and state, federal, and other grants (19%). This does not include revenue from enterprise funds like Metro Water Services or Nashville Electric Service. These operate through customers paying for services.)

Metro's tax base for property taxes is \$66 billion. Because that asset contributes half of Metro's budget, understanding how land is taxed throughout the county is important. Property taxes in Nashville take two forms. The General Services District (GSD) covers the entire county (including satellite cities). Taxes from the GSD pay into all parts of the general operating fund. The Urban Services District (USD) includes only part of the county. The USD levies property taxes in addition to the GSD. These taxes pay for increased police and fire protection, refuse collection, and street lighting.

Unlike cities that can annex more land, the boundaries of Davidson County are fixed. Therefore, the property tax base in Nashville only increases when individual property values increase. The value of particular property increases when the market recognizes higher demand for that property or when physical improvements (like buildings) are made. Typically, increasing market demand and physical improvements go hand in hand.

Because of this, different parts of the county are valued differently. The scale of this difference can sometimes be difficult to understand. For example, because there is so much business, tourist, and retail activity, Downtown is attractive to businesses and residents (reflected through high land prices). It also has valuable physical improvements (like multi-story buildings). In contrast, Union Hill, at the northern corner of the county, is far from jobs and major transportation routes, with no sewer service and few buildings. Its market demand and physical improvements are much lower.

The amount of land covered by properties makes it difficult to understand these differences. One way to compare differently sized properties is to calculate the land value per acre and property tax per acre. The graphics on the next two pages show how different properties and developments in

Nashville compare on property taxes per acre.

This is not to say that one of these land use patterns is better or worse. Rather, it is to acknowledge that different types, locations and densities of development contribute to Metro's tax base to different degrees. A similar analysis was done on every property in the county. The two maps show different ways of portraying this difference in property values across all of Davidson County.

Density of homes, retail, and jobs drive much of the differences shown above – the more dense and mixed use the development, the more property tax revenue it generates. But revenues are only half of the equation in Metro's finances. Locating people in a place also means spending more there for services residents and employees need.

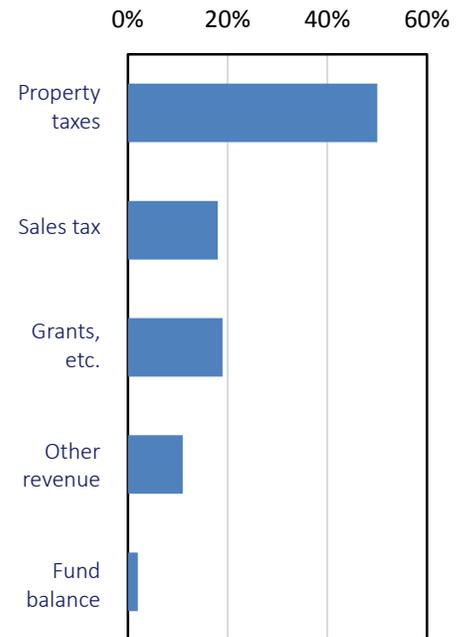
Metro's revenues pay for most of the things that Metro does: schools and public safety, parks and roads, general services, and providing information. Of these, education accounts for 41% of Metro spending. Education figures prominently into Metro budgeting. By law, half of local sales tax revenue must be dedicated to education. In practice, Metro exceeds that amount and routinely allots two-thirds of local sales taxes to schools. A portion of property taxes are also passed on to the school board.

After education, the next largest expenditure is on public safety services (26%). Taken together, public education and public safety account for two-thirds of Metro's budget. These are followed by general government services (12%) and debt service (11%; this is repayment of bonds, primarily for capital improvements).

Urban form is important to understanding revenues. However, it is equally important to understand spending. If the costs of serving dense areas increases faster than revenues increase, it may be a net loss to Metro. Smart Growth America recently reviewed several national studies of municipal services and did new research on development patterns in Nashville.<sup>9</sup> It had three conclusions about density, urban form, and city services. First, compact, mixed use development had lower costs for initial infrastructure like roads and water and sewer lines. Second, this style of development reduces ongoing maintenance and operations costs. Last, compact development produces higher tax returns. Lower up-front costs, lower operating costs, and a higher tax base gives cities more flexibility in managing their

<sup>9</sup> *Building Better Budgets: A National Examination of the Fiscal Benefits of Smart Growth Development.* Smart Growth American, May 2012.

**Revenue sources**  
Metro Nashville 2014



Source: FY 2014-15 Metro Nashville Budget

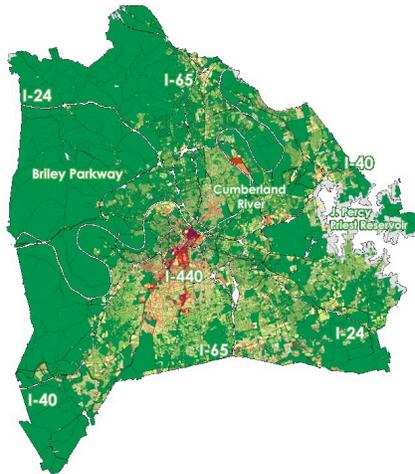
## Understanding the relationship between urban form and tax revenue

How we grow affects quality of life, but also Nashville's finances, by adding to or limiting development. With a fixed amount of land, Nashville can strategically manage growth to help manage its finances.

The examples at right show how different development patterns compare. To make the comparison even, property values are shown per acre. The maps below show how those patterns appear in a countywide context.

### Land value per acre

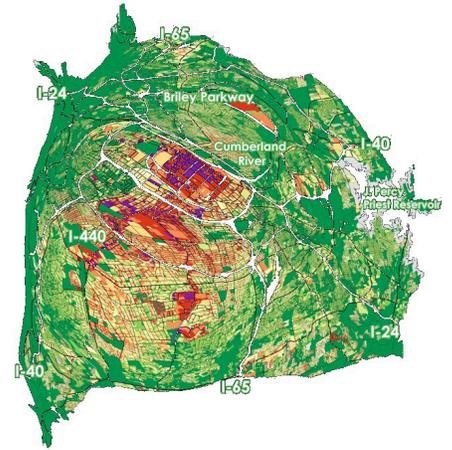
map



This map shows the value per acre of each parcel in the County. Parcels in green have the lowest value per acre (generally, rural, undeveloped, and very low density residential), while parcels in purple have the highest value per acre (mostly downtown or major employers). Most of the county is in green, while only a small part is in purple. Visually, however, this understates the role of different parts of the county to Metro's finances.

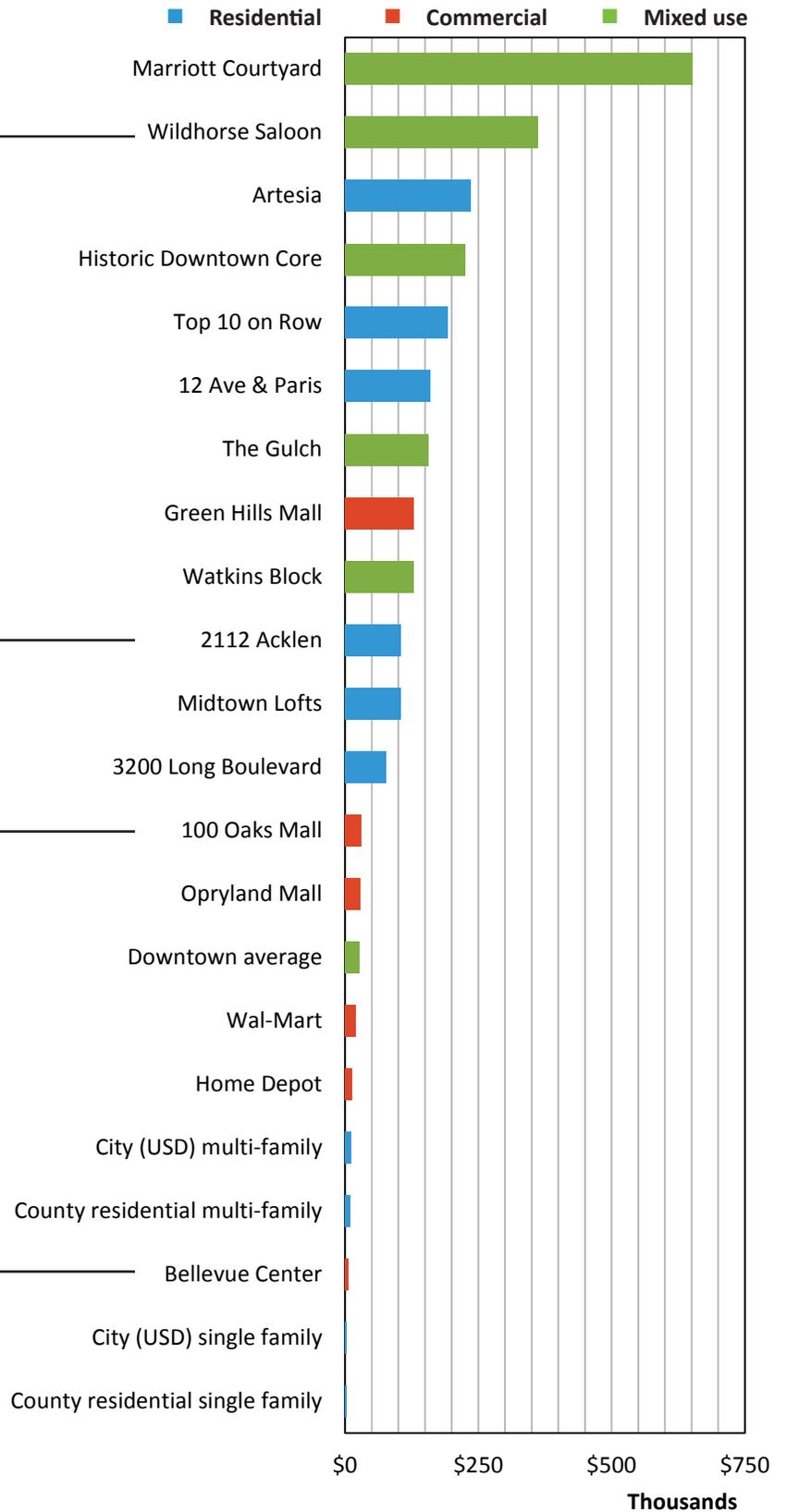
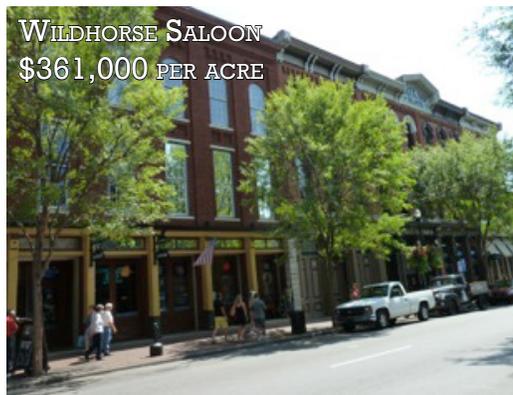
### Land value per acre

cartogram



The second map shows the same data, using the same color scale. Now, however, the map scales the size of each parcel to represent its property value. This means that the size of each parcel on this map represents its contribution to Metro's tax base. For example, this map more accurately reflects that Downtown Nashville occupies less than 0.3% of the county's land area, but generates 10% of Metro's property tax base. Similarly, downtown contributes 19% of the County's retail tax revenues.

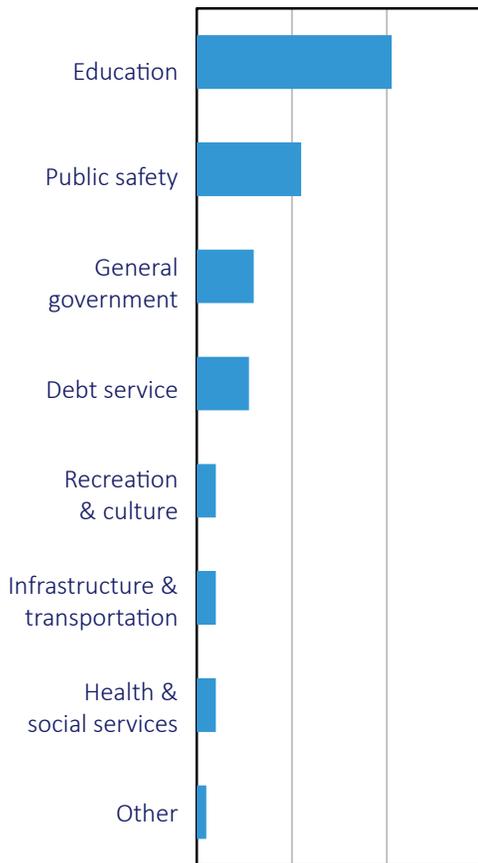
Examples of property tax revenue per acre for select properties and districts in Nashville



bottom line. That mean a choice between more services, lower tax rates, or a mix of the two.

## Expenditures

Metro Nashville 2014



Source: FY 2014-15 Metro Nashville Budget

The relationship between infrastructure, density, and sprawl has long been well understood. Spreading out development increases the miles of roads and utilities (especially per person or per home or workplace). Even when developers pay the up-front costs of roads and utilities, these costs are passed on to residents and businesses as higher home costs. This infrastructure then becomes the permanent obligation of Davidson County. Nashville takes responsibility for maintaining and operating it. More infrastructure per person – more miles of roads, sewers, storm drains, and sidewalks; more parks; more fire stations to provide adequate response times; and more miles to operate buses to bring children to school – increases the cost of providing these services.

The role of density and sprawl in ongoing operating expenses, such as road maintenance or staffing for police, fire and libraries, has been studied less. Smart Growth America studied the impact of different development patterns on these operating expenses, based on three neighborhoods in Nashville. It looked at:

- » Bradford Hills (a conventional suburban residential development in southeast Nashville with a small amount of auto-oriented retail nearby)
- » Lenox Village (a New Urbanist community across the road from Bradford Hills which features a mixture of housing types and office, retail and restaurants)
- » The Gulch (the intense, mixed-use neighborhood on downtown’s west side)

This study found that denser, mixed use patterns had both higher revenues and higher spending. However, the increase in revenues outpaced the increase in spending. Lenox Village had net revenue per home (revenue left over after spending) twice that of Bradford Hills. The Gulch, on the other hand, had net revenue per home 24 times higher than Lenox Village. The chart on the next page shows the breakdown of revenues, costs, and net revenue for each neighborhood.

This research is not intended to argue that all of Nashville should develop like the Gulch, Downtown, or Midtown. Nashvillians treasure the diversity of their neighborhoods. Having rural, suburban and urban areas enrich the

entire county. But as we make decisions about the locations and types of zoning for more intense growth and about where to invest in infrastructure, appropriately located dense, mixed use development is necessary to generate revenues (and reduce costs) so that other areas can remain undeveloped or developed less intensely.



**Bradford Hills**

A conventional single-family suburban development in southeast Nashville (completed)



**Lenox Village**

A New Urbanist project with a mix of housing types in southeast Nashville (completed)



**The Gulch**

An infill development on a brownfield location in Downtown Nashville (at built out)

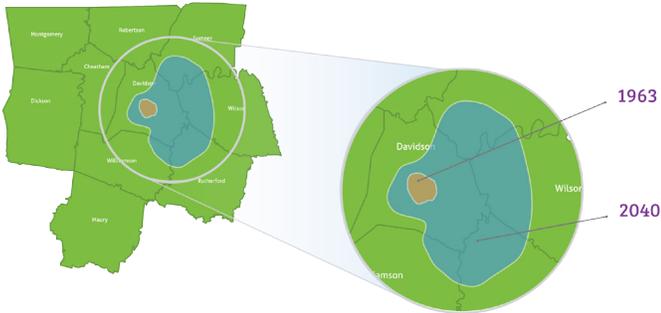
<b>Homes (units)</b>	538	1,715	4,552
<b>Retail/office (sq. ft.)</b>	39,000	67,000	6,000,000
<b>Land area (acres)</b>	185	185	76
<b>Annual cost of service per unit</b>	\$1,590	\$1,260	\$1,400
<b>Annual revenue per unit</b>	\$1,625	\$1,340	\$3,370
<b>Annual net revenue per unit</b>	\$40	\$80	\$1,930

This study examined the relative fiscal costs and benefits of three development scenarios in Nashville. The study estimated the annual General Fund operations and maintenance costs of the three cases. The study also considered the primary sources of local revenues (property taxes, sales taxes, and other recurring revenues). However, the Gulch is assessed at the higher rate for the Urban Services District. This report does not include the Gulch’s Business Improvement District. Both Lenox Village and the Gulch are expected to have a net positive impact on the General Fund. Bradford Hills is expected to have a neutral impact.

Source: *Building Better Budgets: A National Examination of the Fiscal Benefits of Smart Growth Development*. Smart Growth American, May 2012.

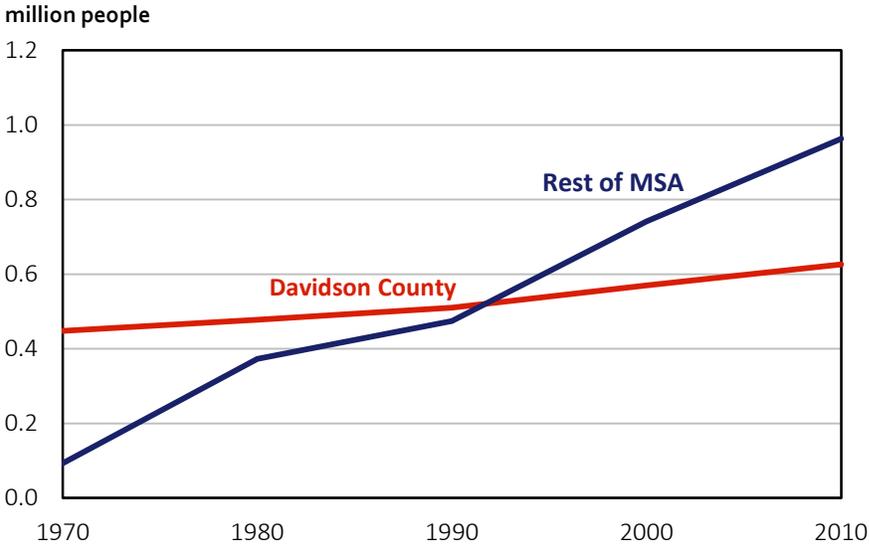
### Regionalism

When the City of Nashville and Davidson County unified to form Metro government in 1963, the decision was in part a far-sighted view to the dominant trend of land use in the second half of the twentieth century: more and more suburbanization, driven by private car ownership and subsidized mortgages for single-family homes. That foresight seems even wiser as that trend has begun to reverse. Within Davidson County, urban areas are home to new investment, while some suburban neighborhoods in Nashville struggle with underinvestment and rising poverty.



However, unification was geographically limited to Davidson County. The chart below shows the share of population in Middle Tennessee that lives in Davidson County compared with the rest of the region. From 1950 to 2010, Nashville’s share dropped from over 60% to under 40%. That trend is expected to continue through 2040.

### Population growth in Davidson County and the rest of Middle Tennessee



Source: U.S. Census (1970 - 2010)

Nashville continues to be a regional leader. For many of the demographic and market shifts discussed above—household size, aging population, and increasing diversity—Davidson County is the front of the region. Changes that are showing up now in or in the next ten years in Davidson County will confront the rest of the region soon after. How the region responds will have as large an impact on Davidson County as our choices.

For example, the region is connected through our environment, especially our waterways. As rain falls, especially during severe storms, development decisions in one county can impact another. Rapidly funneling rainwater into storm drains and then into creeks erodes stream banks and leads to flashflooding. Because Davidson County is situated along the Cumberland River, into which most of the region drains, impervious surfaces throughout Middle Tennessee contribute to floods here.

The region is also tightly connected through our transportation system. More than 60% of workers in the region cross a county line to go to work (the number is only 32% for Davidson County). Because Davidson County is still has the single largest concentration of jobs in the region, many of these workers commute into Nashville, as shown in the map below.

In the opposite direction, one of the factors driving the suburbanization of poverty within and around Davidson County is the availability of lower-wage jobs. As these employers leave Davidson County because of high land prices, they increasingly locate in more remote parts of the region. These locations frequently have little or no access to transit and few supportive services.

Recognizing the critical importance of properly aligning housing policy, transportation planning, and economic development is essential to improve the quality of life for residents and the competitiveness of businesses throughout Middle Tennessee. For example, when economic development efforts recruit major employers to suburban centers without transit, where municipalities are reluctant to increase zoning that would allow for workforce housing, the entire region suffers from congestion and the loss of disposable income.

Regional coordination in Middle Tennessee is complex and multifaceted.

The map on the next page highlights some of the key regional players, along with their geographic scope.

The three major ways of arranging the region are:

- » The Nashville Area Metropolitan Planning Organization, which coordinates Federal and State transportation spending
- » The Nashville-Davidson-Murfreesboro-Franklin Metropolitan Statistical Area; while not an organization, the MSA is the Census Bureau's best way to capture how Middle Tennessee counties form a single economic unit
- » The ten-county region, which is used by organizations like the Mayor's Caucus, Cumberland Region Tomorrow, and the Regional Transit Authority.

Other regional players include the Greater Nashville Regional Council (13 counties), two different Workforce Investment Areas (#10, which includes nine counties, and #9, which includes four counties, including Davidson), and the Nashville Area Ozone Monitoring Site (eight counties).

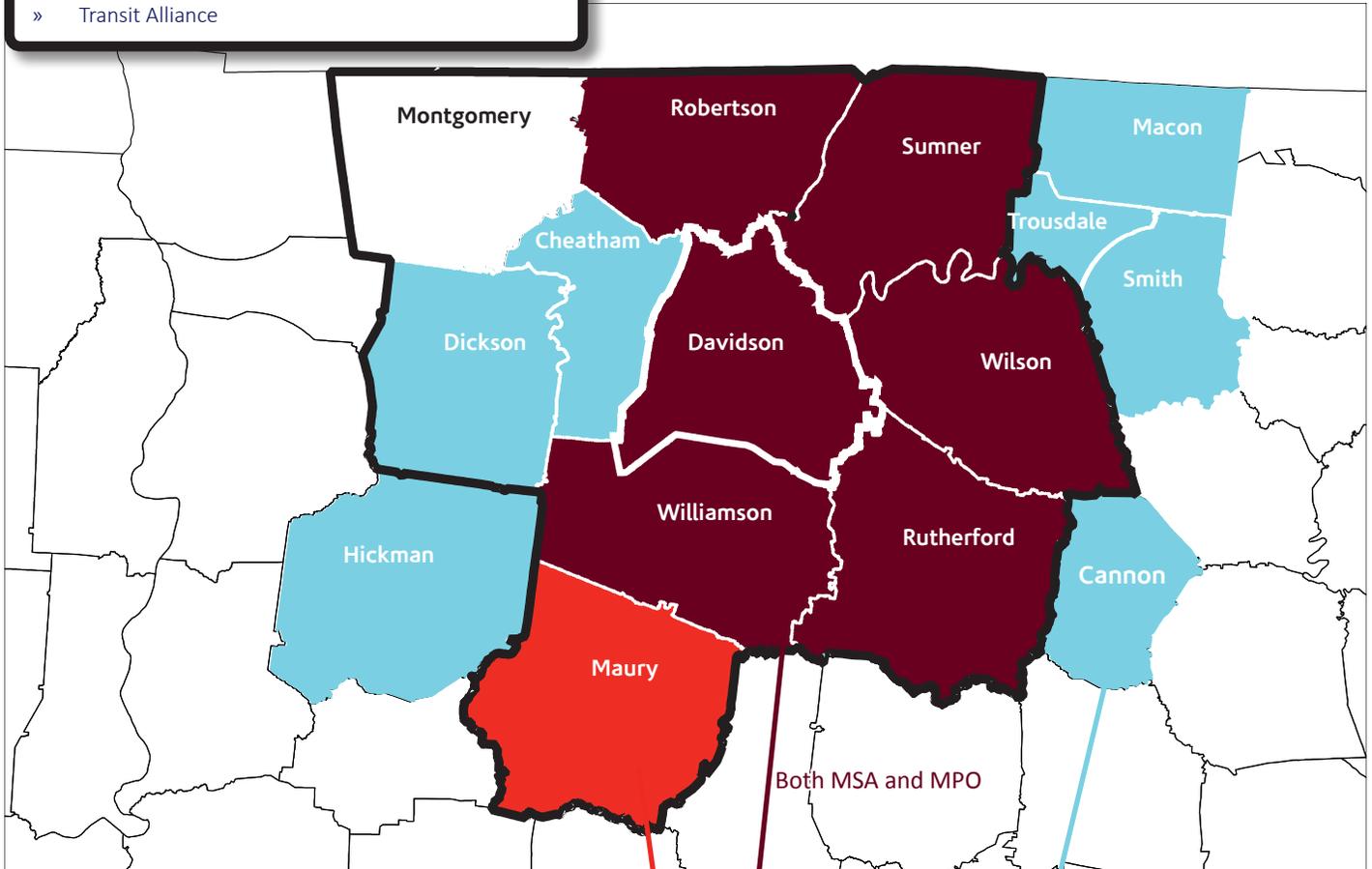
The Nashville Metropolitan Planning Organization is a key regional coordinator. The MPO engages cities and counties within its jurisdiction in long-range transportation planning and studies. In doing so, it incorporates those local governments' land use plans. Once adopted, its long-range plans become the guiding documents for state and federal transportation spending on pedestrian and bicycle facilities, transit service, and roadway improvements. Its most current plan (adopted in 2010) proposed a new vision for regional transit. This plan is being updated alongside NashvilleNext.

Partnership 2020, the region's 10-year economic development plan and forum, has also been fruitful. It has a record of success in attracting and recruiting major employers to the region, while also decreasing inter-jurisdictional competition. Similarly, the Mayor's Caucus brings together county and municipal Mayors to identify, discuss, and respond to regional issues.

## The 10-County Region

Multiple organizations cooperate across the ten counties included in the solid black outline below.

- » Mayors Caucus
- » Cumberland Region Tomorrow
- » Regional Transit Authority
- » Leadership Middle Tennessee
- » Transit Alliance



### Nashville Area Metropolitan Planning Organization

The Nashville Area MPO leads in the development of the region's long-range transportation plan and short-range transportation improvement program.



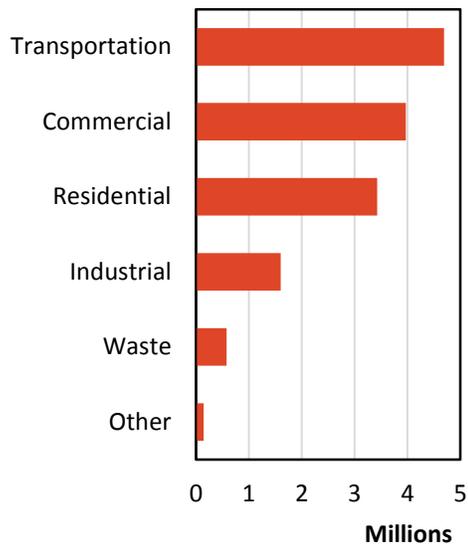
### Nashville-Davidson-Murfreesboro-Franklin, TN Metropolitan Statistical Area

The MSA is our closest approximation of the Middle Tennessee counties with a single, interlocking economy.

## Sources of greenhouse gas emissions in Nashville (2005)

This inventory of greenhouse gas emissions in Davidson County was conducted in 2005 to establish a baseline for Nashville’s efforts to reduce its contributions to climate change.

### Tons of carbon dioxide (equivalent)



Source: Baseline Inventory of Greenhouse Gas Emissions, Metro Health Department, Nashville Electric Service (2009)

Since the 2005 inventory, Nashville has continued to grow. As seen earlier, vehicle miles traveled has increased, though vehicles have also generally become more efficient. From 2005 to 2012, electricity across residential, commercial, and industrial users has declined slightly, though it has increased since Nashville’s economic recovery has solidified.

## Natural hazards and extreme weather

Climate change is one of the longest term trends facing Nashville, as well as one of the most difficult to address because of the long time it takes to happen. Success in minimizing climate change will largely be due to national and international efforts that will shape Nashville’s future decisions on energy and transportation. This is called mitigating climate change – reducing greenhouse gas emissions in order to reduce future global warming.

However, Nashvillians must reinforce external efforts with a companion approach – adapting to changes that have already happened or that are likely to happen because of current levels of carbon emissions. Called “hazard adaptation,” this means preparing for a future with more severe weather.

By and large, the hazards Nashville will face in the future are not new. Floods, droughts, heat waves, and tornadoes have occasionally wreaked havoc on Davidson County. What is new is the frequency and severity of these hazards. In the future, more intense storms will cause more flooding, more wind damage, and more lightning. Major floods, such as the one in 2010, are expected to occur more frequently. More extreme heat is likely, too. Nationally, more than 3,000 deaths were caused by extreme heat between 2006 and 2010, with most victims age 65 or older, one of the fastest growing parts of Nashville’s population.

### Increased heat

Observed warming in Nashville, 1950- 2011

Overnight temperatures	+1.8 °F
Daytime temperatures	+0.5 °F

Anticipated warming in Tennessee, 2011- 2100

Low estimate	+5.0 °F
High estimate	+9.0 °F

### Drier but stormier

Observed precipitation change, 1970 - 2009

Winter	-9.6%
Spring	-29.2%
Summer	-3.6%
Fall	+0.1%

### *Streams and rivers*

Streams and rivers are impacted both by rainfall changes as well as other effects of urban growth. Too much rainfall needs careful management to avoid flooding. Too little requires careful stewardship to maintain water for human use and environmental quality. Erosion, flooding, and habitat loss (especially for Tennessee's unique water species) are all dangers.

### *Water supply*

In the long-term, water availability is likely to be constrained during lengthier droughts. Groundwater will likely recharge more slowly, because when more rain falls during heavier storms, more water runs off into streams and rivers rather than soaking into the ground.

### *Energy system*

TVA's extensive use of reservoirs and dams provides a high level of reserve capacity for hydroelectric power. However, fossil fuels and nuclear power require cool water reserves to operate safely. In periods of combined heat and drought, these facilities may need to operate at reduced capacity. This happened in 2010 at the Drowns Ferry Nuclear Plant.

### *Transportation system*

Existing transportation infrastructure is in danger of pavement rutting and rail buckling, equipment wear, increased closures from flooding and landslides, and comprised structural integrity from thermal expansion, scouring, and erosion. Disrupting Tennessee's transportation system is likely to impact Nashville's economy, as workers and goods experience travel delays.

### *Disease*

A number of diseases may become more common. The mild winters of 2012 lead to a more active tick and Lyme Disease season. West Nile Virus is associated with warm, dry summers. Seafood may bear more contamination, due to warmer and more acidic oceans. Further in the future, more exotic illnesses may reappear—Dengue has re-emerged in Florida, and a warm climate could make Tennessee more welcoming to malaria.

### *Agriculture*

Changes in heat, precipitation, and CO<sub>2</sub> levels will likely change the mix of crops grown in Tennessee. Corn yields are likely to be reduced slightly due to heat, while soybean and cotton yields will likely increase from CO<sub>2</sub> fertilization. Wheat yields are likely to become more variable. Unless new crop varieties are developed to cope with the changing climate, this suggests that Tennessee farmers will shift from corn and wheat to soy and cotton.

### *Plants and animals*

Natural areas in Tennessee will likely see species change as plants and animals continue to migrate north. Oaks and other commercially important species will likely be replaced by hickories and other loess valuable trees.

USDA Hardiness Zone maps, which guide consumer landscaping choices, have recently been revised to reflect the northward migration of these zones.

### *Heat-related illness*

The 2012 heat wave was blamed for more than 70 deaths across the country. Heat exhaustion and heatstroke spike during heat waves, particularly in cities where the urban heat island effect limits night-time cooling. High humidity and poor air quality make heat illnesses worse.