GEORGIA 400 CORRIDOR ALTERNATIVES ANALYSIS

Economic Trends Technical Report

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Metropolitan Atlanta Rapid Transit Authority

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1.0 INTRODUCTION

1.1 Purpose of Analysis

The Georgia (GA) 400 Transit Initiative's purpose and need is to provide reliable, convenient, efficient, and sustainable transit service in the GA 400 corridor study area by:

- Providing high capacity transit (bus and/or rail) through the GA 400 corridor study area;
- Improving transit linkages and coverage to communities within the study area; and
- Enhancing mobility and accessibility to and within the study area by providing a more robust transit network that offers an alternative to automobile travel.

Given the identified purpose and need for the GA 400 Transit Initiative, its effects on the economy were analyzed within the study area.

This document summarizes analyses completed in fall 2013 and was based on the outcomes of the GA 400 Transit Initiative's Alternatives Analysis (AA) conducted from 2011 to 2013. Additionally, this analysis was used during Early Scoping – Phase I (fall 2013) to provide economic trends and forecasted impacts to stakeholders, the public and agency partners. The focus of the analysis was to understand economic trends, namely in real estate and transit oriented development (TOD). Additionally, an understanding of future economic impacts within the study area was needed if the GA 400 Transit Initiative were to be implemented.

1.2 Document Content

The document consists of two chapters that are described below.

- **Real Estate Trends and Transit Oriented Development (TOD) Potential** – This chapter focuses on analyzing existing trends with home-work balance, wage diversity, population/employment and real estate inventory (absorption and development). It also summarizes real estate forecasting conducted for a 30-year period and its implications on market trends, pricing and demand. These forecasts use regional data from the Atlanta Regional Commission (ARC) and their 2040 Regional Transportation Plan (RTP).

- **Economic Impacts of the GA 400 Transit Initiative –** Impacts due to the implementation of the GA 400 Transit Initiative are documented in this chapter. This includes property premiums impacts, tax base impacts, population/employment density changes, reduction of sprawl and compact development potential/benefits.

2.0 REAL ESTATE TRENDS AND TRANSIT ORIENTED DEVELOPMENT (TOD) POTENTIAL

2.1 Home-Work Balance

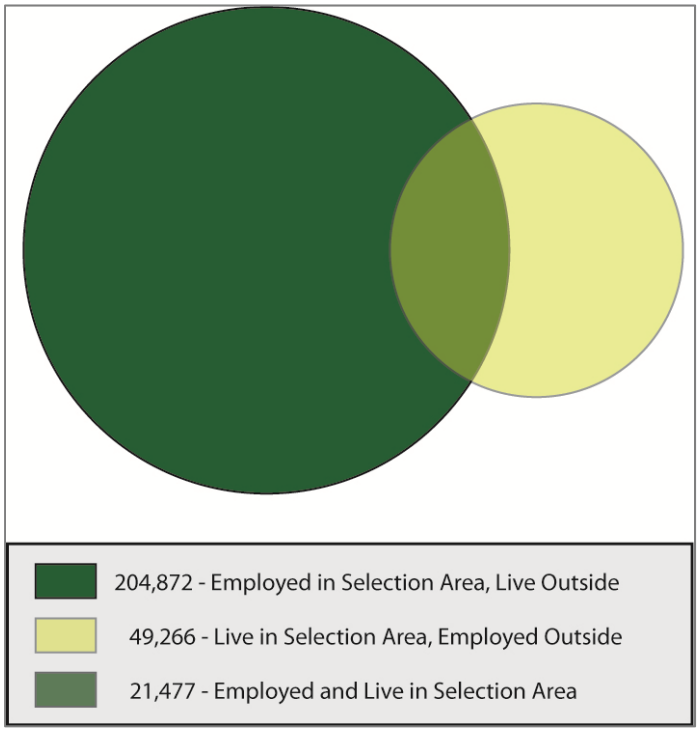
The GA 400 study area is a major regional employment center with roughly three jobs for every working resident in the area. US Census estimates of the 226,349 people who are employed in the study area, nearly 205,000 workers, or 90% of the area's workforce members, commute in to work from outside the study area (see Table 2-1 and Figure 2-1). By contrast, just 30% of the area's nearly 71,000 working residents, work inside the area, with the remaining 49,266 working residents commuting to jobs elsewhere in the region (see Figure 2-1).

Table 2-1: Inflow/Outflow of Employment, 2011, GA 400 Study Area

Category	Count
Employed in the GA 400 study are	226,349
Living in the GA 400 study area	70,743
Living and Employed in the GA 400 study area	21,477
Employed in the GA 400 study area but living outside	204,872

Source: US Census

Figure 2-1: Inflow/Outflow of Employment, 2011, GA 400 Study Area



Source: US Census

2.2 Wage Diversity in the Study Area

Of the estimated 226,000 workers employed in the area, an estimated 39,600, or 17%, earn less than $1,250 per month, which corresponds to annual wages of $15,000 or less. Another 64,000, or 28%, earn between $1,251 and $3,333 per month ($15,000 to $40,000 per year) annually, and 54% of all area workers earn more than $3,333 per month (greater than $40,000 per year). Thus, there is great diversity in the wage levels paid within the study area. Table 2-2 compares the employment in the study area by age and earnings.

Table 2-2: Employment by Age and Earnings, 2011, GA 400 Study Area

Total All Jobs	**Total**	**Percentage**
Total All Jobs	226,349	100.0%
Jobs by Worker Age	**Total**	**Percentage**
Age 29 or younger	43,707	19.3%
Age 30 to 54	149,340	66.0%
Age 55 or older	33,302	14.7%
Jobs by Earnings	**Total**	**Percentage**
Low-wage ($1,250 per month or less)	39,633	17.5%
Moderate-wage ($1,251 to $3,333 per month)	63,842	28.2%
High-wage (More than $3,333 per month)	122,874	54.3%

Source: US Census

2.3 Key Trends: Population and Employment

- The GA 400 study area is among the region's largest and fastest-growing employment centers, comparable to downtown Atlanta/Midtown/Buckhead in terms of total jobs.
- The study area can expect to see strong population growth over the next 30 years, with 27,000 new residents and 15,000 new households.
- Employment growth in the area is forecasted to dramatically out-pace population growth, with over 110,000 new jobs forecasted over the next 30 years.
- The study area has nearly three jobs for every household, which corresponds to strong levels of employment-based commuting into the study area.
- Over 200,000 workers commuted into the GA 400 study area on a typical weekday in 2010.
- Nearly 40,000 workers in the GA 400 study area earn less than $15,000 per year. Over 100,000 workers in the area earn less than $40,000 per year.

2.4 Real Estate Inventory, Absorption and Development

The following sections present recent and historical trends in key sectors of the real estate market for the GA 400 study area and its environs. Sectors evaluated include:

- Residential
- Office
- Industrial
- Retail

Home Sales Volume & Pricing Trends

The residential real estate analysis looks at seven years of historical sales data, classified in several different ways including by unit type, by zip code and by county. Geographies considered include:

- Fulton and DeKalb Counties,
- Northern Fulton County, including all portions of Fulton County north of the Atlanta city limits, including most of the GA 400 study area,
- The GA 400 study area, in this case defined as the combination of nine zip codes which roughly approximate the study area, and
- The individual zip codes, which are the smallest available unit of analysis for home sales data.

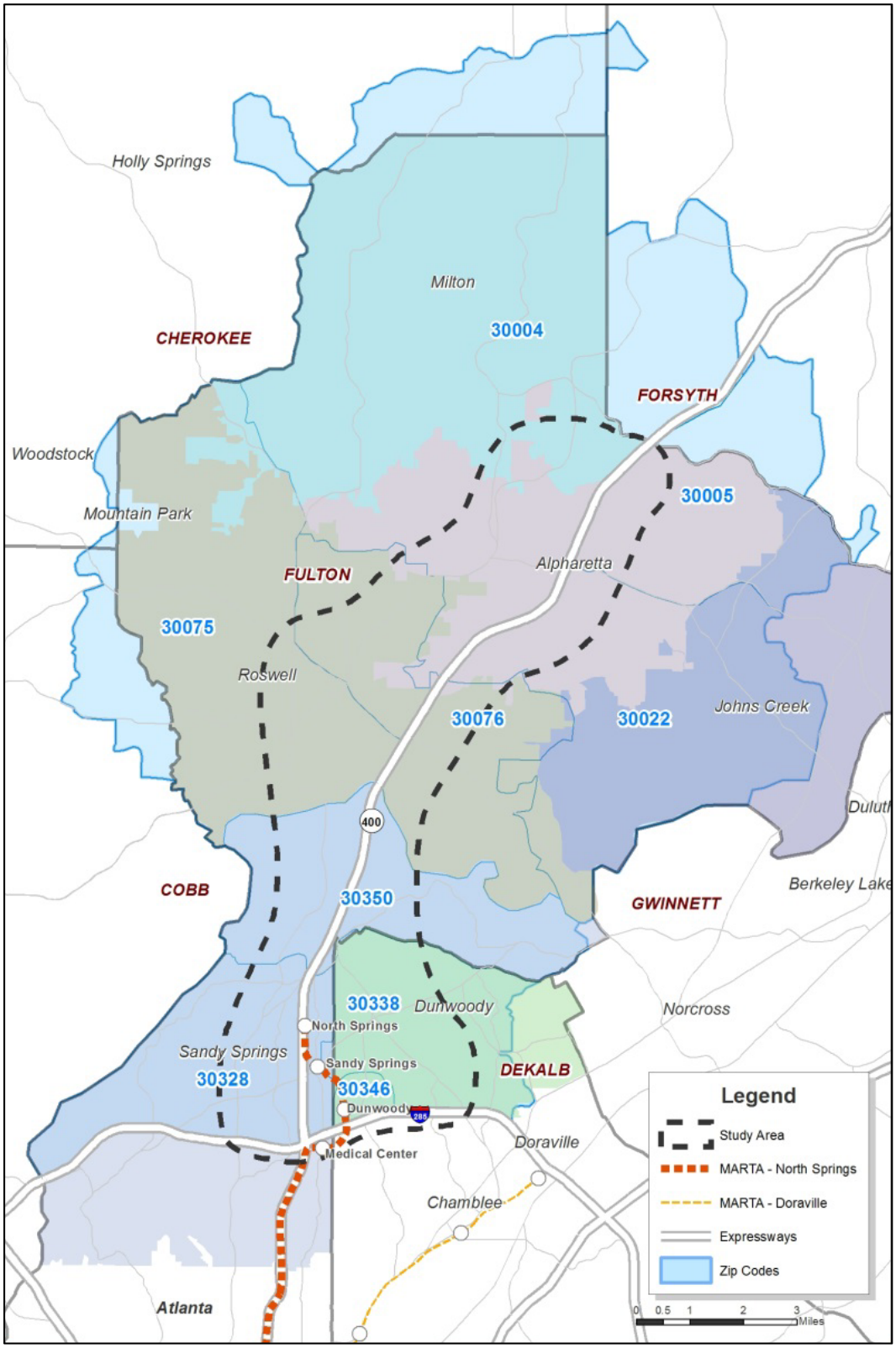
The zip codes included in the analysis and their relation to the GA 400 study area are shown on Figure 2-2.

Home Sale Prices

Average sale prices for new and existing homes (single family, townhomes, and condominiums) are shown in Table 2-3 and Figures 2-3 and 2-4. Home pricing trends are summarized below:

- While the residential real estate market overall has been dramatically impacted by the Great Recession, **new home** prices in Fulton and DeKalb County have fared relatively well, as home-builders responded to drops in demand by scaling back on new construction. The GA 400 market area saw a moderate increase in prices up through the advent of the Great Recession in 2008. This was followed by a reversion to the mean price, attributable to a decline in demand and construction of luxury homes that are more prevalent in the market area than countywide.
- Sale prices of **new homes** in the GA 400 study area tended to be 30% to 50% higher than the average Fulton or DeKalb County home.
- **New home** sales prices in the GA 400 study area dropped from a peak value of $393,000 in 2008 down to $295,000 in 2010, a decline of 25%.
- Average sale prices of **existing homes** dropped even more sharply in Fulton and DeKalb Counties, with 2009 average prices just 50% to 60% of peak 2007 values, while prices in the study area decreased by 7% over the same period.
- Sale prices of **existing homes** in the study area also retained most of their value through the Great Recession, while Fulton and DeKalb County average existing home prices dropped sharply. Existing homes in the study area tend to sell for two-to-four times the price of the average Fulton and DeKalb home.

Figure 2-2: ZIP-Based Study Area for Home Sales Analysis



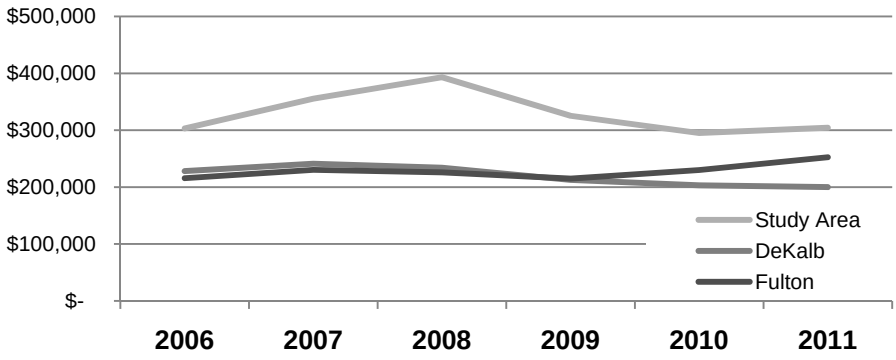
Source: Bleakly Advisory Group (BAG), USPS, ARC

Table 2-3: Residential Sales Trends, 2006-2011 for Study Area and Counties

		Study Area		DeKalb		Fulton	
		Price	Volume	Price	Volume	Price	Volume
New Homes	2006	$303,173	1,744	$228,000	3,295	$215,832	10,748
	2007	$355,481	1,242	$240,995	2,482	$230,390	7,081
	2008	$393,148	673	$234,000	1,511	$225,776	4,034
	2009	$325,427	596	$212,730	860	$215,000	2,788
	2010	$295,114	515	$203,000	611	$230,000	2,141
	2011	$304,221	582	$199,900	591	$252,590	1,926
Resale Of Existing Homes	2006	$275,729	5,681	$166,212	10,588	$201,000	15,237
	2007	$282,453	4,856	$160,000	9,325	$202,750	13,453
	2008	$276,041	3,568	$130,000	8,372	$140,000	12,886
	2009	$263,794	3,207	$87,525	8,716	$115,000	12,774
	2010	$249,337	3,617	$87,000	8,134	$130,000	12,041
	2011	$239,896	4,071	$70,900	8,815	$120,000	13,162
All Homes	2006	$278,754	7,425	$178,250	13,883	$210,640	25,985
	2007	$293,623	6,098	$175,000	11,807	$217,907	20,534
	2008	$288,549	4,241	$149,768	9,883	$172,000	16,920
	2009	$267,778	3,803	$102,000	9,576	$145,000	15,562
	2010	$254,927	4,132	$96,000	8,745	$151,991	14,182
	2011	$248,295	4,653	$77,950	9,406	$140,000	15,088

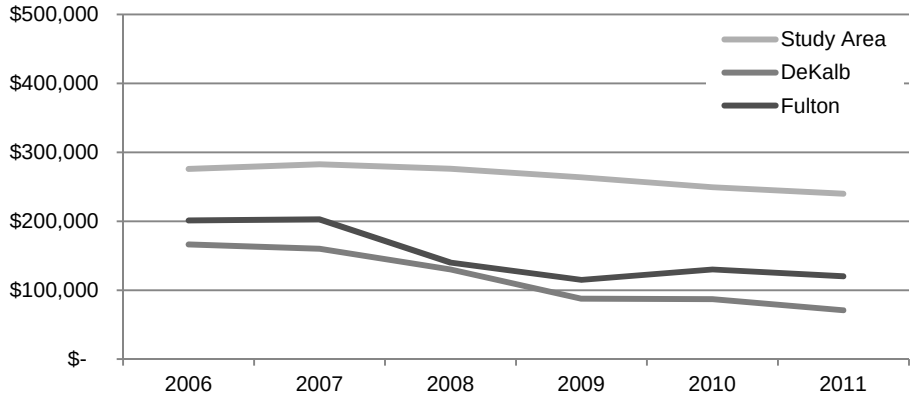
Source: SmartNumbers, Inc., BAG

Figure 2-3: Average Sales Price, New Homes, 2006-2011 for Study Area and Counties



Source: SmartNumbers, Inc.

Figure 2-4: Average Sales Price, Existing Homes, 2006-2011 for Study Area and Counties

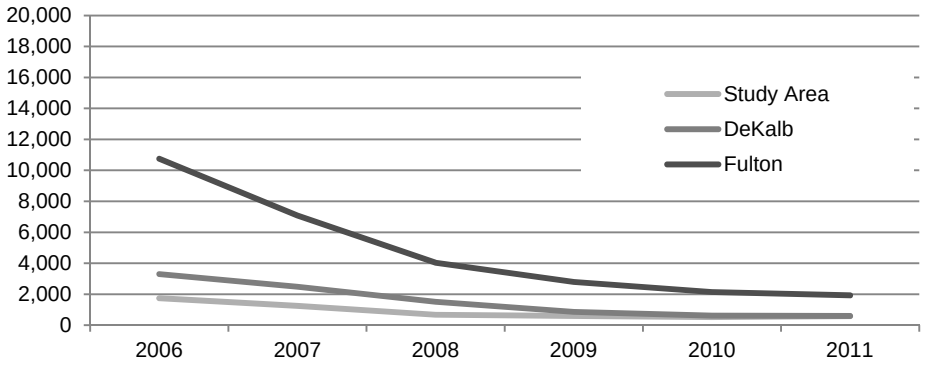


Source: SmartNumbers, Inc.

Home Sale Volumes

New home sales volumes fell sharply in all areas, largely with advent of the Great Recession in 2008. New home sale volumes in the study area fell from over 1,700 units in 2007 to fewer than 600 in 2011, a decline of 66% (see Figure 2-5). The collapse of new home construction in the study area helped to stabilize new home prices, as no new inventory was added allowing demand to recover gradually.

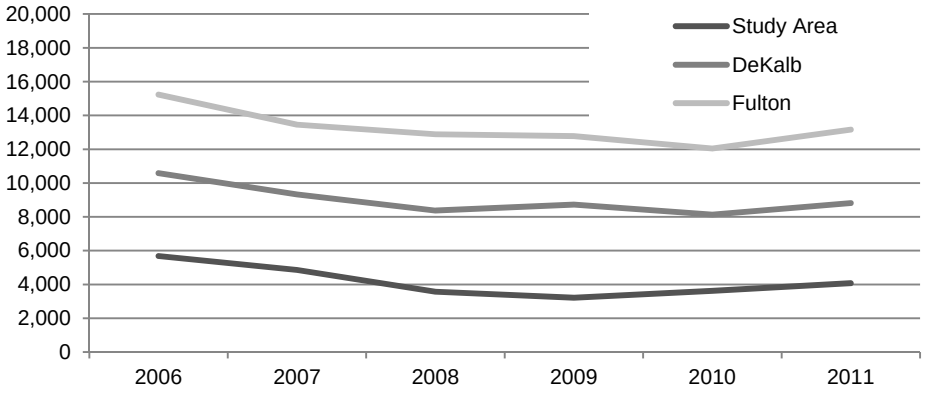
Figure 2-5: Annual Sale Volumes, New Homes, 2006-2011 for Study Area and Counties



Source: SmartNumbers, Inc.

Existing home sale volumes in the GA 400 study area also dropped sharply, with volumes slowly rebounding in the past few years since the 2008-2009 market low (see Figure 2-6).

Figure 2-6: Average Sale Volumes, Existing Homes, 2006-2011



Source: SmartNumbers, Inc.

Localized Home Trends: Pricing and Volume by ZIP and Unit Type

A closer look at 2012 home sales by ZIP code and unit type provides additional insight in to local average home sale trends (see Table 2-4). The strongest residential sales volume activity in the area is found in the Milton/Alpharetta area (30004) followed by John's Creek (30022) and Roswell (30075). See Figure 2-2 for zip code locations.

Single family homes dominated home sales in all ZIP codes in 2012, with the exception of 30028 (Dunwoody), where condominiums outsold single family homes by a ratio of more than five to one. This zip code area, near the Dunwoody and Sandy Springs MARTA stations, illustrates a correlation between the development of condominiums in proximity to transit accessibility.

Table 2-4: 2012 Average Home Sales Trends by ZIP Code

Development Type	Volume / Price	Zip Code									N. Fulton
		30004	30005	30022	30075	30076	30328	30338	30046	30050	
Single Family	Volume	166	13	94	51	9	5	0	0	1	441
	Price	$475,624	$555,700	$435,214	$504,390	$483,126	$563,780	0	0	$645,000	$479,295
Town Home	Volume	12	0	11	30	5	5	0	0	20	269
	Price	$264,350	0	$185,320	$336,655	$221,180	$563,780	0	0	$118,767	$308,242
Condo	Volume	0	0	0	5	0	43	0	0	0	386
	Price	0	0	0	$307,300	0	$149,827	0	0	0	$403,841

Source: SmartNumbers, Inc.

Year-to-Year Price Trends by Unit Type for Northern Fulton County

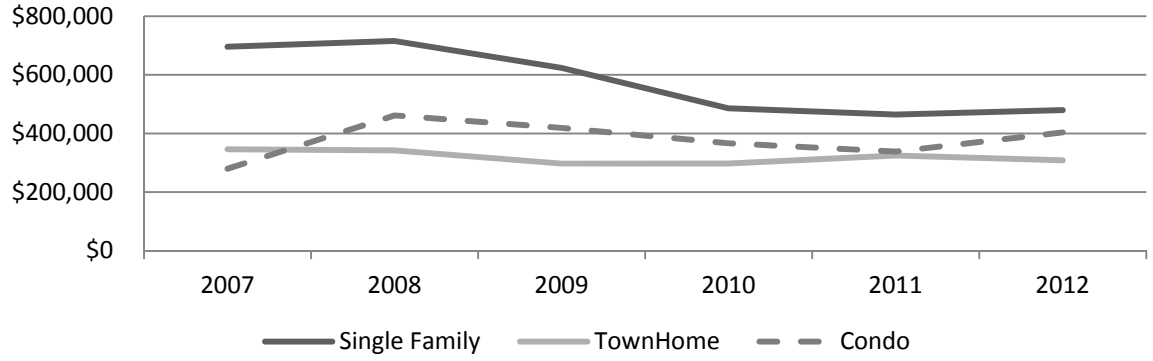
Average sale prices for new single-family homes in northern Fulton County dipped significantly from a pre-Great Recession 2008 peak of over $700,000 to approximately $480,000 in 2012, a decline of 33%, likely due to a combination of Great Recession-related factors, including reduced demand and reduced availability of financing. Sales prices in the townhome and condominium segments have remained more or less consistent over the period, with both typically selling in the $300,000 to $400,000 range throughout the period. Table 2-5 and Figure 2-7 illustrate the residential sales price trends in northern Fulton County between 2007 and 2012.

Table 2-5: New Residential Sale Prices Trends, 2007-2012, Northern Fulton County

Year	Avg. Price		
	Single Family	Townhome	Condo
2007	$695,979	$345,802	$279,831
2008	$715,393	$341,869	$461,392
2009	$623,907	$297,063	$418,749
2010	$485,430	$297,267	$366,649
2011	$464,378	$324,383	$338,140
2012	$479,295	$308,242	$403,841

Source: SmartNumbers, Inc.

Figure 2-7: Average New Home Sales Prices, 2007-2012, Northern Fulton County



Source: SmartNumbers, Inc.

Apartments

The GA 400 study area rental apartment market is among the strongest in the Atlanta metropolitan region. The area contains 171 major apartment communities with more than 48,000 units, according to data provided by Reis, Inc., a major national real estate data firm. Average rents in the Sandy Springs/Dunwoody and Roswell/Alpharetta submarkets, which approximate the GA 400 study area, currently rank as the third and fifth highest in the Atlanta Metro region, after Buckhead and Midtown, with average rents of $960 and $937 per unit respectively, compared to a regional average of $873 per unit (see Table 2-6).

Table 2-6: Overview of Atlanta Metro Apartment Markets, First Quarter 2013

Submarket	Communities	Units	Avg. Asking Rent	Vacancy
Buckhead	86	19,418	$1,205	4.3%
Midtown	88	15,250	$1,124	4.3%
Sandy Springs / Dunwoody	**92**	**25,316**	**$960**	**4.4%**
North DeKalb	171	35,127	$959	6.0%
Roswell/Alpharetta	**79**	**22,914**	**$937**	**4.5%**
Central I-75 West	52	9,244	$927	8.3%
North Gwinnett	85	23,049	$872	4.9%
Marietta	152	34,912	$868	4.7%
Decatur/Avondale	92	16,027	$847	8.4%
Smyrna	92	23,445	$842	4.3%
Cherokee County	23	4,217	$829	3.8%
I-20 East	55	12,081	$801	8.0%
South Gwinnett	115	27,151	$798	4.8%
South Fulton	209	33,709	$759	12.4%
Clayton/Henry	169	31,220	$743	8.0%
I-20 West	46	9,046	$737	9.6%
Clarkston/Stone Mtn.	81	17,210	$714	11.1%
South DeKalb	20	4,726	$656	23.9%
Atlanta Metro Total	**1,707**	**364,062**	**$873**	**6.8%**

Source: Reis Inc.

Vacancy rates in the study area are among the lowest in the Atlanta region, between 4.4% and 4.5%, significantly lower than the regional average of 6.8%.

Reis Inc. estimates that new construction in the metro apartment market will continue at a steady rate of 1.2% annually over the next five years, corresponding to the expected addition of 550 to 600 units annually in the GA 400 study area market.

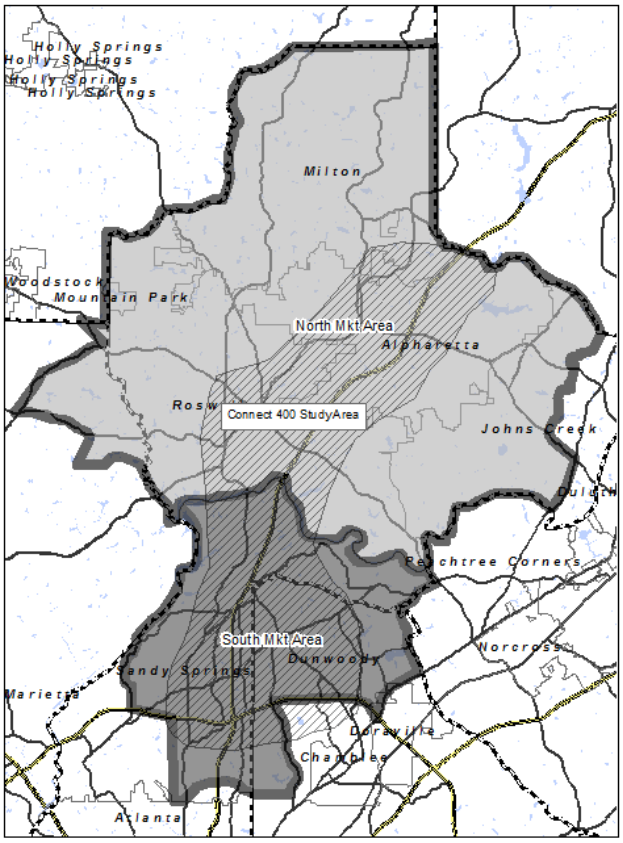
Key Trends: Housing

- The GA 400 study area and the broader North Fulton housing market is extremely strong, with above-average prices and steady sale volumes.
- While negatively impacted, the study area has performed better than the regional housing market during the Great Recession. While prices and volumes did drop, the impacts were much less severe than elsewhere in the region.
- The area's apartment market is strong, with low vacancies and average rents among the highest in the Atlanta region.
- Single-family homes remain the dominant new-home type in the area, particularly in the north. Condominiums tend to be most prevalent in the Dunwoody/Sandy Springs areas.

Overview of Commercial Real Estate Inventory

The commercial real estate analysis presents 20 years of inventory data for office, industrial, and retail real estate, categorized by three geographies: the primary GA 400 study area and two larger secondary market areas, the north market area (north of the Chattahoochee River, including Roswell, Milton, Alpharetta and John's Creek) and south market area (which includes Sandy Springs and Dunwoody). The market areas are shown on Figure 2-8. Most of the study area is contained within the two sub-areas with the exception of a small portion at the southeast corner, which is predominantly residential. All statistics in the following section assess the study area and the two market areas independently: Inventory characteristics for the two market areas include overlapping areas of the study area, and vice versa. Additionally, Real estate inventory data presented in the following sections summarizes historical data by five-year intervals.

Figure 2-8: Methodology Maps



Source: BAG, CoStar, Inc., ARC

While the GA 400 study area represents less than half the total acreage of the two market areas, it contains the vast majority of the commercial buildings in the area and 88% of the commercial real estate inventory in the cumulative market area (north and south market areas). Table 2-7 summarizes the commercial real estate inventory by market area. Key trends are highlighted in the following bullets.

- The south market area contains 55% of the office inventory in the combined market areas, although the bulk of new commercial real estate construction activity in the past 20 years has occurred in the north market area.

- 91% of the industrial inventory is in the north market area.
- 75% of the retail activity in the combined market area is within the GA 400 corridor, meaning a larger share of retail, as compared to office and industrial space is incorporated into the largely residential areas away from the GA 400 corridor.

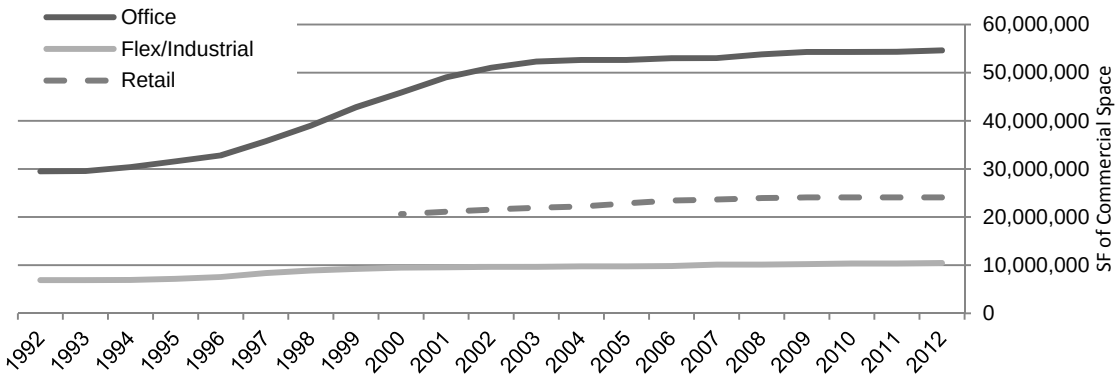
Table 2-7: 2012 Commercial Real Estate Inventory by Area - Square Feet (SF)

2012 Inventory	Office		Flex/Industrial		Retail		Total	
	Million SF	Percentage (%)	Million SF	Percentage (%)	Million SF	Percentage (%)	Million SF	Percentage (%)
South	32.2	55%	1.0	9%	10.6	33%	44.5	43%
North	26.4	45%	9.9	91%	21.4	67%	59.1	57%
South + North	**58.6**	**100%**	**10.9**	**100%**	**32.0**	**100%**	**103.5**	**100%**
GA 400 study area	54.6	93%	10.4	96%	24.1	75%	91.0	88%

The following sections detail the rapid growth of commercial real estate in the office, industrial and retail sectors. Several prevailing trends stand out:

- Northern Fulton County and the GA 400 Area have experienced extremely rapid growth of commercial real estate inventory over the past 20 years.
- The south market area became a dominant regional presence in the office and retail market in the 1980s, after which momentum shifted north, where the north market area began to dominate regional growth in the 1990s, a trend that continues today.
- The GA 400 office market has expanded rapidly, nearly doubling in size over 20 years. The retail and industrial sectors have also seen strong growth, however nowhere near the unprecedented robust growth of the office sector (see Figure 2-9).

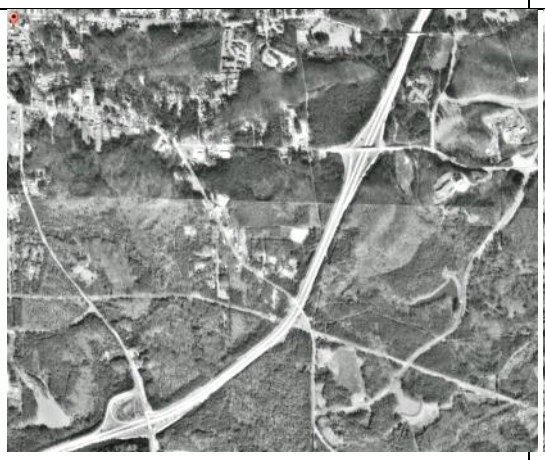
Figure 2-9: Real Estate Inventory by Year and Type, 1993-2012, GA 400 Study Area



Source: CoStar, Inc.

Historic aerial photos of key intersections in the study area (see Figure 2-10) illustrate the rapid onset of development in the area, particularly in the 1993-2002 period.

Figure 2-10: Aerial Photos Showing Growth in GA 400 Corridor 1993-2012

	GA 400 & Old Milton Parkway	GA 400 & Mansell Rd
1993		
2002		
2012		

Source: Google

Office Market Trends

Tables 2-8 through Table 2-12 illustrate real estate trends for the office sector for the GA 400 study area the south market area, and the north market area. Key findings include:

- The office inventory of the GA 400 study area increased by 85% over 20 years from 1993 to 2012, with a total of over 25 million square feet (SF) of office space in 444 buildings added.
- The north market area's office space increased four-fold over 20 years, from 6.5 million SF in 1993 to 26.4 million SF in 2012.
- The south market area, larger than the north, grew robustly over the same period, but at a more measured pace, adding 7.4 million SF of space, or 30%, from 24 million SF to 32 million SF over 20 years.
- Over 80% of the new office growth from 1992 to 2012, nearly 20 million SF of new office space occurred in the north market area, representing a four-fold increase. More than half of that growth, 13.8 million SF of new space was added in the five-year period from 1997 to 2001. During that five-year period, an average of 51 net new office buildings was added to the study area's inventory each year.
- The average annual growth rate for office inventory in the GA 400 study area has been 3.1% annually, averaged over 20 years. The peak 1997-2001 period saw a growth rate of 6.5% annually corridor-wide. During the past 10 years, which includes the Great Recession years of 2008-2012, the average growth rate has been just 0.7%.
- The average absorption of office inventory in the GA 400 study area has been 1.0 million SF annually averaged over the last 20 years. The peak absorption period was 1996-2000, with an average rate of absorption of 2.5 million SF annually corridor-wide, and the past 10 years, which includes the Great Recession years of 2008-2012 has had an average absorption of 391,000 SF annually.
- Office vacancy rates have ranged between 16% and 21% over the past 10 years. The Great Recession, which began in 2008, has had a relatively mild effect on office vacancy rates in the GA 400 study area, with vacancy rates rising modestly in the past four years, ranging from 16% to 19%, compared to a long-term average of 15%.
- Full-service office rents rates in the GA 400 study area average $20.64/SF, slightly higher than the regional average range of $18.00/SF to $19.00/SF. Lease rates in the south market area are slightly higher than those of the north market area.
- The south and north market areas are respectively the first and second largest concentrations of Class A office space in all of the Atlanta region's 42 office submarkets identified by CoStar. Collectively, the two market areas have 37 million SF of Class A office space, representing nearly a third of the region's 116 million SF of Class A office space, most of which was added in the past 20 years.

Figure 2-11 summarizes the volume of new office space added in the two market areas during the 10-year period (1993-2012). It should be noted that RBA in tables on the following pages and sections refers to Rentable Building Area in SF.

Table 2-8: Office Market Snapshot: 4th Quarter, 2012

Office	GA 400	South	North
# Buildings	1,516	656	1,198
Average Age	29	32	26
Total RBA (SF)	54,632,966	32,198,166	26,396,614
2012 Net Absorption	717,703	581,683	64,704
Vacancy Dec. 2012	0	0	0
Rent Range Per SF	$4.05-$28.50	$7.95-$30.00	$4.05-$26.00
Average Rent Per SF	$20.65	$21.10	$20.35
Rent Type	Full Service Gross	Full Service Gross	Full Service Gross

Source: CoStar, Inc.

Table 2-9: Commercial Real Estate Trends: Office, GA 400 Study Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	Avg. Annual New SF	Avg. Bldg. Size	Total Vacant %	Avg. Annual Absorption
2008-2012	1,514	11	54,632,966	323,512	36,085	17%	(174,581)
2003-2007	1,503	81	53,015,408	394,858	35,273	16%	957,812
1998-2002	1,422	223	51,041,116	3,060,818	35,894	12%	1,978,058
1993-1997	1,199	129	35,737,025	1,248,702	29,806	11%	1,418,221
20-Yr Total		**444**		**25,139,450**			
Avg. 2003-2012		9		359,185	35,775	16%	391,616
Avg. 1993-2002		35		2,154,760	31,079	12%	1,698,139
Avg. 1993-2012		22		1,256,973	33,427	14%	1,044,878

Source: CoStar, Inc.

Table 2-10: Commercial Real Estate Trends: Office, South Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	Avg. Annual New SF	Avg. Bldg. Size	Total Vacant %	Avg. Annual Absorption
2008-2012	656	(19)	32,198,166	88,912	49,083	18%	(230,659)
2003-2007	675	7	31,753,605	82,409	47,042	18%	432,984
1998-2002	668	27	31,341,560	887,745	46,919	12%	329,129
1993-1997	641	20	26,902,836	418,994	41,970	12%	781,238
20-Yr Total		**35**		**7,390,302**			
Avg. 2003-2012		(1)		85,661	47,992	18%	101,163
Avg. 1993-2002		5		653,370	42,923	12%	555,184
Avg. 1993-2012		2		369,515	45,457	15%	328,173

Source: CoStar, Inc.

Table 2-11: Commercial Real Estate Trends: Office, North Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	Avg. Annual New SF	Avg. Bldg. Size	Total Vacant %	Avg. Annual Absorption
2008-2012	1,196	55	26,396,614	250,640	22,071	14%	57,871
2003-2007	1,141	121	25,143,414	389,443	22,036	13%	626,762
1998-2002	1,020	280	23,196,198	2,496,764	22,741	11%	1,940,089
1993-1997	740	131	10,712,378	847,115	14,476	7%	664,584
20-Yr Total		**587**		**19,919,813**			
Avg. 2003-2012		18		320,042	22,218	14%	342,317
Avg. 1993-2002		41		1,671,940	16,157	9%	1,302,337
Avg. 1993-2012		29		995,991	19,188	12%	822,327

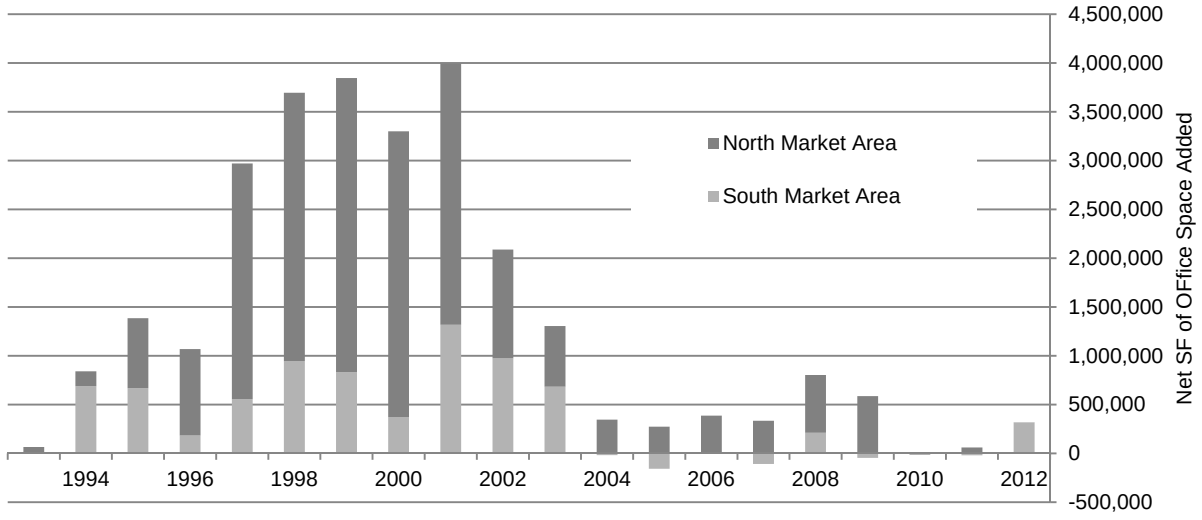
Source: CoStar, Inc.

Table 2-12: Atlanta Metro Office Submarkets: Total Class A Office Space

Office Submarket	Millions of SF of Class A Office Space	% of total Market
South Market Area (Central Perimeter)	**20.72**	18%
North Market Area (North Fulton/Forsyth)	**16.68**	14%
Midtown/Pershing Point	15.93	14%
Upper Buckhead	15.14	13%
Atlanta Downtown	16.43	14%
Cumberland Galleria	16.17	14%
36 Other Submarkets	15.60	13%
Total	**116.66**	**100%**

Source: CoStar, Inc.

Figure 2-11: New Office Space Added, 1993-2012, by Market Area



Source: CoStar, Inc.

Industrial/Flex Market Trends

Table 2-13 through Table 2-16 illustrate real estate trends for the industrial/flex sector for the GA 400 study area, the south market area, and the north market area, while Figure 2-12 summarizes the volume of new industrial/flex spaces added in the two market areas during the 10-year period. Key findings include:

- The Industrial/Flex sector inventory in the GA 400 Study is modest in size in comparison to the office and retail sectors, representing only 10% of the overall commercial inventory.
- Nearly all of the new industrial growth from 1992 to 2012, 92%, occurred in the north market area.
- The GA 400 market area has 10.4 million SF of industrial space. The industrial/flex inventory of the GA 400 study area increased by 52% over 20 years from 1992 to 2012, with a total 3.6 million SF of space added over the period, representing an average addition of 454,000 SF annually.
- The average annual growth rate for industrial inventory in the GA 400 study area has been 2.7% over 20 years. The peak absorption period of 1997-2001 saw a growth rate of 4.5% corridor-wide. During the Great Recession years of 2008-2012, the area had an average inventory growth rate of just 0.9%.
- The average absorption of industrial inventory in the GA 400 study area has been just 178,000 SF annually over 20 years. The study area's industrial market absorption peaked between 1993 and 1997, with an average of 291,000 SF of space absorbed annually.
- Industrial vacancy rates have ranged between 9% and 15% over the past 10 years, compared to a 20-year average of 10%.
- Industrial/flex lease rates in the north market area average $8.59/SF, significantly higher than the regional average of $3.00/SF to $4.00/SF, as more flex space is being used for office purposes rather than industrial use.

Table 2-13: Industrial/Flex Market Snapshot: 4th Quarter, 2012

Industrial/Flex	GA 400	South	North
# Buildings	313	38	294
Average Age	28.5	29.3	27.5
Total RBA (SF)	10,442,991	988,161	9,901,923
2012 Net Absorption	123,374	46,670	71,066
Vacancy Dec. 2012	14%	N/A	13%
Rent Range Per SF	$5.00-$23.70	N/A	$5.00-$23.70
Average Rent Per SF	8.87	N/A	8.59
Rent Type	Modified Gross	N/A	Modified Gross

Source: CoStar, Inc.

Table 2-14: Commercial Real Estate Trends: Industrial/Flex, GA 400 Study Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	Avg. Annual New SF	Avg. Bldg. Size	Total Vacant %	Avg. Annual Absorption
2008-2012	312	8	10,442,991	67,164	33,471	12%	(13,687)
2003-2007	304	9	10,107,171	93,632	33,247	12%	95,875
1998-2002	295	26	9,639,011	260,495	32,675	8%	157,768
1993-1997	269	31	8,336,538	291,453	30,991	7%	317,832
20-Yr Total		**74**		**3,563,717**			
Avg. 2003-2012		9		80,398	33,359	12%	248,037
Avg. 1993-2002		29		245,974	31,833	7%	41,094
Avg. 1993-2012		19		178,168	32,596	10%	216,287

Source: CoStar, Inc.

Table 2-15: Commercial Real Estate Trends: Industrial/Flex, South Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	Avg. Annual New SF	Avg. Bldg. Size	Total Vacant %	Avg. Annual Absorption
2008-2012	37	-	988,161	-	26,707	2%	1,480
2003-2007	37	1	988,161	7,640	26,707	5%	19,400
1998-2002	36	1	949,959	11,658	26,388	4%	2,118
1993-1997	35	6	891,669	53,553	25,476	3%	62,483
20-Yr Total		**8**		**364,257**			
Avg. 2003-2012		1		6,100	21,514	10%	12,900
Avg. 1993-2002		-		3,820	26,579	3%	10,440
Avg. 1993-2012		1		27,680	24,111	5%	24,542

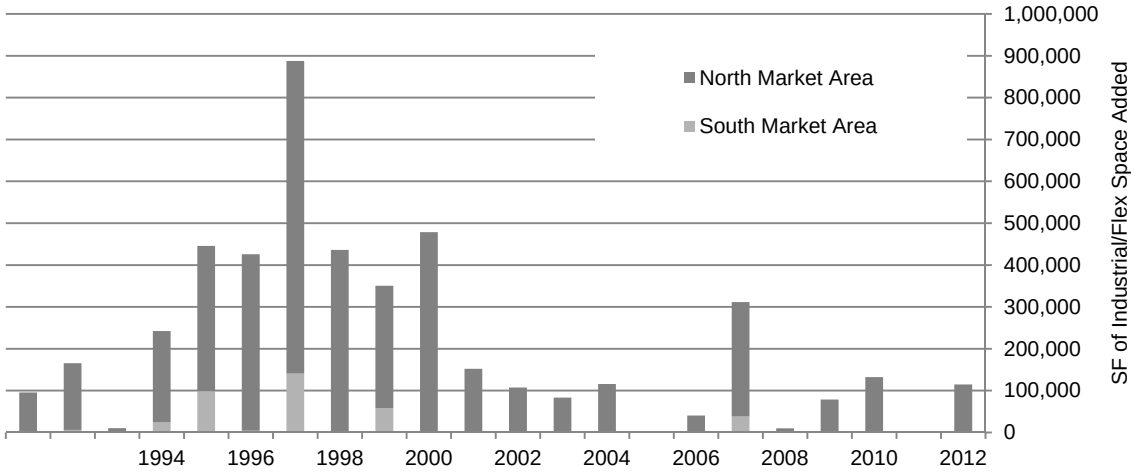
Source: CoStar, Inc.

Table 2-16: Commercial Real Estate Trends: Industrial/Flex, North Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	Avg. Annual New SF	Avg. Bldg. Size	Total Vacant %	Avg. Annual Absorption
2008-2012	294	8	9,901,923	67,164	33,680	11%	25,448
2003-2007	286	10	9,566,103	102,662	33,448	12%	104,811
1998-2002	276	28	9,052,795	293,260	32,800	8%	198,564
1993-1997	248	35	7,586,495	348,745	30,591	7%	337,172
20-Yr Total		**81**		**4,059,154**			
Avg. 2003-2012		6		159,339	27,431	10%	191,774
Avg. 1993-2002		2		84,913	33,261	12%	65,129
Avg. 1993-2012		6		288,753	29,938	8%	240,696

Source: CoStar, Inc.

Figure 2-12: New Industrial/Flex Space Added, 1993-2012, by Market Area



Source: CoStar, Inc.

Retail Market Trends

Tables 2-17 through Table 2-20 illustrate real estate trends for the retail sector for the GA 400 study area, the south market area, and the north market area. Unlike the office and industrial sectors, the majority of inventory data for the retail sector is available only since 2000.

- The retail inventory of the GA 400 study area increased by 12% over the 10 years from 2003 to 2012, with just over 3.4 million SF of retail space added. While the office and retail sectors are concentrated tightly along the GA 400 corridor, within the GA 400 study area, the area's retail inventory is more widely distributed. Approximately 75% of the north and south Market's total retail space, 24 million SF of the area's total of 32 million SF, is located within the GA 400 corridor study area.

- Over 80% of the new retail growth from 2000 to 2012, nearly 4.9 million SF of new retail space occurred in the north market area. This period began with a very strong year in 2001, when over 1.2 million SF of new retail space was added in both market areas. New inventory was added relatively steadily each year until new development came to an essential standstill in 2010.
- The average annual growth rate for retail inventory in the GA 400 study area has been 1.6 % annually since 2000.
- The average absorption of retail inventory in the GA 400 study area has been 156,000 SF annually since 2000, less than half of the 333,000 SF average absorption for the two larger market areas. This indicates that the historic pattern of strong growth along the GA 400 corridor is being replaced by more distributed retail growth.
- The Great Recession, which began in 2008, has had a significant effect on retail vacancy rates in the GA 400 study area, with vacancy rates the past three years averaging between from 11% to 13%, compared to a 10-year average of 8%. The most recent vacancy data shows vacancy rates in all three sub-areas returning to long-term averages.
- Retail lease rates in the GA 400 study area average $17.52/SF (triple-net), significantly higher than the metro average of $13.00/SF to $14.00/SF.

Figure 2-13 illustrates the new retail space added by market area for the 10-year period.

Table 2-17: Retail Market Snapshot: 4th Quarter, 2012

Retail	GA 400	South	North
# Buildings	1,221	503	1,889
Average Age	32.6	29.7	26.5
Total RBA (SF)	24,078,845	10,630,246	21,405,797
2012 Net Absorption	108,414	61,743	123,169
Vacancy Dec. 2012	10%	8%	10%
Rent Range Per SF	$2.81-$81.00	$17.00-$21.00	$2.81-$45.00
Average Rent Per SF	$18.28	$19.42	$17.01
Rent Type	Triple Net	Full Service Gross	Triple Net

Source: CoStar, Inc.

Table 2-18: Commercial Real Estate Trends: Retail, GA 400 Study Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	Avg. Annual New SF	Avg. Bldg. Size	Total Vacant %	Avg. Annual Absorption
2008-2012	1,217	6	24,078,845	90,686	19,785	11%	(113,160)
2003-2007	1,211	98	23,625,415	414,882	19,509	6%	369,826
10-Yr Total		104		**2,527,838**			
Avg. 2003-2012		10	-	252,784	19,576	0	128,333

Source: CoStar, Inc.

Table 2-19: Commercial Real Estate Trends: Retail, South Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	Avg. Annual New SF	Avg. Bldg. Size	Total Vacant %	Avg. Annual Absorption
2008-2012	500	(1)	10,630,246	27,675	21,260	10%	(80,793)
2003-2007	501	33	10,491,870	120,309	20,942	5%	111,219
10-Yr Total		32		**739,921**			
Avg. 2003-2012		3	-	739,921	21,088	0	15,213

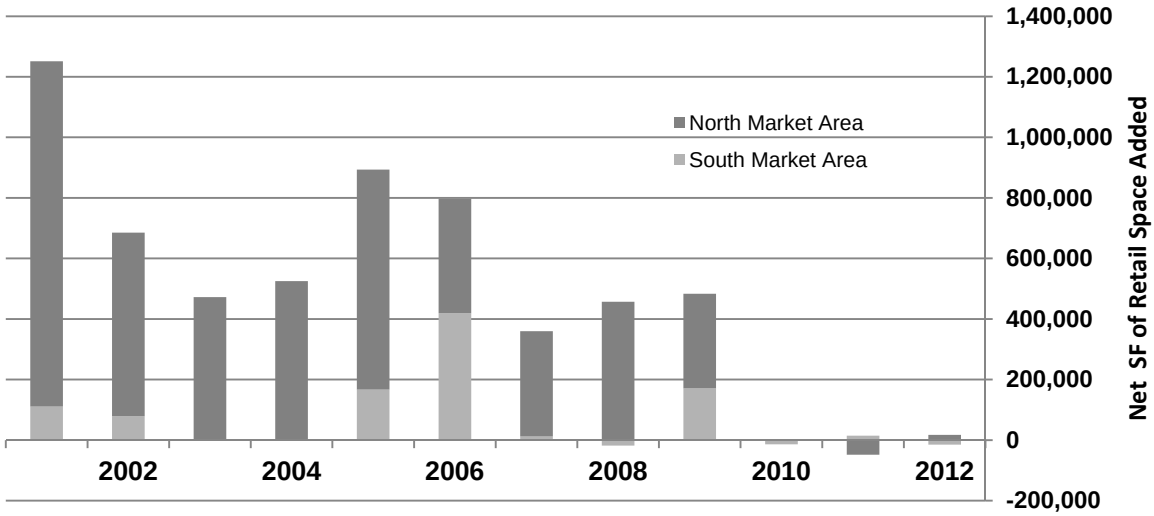
Source: CoStar, Inc.

Table 2-20: Commercial Real Estate Trends: Retail, North Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	Avg. Annual New SF	Avg. Bldg. Size	Total Vacant %	Avg. Annual Absorption
2008-2012	1,119	18	21,405,797	147,624	19,129	13%	(27,010)
2003-2007	1,101	136	20,667,675	489,282	18,772	7%	395,006
10-Yr Total		154		**3,184,533**			
Avg. 2003-2012		15	-	318,453	18,954	0	183,998

Source: CoStar, Inc.

Figure 2-13: New Retail Space Added, 1993-2012, by Market Area



Source: CoStar, Inc.

Key Trends: Commercial Real Estate

- The MARTA GA 400 study area is the largest concentration of office space in the Atlanta region, particularly in terms of Class A office space.
- The study area is not a strong market for industrial or flex real estate, due to high land prices, which make industrial development less feasible.

- The study area's retail sector is large, strong and growing, largely due to the growing presence of affluent households and office workers.
- General growth in the area began in the Dunwoody/Sandy Springs area and gradually shifted north. The vast majority of development in all sectors in the last decade has occurred north of the Chattahoochee River.
- Office space tends to be tightly clustered along the GA 400 corridor, with some additional clustering in the historic city centers of Roswell and Alpharetta. Retail space, while generally located along the GA 400 corridor, tends to penetrate more into the broader residential areas of the study area.

2.5 30-Year Forecast of Real-Estate Demand

30-year forecasts of real estate demand were generated using population, household, and employment forecasts and recent historic growth patterns. These forecasts are based on current development and transportation patterns. Major changes to the study area's transportation network and/or development patterns could significantly affect future demand.

Residential Demand Forecasts

Based on ARC household forecasts, the GA 400 study area can expect to gain between 4,500 and 7,500 new households each decade for the next 30 years, which corresponds to demand for 500 to 750 new housing units annually (see Table 2-21).

Based on 2010 Census estimates of the municipalities in and around the study area, an estimated, 55% of new household demand will seek renter-occupied housing units, while 45% of new households will choose multi-family housing. This suggests an average demand for:

- 250 to 410 owner-occupied homes each year over the next 30 years, and
- 200 to 350 apartments and other rental units each year over the next 30 years.

Table 2-21: Real Estate Demand Forecast: Residential, GA 400 Study Area

	2010	2010-2020	2020-2030	2030-2040
GA 400 study area Household Forecast	77,455	84,910	89,456	94,558
Forecast Net New Households		7,455	4,546	5,102
Forecast Annual Demand from New Households		746	455	510
GA 400 study area Owner Demand		410	250	281
GA 400 study area Renter Demand		335	205	230

Source: ARC, Nielsen, Inc.

While the market is likely to create demand for 200 to 350 apartments and rental units in the area target at moderate-income workforce households, local zoning and land use regulations in the local municipalities limit the development feasibility of these uses. Thus, demand for rental units may not be sufficiently met by adequate supply of new apartments, and demand will likely shift outside of the GA 400 study area.

Office & Industrial Flex Demand Forecasts

ARC job growth forecasts can be used as the basis to forecast future demand of office and industrial/flex space. Current and future employment patterns by employment sector are used to estimate the number of office and warehouse/industrial jobs that are forecast to be added over the next 30 years. Based on an average 250 SF/employee for office space and 500 SF/employee for industrial space, we can reasonably expect to see an average demand of 650,000 to 750,000 SF of office space annually, based on employee growth. Industrial jobs are not expected to grow as much in the corridor, particularly as office-sector growth and housing drives up rents and land costs. Forecasts indicate modest demand for flex and industrial space of roughly 100,000 annually over the next decade, falling to zero after 2020. Table 2-22 highlights the predicted real estate demands for office and industrial/flex employment over the next 30 years.

Table 2-22: Real Estate Demand Forecast: Office & Industrial/Flex, GA 400 Study Area

Year	2010	2020	2030	2040
Total Employment	**226,349**	**271,523**	**304,737**	**343,022**
Office-based Jobs (%)	57%	59%	61%	63%
Total Office Jobs	129,375	160,375	186,234	215,714
Avg. Net New Jobs/ year		3,100	2,586	2,948
Net New Office Space Demand per year (SF)		**775,000**	**646,500**	**737,000**
Industrial/Warehouse based jobs (%)	14%	13%	11%	10%
Total Industrial/Warehouse Jobs	31,062	34,910	34,734	34,777
Avg. Net New Jobs/ year		3,848	(176)	43
Net New Ind./WH Space Demand per year (SF)		**115,435**	**(5,278)**	**1,292**

Source: ARC, Nielsen, Inc., US Census. | WH - Warehouse

Retail Demand Forecasts

Demand for retail space is primarily generated by the creation of new households, population growth, and their related income and spending within a market area. Population growth, multiplied by average per-capita retail spending, provides an estimate of anticipated new retail spending which can then be used to estimated annual demand for new retail space. The per-capita retail spending in the majority of the GA 400 study area is currently estimated at $15,833 per year. This is the average of per-capita retail expenditures in the cities of Roswell and Alpharetta, which represent a significant portion of the study area. This per-capita retail spending, when applied to new household and population growth in the GA 400 study area, will generate an additional $52 to $72 million in retail spending annually over the next 30 years. This additional spending could reasonably support 200,000 to 300,000 SF of new retail space in the MARTA GA 400 study area annually (see Table 2-23).

Table 2-23: Real Estate Demand Forecast: Retail, GA 400 Study Area

Year	2010	2020	2030	2040
Total Population	226,349	271,523	304,737	343,022
Net New Population		45,174	33,214	38,285
New Pop/Year		4,517	3,321	3,829
New Retail Spending/Year		$71,748,063	$52,752,030	$60,806,548
New Retail Demand/Yr. (SF)*		**298,950**	**219,800**	**253,361**

* Assuming a ULI average of $240 in retail sales per SF average.

Source: ARC, Nielsen, Inc., US Census, City of Roswell SEDP

Table 2-24 summarizes annual real estate demand forecasts for residential and commercial real estate for each decade of the next 30 years, compared against historic averages.

Table 2-24: Annual Real Estate Demand Forecast: Summary, GA 400 Study Area

	Historical Average*	Annual Demand 2010-2020	Annual Demand 2020-2030	Annual Demand 2030-2040
Residential				
New Owner Units	446	250 to 410	250 to 410	250 to 410
New Rental Units	400-500	200 to 350	200 to 350	200 to 350
Commercial				
Office (SF)	1,200,000	650,000 to 750,000	650,000 to 750,000	650,000 to 750,000
Industrial (SF)	178,000	50,000 to 100,000	0 to 50,000	0
Retail (SF)	252,000	200,000 to 300,000	200,000 to 300,000	200,000 to 300,000

* Residential historical averages from 2006-2012, Retail from 2000 to 2012, and Office/Industrial from 1992-2012

Source: ARC, Nielsen, Inc., US Census, City of Roswell SEDP

2.6 Implications to Real Estate Trends, Pricing, and Demand

The rapid growth in the MARTA GA 400 study area suggests that it offers strong potential for the expansion of MARTA transit service. The combination of a 20-year history of extremely strong growth, projected continued strong growth into the future, and the potential of expanded transit service has implications that must be addressed to best optimize design, commuting, land-use and development.

The economic power of the existing MARTA network and the economic potential of an expanding transit along GA 400

MARTA's existing network, with 38 stations is currently an undervalued regional economic generator. Within a half-mile radius of the existing MARTA stations, there are an estimated 286,750 jobs, representing 15% of the Atlanta 10-County region's jobs and 29% of Fulton and DeKalb County's jobs. Of those jobs, an estimated 59% pay over $40,000 per year. The area around existing stations encompass 82 million SF of office space, 43% of all of the office space in Fulton and DeKalb counties, and 35 million SF of retail space.

Extending the MARTA system further northward, to incorporate more of the rapidly expanding employment, retail and activity centers along the GA 400 corridor would have a multiplier effect, linking the vast northern Fulton County employment center with the already robust existing MARTA network and vastly expanding opportunities for the access to employment, housing, and commercial activity.

Existing auto-dependent land uses and potential for TOD

With the exception of the small-town character of the town centers of Roswell, Alpharetta and Dunwoody, the vast majority of the GA 400 study area was developed as auto-oriented suburban development in the 1980s and 1990s. Most of the study area is characterized by low-density development patterns, by auto-dominated transportation infrastructure, auto-dependent land use patterns, and design that is not conducive to transit and transit-oriented development as envisioned in MARTA TOD Guidelines. Much of the employment in the study area, particularly within the immediate GA 400 corridor, is located in auto-dependent office parks, corporate campuses and retail centers. A large portion of the area's retail development can be found in retail malls, power retail centers, and strip development. The area's transportation network suffers from a lack of connectivity between parcels, and between major thoroughfares. Additionally, Pedestrian infrastructure is lacking in many areas.

Figure 2-14: Typical 1980s Suburban Development Pattern in Alpharetta

Source: Google

The GA 400 study area has great potential as a location for transit oriented development. Local authorities working with the private real estate sector can develop guidelines and standards that support TOD, both in regards to new green-field development and the redevelopment and retrofitting of existing properties. Assuming that it would take at least 10 years to implement new heavy rail service in the GA 400 corridor, much of the existing development in the area will be approaching 20 years old or more by the time transit service is established. Many of these older properties, which emerged during the 1996-2001 building boom, would be ripe for potential redevelopment. Rising land costs will change the economics of parking, leading to increasing redevelopment of surface

parking lots. While the retrofitting of individual large parcels to accommodate TOD principles will be relatively feasible, larger-scale area-wide initiatives to improve mobility, access and infrastructure will depend on the efforts of local governments.

Establishing new transit-oriented development patterns within a walkable radius of potential station areas will allow new development choices to be added to the area's real estate market mix, making the GA 400 area competitive with other parts of the region in terms of availability of diverse options for housing, commerce, entertainment and transportation.

Demographic shifts, the rise of the millennial generation and changing patterns of household-type and affordability

The future retail and real estate market will be dominated by the preferences of the Millennials and Generation X and not those of the rapidly retiring Baby Boomers. The 78 million Millennials now entering their twenties and Generation X now entering their late thirties and forties, have demonstrated a much stronger affinity than their preceding generation for housing and transportation choices that are consistent with TOD.

While single-family housing and low-density development patterns will remain strong in the study area over the coming decades, future real estate demand in the GA 400 area will shift towards more typically "urban" housing, shopping and entertainment options regardless of whether fixed transit is introduced. The share of demand for smaller attached and multi-family housing units, such as apartments, condominiums, townhomes, and small-lot single-family housing is likely to increase, while the traditional single-family subdivision will decline. Long-term forecasts, both at the regional and national scale, show households shrinking, and one of the fastest growing demographic sectors is single-person households. To adapt to these demographic shifts, it will be important for new development in the GA 400 study area to provide a wide range of housing and transportation choices.

The easy financing which drove much of the residential and commercial boom of the 1990s and early 2000s has vanished, which will lead towards more measured growth across all sectors. This will be evident in a reduction of speculative real estate development, and increased demand for rental housing rather than home-ownership due to tighter mortgage financing restrictions.

As the GA 400 area's housing and jobs continue to grow, there will be increased demand for diversified housing choices, especially in regards to tenure and affordability. Increased demand for local services will increase the demand for affordable housing and improved transportation options for new service sector employees.

Major conceptual shifts currently underway towards mixed-use & TOD development

Many communities in the GA 400 study area have already begun to embrace the idea of TOD, most notably the Perimeter area of Dunwoody. The Perimeter area is the home of two of the newest existing MARTA stations, Dunwoody (1996) and Sandy Springs (2000). Over the past 10 years, the area has significantly transformed into a more vibrant area largely supportive of TOD principles thanks to dedicated work by local elected officials with the support of the business and real estate sectors through the activities of the Perimeter Community Improvement District (PCID). Recent revitalizations of existing shopping centers and office parks have embraced many, if not all, of the ideas and design features of transit-oriented development.

All of the city centers in the GA 400 study area have embraced planning concepts such as the ARC's Livable Centers Initiative (LCI) program to enhance their city centers, returning to many classic tenets of TOD. Over the last decade, TOD has gone from a novel idea to one that is widely accepted, as demand for this form has grown and has proven to be feasible and economically competitive. Older small towns-turned suburbs such as Woodstock and Suwanee have reinvented themselves as new-urbanism and transit-supportive communities, and have thus demonstrated to businesses and real estate interests that these ideas can succeed in the marketplace.

In the GA 400 study area, the proposed development plans for Avalon (see Figure 2-15), a major mixed-used development at GA 400 and Old Milton Parkway, shows that walkable, mixed-use development concepts are being embraced by the development community. Avalon's first phase has been proposed to include 389,000 SF of retail, 250 multi-family units, 101 single-family units and 83,000 SF of office space, all organized in a new-urbanist style development pattern that emphasizes pedestrian connectivity and mixed-use, transit-supportive higher density design.

Figure 2-15: Proposed Avalon Mixed-Use Development, 2013, Alpharetta

Source: North American Properties

Chapter 2 Data Appendix

Table 2-25: Employment by Age and Wage, 2011, GA 400 Study Area

Total All Jobs	**Count**	**Share**
Total All Jobs	226,349	100.0%
Jobs by Worker Age	**Count**	**Share**
Age 29 or younger	43,707	19.3%
Age 30 to 54	149,340	66.0%
Age 55 or older	33,302	14.7%
Jobs by Earnings	**Count**	**Share**
$1,250 per month or less	39,633	17.5%
$1,251 to $3,333 per month	63,842	28.2%
More than $3,333 per month	122,874	54.3%
Jobs by NAICS Industry Sector	**Count**	**Share**
Agriculture, Forestry, Fishing and Hunting	32	0.0%
Mining, Quarrying, and Oil and Gas Extraction	17	0.0%
Utilities	608	0.3%
Construction	4,067	1.8%
Manufacturing	3,310	1.5%
Wholesale Trade	14,657	6.5%
Retail Trade	18,263	8.1%
Transportation and Warehousing	4,729	2.1%
Information	25,407	11.2%
Finance and Insurance	22,214	9.8%
Real Estate and Rental and Leasing	6,339	2.8%
Professional, Scientific, and Technical Services	32,463	14.3%
Management of Companies and Enterprises	7,575	3.3%
Administration & Support	21,419	9.5%
Educational Services	6,755	3.0%
Health Care and Social Assistance	31,008	13.7%
Arts, Entertainment, and Recreation	2,763	1.2%
Accommodation and Food Services	18,594	8.2%
Other Services (excluding Public Administration)	3,878	1.7%
Public Administration	2,251	1.0%

Source: U.S. Census Bureau

Table 2-26: Commercial Real Estate Trends: Office, GA 400 Study Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	1 Yr. New SF	Avg. Bldg. Size	Total Vacant %	1 Yr. Absorption
2012	1,514	2	54,632,966	316,000	36,085	17%	1,349,856
2011	1,512	0	54,316,966	40,000	35,924	19%	(346,466)
2010	1,512	(1)	54,276,966	(5,142)	35,897	18%	(902,885)
2009	1,513	8	54,282,108	500,431	35,877	16%	(818,844)
2008	1,505	2	53,781,677	766,269	35,735	14%	(154,565)
2007	1,503	7	53,015,408	22,662	35,273	13%	947,747
2006	1,496	10	52,992,746	356,259	35,423	14%	787,981
2005	1,486	15	52,636,487	26,386	35,422	15%	1,720,076
2004	1,471	32	52,610,101	305,083	35,765	18%	1,335,471
2003	1,439	17	52,305,018	1,263,902	36,348	21%	(2,213)
2002	1,422	15	51,041,116	1,993,546	35,894	19%	(575,568)
2001	1,407	46	49,047,570	3,215,163	34,860	14%	977,317
2000	1,361	72	45,832,407	3,027,622	33,676	10%	2,395,960
1999	1,289	49	42,804,785	3,819,368	33,208	9%	3,865,316
1998	1,240	41	38,985,417	3,248,392	31,440	10%	3,227,265
1997	1,199	49	35,737,025	2,939,934	29,806	11%	1,907,928
1996	1,150	24	32,797,091	1,206,311	28,519	9%	1,345,643
1995	1,126	38	31,590,780	1,219,131	28,056	10%	1,542,897
1994	1,088	10	30,371,649	812,000	27,915	11%	1,353,133
1993	1,078	8	29,559,649	66,133	27,421	14%	941,503
Avg. 2003-2012		**9**		**359,185**	**35,775**	**16%**	**391,616**
Avg. 1993-2002		**35**		**2,154,760**	**31,079**	**12%**	**1,698,139**
Avg. 1993-2012		**22**		**1,256,973**	**33,427**	**14%**	**1,044,878**

Source: CoStar, Inc.

Table 2-27: Commercial Real Estate Trends: Office, South Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	1 Yr. New SF	Avg. Bldg. Size	Total Vacant %	1 Yr. Absorption
2012	656	2	32,198,166	316,000	49,083	17%	1,287,355
2011	654	(1)	31,882,166	(20,000)	48,749	21%	(466,340)
2010	655	(2)	31,902,166	(17,142)	48,706	19%	(592,756)
2009	657	(2)	31,919,308	(45,616)	48,583	17%	(1,031,055)
2008	659	(16)	31,964,924	211,319	48,505	14%	(350,501)
2007	675	(1)	31,753,605	(108,456)	47,042	13%	738,432
2006	676	1	31,862,061	12,500	47,133	15%	430,728
2005	675	(1)	31,849,561	(157,275)	47,185	16%	1,249,599
2004	676	3	32,006,836	(17,535)	47,347	21%	582,959
2003	673	5	32,024,371	682,811	47,585	23%	(836,796)
2002	668	4	31,341,560	974,238	46,919	18%	(704,673)
2001	664	5	30,367,322	1,317,094	45,734	13%	178,149
2000	659	4	29,050,228	371,398	44,082	10%	685,750
1999	655	7	28,678,830	831,675	43,784	11%	376,275
1998	648	7	27,847,155	944,319	42,974	10%	1,110,143
1997	641	7	26,902,836	556,024	41,970	11%	318,029
1996	634	3	26,346,812	182,774	41,556	10%	487,528
1995	631	6	26,164,038	668,182	41,464	12%	803,297
1994	625	4	25,495,856	687,992	40,793	12%	1,377,266
1993	621	0	24,807,864	0	39,948	15%	920,072
Avg. 2003-2012		**(1)**		**85,661**	**47,992**	**18%**	**101,163**
Avg. 1993-2002		**5**		**653,370**	**42,923**	**12%**	**555,184**
Avg. 1993-2012		**2**		**369,515**	**45,457**	**15%**	**328,173**

Source: CoStar, Inc.

Table 2-28: Commercial Real Estate Trends: Office, North Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	1 Yr. New SF	Avg. Bldg. Size	Total Vacant %	1 Yr. Absorption
2012	1,196	1	26,396,614	2,400	22,071	14%	165,073
2011	1,195	1	26,394,214	60,000	22,087	15%	205,883
2010	1,194	1	26,334,214	12,000	22,055	16%	(334,002)
2009	1,193	21	26,322,214	586,646	22,064	14%	95,184
2008	1,172	31	25,735,568	592,154	21,959	13%	157,219
2007	1,141	26	25,143,414	334,578	22,036	11%	542,478
2006	1,115	15	24,808,836	373,339	22,250	12%	444,710
2005	1,100	28	24,435,497	273,321	22,214	13%	582,797
2004	1,072	32	24,162,176	345,004	22,539	14%	917,778
2003	1,040	20	23,817,172	620,974	22,901	17%	646,046
2002	1,020	27	23,196,198	1,113,723	22,741	17%	178,088
2001	993	64	22,082,475	2,677,854	22,238	14%	1,350,308
2000	929	92	19,404,621	2,927,927	20,888	9%	2,102,014
1999	837	56	16,476,694	3,014,211	19,685	6%	3,572,242
1998	781	41	13,462,483	2,750,105	17,237	11%	2,497,795
1997	740	46	10,712,378	2,413,615	14,476	12%	1,607,317
1996	694	23	8,298,763	885,500	11,958	5%	769,987
1995	671	45	7,413,263	716,881	11,048	5%	909,755
1994	626	9	6,696,382	153,448	10,697	8%	(30,120)
1993	617	8	6,542,934	66,133	10,604	5%	65,982
Avg. 2003-2012		**18**		**320,042**	**22,218**	**14%**	**342,317**
Avg. 1993-2002		**41**		**1,671,940**	**16,157**	**9%**	**1,302,337**
Avg. 1993-2012		**29**		**995,991**	**19,188**	**12%**	**822,327**

Source: CoStar, Inc.

Table 2-29: Commercial Real Estate Trends: Industrial/Flex, GA 400 Study Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	1 Yr. New SF	Avg. Bldg. Size	Total Vacant %	1 Yr. Absorption
2012	312	2	10,442,991	114,769	33,471	15%	88,712
2011	310	0	10,328,222	0	33,317	15%	(382,539)
2010	310	1	10,328,222	132,403	33,317	11%	14,676
2009	309	4	10,195,819	78,720	32,996	10%	32,371
2008	305	1	10,117,099	9,928	33,171	9%	178,347
2007	304	5	10,107,171	311,590	33,247	11%	172,876
2006	299	2	9,795,581	40,605	32,761	10%	277,581
2005	297	0	9,754,976	0	32,845	13%	69,024
2004	297	2	9,754,976	115,965	32,845	13%	2,831
2003	295	0	9,639,011	0	32,675	12%	(42,935)
2002	295	3	9,639,011	107,259	32,675	12%	(200,164)
2001	292	3	9,531,752	68,004	32,643	9%	(267,248)
2000	289	4	9,463,748	245,998	32,747	5%	324,044
1999	285	7	9,217,750	350,552	32,343	6%	278,008
1998	278	9	8,867,198	530,660	31,896	6%	654,200
1997	269	13	8,336,538	775,442	30,991	7%	583,621
1996	256	7	7,561,096	425,879	29,536	6%	467,036
1995	249	8	7,135,217	215,079	28,655	7%	165,053
1994	241	2	6,920,138	30,606	28,714	6%	177,412
1993	239	1	6,889,532	10,258	28,826	8%	196,037
1992	238	7	6,879,274	165,439	28,905	11%	248,037
Avg. 2003-2012		**2**		**80,398**	**33,064**	**12%**	**41,094**
Avg. 1992-2002		**6**		**275,974**	**30,583**	**8%**	**216,287**
Avg. 1992-2012		**4**		**178,186**	**31,594**	**10%**	**138,633**

Source: CoStar, Inc.

Table 2-30: Commercial Real Estate Trends: Industrial/Flex, South Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	1 Yr. New SF	Avg. Bldg. Size	Total Vacant %	1 Yr. Absorption
2012	37	0	988,161	0	26,707	0%	56,562
2011	37	0	988,161	0	26,707	6%	(36,887)
2010	37	0	988,161	0	26,707	2%	(4,106)
2009	37	0	988,161	0	26,707	2%	(15,069)
2008	37	0	988,161	0	26,707	0%	6,900
2007	37	1	988,161	38,202	26,707	1%	30,802
2006	36	0	949,959	0	26,388	0%	57,300
2005	36	0	949,959	0	26,388	6%	35,400
2004	36	0	949,959	0	26,388	10%	(33,600)
2003	36	0	949,959	0	26,388	6%	7,100
2002	36	0	949,959	0	26,388	7%	(8,800)
2001	36	0	949,959	0	26,388	6%	11,000
2000	36	0	949,959	0	26,388	7%	(57,500)
1999	36	1	949,959	58,290	26,388	1%	58,490
1998	35	0	891,669	0	25,476	1%	7,400
1997	35	2	891,669	140,505	25,476	2%	150,805
1996	33	1	751,164	4,000	22,763	4%	(6,700)
1995	32	2	747,164	98,454	23,349	2%	89,354
1994	30	1	648,710	24,806	21,624	1%	59,256
1993	29	0	623,904	0	21,514	7%	19,700
1992	29	1	623,904	6,100	21,514	10%	12,900
Avg. 2003-2012		**0**		**3,820**	**26,579**	**3%**	**10,440**
Avg. 1992-2002		**1**		**27,680**	**24,111**	**5%**	**24,542**
Avg. 1992-2012		**0**		**42,964**	**25,095**	**4%**	**17,142**

Source: CoStar, Inc.

Table 2-31: Commercial Real Estate Trends: Industrial/Flex, North Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	1 Yr. New SF	Avg. Bldg. Size	Total Vacant %	1 Yr. Absorption
2012	294	2	9,901,923	114,769	33,680	13%	62,956
2011	292	0	9,787,154	0	33,518	13%	(136,315)
2010	292	1	9,787,154	132,403	33,518	11%	15,344
2009	291	4	9,654,751	78,720	33,178	10%	5,206
2008	287	1	9,576,031	9,928	33,366	10%	180,047
2007	286	4	9,566,103	273,388	33,448	11%	129,320
2006	282	2	9,292,715	40,605	32,953	10%	268,456
2005	280	0	9,252,110	0	33,043	13%	27,898
2004	280	2	9,252,110	115,965	33,043	13%	45,124
2003	278	2	9,136,145	83,350	32,864	12%	53,258
2002	276	3	9,052,795	107,259	32,800	12%	(186,616)
2001	273	5	8,945,536	152,116	32,768	9%	(172,691)
2000	268	6	8,793,420	478,503	32,811	5%	524,615
1999	262	6	8,314,917	292,262	31,736	6%	276,286
1998	256	8	8,022,655	436,160	31,338	6%	551,228
1997	248	13	7,586,495	746,962	30,591	8%	540,793
1996	235	6	6,839,533	421,879	29,104	6%	479,650
1995	229	11	6,417,654	347,237	28,025	7%	233,727
1994	218	4	6,070,417	217,390	27,846	6%	329,036
1993	214	1	5,853,027	10,258	27,351	8%	102,653
1992	213	6	5,842,769	159,339	27,431	10%	191,774
Avg. 2003-2012		**2**		**84,913**	**33,261**	**12%**	**65,129**
Avg. 1992-2002		**6**		**288,753**	**29,938**	**8%**	**240,696**
Avg. 1992-2012		**4**		**430,518**	**31,272**	**10%**	**164,498**

Source: CoStar, Inc.

Table 2-32: Commercial Real Estate Trends: Retail, GA 400 Study Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	1 Yr. New SF	Avg. Bldg. Size	Total Vacant %	1 Yr. Absorption
2012	1,217	(1)	24,078,845	9,980	19,785	11%	115,945
2011	1,218	0	24,068,865	7,368	19,761	11%	393,325
2010	1,218	(1)	24,061,497	(5,000)	19,755	13%	(239,861)
2009	1,219	2	24,066,497	120,081	19,743	12%	(818,592)
2008	1,217	6	23,946,416	321,001	19,677	8%	(16,618)
2007	1,211	8	23,625,415	180,189	19,509	7%	87,341
2006	1,203	25	23,445,226	617,866	19,489	6%	309,606
2005	1,178	28	22,827,360	651,729	19,378	5%	701,269
2004	1,150	18	22,175,631	238,420	19,283	5%	167,298
2003	1,132	19	21,937,211	386,204	19,379	5%	583,615
2002	1,113	21	21,551,007	428,368	19,363	6%	297,694
2001	1,092	27	21,122,639	500,302	19,343	6%	372,247
2000	1,065		20,622,337	20,622,337	19,364	5%	78,637
Avg. 2003-2012		10		252,784	19,576	8%	128,333

Source: CoStar, Inc.

Table 2-33: Commercial Real Estate Trends: Retail, South Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	1 Yr. New SF	Avg. Bldg. Size	Total Vacant %	1 Yr. Absorption
2012	500	(2)	10,630,246	(15,232)	21,260	11%	(1,745)
2011	502	1	10,645,478	14,594	21,206	11%	106,323
2010	501	(2)	10,630,884	(13,800)	21,219	12%	(220,633)
2009	503	5	10,644,684	170,822	21,162	10%	(181,178)
2008	498	(3)	10,473,862	(18,008)	21,032	7%	(106,733)
2007	501	1	10,491,870	11,898	20,942	6%	77,766
2006	500	19	10,479,972	419,451	20,960	6%	135,566
2005	481	11	10,060,521	166,900	20,916	4%	143,367
2004	470	2	9,893,621	3,296	21,050	4%	1,172
2003	468	0	9,890,325	0	21,133	4%	198,226
2002	468	4	9,890,325	78,811	21,133	6%	269,845
2001	464	6	9,811,514	110,513	21,146	8%	(91,902)
2000	458		9,701,001	9,701,001	21,181	6%	(69,858)
Avg. 2003-2012		3		73,9921	21,088	7%	15,213

Source: CoStar, Inc.

Table 2-34: Commercial Real Estate Trends: Retail, North Market Area

Period	# Bldgs.	New Bldgs.	Total RBA (SF)	1 Yr. New SF	Avg. Bldg. Size	Total Vacant %	1 Yr. Absorption
2012	1,119	0	21,405,797	17,105	19,129	12%	205,919
2011	1,119	(2)	21,388,692	(48,496)	19,114	12%	438,330
2010	1,121	0	21,437,188	0	19,123	15%	(248,968)
2009	1,121	3	21,437,188	312,509	19,123	14%	(532,474)
2008	1,118	17	21,124,679	457,004	18,895	10%	2,145
2007	1,101	22	20,667,675	347,613	18,772	8%	85,206
2006	1,079	24	20,320,062	377,848	18,832	7%	221,888
2005	1,055	32	19,942,214	726,472	18,903	6%	713,351
2004	1,023	32	19,215,742	522,016	18,784	6%	455,400
2003	991	26	18,693,726	472,462	18,863	6%	499,186
2002	965	30	18,221,264	606,557	18,882	6%	319,399
2001	935	49	17,614,707	1,140,497	18,839	5%	1,139,491
2000	886		16,474,210	16,474,210	18,594	5%	779,040
Avg. 2003-2012		15		318,453	18,954	9%	183,998

Source: CoStar, Inc.

Table 2-35: Overview of Commercial Real Estate Inventory by Type, 1992-2012, Study Area.

	Office			Flex/Industrial			Retail		
Period	Total Inventory (Mil. SF)	Change from Prev. Yr.	Net New Mil. SF	Total Inventory (Mil. SF)	Change from Prev. Yr.	Net New Mil. SF	Total Inventory (Mil. SF)	Change from Prev. Yr.	Net New Mil. SF
2012	54.6	1%	0.3	10.9	1%	0.1	32.0	0%	0.0
2011	54.3	0%	0.0	10.8	0%	-	32.0	0%	(0.0)
2010	54.3	0%	(0.0)	10.8	1%	0.1	32.1	0%	(0.0)
2009	54.3	1%	0.5	10.6	1%	0.1	32.1	2%	0.5
2008	53.8	1%	0.8	10.6	0%	0.0	31.6	1%	0.4
2007	53.0	0%	0.0	10.6	3%	0.3	31.2	1%	0.4
2006	53.0	1%	0.4	10.2	0%	0.0	30.8	3%	0.8
2005	52.6	0%	0.0	10.2	0%	-	30.0	3%	0.9
2004	52.6	1%	0.3	10.2	1%	0.1	29.1	2%	0.5
2003	52.3	2%	1.3	10.1	1%	0.1	28.6	2%	0.5
2002	51.0	4%	2.0	10.0	1%	0.1	28.1	2%	0.7
2001	49.0	7%	3.2	9.9	2%	0.2	27.4	5%	1.3
2000	45.8	7%	3.0	9.7	5%	0.5	26.2		26.2
1999	42.8	10%	3.8	9.3	4%	0.4	NA	NA	NA
1998	39.0	9%	3.2	8.9	5%	0.4	NA	NA	NA
1997	35.7	9%	2.9	8.5	12%	0.9	NA	NA	NA
1996	32.8	4%	1.2	7.6	6%	0.4	NA	NA	NA
1995	31.6	4%	1.2	7.2	7%	0.4	NA	NA	NA
1994	30.4	3%	0.8	6.7	4%	0.2	NA	NA	NA
1993	29.6	0%	0.1	6.5	0%	0.0	NA	NA	NA
1992	29.5	1%	0.4	6.5	3%	0.2	NA	NA	NA

Source: CoStar, Inc.

3.0 ECONOMIC IMPACTS OF THE GA 400 TRANSIT INITIATIVE

3.1 Methodology

Based on technical analysis and input from stakeholders and the public during the AA, the three best performing alternatives were further examined during Early Scoping. These alternatives would provide approximately 12 miles of new service along the GA 400 corridor within existing ROW, from the existing North Springs station to Windward Parkway, but with differing technologies - heavy rail transit (HRT), light rail transit (LRT) and bus rapid transit (BRT). This section outlines the approach for identifying the economic, fiscal and density impacts of the HRT, LRT and BRT technology alternatives. The economic impacts evaluated in this section are associated with changes in population and employment development patterns. The specific analysis areas used in the assessment of economic and density impacts vary by the impact type and alternative.

Property Premiums and Additional Tax Base Impacts

Property values within a ¼ and ½-mile radius of the potential transit stations are expected to increase due to the improved access provided by a potential transit station and a more walkable community. A ¼-mile and a ½-mile radius were chosen based on empirical evidence in previous studies, which found that property values within this distance are the most greatly impacted by the presence of a potential rail transit station.[1, 2] For each of the alternatives and radii, a unique premium was applied to Fiscal Year (FY) 2012 tax assessed values to capture the increased values associated with this improved access and walkability. These are conservative estimates that are consistent with empirical findings.[3] This increase in property values would generate additional tax revenues for Fulton County compared to the No Build Alternative.

Population and Employment Density Analysis

The existence of a new transit mode along the GA 400 corridor is expected to increase the population and employment densities in the immediately surrounding area, particularly if the local jurisdictions enact zoning to accommodate growth around the potential station nodes. The population and employment projections from the ARC Plan 2040 forecasts were used as the base for the analysis and include population, household and employment figures for years 2010, 2020, 2030 and 2040.[4] Because the Plan 2040 forecasts do not include the GA 400 project, additional density impacts attributed to the GA 400 project were calculated in addition to the Plan 2040 forecasts. These calculations were used to project density increases within the analyzed radii and decreases in sprawl beyond the radii.

The ARC figures used were the total population and total employment reported by Traffic Analysis Zone (TAZ) for each of the forecasted years. For each potential station and four

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[1] Gary Pivo and Jeffrey Fischer. 2011. "The Walkability Premium in Commercial Real Estate investments," Real Estate Economics, Vol. 39, issue 2, pages 185-219.

[2] WMATA, "Making the Case for Transit: WMATA Regional Benefits of Transit Technical Report," 2011.

[3] Ibid.

[4] Atlanta Regional Commission. Plan 2040 Forecasts. Accessed at: http://www.atlantaregional.com/info-center/arc-region/plan-2040-forecasts; TAZ data provided directly by ARC.

existing stations on the Red line, the population and employment were calculated within a ¼, ½ and 1-mile radius surrounding the potential stations. The percentage of each TAZ, which fell inside the given radius, was applied to the population and employment within that TAZ and the resulting figure was included in the area population or employment figure. For example, if 100% of a TAZ with a population of 30 fell inside a given radius, the population of that TAZ included would be 30; however if only 50% of that TAZ fell within the radius, only 15, or half of the population of that TAZ, would be included in the figure. The populations for each complete and partial TAZ were summed for their respective radii to be used in the next step of the density calculations. The same was done for employment.

Population and employment densities were then analyzed per square mile, which resulted in the density calculation for each of the six potential stations and four existing stations on the Red line. The existing stations chosen were Dunwoody, Medical Center, North Springs and Sandy Springs because of their proximity to the potential stations and other comparable qualities.

Population Density

Population density was calculated for each of the six potential and four existing stations for each of the three radii discussed above for all four forecast years. The average population density was calculated for the potential and existing stations separately for the purpose of comparison. The average density of the potential stations was then compared to both the existing station average density and the density of North Springs station. North Springs was chosen over the other existing stations because it was closest in proximity to the potential stations and because of other similar land use qualities. Ultimately, the density changes attributed to the GA 400 Transit Initiative were calculated using the proportion of average potential station density to the density surrounding the North Springs station and applied to the HRT scenario. The density changes for the LRT and BRT scenarios were then calculated using lower magnitudes of change.

Employment Density

Employment density was calculated for each of the six potential and four existing stations for each of the three radii discussed above for all four forecasted years. The average employment density was calculated for the potential and existing stations separately for purposes of comparison. The average density of the potential stations was then compared to both the existing station average density and the density of North Springs station. North Springs was chosen over the other existing stations because of its closest proximity to the potential stations and other similar land use qualities. Ultimately, the density changes attributed to the GA 400 Transit Initiative were calculated using the proportion of average potential station density to the density surrounding the North Springs station and applied to the HRT scenario. The density changes for the LRT and BRT scenarios were then calculated using lower magnitudes of change.

Compact Development

In additional to density gains, the GA 400 project will encourage compact development around potential stations making the corridor more walkable and the nearby commercial opportunities more accessible. Compact development not only offers denser residential and commercial development, but also includes a greater mix of development (residential, office, and retail) in a pedestrian and transit friendly environment. The presence of more dense or compact development that occurs within a ¼-mile of the GA 400 project results in a further reduction of VMT in the ½-mile project corridor as residents and employees in the area are able to conduct more personal business (retail, restaurants, services, etc.) within the corridor without using cars. This reduction in VMT is estimated based on the findings of *Growing Cooler* (2007), *Moving Cooler* (2009), and *Location Efficiency and Housing Type: Boiling it Down to BTUs* (2011) studies. Since the development within a ¼-mile of the GA 400 project would be both more dense and compact, the analysis conservatively assumes that the compact development will reduce VMT in the ½-mile corridor by no more than 20% over 40 years. HRT is assumed to have the greatest impact on VMT reduction due to the greater density and mix of development occurring. LRT is assumed to have 75% of the impact on VMT that HRT has, largely due to the ability to move fewer people than HRT; while, BRT is assumed to have 50% of the impact of LRT due to the perceived lack of permanence of the investment (i.e. no rails). The reduced VMT is then translated into monetized transportation benefits (travel cost savings), environmental benefits (reduced emissions), and safety (reduced accidents).

3.2 Property Premiums and Tax Base Impacts

The operation of all alternatives would provide the property parcels within ½-mile of the potential stations with greater access to transit as well as the broader metropolitan economy. For the purpose of this study, a ½-mile radius and a ¼-mile radius (which lies inside the ½-mile radius), were chosen based on empirical evidence that property values within these distances are the most greatly impacted by the presence of a potential transit station. The economic impact of transit access and the value of walkable community centers indicate that there are often positive impacts on property values associated with such investments and vary depending on property type, transit mode, and distance to the potential station.[5] In one study, bus rapid transit was found to display premiums between 0% (no impact) and 17%.[6] For streetcar/light rail, another recent study has demonstrated an overall property value appreciation range of three to 26%,[7] and within a half mile of the potential station, heavy rail has been shown to display premiums between 6.8 and 9.4%.[8] Based on these empirical findings, the following premiums were chosen for the purpose of this analysis: a conservative 3% premium has been assumed for BRT within the ¼-mile radius and 1.9%within the ½-mile radius, 4% for LRT within the ¼-mile radius and 2.5% within the ½-mile radius, and 10% for HRT within the ¼-mile radius and 6.3% within the ½-mile radius.

The premiums within ¼-mile were chosen based on property premiums previously seen in comparable locations for the same transit mode at the same radius. It is assumed based on

[5] Center for Transit Oriented Development, *Capturing Value from Transit*, 2008; Belzer, Dena, Nancy Eaton, Nadine Fogarty, and Gloria Ohland, "Real Estate Market Impacts of TOD."

[6] Ibid.

[7] Arlington County and Fairfax County, Virginia. Columbia Pike Return on Investment Study. July 2012.

[8] Making the Case for Transit: WMATA Regional Benefits of Transit, AECOM November 2011

evidence from previous studies that properties within the ½-mile radius but outside the ¼-mile radius would only experience half the premium rate as those inside of the ¼-mile radius. For this reason, a weighted average based on area was applied to the ½-mile radius, which encompasses all properties from the potential station to the perimeter. Twenty five percent (25%) of the area is within the ¼-mile radius and 75% falls outside of the ¼-mile radius but within the ½-mile radius. The equation used to determine the ½-mile premium is as follows:

25% x [Quarter mile premium] + 75% x ½ [Quarter mile premium]

= Half mile premium

Ultimately, the ½-mile radius premium is equal to five-eighths of the ¼-mile premium for each technology alternative. Table 3-1 below displays the premiums side by side.

Table 3-1: Property Premiums

Distance from Potential Stations	BRT	LRT	HRT
Quarter-mile Radius	3.0%	4.0%	10.0%
Half-mile Radius	1.9%	2.5%	6.3%

Property Premium for Properties within ¼-Mile of the Corridor

The property value appreciation associated with potential stations' proximity is shown in Table 3-2. It is anticipated that the appreciation will occur over multiple years. Table 3-3 displays the appreciated value over a three-year span, beginning the opening year of each project.

Table 3-2: Property Appreciation within ¼-Mile of Potential Stations, Millions of $2012

Alternative	Total Assessed Value	Parcel Value Appreciation
BRT	$128.7	$3.9
LRT	$128.7	$5.2
HRT	$118.7	$11.9

Sources: Fulton County Assessor and AECOM

Table 3-3: Projected Property Value Appreciation Timeline within ¼-Mile, $2012

Technology Alternative	2028	2029	2030	3-Year Total
BRT	$1,287,431	$1,287,431	$1,287,431	**$3,862,294**
LRT	$1,716,575	$1,716,575	$1,716,575	**$5,149,726**
HRT	$3,956,421	$3,956,421	$3,956,421	**$11,869,264**

Source: AECOM

No Build Alternative

Under the No Build Alternative, no new transit mode would be present in the GA 400 corridor and therefore property values within the area would not be impacted.

BRT

In Fulton County, BRT would affect a total of 344 parcels within ¼-mile of the potential transit stations. Using the conservative estimate of a 3% appreciation rate, the total appreciation of property values surrounding potential stations would be $3.9 million in 2013 dollars within ¼-mile over the first three years of operation.

LRT

In Fulton County, BRT would affect a total of 344 parcels within ¼-mile of the potential transit stations. Using the conservative estimate of a 4% appreciation rate, the total appreciation of property values surrounding the potential stations would be $5.2 million in 2013 dollars within ¼-mile over the first three years of operation.

HRT

In Fulton County, HRT would affect a total of 249 parcels within ¼-mile of the transit. Using the conservative estimate of a 10% appreciation rate, the total appreciation of property values surrounding the potential stations would be $11.9 million in 2013 dollars within ¼-mile over the first three years of operation.

Property Premium for Properties within ½-mile of the Corridor

The property value appreciation associated with the potential stations' proximity is shown in Table 3-4. It is anticipated that the appreciation will occur over multiple years. Table 3-5 displays the appreciated value over a three-year span, beginning the opening year of each project.

Table 3-4: Projected Property Appreciation within ½-Mile of Potential Stations, Millions of $2013

Alternative	Total Assessed Value	Parcel Value Appreciation
BRT	$771.2	$14.5
LRT	$771.2	$19.3
HRT	$658.7	$41.2

Sources: Fulton County Assessor and AECOM

Table 3-5: Projected Property Value Appreciation Timeline within ½-mile, $2013

Alternative	2028	2029	2030	3-Year Total
BRT	$4,820,270	$4,820,270	$4,820,270	**$14,460,811**
LRT	$6,427,027	$6,427,027	$6,427,027	**$19,281,081**
HRT	$13,721,958	$13,721,958	$13,721,958	**$41,165,875**

Source: AECOM

No Build Alternative

Under the No Build Alternative, no new transit mode would be present in the GA 400 corridor and therefore property values within the area would not be impacted.

BRT

In Fulton County, BRT would affect a total of 1,664 parcels within ½-mile of the potential transit stations. Using the conservative estimate of a 1.9% appreciation rate, the total appreciation of property values surrounding the potential stations would be $14.5 million in 2013 dollars within ½-mile over the first three years of operation.

LRT

In Fulton County, BRT would impact a total of 1,664 parcels within ½-mile of the potential transit stations. Using the conservative estimate of a 2.5% appreciation rate, the total appreciation of property values surrounding the potential stations would be $19.3 million in 2013 dollars within ½-mile over the first three years of operation.

HRT

In Fulton County, HRT would affect a total of 1,210 parcels within ½-mile of the potential transit stations. Using the conservative estimate of a 6.3% appreciation rate, the total appreciation of property values surrounding the potential stations would be $41.2 million in 2013 dollars within ½-mile over the first three years of operation.

Tax Base Impacts after the Applied Property Premiums

The increase in property values within ¼-mile and ½-mile of each of the Build Alternatives would result in an increase in the tax base for Fulton County, which translates into an increase in annual property tax revenue. ***The calculations do not include any new development or large-scale redevelopment projects in the analysis area.*** The property tax estimate is based on the 2013 property tax rates for Fulton County and assumes property values increase equally over three years after potential station openings. The total property value appreciation for each alternative is displayed in Table 3-6.

Table 3-6: Annual Property Tax Revenues and Impacts

Alternative	Additional Property Tax Revenue from Appreciation	
	Quarter-mile Radius	Half-mile Radius
No Build	$0	$0
BRT	$138,775	$515,100
LRT	$185,033	$686,800
HRT	$427,404	$1,470,690

Note: All dollar amounts are in year 2012 dollars.

3.3 Population and Employment Density

The existence of a new transit mode along the GA 400 corridor is expected to increase the population and employment densities in the immediately surrounding area. The population and employment projections from the ARC Plan 2040 forecasts were used as the base for the analysis and include population and employment figures for years 2010, 2020, 2030 and 2040. Because the Plan 2040 forecasts do not include the GA 400 project, density impacts attributed to the GA 400 project were calculated in addition to

the Plan 2040 forecasts. These calculations were used to project density increases within the analyzed radii and decreases in sprawl beyond the radii.

In the sub-sections below, the calculations behind the population and employment density projections are explained in detail and the results for each potential station are shown for each alternative.

Population density around the potential stations is expected to increase to similar levels as existing HRT stations on the Red line. After analyzing the four existing stations in the study area, North Springs was chosen for comparison to the potential stations. The projected increases in population density surrounding the potential stations were based on this comparison.

Population Density Calculations

The population densities were calculated for North Springs and each of the potential stations within the ¼ and ½-mile radii using ARC's Plan 2040 forecasts (see Table 3-7 and Table 3-9). In Table 3-8 and Table 3-16, the densities within each of the radii for North Springs station were then compared to the average densities of the potential stations within the respective radii. The ratios for years 2010, 2020, 2030 and 2040 were then averaged for each respective radius.

These calculations based directly on the ratio are applicable to HRT only because the existing stations serve an HRT line. Density projections for the areas around potential LRT and BRT stations are less than that of HRT. It is assumed that the ratio of increased density for an area surrounding a potential LRT station will only be 75% of the ratio for HRT, based on lower ridership capacity for LRT. The ratio for increased density in an area surrounding a potential BRT station is assumed to be 50% of the ratio for LRT due to perceived lack of permanence of the transit mode. A summary of these ratios is shown in Table 3-11. This analysis is provided to assess and illustrate the potential gains to the corridor from changing the development pattern.

The resulting ratios from Table 3-11 were applied to 2040 population density figures from the Plan 2040 Forecast to project the density surrounding each potential station in 2040 with new transit within a ¼-mile radius (see Table 3-12) and a ½-mile radius (see Table 3-13).

Table 3-7 shows the population per square mile within a ¼-mile radius for North Springs station and each of the potential stations, as well as the average population per square mile for the potential stations. Table 3-8 shows the density ratio of North Springs station to the average density of the potential stations. This ratio was used directly in the density calculations for HRT and as the basis for LRT and BRT density projections.

Table 3-7: Population per Mile^2 within a ¼-Mile Radius, without GA 400

Station	2010	2020	2030	2040
North Springs	**3,722**	**4,476**	**5,134**	**5,566**
Holcomb Bridge	4,736	5,117	5,438	5,733
Mansell	503	1,000	1,506	1,816
North Point	597	703	781	850
Northridge	2,907	3,052	3,051	3,094
Old Milton	1,697	1,933	2,012	2,097
Windward	693	1,092	1,280	1,353
Potential Stations Average	**1,855**	**2,149**	**2,345**	**2,490**

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Table 3-8: Density Population Ratio within a ¼-Mile Radius, without GA 400

Station	2010	2020	2030	2040	Average
North Springs	3,722	4,476	5,134	5,566	
Potential Stations Average	1,855	2,149	2,345	2,490	
Density Ratio	**100.6%**	**108.2%**	**119.0%**	**123.5%**	**112.8%**

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Table 3-9 shows the population per square mile within a ½-mile radius for North Springs station and each of the potential stations, as well as the average population per square mile for the potential stations. Table 3-10 shows the density ratio of North Springs station to the average density of the potential stations. This ratio was used directly in the density calculations for HRT and as the basis for LRT and BRT density projections.

Table 3-9: Population per Mile^2 within a ½-Mile Radius, without GA 400

Station	2010	2020	2030	2040
North Springs	**3,480**	**4,117**	**4,594**	**4,923**
Holcomb Bridge	4,542	5,016	5,366	5,673
Mansell	1,603	2,045	2,425	2,663
North Point	906	1,225	1,416	1,551
Northridge	2,906	3,104	3,101	3,149
Old Milton	1,718	1,952	2,031	2,119
Windward	808	1,158	1,305	1,370
Potential Stations Average	**2,081**	**2,417**	**2,607**	**2,754**

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Table 3-10: Population Density Ratio within a ½-Mile Radius, without GA 400

Station	2010	2020	2030	2040	Average
North Springs	3,480	4,117	4,594	4,923	
Potential Stations Average	2,081	2,417	2,607	2,754	
Density Ratio	**67.2%**	**70.4%**	**76.2%**	**78.8%**	**73.1%**

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

For both radii surrounding the potential stations, the average density ratios were applied to the Plan 2040 forecast population figures to project density for the year 2040. Table 3-11 shows the density ratio (magnitude of density increase over the 2040 projection) for each of the alternatives.

Table 3-11: Increased Population Density Ratios Attributed to GA 400

Alternative	Magnitude of Density Increase in 2040	
	¼-Mile Radius	**½-Mile Radius**
No Build	0%	0%
HRT *(based on avg. ratios)*	112.8%	73.1%
LRT *(75% of HRT ratio)*	84.6%	58.9%
BRT *(50% of LRT ratio)*	42.3%	27.4%

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Table 3-12 and Table 3-13 show the population density per square mile for the ¼ and ½-mile radius, respectively. All three technology alternatives are displayed along with the percentage of increased density anticipated.

Table 3-12: 2040 Population per Mile^2 Projections within a ¼-Mile Radius with GA 400

Potential Station	No Build	BRT	LRT	HRT
Total % Increase	***0%***	***42.3%***	***84.6%***	***112.8%***
Holcomb Bridge	5,733	8,159	10,584	12,202
Mansell	1,816	2,585	3,353	3,866
North Point	850	1,209	1,569	1,809
Northridge	3,094	4,403	5,712	6,585
Old Milton	2,097	2,984	3,871	N/A
Windward	1,353	1,925	2,498	2,880

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Table 3-13: 2040 Population per Mile^2 Projections within a ½-Mile Radius with GA 400

Potential Station	No Build	BRT	LRT	HRT
Total % Increase	***0%***	***27.4%***	***58.9%***	***73.1%***
Holcomb Bridge	5,673	7,229	8,785	9,822
Mansell	2,663	3,394	4,124	4,611
North Point	1,551	1,976	2,402	2,685
Northridge	3,149	4,012	4,876	5,452
Old Milton	2,119	2,700	3,281	N/A
Windward	1,370	1,746	2,121	2,372

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Employment Density Calculations

Employment density around the potential stations is expected to increase to similar levels as existing HRT stations on the Red line. After analyzing the four existing stations in the study area, North Springs was chosen for comparison to the potential stations. The projected increases in employment density surrounding the potential stations were based off this comparison.

The employment densities were calculated for North Springs and each of the potential stations within the ¼ and ½-mile radii (see Table 3-14 and Table 3-16). In Table 3-15 and Table 3-17, the densities within each of the radii for North Springs station were then compared to the average densities of the potential stations within the respective radii. The ratios for years 2010, 2020, 2030 and 2040 were then averaged for each respective radius.

These calculations based directly on the ratio are applicable to HRT only because the existing stations serve an HRT line. Density projections for the areas around potential LRT and BRT stations are less than that of HRT. It is assumed that the ratio of increased density for an area surrounding a potential LRT station will only be 75% of

the ratio for HRT, based on lower ridership capacity for LRT. The ratio for increased density in an area surrounding a potential BRT station is assumed to be 50% of the ratio for LRT due to perceived lack of permanence of the transit mode. A summary of these ratios is shown in Table 3-18.

The resulting ratios from Table 3-18 were applied to employment density figures from the Plan 2040 forecast to project the densities surrounding each potential station in 2040 within new transit within a ¼-mile radius (see Table 3-19) and a ½-mile (see Table 3-20) for each radius.

Table 3-14 shows the employment per square mile within a ¼-mile radius for North Springs station and each of the potential stations, as well as the average employment per square mile for the potential stations. Table 3-15 shows the density ratio of North Springs station to the average density of the potential stations. This ratio was used directly in the density calculations for HRT and as the basis for LRT and BRT density projections.

Table 3-14: Employment per Mile^2 within a ¼-Mile Radius, without GA 400

Station	2010	2020	2030	2040
North Springs	**9,961**	**11,953**	**13,056**	**14,188**
Holcomb Bridge	1,399	1,703	1,859	2,037
Mansell	5,246	6,782	7,766	8,947
North Point	3,985	5,499	6,482	7,655
Northridge	2,396	3,303	3,880	4,501
Old Milton	2,761	3,918	4,636	5,418
Windward	3,340	4,567	5,065	5,639
Potential Stations Average	**3,188**	**4,295**	**4,948**	**5,699**

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Table 3-15: Employment Density Ratio within a ¼-Mile Radius, without GA 400

Station	2010	2020	2030	2040	Average
North Springs	9,961	11,953	13,056	14,188	
Potential Stations Average	3,188	4,295	4,948	5,699	
Density Ratio	**212.5%**	**178.3%**	**163.9%**	**148.9%**	**175.9%**

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Table 3-16 shows the employment per square mile within a ½-mile radius for North Springs station and each of the potential stations, as well as the average employment per square mile for the potential stations. Table 3-17 shows the density ratio of North Springs station to the average density of the potential stations. This ratio was used directly in the density calculations for HRT and as the basis for LRT and BRT density projections.

Table 3-16: Employment per Mile^2 within a ½-Mile Radius, without GA 400

Station	2010	2020	2030	2040
North Springs	**8,287**	**9,608**	**10,318**	**11,049**
Holcomb Bridge	1,483	1,844	2,024	2,224
Mansell	4,543	5,853	6,661	7,616
North Point	3,596	5,030	5,902	6,920
Northridge	2,807	3,920	4,623	5,377
Old Milton	2,789	3,925	4,624	5,385
Windward	3,590	5,018	5,609	6,292
Potential Stations Average	**3,135**	**4,265**	**4,907**	**5,636**

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Table 3-17: Employment Density Ratio within a ½-Mile Radius, without GA 400

Station	2010	2020	2030	2040	Average
North Springs	8,287	9,608	10,318	11,049	
Potential Stations Average	3,135	4,265	4,907	5,636	
Density Ratio	**164.4%**	**125.3%**	**110.3%**	**96.1%**	**124.0%**

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

For both radii surrounding the potential stations, the average density ratios were applied to the Plan 2040 forecast employment figures to project density for the year 2040. Table 3-18 shows the density ratio (magnitude of density increase over the 2040 projection) for each of the alternatives.

Table 3-18: Increased Employment Density Attributed to GA 400

Alternative	Magnitude of Density Increase in 2040	
	¼-Mile Radius	**½-Mile Radius**
No Build	0%	0%
HRT *(based on avg. ratios)*	175.9%	124.0%
LRT *(75% of HRT ratio)*	131.9%	93.0%
BRT *(50% of LRT ratio)*	66.0%	46.5%

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Table 3-19 and Table 3-20 show the employment density per square mile for the ¼-mile radius and ½-mile radius, respectively. All three alternatives are displayed along with the percentage of increased density anticipated.

Table 3-19: 2040 Employment per Mile^2 Projections within a ¼-Mile Radius with GA 400

Potential Station	No Build	BRT	LRT	HRT
Total % Increase	***0%***	***66.0%***	***131.9%***	***175.9%***
Holcomb Bridge	2,037	3,381	4,724	5,620
Mansell	8,947	14,849	20,751	24,685
North Point	7,655	12,704	17,753	21,119
Northridge	4,501	7,470	10,438	12,418
Old Milton	5,418	8,991	12,564	N/A
Windward	5,639	9,358	13,078	15,557

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

Table 3-20: 2040 Employment per Mile^2 Projections within a ½-Mile Radius with GA 400

Potential Station	No Build	BRT	LRT	HRT
Total % Increase	***0%***	***46.5%***	***93.0%***	***124.0%***
Holcomb Bridge	2,224	3,258	4,292	4,981
Mansell	7,616	11,158	14,699	17,060
North Point	6,920	10,137	13,355	15,500
Northridge	5,377	7,877	10,377	12,044
Old Milton	5,385	7,889	10,393	N/A
Windward	6,292	9,217	12,142	14,093

Source: Atlanta Regional Commission – Plan 2040 Forecast and AECOM

3.4 Reducing Sprawl

The compact development attributed to the GA 400 project will have an impact on the surrounding area through population and employment density changes. Within the ½-mile radius surrounding the potential stations, population and employment densities will increase, drawing residents and employees from regions outside of the immediate radius. The areas outside of this radius will become slightly less dense as this relocation occurs. The decreases in these densities are calculated and discussed in the following subsections as a way of illustrating the amount of land resources freed up for another use; no assumption is made on the potential use.

Reducing Population Sprawl

The total increase in population within a ¼ and ½-mile radius of all potential stations was calculated by applying the ratios of expected population (from Table 3-11) to the Plan 2040 forecast population figures. This increase in population translates to the number of residents who will relocate within the ¼ or ½-mile radius from an area outside and is displayed below in Table 3-21. For the purpose of this analysis, it is assumed that those relocating are leaving less dense, local areas to gain increased proximity to the transit mode and land use features associated with compact development. The average density of the areas from where residents are assumed to be coming was calculated as the density outside the ½-mile radius of all potential stations but within 1-mile and is equal to 2,970 residents per square mile. The number of new residents within the ¼ and ½-mile

radii was then compared to the average density outside of the ½-mile radius. This comparison was then translated into the number of square miles that are vacated by residents outside of the ½-mile radius, thus reducing sprawl. The results of these calculations are in Table 3-22. This is for illustrative purposes to describe the amount of land resource gained for other uses; there is no assumption that this would remain open space.

Table 3-21: Total Increase in Population Attributed to GA 400

Distance from a Potential Station	BRT	LRT	HRT
¼-mile Radius	1,241	2,482	2,845
½-mile Radius	3,559	7,118	8,274

Source: AECOM

Table 3-22: Unoccupied Space/Reduced Sprawl Attributed to GA 400 in Mile^2

Distance from a Potential Station	BRT	LRT	HRT
¼-mile Radius	0.42	0.84	0.96
½-mile Radius	1.20	2.40	2.79

Source: AECOM

Reducing Employment Sprawl

The total increase in jobs due to relocation within a ¼ and ½-mile radius of all potential stations was calculated by applying the ratios of expected employment (from Table 3-18) to the Plan 2040 Forecast employment figures. This increase in jobs translates to the number of employed people who will relocate within the ¼ or ½-mile radius from an area outside and is displayed in Table 3-23. For the purpose of this analysis, it is assumed that those relocating are leaving less dense, local areas to gain increased proximity to the transit mode and land use features associated with compact development. The average density of the areas from where residents are assumed to be coming was calculated as the density outside the ½-mile radius of all potential stations but within 1-mile and is equal to 4,840 people employed per square mile. The number of new employees within the ¼ and ½-mile radii was then compared to the average density outside of the ½-mile radius. This comparison was then translated into the number of square miles which become unoccupied by employees outside of the ½-mile radius, thus reducing sprawl. The results of these calculations are in Table 3-24.

Table 3-23: Total Increase in Employment Attributed to GA 400

Distance from a Potential Station	BRT	LRT	HRT
¼-mile Radius	4,427	8,855	9,936
½-mile Radius	12,346	24,693	27,680

Source: AECOM

Table 3-24: Unoccupied Space/Reduced Sprawl Attributed to GA 400 in Mile^2

Distance from the Potential Station	BRT	LRT	HRT
¼-mile Radius	0.91	1.83	2.05
½-mile Radius	2.55	5.10	5.72

Source: AECOM

3.5 Compact Development Benefits

In addition to density gains, the GA 400 project will encourage compact development around potential stations making the corridor more walkable and the nearby commercial opportunities more accessible. Compact development not only offers denser residential and commercial development, but also includes a greater mix of development (residential, office, and retail) in a pedestrian and transit friendly environment. One of the key findings of the emerging "local accessibility" research is that "accessibility is a function of both proximity and connectivity."[9] Portland, Oregon has coined the term "20-minute neighborhood" for such areas: places with 1) a walkable environment; 2) destinations that support a range of daily needs (shop, parks, jobs); and 3) residential density. Collectively, these attributes reduce the need for car trips for a share of a typical household's trips.[10]

VMT Reduction

The presence of more dense or compact development that occurs within a ¼-mile of the GA 400 project results in a further reduction of VMT in the ½-mile project corridor as residents and employees in the area are able to conduct more personal business (retail, restaurants, services, etc.) within the corridor without getting in their cars. This reduction in VMT is estimated based on the findings of *Growing Cooler* (2007), *Moving Cooler* (2009), and *Location Efficiency and Housing Type: Boiling it Down to BTUs* (2011) studies. These studies estimate that compact development could reduce overall urban VMT between 20 and 57%,[11,12] while denser development could reduce VMT by 12.6% by 2050.[13] Since the development within a ¼-mile of the GA 400 project would be both more dense and compact, the analysis conservatively assumes that the compact development will reduced VMT in the ½-mile corridor by no more than 20% over 40 years, as shown in Table 3-25 below. HRT is assumed to have the greatest impact on VMT reduction due to the greater density and mix of development occurring. LRT is assumed to have 75% of the impact on VMT that HRT has, largely due to the ability to move fewer people than HRT; while, BRT is assumed to have 50% of the impact of LRT due to the perceived lack of permanence of the investment (i.e. no rails).

[9] Pivo, G. and Fisher, J. D., *The Walkability Premium in Commercial Real Estate Investments*. Real Estate Economics, 39: 185–219, 2011.

[10] City of Portland Bureau of Planning and Sustainability, Status Report: Twenty-minute Neighborhoods, May 2009.

[11] Reid Ewing, Arthur C. Nelson, and Keith Bartholomew, *Growing Cooler*, Urban Land Institute, 2007, pp.5-7.

[12] Jonathan Rose Companies, *Location Efficiency and Housing Type: Boiling it Down to BTUs*, US EPA, 2011, pp.4-5.

[13] Cambridge Systematics, Inc., *Moving Cooler*, Technical Appendix B, Urban Land Institute, 2009, p. B-22.

Table 3-25: VMT Reduction Due to Compact Development for Each Scenario

Alternative	Annual Reduction for 40 years	40-yr Total
BRT	0.19%	7.5%
LRT	0.38%	15.0%
HRT	0.50%	20.0%

Source: AECOM

To estimate the VMT reduced due to compact development associated with the project, the total baseline VMT for the ½-mile corridor was estimated by the project's travel demand modeling for 2040. In order to get opening year VMT (2028), the annual growth rates in the ARC baseline travel demand model for the corridor between 2016 - 2030 and 2030 - 2040 were analyzed. The average annual growth rates in the baseline travel demand model VMT are 0.98% between 2016 - 2030 and 2.26% between 2030 - 2040 for the corridor. The higher growth rate between 2030 - 2040 is associated with the potential construction of the GA 400 Managed Lanes project. As a result, the analysis conservatively assumes that the growth in VMT for the ½-mile project corridor between 2028 - 2040 is 2% per year and 1% per year after 2040, yielding the baseline annual VMT estimates shown in Table 3-26.

Table 3-26: Annual Projected VMT (in Millions) in the ½-Mile Project Corridor (for Key Years)

Alternative	2028	2040	2057	2067	2077
BRT	1,106.7	1,410.3	1,670.2	1,845.0	2,038.0
LRT	1,105.7	1,409.1	1,668.8	1,843.4	2,036.3
HRT	1,102.0	1,404.3	1,663.1	1,837.1	2,029.3

Note: 2040 VMT is reduced by 2% per year for years prior to 2040, and 2040 VMT is increased by 1% per year for years after 2040.

The VMT in each year for the 40-year period after opening is then reduced by the amount shown in Table 3-25, depending on the scenario. After 40 years of operation (beginning in 2028), the annual VMT reduced is held constant at the level of VMT reduced in year 40 (2067) through 2077. The annual VMT reduced for each scenario is summarized in Table 3-27.

Table 3-27: Annual Reduced VMT in the ½-Mile Project Corridor (for Key Years)

Alternative	2028	2040	2057	2067	2077
BRT	2,075,036	30,538,849	79,762,059	112,853,909	112,853,909
LRT	4,146,541	61,025,728	159,388,381	225,515,766	225,515,766
HRT	5,509,888	81,090,465	211,793,915	299,663,417	299,663,417

The reduced VMT is then translated into monetized transportation benefits (travel cost savings), environmental benefits (reduced emissions), safety (reduced accidents), and external benefits (reduction of congestion and noise). These benefits are summarized in Table 3-28 and described in the following four sections.

Table 3-28: Summary of Compact Development Benefits ($2012), Auto $/Mile

	Total 2028-2047 (20 years)		Total 2028-2057 (30 years)		Total 2028-2077 (50 years)	
	3%	7%	3%	7%	3%	7%
BRT						
Transportation Benefits (travel cost savings)	$51.84	$18.73	$100.01	$29.44	$199.29	$42.39
Environmental Benefits (reduced emissions)	$1.48	$0.53	$2.85	$0.84	$5.68	$1.21
Safety Benefits (reduced accidents)	$50.76	$18.34	$97.93	$28.83	$195.15	$41.51
External Benefits (congestion/noise reduction)	$13.00	$4.70	$25.09	$7.38	$49.99	$10.63
Total BRT Benefits	**$117.07**	**$42.31**	**$225.88**	**$66.49**	**$450.11**	**$95.74**
LRT						
Transportation Benefits (travel cost savings)	$103.58	$37.43	$199.85	$58.82	$398.24	$84.71
Environmental Benefits (reduced emissions)	$2.95	$1.07	$5.70	$1.68	$11.36	$2.42
Safety Benefits (reduced accidents)	$101.43	$36.65	$195.70	$57.60	$389.97	$82.95
External Benefits (congestion/noise reduction)	$25.98	$9.39	$50.13	$14.76	$99.90	$21.25
Total LRT Benefits	**$233.95**	**$84.54**	**$451.38**	**$132.86**	**$899.46**	**$191.32**
HRT						
Transportation Benefits (travel cost savings)	$137.64	$49.74	$265.56	$78.17	$529.18	$112.56
Environmental Benefits (reduced emissions)	$3.93	$1.42	$7.57	$2.23	$15.09	$3.21
Safety Benefits (reduced accidents)	$134.78	$48.71	$260.04	$76.54	$518.19	$110.22
External Benefits (congestion/noise reduction)	$34.53	$12.48	$66.61	$19.61	$132.74	$28.24
Total HRT Benefits	**$310.87**	**$112.34**	**$599.79**	**$176.54**	**$1,195.20**	**$254.23**

Source: NHTSA.

Vehicle Operating Cost Savings

The reduction of VMT due to compact development provides transportation benefits to users in terms of travel cost savings, associated with reduced auto use. The reduced VMT translates into a reduced operating cost in terms of fuel, maintenance, tires, and a portion of depreciation. For autos, these savings vary by the size of the car. The average auto operating cost per mile (including half of the cost of depreciation) is $23.63, according to AAA's 2012 Edition of *Your Driving Costs*.[14] The travel cost savings is monetized by multiplying the annual VMT reduced by the average auto operating cost per mile. The total transportation benefits are summarized in Table 3-28 for the 20, 30, and 50-year periods following completion of the project. It is important to note that these benefits are slightly overstated because they do not include the cost of additional transit trips that may be taken.

[14] AAA, *Your Driving Costs*, 2012. Accessed at: http://newsroom.aaa.com/wp-content/uploads/2012/04/YourDrivingCosts2012.pdf

As VMT is removed from the system due to compact development, some of the auto trips will be replaced with walk/bike trips and others will be replaced with transit trips. These transit trips have a cost (fare paid) that is not included in the table.

Emissions Savings

Compact development would reduce VMT in the ½-mile project corridor. This reduction in VMT in turn decreases the amount of Nitrogen Oxide (NOx), Volatile Organic Compounds (VOCs), and Particulate Matter (PM2.5) emissions in the region. The emissions rates for the Atlanta region were taken from Volume II of the *ARC Plan 2040 Conformity Determination Report*.[15] The transportation emissions rates provided in the conformity report were in tons per day for 2020, 2030, and 2040. In an effort to be conservative, the 2030 emissions rates were used because they were the lowest of all years forecasted. The 2030 emissions in tons per day were converted to grams per VMT by first converting tons to grams and then dividing by the 2030 VMT for the baseline Plan 2040 travel demand model. The emissions rates used in the analysis are summarized in Table 3-29 below. It is important to note that the determination report did not include emissions rates for Carbon Monoxide (CO), Sulfur Dioxide (SO2), or Carbon Dioxide (CO2); therefore, these emissions are potentially an additional benefit that could not be quantified at this time.

Table 3-29: Atlanta 20-County Motor Vehicle Emissions Rates, 2030

	2030 Tons per Day	2030 Grams per VMT
VOCs	71.96	0.32
NOx	54.32	0.24
PM (2.5)	2.91	0.01

Note: Tons per day were converted to grams (1 ton = 907,185 grams) and then divided by 2030 Daily VMT (204,999,137)
Source: ARC, *Plan 2040 Conformity Determination Report, Volume II*, Table 2

The emissions savings is monetized by multiplying the annual VMT reduced by the emissions rates shown above (g/VMT) and the economic cost of air emissions to the reduction VOCs, NOx, and PM as specified by the National Highway Traffic Safety Administration (NHTSA).[16] Table 3-28 summarizes the sum of the emissions savings for the 20, 30 and 50-year periods.

Accident Avoidance Savings

Compact development would reduce VMT in ½-mile project corridor. This reduction in VMT decreases the occurrence of auto crashes involving fatalities, injuries, and property damage only. To estimate the reduction in fatal, injury, and property damage only accidents, the reduced VMT is multiplied by fatal, injury, and property damage only crash rates developed by the USDOT Bureau of Transportation Statistics (BTS).[17] The injuries must then be allocated

[15] ARC, Conformity Determination Report, Volume II, Atlanta Region Plan 2040. Accessed at: http://documents.atlantaregional.com/plan2040/docs/tp_PLAN2040CDR_072711.pdf

[16] NHTSA, *CAFE and GHG Emissions Standards for Model Years 2017 and Beyond*, Federal Register Vol. 77, No. 199, October, 15, 2012, Table IV-9, p.62986. Accessed at: http://www.nhtsa.gov/fuel-economy

[17] BTS, *National Transportation Statistics*, Motor Vehicle Safety Data, Table 2-17, 2010. Accessed at: http://www.bts.gov/publications/national_transportation_statistics/#chapter_2

to severity using the NHTSA KABCO-AIS Conversion Table.[18] The BTS crash rates and the NHTSA injury severity conversion factors are shown in Table 3-30 below.

Table 3-30: Crash Rates and Injury Severity Conversion Factors

		Allocation of Injured – Severity Unknown to AIS categories					
Injured Persons	75.478	AIS 0 No injury	AIS 1 Minor	AIS 2 Moderate	AIS 3 Serious	AIS 4 Severe	AIS 5 Critical
		0.21538	0.62728	0.10400	0.03858	0.00442	0.01034

Source: BTS, *National Transportation Statistics*, Motor Vehicle Safety Data (Crash Rates, 2010) and NHTSA, KABCO-AIS Conversion Table (Allocation of Injuries, July 2011). 182.684 crashes per 100,000,000 VMT. 1.109 fatalities per 100,000,000 VMT.

The economic benefit of the decreased accident occurrence is estimated by applying the value of a statistical life as published by the USDOT Office of the Secretary[19] and the economic cost of motor vehicle crashes as developed by NHTSA[20] to the annual VMT reduced. The total accident avoidance savings for the 20, 30, and 50-year analysis periods are summarized in Table 3-28.

External Cost Savings

Compact development would reduce VMT in the ½-mile project corridor. This reduction in VMT decreases the congestion and noise experienced by other users in the corridor due to additional auto use. The emissions savings is monetized by multiplying the annual VMT reduced by the marginal costs per VMT associated with congestion and noise provided by NHTSA.[21] Table 3-28 summarizes the sum of the external cost savings for the 20, 30 and 50 year periods.

Health Benefits

Collectively, the compact development and the enhanced walkability and accessibility of the corridor would not only support a reduction in VMT, but could also support the transformation of residents' experience of place in the GA 400 corridor. Real estate studies are finding that more walkable environments are desirable places for development investment.[22] This desirability, in turn, fosters investment and helps encourage the creation of a destination to spend time shopping, dining out, and enjoying leisure time.

This "place making" would allow residents and employees in the corridor to conduct more personal business (retail, restaurants, services, etc.) within the corridor by walking or biking, increasing their daily physical activity. Inactivity is one the leading contributors to obesity and its resulting health complications including, diabetes, hypertension, and heart disease. The

[18] NHTSA, KABCO-AIS Conversion Table, July 2011. Accessed on p. 50308 of the TIGER III Notice of Funding Availability (August 12, 2011).

[19] US DOT, OST, *Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses*, February 28, 2013. Accessed at: http://www.dot.gov/sites/dot.dev/files/docs/DOT%202013%20Signed%20VSL%20Memo.pdf

[20] NHTSA, Economic Impact of Motor Vehicle Crashes (2000), Table 2, 2002. Accessed at: http://www.nhtsa.gov/Driving+Safety/The+Economic+Impact+of+Motor+Vehicle+Crashes+2000. Values were inflated to $2012 using GDP deflators.

[21] NHTSA, *CAFE and GHG Emissions Standards for Model Years 2017 and Beyond*, Federal Register Vol. 77, No. 199, October, 15, 2012, Table IV-9, p.62986. Values were escalated to $2012 using GDP deflators. Accessed at: http://www.nhtsa.gov/fuel-economy

[22] Pivo, G. and Fisher, J. D., *The Walkability Premium in Commercial Real Estate Investments*. Real Estate Economics, 39: 185–219, 2011.

ability to reduce VMT and increase physical activity associated with conducting daily business and errands has the potential to improve health and reduce healthcare expenses in the corridor. Health benefits are frequently measured in terms of mortality, medical costs, workers compensation, and/or lost productivity.

Several studies have quantified the health benefits resulting from improved walkability associated with transportation improvements and compact development.

- **Due to increased density:** Boarnet, Greenwalk, and McMillan (2008)[23] estimated the health benefits associated with various urban design improvements that increased walkability, including increased density, in Portland. The health benefits were measured in terms of a reduction in mortality risk due to moving to the next tertile of physical activity based on additional walking. The per capita benefits associated with an increase in employment density ranged from $31 to $3,898/year, while the per capita benefits associated with an increase in population density ranged from $311 to $1,671/year.[24]
- **Due to built environment:** McDonald, Stokes, Cohen, Kofner, and Ridgeway (2010)[25] examined the impacts of LRT use and perception of neighborhood on Body Mass Index (BMI) and odds of obesity and meeting recommended physical activity through walking in Charlotte. They analyzed data collected before the opening of the Charlotte LRT and after. Their findings indicated that more positive perceptions of neighborhood/built environment were associated with a 0.36 lower BMI, 15% lower odds of obesity, and 9% higher odds of meeting weekly physical activity through walking.[26] Similarly, the use of LRT to commute was associated with a 1.18 lower BMI and 81% reduced odds of becoming obese over time.[27]

  While these health benefits are modest in comparison to the costs of the compact development and transit investments, they are an important component of the livability of the project corridor. Livability and walkability are aspects that make the corridor more attractive to residents and employers, and therefore, to developers.

Cost of Public Resource Impacts

Compact development often allows municipalities to take advantage of economies of scale when providing community resources such as public safety, utilities, refuse collection, schools, public parks, and more, making them less expensive on the margin than they would be for areas with lower densities. However, not all types of density produce the same types of cost-saving benefits. According to the Transit Cooperative Research Program (TCRP) "Costs of Sprawl – 2000,"[28] residentially driven growth is

[23] Marlon G. Boarnet, Michael Greenwald and Tracy E. McMillan (2008), "Walking, Urban Design, and Health: Toward a Cost-Benefit Analysis Framework," *Journal of Planning Education and Research*, Vol. 27, No. 3, pp. 341-358.

[24] Ibid; the estimates are in 2008 discounted dollars and assume a hypothetical affected population of 5,000.

[25] John M. MacDonald, Robert J. Stokes, Deborah A. Cohen, Aaron Kofner, Greg K. Ridgeway, "The Effect of Light Rail Transit on Body Mass Index and Physical Activity." *American Journal of Preventive Medicine*, Vol. 39, Issue 2, 1 August 2010, pp.105-112.

[26] Ibid.

[27] Ibid.

[28] Transportation Research Board. "Costs of Sprawl – 2000," Transit Cooperative Research Program, Report 74. Accessed at: http://www.trb.org/Publications/Blurbs/Costs_of_Sprawl_2000_160966.aspx

costly for public service provision until a critical population mass has been reached because the fixed cost of adding services such as schools and water exceeds the savings from density. Once the initial threshold is crossed, however, additional public service demands can be met incrementally with a smaller financial burden.

Areas of high employment density do not demand many of the same public services as area of heavily residential density, mainly because there is no demand for schools. This decreases the public service burden in comparison to residential areas.

The revenue structures in compact development areas are typically more varied than those with lower density. This allows more dense areas to better respond to the costs of growth. For most municipalities, regardless of density, property tax yields are the largest source of revenue.

The expected density growth along the GA 400 corridor is anticipated to be weighted more heavily toward employment growth. While more resources will be demanded in the near term to meet residential needs in the short-term, the marginal cost will decline once the critical mass has been reached and the revenue yields could potentially outpace the costs making the corridor more competitive in the long run.

4.0 CONCLUSIONS

The GA 400 Transit Initiative study area is one of the Atlanta region's largest and fastest-growing areas. In terms of forecasted employment growth rates, it is comparable to downtown Atlanta, Midtown and Buckhead. This growth is expected to bring 110,000 new jobs over the next 30 years. Additionally, the study area is expected see strong population growth during this time with 27,000 new residents and 15,000 new households.

When comparing the three technologies considered, HRT, BRT and LRT, it is clear that HRT has the highest level of global benefits in terms of increased population and employment density, reduced sprawl area, appreciated property values and increased tax revenue. LRT had the second highest level of positive impacts and BRT had the least amount of positive impact within the study area.

The analysis conducted also demonstrates that if the GA 400 Transit Initiative were constructed, it would have additional positive impacts on the economy by:

- Increasing population and employment density surrounding potential stations.
- Reducing vehicle operating and emission costs.
- Increasing accident avoidance savings by improving safety.

Since the study area comprises a large portion of the regions jobs, it experiences a high level of commuting traffic. This accounts for 200,000 workers commuting in 2010 alone with the study area. With a substantial increase in workers and a strong increase in residential growth anticipated, new and sustainable transportation solutions are needed to meet future demand. The GA 400 Transit Initiative would be a major step towards meeting that demand while at the same time creating a more robust and sustainable economic climate within the study area.

5.0 REFERENCES

AAA. Your Driving Costs, 2012. http://newsroom.aaa.com/wp-content/uploads/2012/04/YourDrivingCosts2012.pdf

Arlington County and Fairfax County, Virginia. Columbia Pike Return on Investment Study. July 2012

Atlanta Regional Commission, Conformity Determination Report, Volume II, Atlanta Region Plan 2040.

Atlanta Regional Commission. Plan 2040 Forecasts.

Belzer, Dena, Nancy Eaton, Nadine Fogarty, and Gloria Ohland. United State Department of Transportation. Federal Transit Administration. "Capturing the Value of Transit". Center for Transit Oriented Development, 2008. Print.

Boarnet, Marlon G., Michael Greenwald and Tracy E. McMillan (2008), "Walking, Urban Design, and Health: Toward a Cost-Benefit Analysis Framework," Journal of Planning Education and Research, Vol. 27, No. 3, pp. 341-358.

Cambridge Systematics, Inc., Moving Cooler, Technical Appendix B, Urban Land Institute, 2009, p. B-22.

City of Portland. Bureau of Planning and Sustainability, Status Report: Twenty-minute Neighborhoods, May 2009.

Ewing, Reid, Arthur C. Nelson, and Keith Bartholomew, Growing Cooler, Urban Land Institute, 2007, pp.5-7

Fisher, Jeffrey D., and Gary Pivo. "The Walkability Premium in Commercial Real Estate investments," Real Estate Economics, Forthcoming. Vol. 39, issue 2, (2010): pages 185-219. Print.

Georgia Department of Revenue. Local Government Services Division. 2012 Georgia County Ad Valorem, Tax Digest Millage Rates. https://etax.dor.ga.gov/PTD/cds/csheets/millrate.aspx

Georgia Department of Revenue. Local Government Services. Summary of Ad Valorem Taxes Levied in Georgia Counties for Tax Year 2011. https://etax.dor.ga.gov/PTD/cds/revenue/LGS_Summary_of_Property_Tax_Revenue_Levied_in_Georgia_Counties_2011.pdf

Georgia Department of Revenue. Tax Digest Consolidated Summary. Fulton County, Tax Year 2012. https://etax.dor.ga.gov/DigestConsolidation/Default.aspx

Jonathan Rose Companies, Location Efficiency and Housing Type: Boiling it Down to BTUs, US EPA, 2011, pp.4-5.

MacDonald, John M., Robert J. Stokes, Deborah A. Cohen, Aaron Kofner, Greg K. Ridgeway, "The Effect of Light Rail Transit on Body Mass Index and Physical Activity." American Journal of Preventive Medicine, Vol. 39, Issue 2, 1 August 2010, pp.105-112.

NHTSA, CAFE and GHG Emissions Standards for Model Years 2017 and Beyond, Federal Register Vol. 77, No. 199, October, 15, 2012, Table IV-9, p.62986. Values were escalated to $2012 using GDP deflators. http://www.nhtsa.gov/fuel-economy

NHTSA, Economic Impact of Motor Vehicle Crashes (2000), Table 2, 2002.

NHTSA, KABCO-AIS Conversion Table, July 2011. Accessed on p. 50308 of the TIGER III Notice of Funding Availability (August 12, 2011).

Pivo, G. and Fisher, J. D., The Walkability Premium in Commercial Real Estate Investments. Real Estate Economics, 39: 185–219, 2011.

Transportation Research Board. "Costs of Sprawl – 2000," Transit Cooperative Research Program, Report 74.
http://www.trb.org/Publications/Blurbs/Costs_of_Sprawl_2000_160966.aspx

United States. Bureau of Labor Statistics. Occupational Employment Statistics. U.S. Bureau of Labor Statistics. U.S. Bureau of Labor Statistics, May 2011. Web. 28 Mar. 2013.

United States. Department of Transportation. Office of the Secretary of Transportation, Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses, February 28, 2013.
http://www.dot.gov/sites/dot.dev/files/docs/DOT%202013%20Signed%20VSL%20Memo.pdf.

United States. Department of Transportation. Bureau of Transportation Statistics, National Transportation Statistics, Motor Vehicle Safety Data, Table 2-17, 2010.
http://www.bts.gov/publications/national_transportation_statistics/#chapter_2.

Washington Metropolitan Area Transit Authority. "Making the Case for Transit: WMATA Regional Benefits of Transit Technical Report," 2011