

# Forecasting Land Use Issues and Trends

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# Forecasting Land Use Trends and Issues

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Cities and counties are constantly evolving: they are periodically shaped and reshaped by global forces and shifting markets. Planners and decision makers are confronted with new global and national forces – accelerating globalization, changing demographics, and evolving technologies – that will continue to drive changes in how and where we live, work, travel and communicate.

In this report, commissioned by the Durham City-County Planning Department, the authors seek to identify national trends that may have an impact on land use planning and policy in the future: demographics, transportation, energy infrastructure, and communication technologies. Understanding these trends and anticipating associated land use issues can provide a context and framework for developing the next generation of plans and policies in Durham. While broad in scope, this report is not intended to be comprehensive, and in fact, should be appended as new research unfolds.

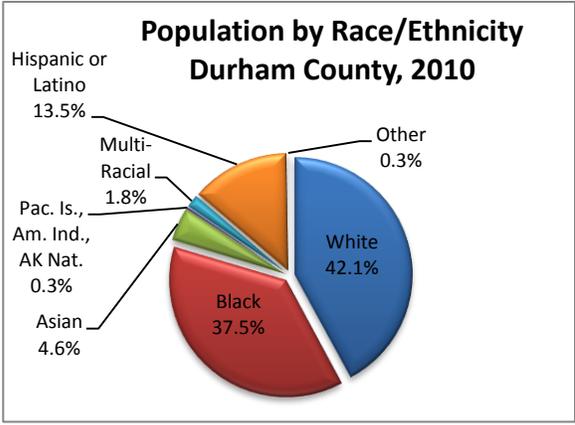
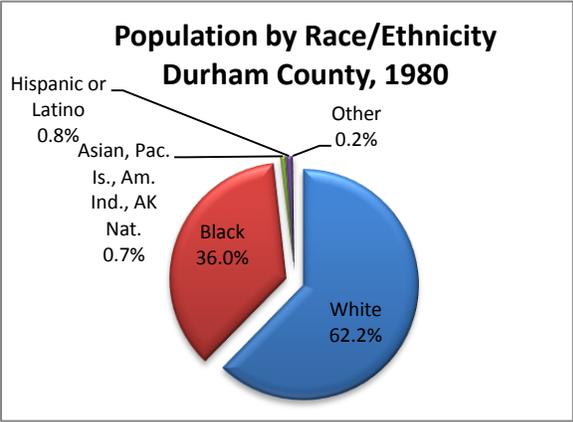
## Changing Demographics

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Our nation's demographics are rapidly changing. In the near future, for the first time in U.S. history, it is projected that there will be relatively equal proportions of the population in each age cohort and no clear racial or ethnic majority group. In this section we will highlight the primary demographic changes that have taken place at both the national level and locally in Durham and the Triangle over the past 20 – 30 years. Such changes include rapidly increasing ethnic diversity, the aging of the Baby Boomers, the arrival of "Gen Y" to employment and housing markets, the shifting of dominant family structures, and an increasingly more global, more environmentally aware, and more technology driven population and employment market. For each topic, we will address what changes have taken place, what we expect to see in the future, and how these changes may impact land use plans and policies for Durham.

### Increasing Diversity

By 2050, it is expected that our nation will be one of a minority majority. In other words, sometime within the next 50 years we will cross the point where the historical majority of non-Hispanic Whites will account for less than 50% of the American population. In Durham, that reality has already come to pass. Just in the past decade Durham has had increases in the Hispanic population by 112%, the Asian population by 67%, the Multi-Racial population by 58%, the Black population by 15%, but has had only a 5% increase in the White population. This trend in Durham shows no signs of slowing. As of 2010, more than half of Durham's young populations belong to various minority groups, compared to only 30% of the generation of aging seniors.



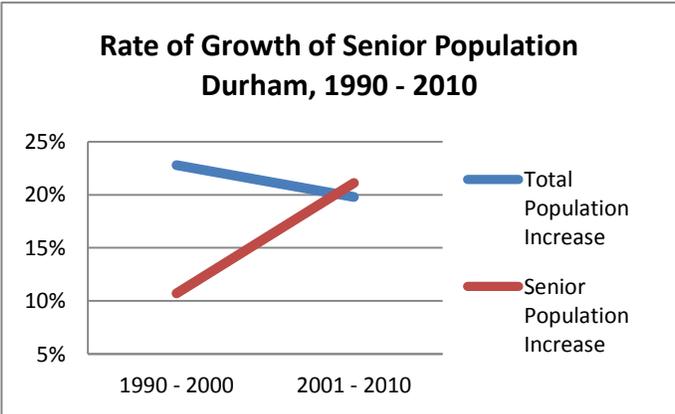
Source: U.S. Census Bureau, Census 1980, 2010.

As the Triangle region is expected to grow by 1.2 million residents over the next 20 years, this trend of ever increasing diversity is expected to continue, and could create changes for our housing and employment markets. Minorities typically have lower household wealth and 25 – 30% lower rates of homeownership than the current non-Hispanic White majority. They also have higher percentages of multigenerational households and higher public transit use. Given the projected increase in the non-White population, one potential outcome could be that large expensive houses in the suburbs may be less in demand in the future, and smaller, affordable, transit-oriented urban housing in places with easy access to shopping and jobs will better suit the growing population.

**Aging Baby Boomers**

According to the Urban Land Institute, the senior (65+) population is the fastest growing population in the nation today; and the 76 million strong Baby Boomer generation is just starting to reach retirement age. However, the recent recession has required many in this age cohort to delay retirement. Furthermore, some are also experiencing difficulty with underwater mortgages from the housing bust, so we are seeing a larger number of seniors aging in place or moving in with family rather than moving to warm-weather climates or retirement communities, as was done in previous generations.

For those seniors who are able to move, the temperate climate and superior healthcare found in the Triangle region has recently been a huge draw. While the rate of growth of Durham’s senior population



Source: U.S. Census Bureau, Census 1990, 2000.

declined sharply in the 1990’s, it made a remarkable comeback in the decade between 2000 and 2010 in which it outpaced the rate of growth for the total population. By 2000, the senior population had only increased 10.7% since 1990, while the total population had increased 22.8%. In the decade leading up to 2010, however, the senior population in Durham increased 21.1%, compared with only 19.8% for the total population. In addition,

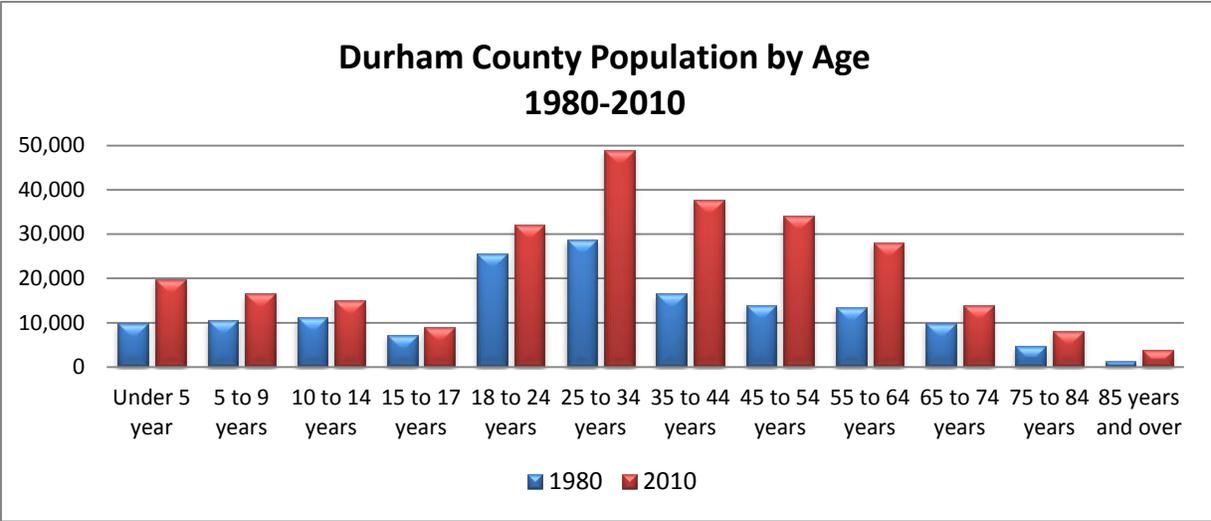
other areas of the Triangle have seen even larger increases in residents of this age group. Raleigh, for example, saw its senior population grow more than 60% over the last decade.

With a growing senior population, future policies should emphasize ways to improve mobility between where people live and the services they need. A 2010 Transportation for America study found the Triangle region to fifth worst metropolitan region in the country for access to transit for seniors among areas of similar size. More affluent empty-nesters and seniors have opted to move to urban areas where shopping is walkable and public transit is good, leaving single-family homes in the suburbs. However, for some cash-strapped seniors the new downtown condos are not affordable and their single-family homes are not accessible to public transit. As Durham moves forward with light rail, commuter rail, and enhanced bus service, policies focusing on accessing the suburbs through transit will become increasingly important if they are paired with policies that place affordable, high-density senior housing near transit stops and in areas of mixed-use development, rather than promoting more low-density single-family housing.

### **The Rise of Gen Y and the Creative Class**

The newest generation to enter the employment and housing market is Generation Y, otherwise known as the Millennials. This generation of 15 – 32 year olds is nearly 80 million strong, larger than even the Baby Boomer generation. They are technologically savvy, mobile, environmentally aware, have a global world-view, and are keen on building careers and postponing families. An estimated 88% of them want to live in a walkable, transit-oriented urban setting, but mounting college debt and the limited job opportunities brought by the recession have severely restricted their cash flow. As a result, they seek small affordable city living spaces to rent that are preferably adjacent to community areas and close to jobs.

Durham has not yet seen a large increase in the percentage of renters, which has remained fairly stable at 46 - 47% over the last thirty years. However, we are seeing a larger influx of people in the Gen Y age group, most likely due to the region's highly rated universities and strong prospects for health care and professional jobs. This age group will make up the majority of the housing and employment market of the near future, so the demand for urban rental units is expected to increase. It would benefit Durham to try to keep young professionals who are educated here to remain post-graduation and to attract other young professionals by having a full range of urban housing choices and mixed-use communities linked through public transit.



Source: U.S. Census Bureau, Census 1980, 2010.

Durham has been rated by urbanist Richard Florida in his book, *The Rise of the Creative Class, Revisited*, as the metro area with the largest percentage of its population in the so-called “Creative Class,” or those members of the workforce involved in knowledge-based or innovative careers. This cohort of workers has been associated with developing technological advancement, innovation, economic stability, and strong democratic institutions in the areas where they are concentrated, which has led to competition among cities to attract these individuals. The Creative Class is also associated with a preference for living in urban high-density areas with good public transit so they may easily engage in a variety of work and socially related activities. Between the region’s universities and the Research Triangle Park, the Triangle already has some of the best professional jobs, health care systems and technology driven companies in the nation. If Durham desires to further attract and retain this dynamic workforce, it could promote policies that encourage the enhancement of urban areas with high density mixed-use offices and living spaces and develop a more streamlined and accessible public transit system.

**Shifting Households and Family Structures**

Over the past two or three decades, the nation has seen an increase in the number of single adult and multigenerational households. The increase in single adult households has been dramatic; this trend is expected to continue to increase by at least 27% by 2020, and eventually become the majority household tenure for the United States by 2050. Possibly due to the larger numbers of senior and Gen Y households, there has also been an increase in households without children present, which is expected to become 40% or more of all households in the nation by 2025.

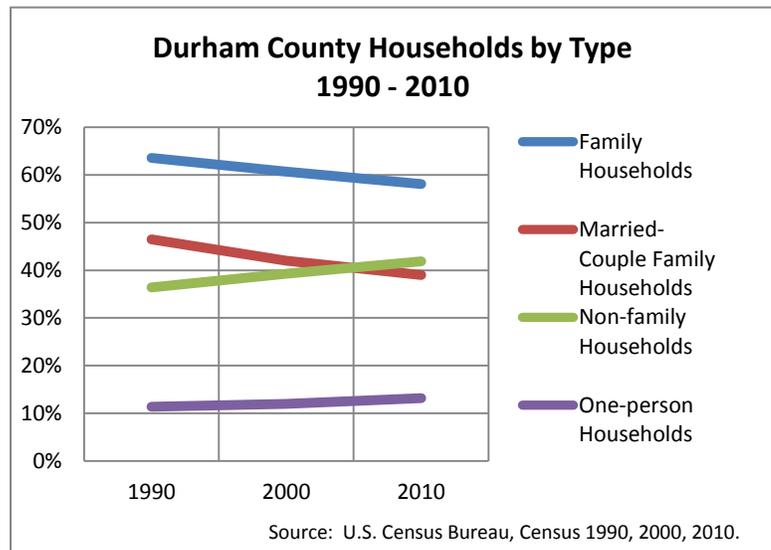
Also largely attributed to the large senior and Gen Y populations, the growing minority populations, and the large numbers of immigrants from Mexico, Central and South America coming to the U.S., we are beginning to see a growing number of multigenerational households consisting of at least three generations of relatives in one household. In 2000, the number of multigenerational households in the U.S. numbered around 3.9 million, or 3.7% of the total number of households, but had increased to 5.1

million, or 4.4%, by 2008. In addition, the number of U.S. households with individuals that were 65 or older increased from 23% in 2000 to 25% in 2010.

The Census defines a “family household” as consisting of two or more people (one being the householder) related by birth, marriage, or adoption residing in the same housing unit with or without additional unrelated individuals. “Non-family households” include single individuals living alone or any combination of individuals cohabitating, provided they are unrelated. Although the total number of all households in the U.S. grew by 11 million over the past decade, the 2010 Census showed a declining portion of family households and an increasing portion of non-family households, primarily in the category of one-person households. One-person households consisting of a single adult living alone now make up more than a quarter of all households in the nation.

The 2010 Census numbers showed that Durham household patterns were following along the same lines as the nation. Durham family households have decreased from 64% of all households in 1990 to 58% in 2010. Non-family households steadily

increased from 36% to 42% and the proportion of one-person households increased from 11% to 13% over the same time period. These changes may possibly be attributed to the larger proportion of Gen Yers and seniors in Durham compared to a couple of decades ago, or the fact that individuals today are more career focused than generations in the past. Whatever the reason, this demographic shift could point toward a future where demand may drop for large single-family homes



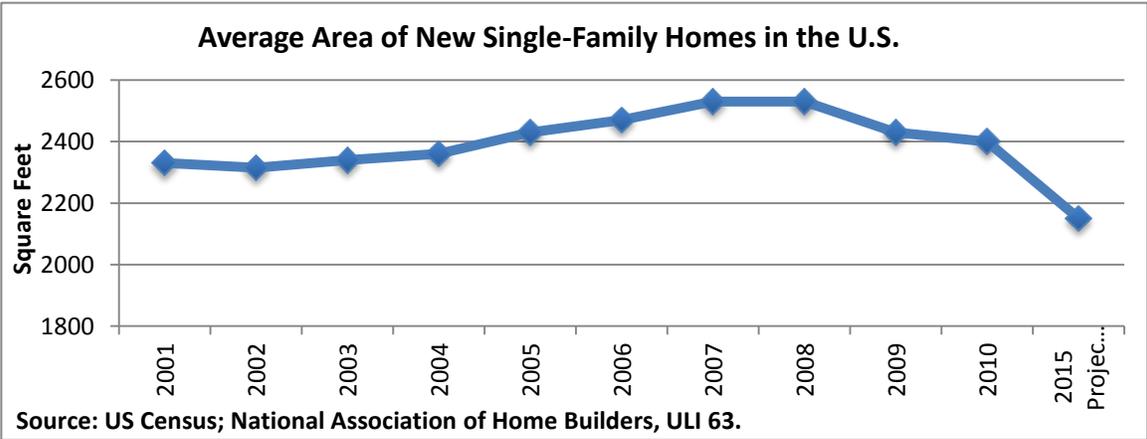
with large yards in the suburbs. Builders across the nation have recognized this trend and have started building smaller and more densely designed developments. Given that household patterns are diversifying, Durham could focus its land use planning to encourage the development of a broader range of housing choices for all household types.

### “Rightsizing” and the “5<sup>th</sup> Migration”

Historians refer to time periods of population shifts as “migrations.” The first migration happened when the pioneers from Europe began settling on this continent and expanded westward, the second was the shift from outlying farms to factories and industrial centers, the third migration was when the population flooded the cities as they became mega financial and productivity centers, and finally the fourth great migration happened as cities decentralized and their populations sprawled to the suburbs. It has been suggested that a fifth migration is now taking place through renewed interest in city centers and inner-ring suburbs, leading to gentrification and the building of new urban residential units. This interest in rebuilding downtown areas into high density, multi-use areas could reduce traffic congestion, reduce the production of greenhouse gases from cars, and promote improved energy efficiency.

However, these trends might also be associated with gentrification and increase in housing costs. While the number of people interested in city life is increasing (i.e., Gen Y and affluent empty-nesters), the change hasn't been as rapid as some have predicted. Nationwide, about one-third of cities are still losing a significant portion of population to their surrounding suburbs. This may have to do with the fact that many downtown areas are perceived as over-priced, crime ridden, or simply are not prepared to handle large influxes of residents. At best, city centers have only been able to absorb just over 1% of their regional population growth. Still, the populations expressing a desire to move downtown is increasing in numbers so more of an influx into downtown areas is expected as more housing choices become available and the economy improves.

“Right-sizing” is a term used by the Urban Land Institute to describe how the real estate market is adapting to changing demographics, technological advancements and economic realities. In the housing market, both the Baby Boomers and Gen Y tend to prefer smaller living spaces located close to jobs and housing, a trend demonstrated by the declining average size of new single-family homes. Durham should focus its efforts on enhancing its downtown, strengthening its public transit system, and creating a regulatory framework that allows for a wide variety of high density housing both in the downtown and around transit stops. In this way, Durham would be better prepared to welcome new populations into the city without displacing current residents, leading to a more positive and economically stable community.



At the same time, businesses are looking for ways to cut costs and reduce commutes for their employees. Fortunately, technology has allowed today's companies to have regional, national, or even global marketplaces with less need for office space. Many allow employees to work from home, making the office environment more of a meeting place for when face-to-face interactions are necessary. Large office parks located in fringe areas have had difficulty in recent years attracting businesses and workers and are becoming obsolete for all but those industries that require large amounts of land. To facilitate the most economic growth, Durham should continue its efforts to provide more flexible regulations for new and renovated business space in the downtown and urban neighborhoods.

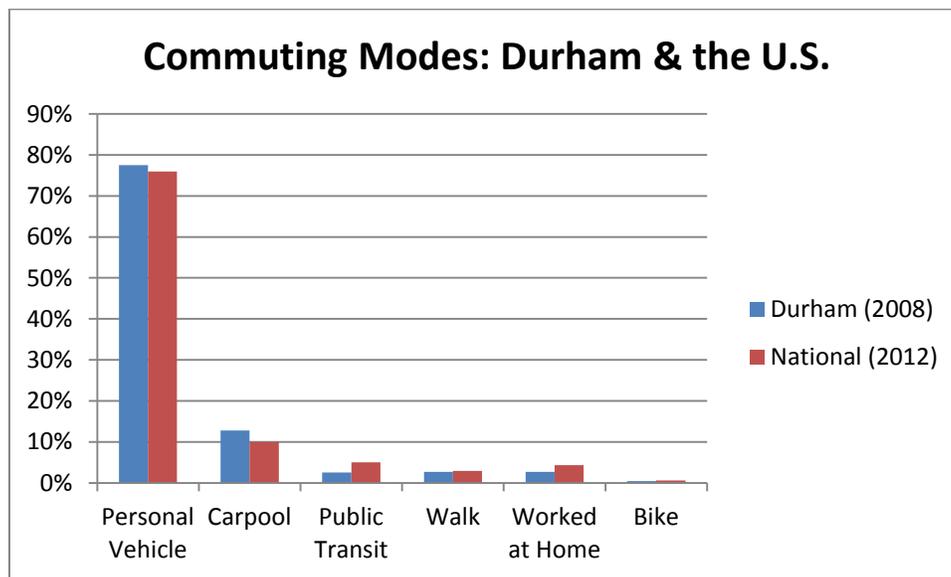
## Transportation and Mobility

*Daniel Band, 2014 MCRP Candidate*

As the demographic composition of our nation changes, trends point toward a slow adjustment in travel behavior. Looking ahead, more Americans – aging seniors, immigrant populations, and younger generations – will look to live in places closer to work, services, and entertainment. While there is increasing demand for neighborhoods where walking, biking, and using transit are alternatives to car commuting, historic and existing land use patterns can obstruct the overall efficiency and viability of a non auto-oriented system. At the same time, the so-called “infrastructure investment deficit”<sup>1</sup> is leaving congested roadways in poor condition causing economic inefficiencies, but also inspiring innovations in technology. In this section we will focus on transportation mode split, public transit usage, average commute time, and potential innovations and technologies.

### Transportation Mode Split

National preferences for commuting have largely held steady over the last half-century. During that time, the vast majority of Americans have preferred commuting by car. As the chart below shows, the personal vehicle continues to be the method by which most people in Durham and the nation commute to work.



However, while Americans as a whole continue to rely on single-occupancy vehicle travel, there are distinctions in how different socio-demographic groups use transportation. Some of these distinctions include:

- **Certain ethnic and racial groups are more likely to use public transportation or to carpool.** African-Americans use public transportation much more often than non-Hispanic Whites, with

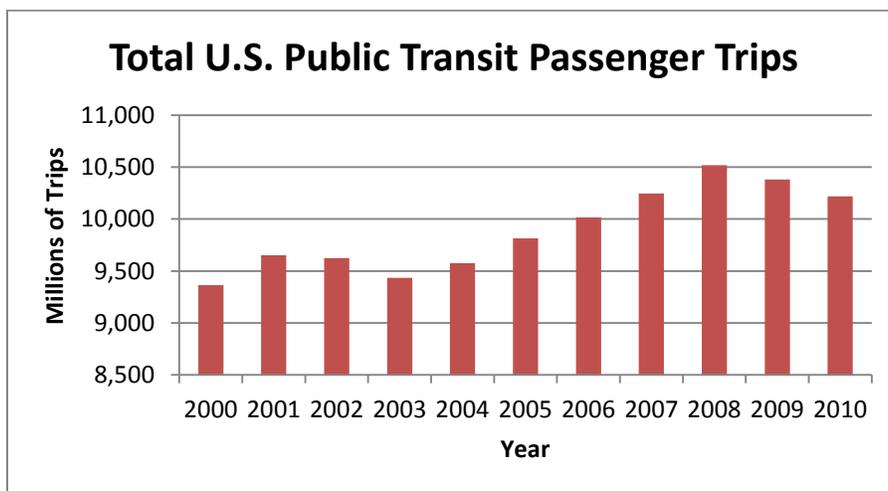
<sup>1</sup> Infrastructure investment deficit refers to the fact that we spend less on infrastructure improvements and upgrades than the amount that must be spent in order to maintain current infrastructure.

11.5% of African-American workers using public transit versus only 3.2% of non-Hispanic Whites. In addition, Hispanics are more likely to carpool than other groups (16.4% carpool compared to 9.5% for other groups).

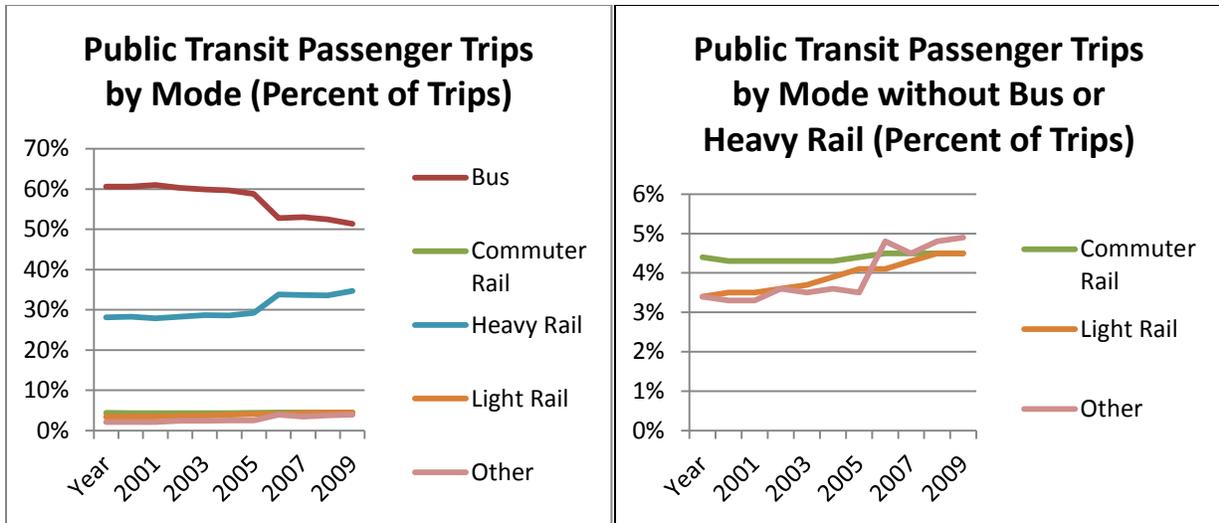
- **Residents of central cities are more likely to forego the use of single-occupancy vehicles as compared to their suburban peers.** Among central city residents, 72.1% commute via single-occupancy vehicle compared to 81.5% of workers who live in the suburbs.
- **Younger generations (particularly, Generation Y) drive less than previous generations and many do not have drivers licenses.** In addition, they are more likely to forego the purchase of a car in favor of alternatives such as car-sharing memberships. Virtually unheard of ten years ago, car-sharing programs now boast upwards of 500,000 members.
- **Public transit ridership among retirees has trended upward substantially over the last decade.** Overall ridership among Americans ages 65 and older grew from 661 million trips in 2001 to 1 billion trips in 2009, a substantial increase of 54.
- **There are also some differences in how men and women approach commuting options.** For example, men are more likely to bike to work than women. Commuting by bike has almost doubled in the past thirty years, but the increase is almost entirely due to men ages 25-64.

### Public Transit Usage

Additionally, while driving alone remains the dominant form of travel, public transit usage has increased in the recent past. From 2000-2010, overall ridership increased by 8.4% nationally. It peaked in 2008 during the height of the recession, and has fallen slightly since then, but ridership is still well-above the level of transit usage in 2000 (See below).



However, while overall public transit trips have increased in the last decade, some forms of public transit have become more popular while others less so, as can be seen in the charts below:



At the national level commuting by heavy and light rail has become more popular at the expense of buses. Bus transit lost market share over the decade, falling from 60% of ridership to 50%. Over the last decade heavy rail ridership has increased from 21 million passenger-trips to 31.2 million passenger-trips.

The national increase in rail ridership has also been seen regionally. In 2012, the Raleigh-Charlotte Amtrak line (serving Durham) saw record high numbers, as ridership increased by 16%. However, Durham bucks national trends in that rail ridership has not been at the expense of bus ridership. In fact, in 2011 the Durham Area Transit Authority (DATA) set all-time records for bus ridership with 5.65 million passenger-trips for the year, a 15% increase over 2010.

### Average Commute Time and Congestion Costs

In 2000 Americans spent on average of 26 minutes commuting to work, a figure which had grown by 4 minutes since 1980. However, in the last decade the average commute time decreased to approximately 25 minutes. Similar patterns hold for the amount of time commuters spend in traffic. According to the Urban Mobility Report, congestion peaked in 2005 and has declined slightly since. The report also predicted that traffic will pick up as the economy recovers, and thus the congestion relief is only temporary. Locally, Raleigh-Durham ranks 42<sup>nd</sup> among metropolitan areas in terms of yearly delay per auto commuter, with the average commuter spending 25 hours per year in congestion. That congestion is estimated to cost \$537 annually per commuter.

The costs of commuting and other auto related expenses such as fuel, insurance and maintenance are not typically factored into the equation when weighing housing affordability. The Housing and Transportation Affordability Index is a tool offered by the Center for Neighborhood Technology that demonstrates how auto-oriented land use patterns, which can lead to greater transportation costs, can consume a significant slice of a household’s income.

<sup>2</sup> The distinction between heavy, commuter and light rail is largely based on capacity and size of the train. Heavy rail trains are larger and carry passengers and goods inter-regionally. Commuter rail is somewhat smaller than heavy rail and largely serves to move people from surrounding communities into central cities. Light-rail trains are more similar to bus transit in that they, are small, can travel in crowded downtowns, and make frequent stops.

## Technological Innovations in Transportation

Finally, technological innovations may play a big role in how people commute in the future. A few possible innovations that could have a big impact on commuting habits include:

- **Automation of Vehicles** - Although vehicle automation is in its infancy, many experts predict that self-driving cars will become the norm within one to two decades. Companies working on this technology include Google and General Motors (GM), and GM predicts that they will start selling automated cars in 2018.
  - Potential benefits of this technology include reduced congestion and accidents due to the elimination of human error; improved mobility for older, younger and disabled people who cannot use manual vehicles; and reduced need for road signage.
  - Potential drawbacks include increased vehicle miles driven, CO2 emissions, and congestion because driving becomes a less onerous task. Issues surrounding legal liability remain unclear.
- **Increase in High-Tech Toll Roads (aka congestion pricing)** - Recent advances in toll road technology could reduce congestion and encourage alternatives to single-occupancy vehicle commuting through the use of variable rates according to the time of day and day of the week. An example system has been unveiled outside of Washington D.C.
  - Potential benefits include reduced congestion and increased use of public transit and carpooling (if transit and carpooling are not charged for using the toll road).
  - Potential drawbacks include issues of fairness and equity, since disadvantaged populations often have less control over their schedules and thus, less flexibility in taking advantage of variable pricing.

## Forecasting Transportation Trends

Taking these trends into consideration, we can make a few predictions as to how people will use transportation in the near future. Here are a few pertinent projections:

1. **The use of single-occupancy vehicles will continue to be the dominant form of transportation.** It has remained the dominant form of travel over the last few decades and barring drastic changes, such as skyrocketing gasoline prices or governmental regulations that make vehicle ownership more difficult, it will remain the preference of most commuters.
2. **Various transportation alternatives, such as public transit and cycling, will gain market share due to changes in land use patterns and personal preferences.** As the U.S. and Durham become more urbanized, people will shift towards public transportation. As mentioned before, city dwellers use public transportation more often than suburbanites. In addition, cycling has doubled in the past 30 years and has become a significant alternative in some places that have similarities to Durham such as Madison, Wisconsin and Arlington, Virginia.
3. **In Durham, socio-demographic changes will encourage non-car use.** Many groups that are expected to grow in Durham – minorities, the younger generation, and retirees - use public and alternative forms of transportation more often than other groups.

4. **The effect of an increase in automated cars is debatable.** This new technology could make streets less congested and safer through the elimination of human error, but it could also increase congestion if it encourages car use among those who currently cannot use vehicles.

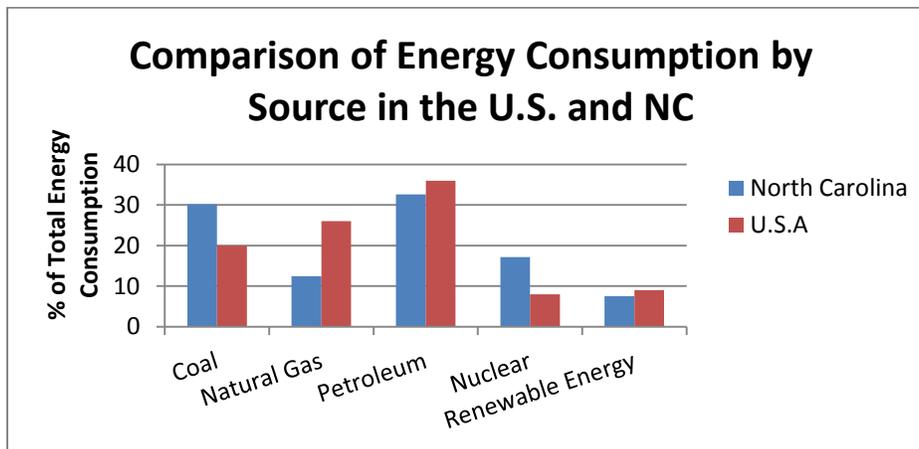
## Energy and Infrastructure

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As the global population soars toward 8 billion there is bound to be increasing competition for dwindling supplies of fossil fuels. In the near future, unstable energy prices and growing concern over the effects of carbon emissions will accelerate research and investment in decentralized and alternative energy solutions. As alternative energy and smart technologies become more common, local government's role will become more apparent and important. This section will first set the stage by outlining current and projected energy demands at the national and local level, then discuss some of the opportunities and challenges associated with green building and the installation of urban renewable technologies.

### Current Energy Portfolios: National & State

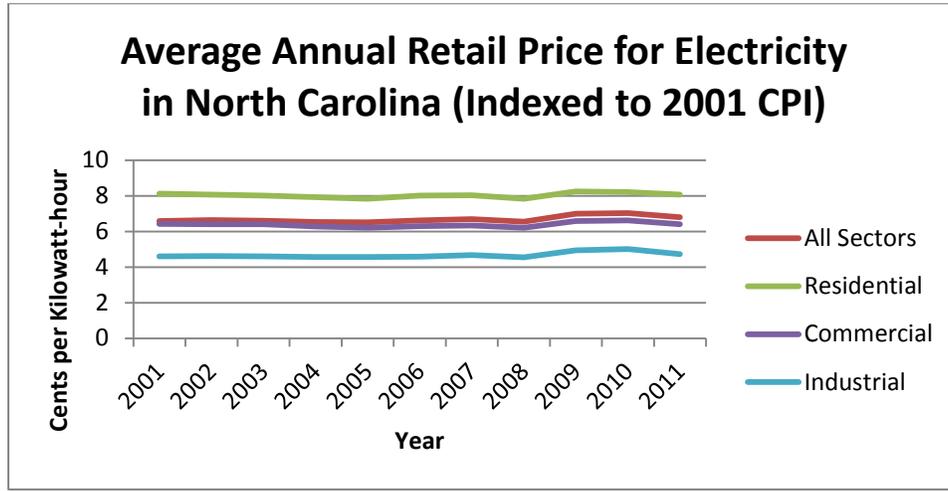
Durham residents draw energy from a statewide energy grid, so in order to examine Durham's energy portfolio we must look at North Carolina as a whole. Currently, North Carolina's energy portfolio differs somewhat from the national norm as seen in the graph below. Compared to national figures, North Carolina is significantly more reliant on coal and nuclear power for energy, and less beholden to natural gas. In addition, North Carolina uses a similar amount of renewable energy as the rest of the nation.



### Price of Electricity in North Carolina

In North Carolina, electricity prices are very important for residential, commercial and industrial users as they oftentimes are their single-largest energy cost. Over the past decade, electricity prices have remained steady in North Carolina. The graph below shows the average retail price per sector for electricity from 2001-2011 (adjusted for inflation). Over that time, residential prices have averaged approximately 8 cents/kWh, commercial firms paid about 6.5 cents/kWh, and industrial companies paid approximately 4.7 cents/kWh. Whether that price will remain stable in the future is uncertain. The

Energy Information Administration estimates that national demand for electricity will grow 22% by 2035; this significant growth could put strains on electrical utilities and cause prices to rise.



### Green Building and Energy-Efficient Retrofits

In the U.S., buildings consume approximately 41% of all energy used, and thus represent a major opportunity for reducing our energy needs. Reductions in energy consumption can be achieved either through the construction of more energy-efficient buildings or by retrofitting buildings to minimize their environmental impact.

The U.S. Green Building Council’s LEED-standard is the industry leader for setting building energy efficiency targets. LEED stands for Leadership in Energy and Environmental Design, and it is a voluntary, market-driven program that evaluates the environmental sustainability of buildings. It grades buildings according to green design standards and then awards them a designation of platinum (the highest), gold, silver, or certified (the lowest). The success of LEED buildings in conserving energy and water has been well-documented, though the magnitude of savings is still debated. Researchers at National Research Council Canada matched LEED buildings with similar non-LEED buildings and found that the sample of LEED buildings had an 18-39% reduction in energy usage.

Many municipalities have attempted to promote green building and retrofits within their jurisdictions. Although implementation of many of these policies would be complicated by the necessity of obtaining enabling legislation from the State, they are worth looking at and considering for Durham. Some innovative policies include:

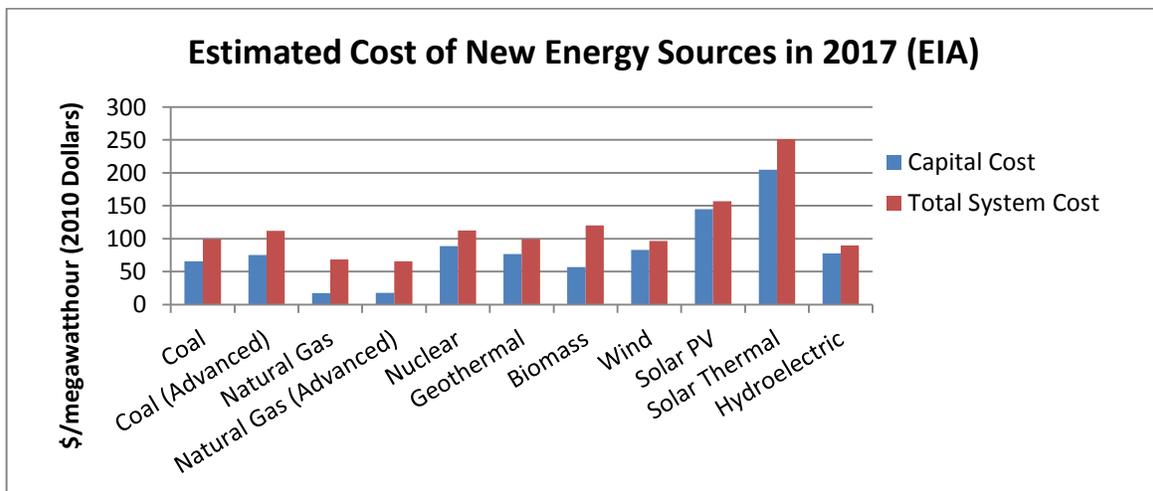
- **Encourage home builders to engage with the NC HealthyBuilt Homes Certification Program.** That program, founded in 2005, helps small-to-medium sized home builders to improve their homes energy efficiency and green building credentials. Home builders receive a “green-building” certificate for each of their homes that meet “key building envelope and insulation requirements” and receives a Home Energy Rating System (HERS) audit.
- **Requiring all new homes and buildings to get be graded based on the Home Energy Rating System (HERS) test and publicly post that grade.** The city of Santa Fe recently passed an

ordinance to this effect. The program is intended to make developers more conscious of their buildings energy usage and allow customers to include energy efficiency in their market decisions. HERS audits are already commonly used in North Carolina with 22,759 homes having received a HERS audit as of 2011. **Requiring sellers to disclose information about their building’s energy consumption to potential buyers.** The benefits of this policy are that it makes both parties more conscious about building energy consumption and it potentially encourages energy retrofits by the seller. Montgomery County, Maryland passed a law in 2008 requiring home sellers to provide this information to potential buyers, and found an ally in the area’s largest realtor association.

### Small-Scale Renewable Energy Options

In addition to reducing energy consumption in buildings, there is significant potential for urban buildings to produce clean energy by installing small-scale renewable energy technologies on-site. In particular, photovoltaic panels, which convert sunlight into electricity, are suited to areas like Durham. Already, North Carolina is a leader in the installation of photovoltaic panels, ranking 11<sup>th</sup> in the nation with 40 MWDC of installed capacity in 2010. Photovoltaic’s falling price and increasing capacity have made them an attractive and feasible option for many businesses and homeowners.

In addition to photovoltaics, there are a few other technologies that are appropriate for urban areas like Durham. Among these options are geothermal heat pumps, which use subterranean heat for heat and hot water, small wind turbines, which convert wind to electricity, and solar water heaters. Downtown Durham is already home to geothermal heat pump technology, which was installed at the Rogers Alley development in 2008. That installation was notable in that it was the first private commercial geothermal heat pump in North Carolina. As can be seen below, many of these technologies will soon be cost-competitive with traditional fossil fuels. In particular wind, biomass, and geothermal are projected to be nearly cost-competitive by 2017.



Public policy can play a big role in promoting clean energy projects. Here are a few of the ways that clean energy can be promoted in an urban area like Durham:

- **Publicize federal, state and local subsidies for clean energy installation.** Federal tax credits for all of the aforementioned technologies have been extended until 2016, and when combined with tax credits and subsidies from other levels of government, clean energy becomes more cost-effective.
- **Promote neighborhood collective purchase plans for renewable energy and provide technical assistance.** The City of Portland partnered with neighborhood coalition offices, Solar Oregon, and the Energy Trust of Oregon to assist local communities in purchasing solar photovoltaics. Through this program, Portland increased their installed capacity by more than 1.7 MW (enough to power ~800 homes). The resulting Solarize Guidebook has helped to spread the program to over a dozen other places throughout the country.
- **Streamline the permitting process for installing photovoltaic and solar thermal systems.** According to experts, many local permitting requirements were drafted when both technologies were still in their infancy, and are now becoming outdated. Today most panels are made by established manufacturers whose products have received approval from national testing laboratories. Eliminating unnecessary engineering studies and reviews would make the process less expensive and cumbersome for potential renewable energy users.

### Forecasting Energy Trends

1. **Durham's growing population combined with a national trend toward increasing electricity use will necessitate increased electricity-generating capacity.** This increased demand could be partially met through the promotion of renewable energy technologies, as well as increased energy conservation due to green building and retrofitting.
2. **However, a countervailing trend is the greying of the population and a move towards smaller family sizes, which may decrease energy consumption.** This may result in a diminished demand for large, suburban single-family homes and a greater need for more energy-efficient multi-family developments. The National Association of Home Builders projects that the average area of new single-family homes will decrease to 2,150 square feet. This is down from its peak in 2007 when the average new home built was over 2,500 square feet.
3. **Renewable energies will continue to gain market share as they become more cost-competitive due to economies of scale and cost-cutting innovations.** The prices of wind and solar energy technology have fallen dramatically in the last decade, and they are expected to be nearly cost-competitive with fossil fuels in the near to mid-term. Permitting and regulations may need to be reworked to deal with increased public demand.
4. **Green building and energy retrofits should help to lessen building-related demand for energy in the future.** Many companies are realizing the financial and health benefits of green building and are choosing to build based on those considerations. However, as previously mentioned there are still many policies that government can pursue to further encourage green building.

## Advanced Computing and Communication Technologies

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As recently as a few decades ago, smart communication technologies and mobile device technologies were in their infancy and played only a minor role in our daily lives. Today we can hardly imagine living without them. Taking this trajectory into account, this section reviews telecommunications, personal computing (i.e. smart phones, tablets, and other devices), and so-called Smart City technology, which are designed to more effectively and efficiently manage cities. In addition, there is a brief look at the trends for each category and informed predictions for how these trends may affect Durham in the future.

### Telecommunications

The field of telecommunications has progressed rapidly in the last few decades, especially with the proliferation of internet-connected audio-visual equipment and software. Increasingly organizations are using telecommunications technologies in order to increase information-sharing and circumvent travel costs. In addition, many inexpensive or free programs – Skype, Google Hangouts, Facebook - have entered the market, bringing telecommunication ability to a wider range of people. According to the Urban Land Institute (ULI), the traditional office is transforming from a work space to a meeting space, and it expects a sharp decline in average space per employee from close to 400 square feet in 1985 to less than 150 square feet in 2020.

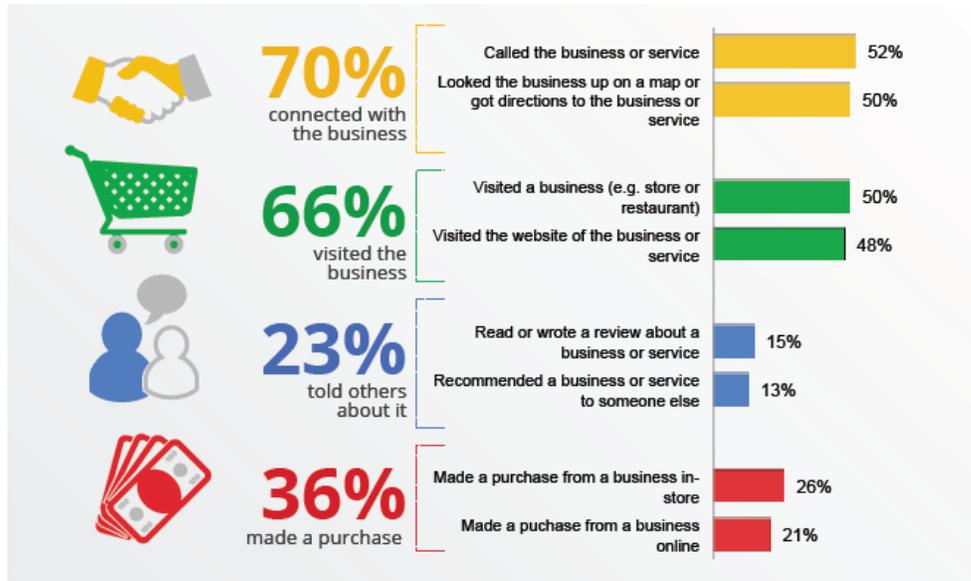
Partially accounting for the decline are telecommunication devices that enable employees to work from home instead of going to an office. As a result, the number of people working from home has grown by 41% in the last decade, to 13.4 million people. This trend has lagged somewhat locally; in 2008, only 2.7% of people in Durham County worked at home compared to about 4.2% nationally. Among all sectors nationally, the public sector took advantage of this new trend the most. The number of state employees who work from home grew by 133% during the past decade, and the number of federal employees working from home grew by 88%. These trends of shrinking office space per employee and a greater number of employees working from home, may suggest that Durham can plan for less office space and acreage than previously projected.

### Trends in Smart Phone/Mobile Internet Usage

Although they are relatively new technologies, the use of smart phones and mobile internet devices such as tablets is increasing rapidly throughout the country. According to Google, in 2012 44% of Americans had a smart phone, which was an increase of 13% in just one year. Mobile internet devices are also becoming dominant in the field of personal computing. This year mobile devices are expected to surpass their stationary predecessors – desktop computers – with each type of technology having 1.6 billion users. From there, mobile internet use is expected to experience remarkable growth. ULI projects that about 50 billion devices (computers, smartphones, tablets, etc.) will be connected to the internet by 2020, far exceeding global human population.

The increase in smart phones and mobile internet devices has been striking in the past few years. These devices allow easy and portable access to the internet almost anywhere and have been a boon to

downtown retail and businesses in reaching customers. As seen in the graphic below (created by Google), smart phones and mobile internet devices provide retailers with an interactive marketing platform and they assist customers with finding stores.



However, the internet also poses problems for typical brick-and-mortar retailers. Between 2007 and 2012, the online retail market grew by 40% and as of 2012, approximately 5% of non-automobile purchases were made online. Those purchases were especially concentrated in specific sectors such as book-selling, electronics, and apparel. In addition, price-conscious shoppers often use real-world retailers as “showrooms” to examine goods and then make their purchases online.

As a result of this transference of purchases to the online market, retailers have begun cutting costs on physical infrastructure by building smaller and fewer buildings. According to RREEF Real Estate, the winners in this challenging atmosphere will be “the best-located malls, main-street shopping districts, and grocery-anchored centers, while big-box retailers will begin a long period of decline” (*Bricks and Clicks...*, 2012). Essentially, retailers who are conveniently located for shoppers will be able to maintain a customer base, whereas those that are somewhat out-of-the-way will struggle.

Based on these findings, online shopping could have a big effect on land use planning in Durham. If retailers continue to downsize their physical operations, there will be decreased demand for new commercial facilities, which could slow the expansion of development outward into the suburban tier. In addition, if retail analysts are correct in predicting that inconveniently located retailers will be the hardest hit, then a result could be a relative strengthening of downtown Durham and conveniently located shopping centers at the expense of other areas.

### Smart Cities – Harnessing Information Technology for the Public Good

In addition, there is optimism among many city planners about the ability of cities to harness information technology to improve municipal efficiency, services distribution, and community involvement in planning. The goal is to use advanced technologies to collect information and use it to

optimize services, digitize more municipal services, and expand residents' accessibility to advanced technologies.

This is being put into practice in the post-industrial City of Holyoke, Massachusetts (population: 40,000). There they are piggybacking on the high-performance computing capabilities enabled by a recently built Cisco facility to improve government services and create opportunities for residents. For example, the City is using the high-speed internet capabilities to "stream adult education and tutoring classes" into public housing apartment buildings and they have also installed a "specialized digital communications network" to allow many city services – the police and fire departments and local hospitals – to access a common radio frequency.

Outside of that example, a few other examples of smart technology that cities are considering include:

- **Electric vehicle charge points** – Electric cars emit 30% less emissions and are much quieter than standard cars, making them ideal for the city. Some cities, particularly San Francisco and Los Angeles, have promoted electric vehicle use by installing charging systems. Ideal locations for these systems include parking garages and shopping centers, so that users can park and shop while their car is charging.
- **Intelligent transportation systems** – These systems draw on real-time data obtained through cameras and sensors to adjust traffic lights and decrease inner-city congestion.
- **Integrated Operations Center** – Rio de Janeiro recently partnered with IBM to create a high-tech operations center that integrates feedback from 32 government agencies in order to better manage transportation, crime, and provide for public security. Much of the information is also available to citizens so that they can be informed about public security concerns (i.e. flooding, rain, etc.) and transportation challenges.

### Forecasting Communication Technology Trends

1. **The increasing proliferation of quality telecommunication equipment will enable growth of at-home workers.** This may counteract congestion during peak commuting hours and decrease need for office space. Durham should take a fresh look at its assumptions for office demand and adjust, if necessary, its Future Land Use Map and analysis accordingly.
2. **The increase of internet-enabled devices will result in a rapid increase in population data and increased mechanization of tasks.** This increase in data could enable more efficient and informed decision-making provided the data is used intelligently. Increased data-gathering could be harnessed with information technology advances to make a smarter city.
3. **Increased smart phone usage could be a draw for downtown tourism.** Smart phone apps enable information relay that couldn't be easily relayed to tourists otherwise. This could enable Durham and other cities to draw in more tourists, and thus greater revenue.
4. **Online retail will continue to grow, taking market share from some (but not all) brick-and-mortar retailers.** Some industries such as publishing and electronics will be particularly hard hit and will most likely transfer operations online. In terms of general trends, retailers will likely cut back on building costs by demanding less total retail space, especially in out-of-the-way fringe areas. Resulting vacancies could pose a problem to planning departments. In addition, Durham

should review its assumptions about needed retail space per population and adjust, if necessary, its Future Land Use Map and analysis accordingly.

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