6

Jobs-housing balance, transit-oriented development, and commute time: Integrating GIS and GPS

Hongmian Gong, contributor

Objectives

- To discuss the role of global positioning system (GPS) technology in economic development
- To discuss how GPS can be used to assess the traffic and congestion implications of specific economic development projects
- To show how GPS technology can be combined with GIS to enhance economic development analysis

Introduction

Commute distance and travel time affect economic development in profound ways. Accessibility is important in determining the desirability of a site for retail (as seen in chapter 4), manufacturing, and other activity (as seen in chapter 1). Chapter 2 noted that drive times are quite different from "as the crow flies" radii. As with chapter 5, the outline of this chapter will be based on the Geographic Approach: Ask, acquire, examine, analyze, and act.

This chapter examines the economic development aspects of transportation, specifically looking at the intersection of GIS with a related technology, GPS. This chapter discusses two major issues in economic development related to transportation costs and commuting—the jobs-housing balance and transit-oriented development—and also looks at how GPS technology can be used along with GIS by economic development analysts.

GPS has far-ranging applications to economic development analysis—from surveying local businesses to collecting data on commute patterns of workers of a specific employer. In these cases, GPS can be used to collect more accurate data at a lower cost than traditional diary-keeping and survey methods. ArcGIS software tools make analysis of the data easier and provide insights about a variety of topics in economic development, such as site selection and congestion effects. This chapter develops an example from New York City to demonstrate how GPS data can be employed in ArcGIS and combined with other data to understand an individual's **journey-to-work.** The chapter provides several other related examples.

What is GPS?

GPS is a system for identifying a location based on signals from a constellation of twenty-seven satellites orbiting the earth. Reading signals using individual receivers from three or more of these satellites at the same time can pinpoint the exact location of a receiver with latitude and longitude coordinates. A receiver equipped with a memory chip, called a GPS logger, can store tens of thousands of positions for a prescribed time interval, speed, or distance. Some loggers can also record altitude (elevation).

A GPS tracker is a related device for recording the travel itinerary of an individual; rather than storing the traces on a memory chip, the GPS tracker employs a wireless phone line to transmit real-time location information to a central server. Because a GPS tracker requires a separate phone number for each individual—as well as the involvement of private mobile phone companies—GPS trackers are not used in travel surveys as often as GPS loggers but are quite popular in tracking delivery trucks, the movement of children for safety purposes, and transit buses for real-time arrival predictions.[1] GPS loggers and trackers differ from the GPS navigators installed in cars and smart phones. GPS navigators have a screen, maps, and software designed to guide users through traffic to a final destination. GPS navigators usually do not automatically record latitude and longitude information.

Since GPS was first introduced as a component of travel survey data collection in 1996,[2] there have been dozens of GPS-based travel surveys conducted around the world.[3] Most of the earlier GPS travel surveys were vehicle-based and deployed in urban areas where car driving is the predominant mode of transportation. As GPS technology continues to evolve, person-based or handheld GPS data collection is becoming a convenient and cost-effective way to gather information from survey participants. GPS-generated journey-to-work data collection holds great promise, especially in complex urban environments such as Chicago, San Francisco, and New York City, where public transit is a major mode of transportation.

The Geographic Approach: Ask

GPS can be used for many straightforward and useful applications in economic development and other planning situations. For example, handheld GPS units, which record the longitude and latitude of a specific point, are often used to create a dataset of locations—such as locations of fire hydrants—that may not have specific street addresses. Similarly, using GPS may be a more cost-effective way to do a "walking survey" of businesses—locating them with a handheld GPS unit—rather than recording street addresses. These tasks can be done by people with minimal training. The results can be represented in a GIS program, and the tools mentioned in chapter 1 can be used to develop analyses of the data.

Another application of GPS would be to compare alternative routes. Because GPS loggers can record time and position, it is possible to determine speed over different legs of alternative routes. In setting up a delivery route or determining the best route for commuters, information from GPS loggers, combined with GIS, can provide crucial insight. Along the same lines, GPS can be useful in determining the impact on traffic congestion of the siting of a specific new facility.

Journey-to-work and jobs-housing balance

Americans increasingly spend more time commuting to work. The average commute in 1980 was 21.7 minutes. That grew to 22.4 minutes by 1990, and to 25.5 minutes by 2000. More significantly, commute times are becoming more dispersed—the proportion of trips in all categories under twenty minutes declined between 1990 and 2000, while the proportion of trips in all categories twenty-five minutes or more increased between 1990 and 2000.[4] This change in the distribution of commute times has a direct connection with possible explanations for the increase in commute times. Figure 6-1 illustrates this change in the distribution of commute times for the San Francisco Bay Area.

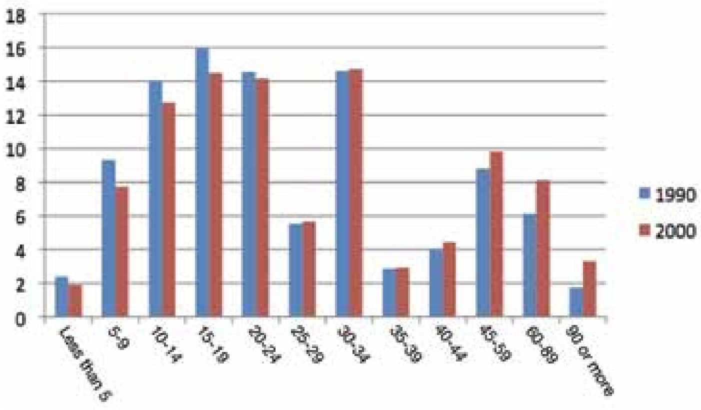


Figure 6-1. Percent of commuters and commute times, San Francisco Bay Area, 1990 and 2000. Courtesy of US Census.

Furthermore, the increase in commute time has both social and economic implications. Longer commutes mean less time with family and lower real earnings for workers. If the wage is constant but the commute time increases, the net wage is lower.

The economic impact of increased commute time is not confined to workers: increased commute time impacts the ability of business firms to attract workers. In a competitive environment, employers would need to pay a "compensating differential" to make up for longer commute times to some facilities. Because the attractiveness of a site depends, among other things, on accessibility to customers or employees, economic development officials have a keen interest in commuting issues.

The issue of jobs-housing balance concerns the proximity of jobs in given pay categories to housing in given price ranges. According to Cervero (1989),[5] part of the reason for the longer journey-to-work trips in the United States is the widening jobs-housing imbalance, a spatial mismatch between the location of jobs and the location of affordable housing.

This imbalance has several causes. It stems, in part, from fiscal and exclusionary zoning policies implemented by many suburban communities that favor commercial and industrial land uses and large lot zoning.[6] The fiscal zoning policies may reduce the number of homes close to employment centers or reduce density, forcing urban development farther from the employment centers, thereby increasing the length of the commute and congestion. The exclusionary zoning policies often drive housing prices upward and make housing less affordable to low-income or even middle-income workers who may like to live near work in the suburban employment centers.

Some policies can mitigate these undesirable effects. Initiatives at the private, local, regional, and state levels, such as inclusionary mixed-use zoning, growth phasing that ties job expansion to housing production, regional tax-sharing programs that remove the fiscal incentive for commercial growth at the expense of residential development, and fair-share housing laws, are recommended by Cervero (1989) to close the jobs-housing gap.

Each of these policies has been employed in various parts of the United States, with some indications of success. Broadly speaking, urban form has a significant effect on **vehicle-miles traveled** (**VMT**), according to Bento et al.[7] Population centrality, city shape, and road density are among factors that can significantly impact household annual VMT.

Journey-to-work has, therefore, become one of the central issues in economic development analysis since human capital constitutes an increasing part of the production costs for goods and services in the information age. Journey-to-work affects human capital in several ways that have not always been appreciated in policy discussions. Longer commutes mean that workers are more tired and distracted on the job, and additional commute time reduces the time available for acquiring new skills. Attention has especially been focused on policy strategies concerning regional jobs-housing balances to shorten the length of the journey-to-work.

The Geographic Approach: Acquire

Journey-to-work is a term used to describe commuting between the place of work and the place of residence of the labor force. Many countries collect journey-to-work data as part of their population censuses. In the United States, the decennial census collects information about where people work, what time they leave for work, how they travel, and how long it takes them to get there.[8] Journey-to-work data are also part of the American Community Survey (ACS). The data available at the census tract level include travel time to work, means of transportation, and time leaving home to go to work. These data can be downloaded from the American Factfinder websites; see the sidebar, "Relationships among different geographies," in chapter 5.

Commuting data and their uses

These journey-to-work data are used by government agencies at all levels for economic, transportation, and environmental planning. For example, these data are used by the US Bureau of Economic Analysis to define economic areas[9] and by the US Census Bureau to define metropolitan statistical areas based on the commuting patterns between and within counties. State, regional, and metropolitan planning organizations (MPOs) use these data to design programs for reducing peak-hour traffic congestion, energy consumption, and the emission of vehicle pollutants. Emergency management officials, mitigation planners, and police and fire departments use the journey-to-work data along with place-of-work data to plan for emergency evacuations in case of disasters.

Measuring imbalance in jobs-housing

While the study of regional jobs-housing balance has gained a great deal of popularity, controversies revolve around how this is to be properly defined and measured. One common measure of jobs-housing balance is the *ratio of jobs to housing units in the area,* with a value of one (and up to 1.5, according to Cervero) representing an area with appropriate balance. However, as Giuliano (1991)[10] notes, a ratio of one may still result in long journey-to-work times if the *mix* of jobs and housing is not compatible. To achieve job-housing balance, the available housing choices should match the earning potential of available jobs in an area. On the other hand, not all commuting to workplaces outside of the area should be considered jobs-housing mismatches. For example, commuting to neighboring areas does not contribute to jobs-housing imbalance if these neighboring areas are within walking distance (the next census tract, for example) and no vehicle traffic is generated (Peng 1997).[11] Another common measure of jobs-housing imbalance is "wasteful commuting,"[12] the difference between the actual commuting and the theoretical minimum commute to connect workers to jobs in a given area. Using journey-to-work data from the 1980 Census, Hamilton (1982, 1989) revealed a very imbalanced urban America, with 90 percent wasteful commuting. White[13] found a much lower amount (11 percent) of wasteful commuting in urban America, using the same data but a different model.

The disparity in these findings provides an example of the importance of properly measuring the jobs-housing balance to derive consistent results. Overwhelmingly, studies pertaining to jobs-housing balance use journey-to-work data at aggregate levels from the census. This represents a problem in terms of the statistical estimation of the jobs-housing imbalance. This is called the modifiable areal unit problem—a statistical bias introduced when data about individuals (such as locations of jobs and housing) are aggregated into areal levels (such as census tracts or counties) for analyses. It causes the results to vary according to the numbers and sizes of the areas used in the statistical analyses. As a result, the larger the areal unit used in a study (for example, census tracts versus census block groups; see the sidebar, "Relationships among different geographies," in chapter 5), the more balanced the area will appear in terms of jobs and housing. Using individualized, scale-invariant journey-to-work data, as supported by GPS, will help to avoid this problem, bring greater consensus to the literature on jobs-housing balance, and make transit policies more effective.[14]

ArcGIS Data Interoperability for Desktop and regional economic development

ArcGIS for Desktop includes an extension called Data Interoperability that allows the software to read data in nonnative formats. These nonnative formats include MapInfo TAB files. They also include many formats in which GPS data may be gathered. The significance of data interoperability for economic development is particularly evident at the regional level. Regional economic development officials may find themselves in the position of having to assemble a dataset from different localities that each uses a different format for maintaining GIS records. This can be a daunting task, which is made easier using ArcGIS Data Interoperability for Desktop and automated geoprocessing workflows (including ModelBuilder), as outlined in chapter 3.

Transit-oriented development

Transit-oriented development is the conscious policy of locating a mix of employment and residences within easy access of transit infrastructure. This is another broad policy designed to alleviate excess commuting. It is hoped that such measures will improve regional mobility and ease transportation constraints on further economic development in urban areas.

To some extent market forces tend to result in firms and people locating near transit infrastructure. The bulk of biotech firms mapped in chapter 1 are concentrated near major highways. Also, the greatest density of population as mapped in chapter 1 is close to major highways.

The Geographic Approach: Examine

Despite the significance of journey-to-work analysis, reliable data at the individual level are difficult to find. Travel surveys are conducted every ten years or so in large cities around the world to obtain individual travel data and to better understand analyses involving journey-to-work. Traditional travel surveys are very time-consuming and costly, requiring participants to fill out many pages of travel diaries on where they have been and at what times they were there during a survey day. Quite often, participants miss some short trips, report trips out of sequence, and approximate departure and arrival times. Furthermore, individual travel surveys may not serve the purposes of a particular business or economic development agency.

Because GPS can accurately record time and location, the technology is supplementing and may eventually replace traditional travel surveys in providing individual journey-to-work data.

How GPS promotes better journey-to-work analysis and commuter policy

GPS can be used to generate highly relevant data, and GIS can be employed to analyze these data. How well and easily do the two technologies work together?

Travel survey data generated using GPS technology can be imported into a GIS program to provide important journey-to-work information such as departure time, arrival time, travel time, workplace location, travel mode, and even trip purpose. Some of these attributes (such as departure and arrival times) are easy to obtain solely from GPS data, while others (such as travel mode and trip purpose) require development of software tools to figure them out. Although attention in the field is still focusing on how to better implement GPS into travel surveys, there have

Data formats

Data come to the economic development official in many formats, as shown in table S6-1.

Table S6-1. Common data formats

Format	Extension	ArcGIS capability
Data Base (dBase) format	.dbf	read directly
Text (ASCII) format	.txt	data interoperability
Microsoft Excel (1997-2003) Workbook	.xls	read directly
Microsoft Excel Workbook	.xlsx	data interoperability
Comma separated values	.csv	data interoperability
Shapefile	.shp	read directly
Digital photograph (joint photographic experts group)	.jpg or .jpeg	read directly
Digital photograph (tagged image file format)	.tiff	read directly
Digital photograph (graphics interchange format)	.gif	read directly
ArcGIS compression format	.sdx	read directly

been some early and promising attempts in developing algorithms and methodologies to extract as much journey-to-work information as possible from the GPS travel survey data.

For example, in one study designed to identify the purpose of 151 vehicle-based trips in the Atlanta metropolitan region, only ten trips (7 percent of the total) were incorrectly assigned a trip purpose.[15] In Toronto, a trip reconstruction software tool was developed to identify four travel modes (walk, bicycle, bus, and car) by travelers in the downtown area. The result was that 92 percent of all trip modes were correctly identified.[16] In New York City, Gong et al. developed a GIS algorithm to identify five travel modes (walk, car, bus, subway, and commuter rail) from person-based GPS travel data. Despite the considerable **urban canyon effect** in Manhattan, 82.6 percent of the trip modes were correctly identified.[17] A GPS receiver identifies its latitude and longitude by locating three or more satellites, calculating the distance to each, and deducing its location through trilateration. Given the speed of the radio signal from the satellite, the distance is determined by the travel time of the signal from the satellite to the receiver. In urban environments with urban canyons created by tall buildings, radio signals may bounce off the surrounding buildings on their way down, causing the receiver to derive longer time and distances than they actually are and therefore identifying an inaccurate location.

The Geographic Approach: Analyze

This section discusses methods used to infer the nature of an individual's daily travel patterns and transportation mode. The example used here of GPS data concerning journey-to-work from New York City will employ data interoperability (see the sidebar on data interoperability in this chapter), Esri Business Analyst Desktop (BA Desktop) (see chapter 2), and additional data.

Importing GPS data into ArcGIS for the New York City example

Two days of journey-to-work data in New York City were recorded by a handheld GPS logger. About the size of a cell phone, the GPS logger was carried in the commuter's pocket (we will call her Mary). The GPS unit was preset to record Mary's position every second. For privacy reasons, the home address and name of the commuter have been modified for this example.

The data were generated in .csv format. These files, called **traces,** were imported into a spreadsheet and formatted for use in ArcGIS. An example of the formatting involved is making sure that the latitude and longitude have the correct sign: positive for latitude (+40.76 degrees) and negative for longitude (-73.83 degrees) to account for Mary's location in the northern and western hemispheres. Once the data were properly formatted in a spreadsheet, the **Add XY Data** tool in ArcGIS was used to import the spreadsheet data and transform the latitude and longitude coordinate pairs into digital points.

Figures 6-2, 6-3a, and 6-3b show the GPS traces for day one and day two of Mary's journey-to-work trips, respectively. Figure 6-2 shows that Mary made three trips on day one. She drove from home to work in the morning (the green stream of points), then went out during the lunch hour to Rego Center for shopping (the purple stream of points), and then drove from work to home in the afternoon (the blue stream of points). (Home and work are shown as circles, and shopping centers are shown as squares.) The green dot represents Mary's home, and the red dot represents her office.

On day two, Mary made two trips, as shown in figures 6-3a and 6-3b. These GPS traces have been cleaned to remove inaccurate GPS points due to the **urban canyon effect**, which tends to cause GPS points to deviate from Mary's travel paths, and also to remove stationary points. First, she took the subway to work in the morning because her car was in a repair shop; the green stream of points recorded her walk to and from subway stations and her ride on an elevated subway train. The stream of points is divided into three segments, as shown in figure 6-3a, because the GPS logger could not receive satellite signals while the subway train was underground. After work Mary took the subway home (the blue stream of points), stopping at the Rego Center (as shown in figure 6-3b).

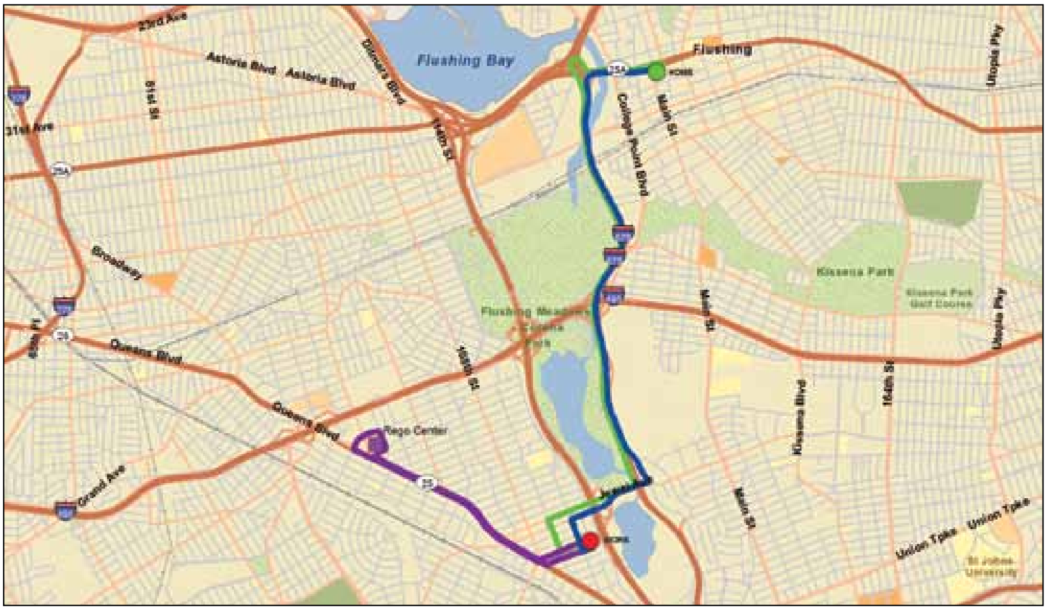


Figure 6-2. Mary's traces for three trips (from home to work, in green; lunchtime shopping at the Rego Center, in purple; and her return from work, in blue) on day one. Data displayed in screenshots of Esri Business Analyst are courtesy of Esri; US Census Bureau; Infogroup; Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK MRI; and Market Planning Solutions, Inc.

Figure 6-3a. Mary's traces (in green) for the day two trip to work via subway. Data displayed in screenshots of Esri Business Analyst are courtesy of Esri; US Census Bureau; Infogroup; Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK MRI; and Market Planning Solutions, Inc.

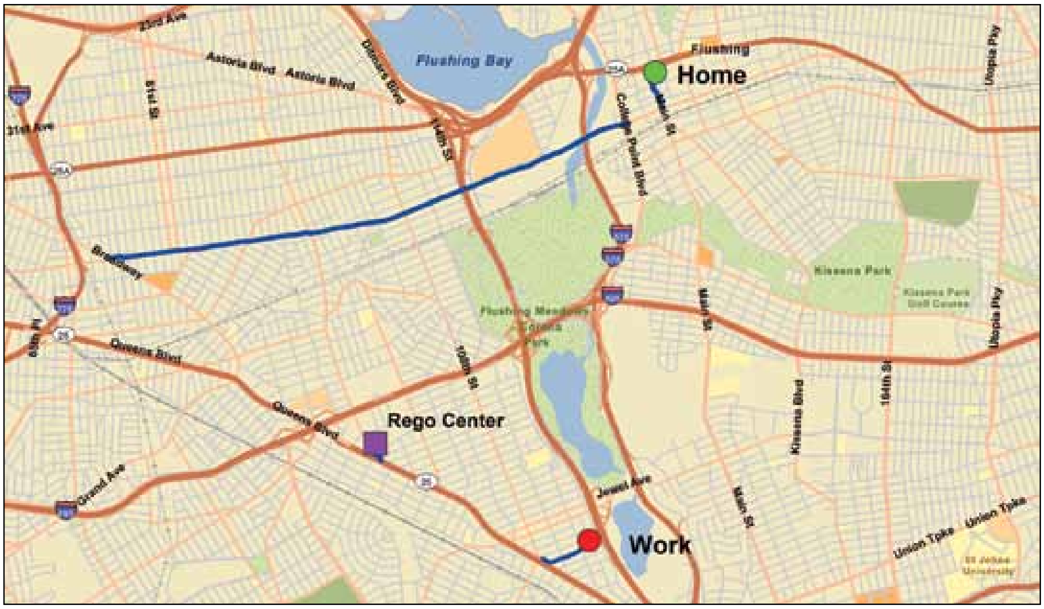


Figure 6-3b. Mary's traces (in blue) for the day two trip home from work via subway with a shopping stop. Data displayed in screenshots of Esri Business Analyst are courtesy of Esri; US Census Bureau; Infogroup; Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK MRI; and Market Planning Solutions, Inc.

Inferring trip purpose from the data

It is important to know why people take trips, known generally as the *trip purpose.* Work trips are very different from nonwork trips. For example, work trips are less flexible in terms of arrival time and destination since employees must arrive on time at the office. The workday is generally eight hours. These are the main reasons for morning and evening rush hours when the amount of vehicle traffic exceeds the capacity of the transportation networks. On the other hand, nonwork trips, such as those for shopping or social visits, are more discretionary in nature: travelers might choose one shopping center over another, travel in the morning or the afternoon, or choose to travel today or wait until tomorrow. Discretionary trips are often made during off-peak hours in order to avoid traffic and are more responsive to transportation policies such as congestion pricing, wherein higher fares are imposed during rush hours for some congested areas of cities.

Unlike time and location information, trip purpose is not inherently an attribute collected by GPS receivers. However, work trips are not difficult to identify from successive days of travel data because a commuter typically repeats the same trip each weekday and often starts and ends these trips around the same time each day. For example, Mary started her morning trips between 7 a.m. and 7:30 a.m. and arrived at her work place before 8 a.m. on both day one and day two.

Compared to traditional, diary-based travel surveys, it is much easier and less costly to use GPS to collect data for multiple days of travel since the survey participants simply need to switch on the GPS logger in the morning and switch it off at night. Most of the traditional paper surveys, by contrast, collected data for just one day due to the tremendous burdens imposed on survey participants since they were asked to write down every trip origin, destination, time period, and travel path over the course of that day.

Even though discretionary trips are more difficult to identify, start and end times of the trip, duration of the trip, and the businesses or land uses at the destination all can be used to infer the trip purpose. Take Mary's second trip on day one as an example (the purple stream of points in figure 6-2). Mary started the trip at 12:10 p.m. and ended the trip at 12:55 p.m., so it can be assumed the trip occurred during her lunch hour. BA Desktop provides a map layer depicting the locations of shopping centers. Adding the shopping center layer to the map

Figure 6-4. Detail of Mary's lunchtime shopping trip (in dark green points) on day one. Data displayed in screenshots of Esri Business Analyst are courtesy of Esri; US Census Bureau; Infogroup; Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK MRI; and Market Planning Solutions, Inc.

reveals a cluster of GPS points near the Rego Center (figure 6-4), indicating that Mary's trip purpose was for shopping. It is important to consider that she may have used the lunch hour either to buy lunch or shop for something, or a combination of both during the forty-five-minute period.

Besides providing business data to help determine why people travel, BA Desktop offers many tools for travel planning. For example, before Mary went out to the Rego Center, she may have used the drive-time trade areas tool to select a shopping center for her shopping trip on day one. Since she is using her lunch hour to do the shopping, Mary wanted to spend no more than twenty minutes traveling, including trip time, parking, and getting to and from parking to work or shopping. This means that the drive-time component of the shopping has to be very short. The Trade Area wizard from the BA Desktop toolbar allows Mary to create two trade areas within three- and eight-minute drive times from her workplace.

Figure 6-5 shows the two trade areas generated from the Drive-time Trade Area tool. The yellow trade area represents areas that can be reached within a three-minute drive-time window, and the orange trade area represents an eight-minute window. Only one shopping center, the Rego Center, falls within the three-minute drive-time trade area. Three other shopping centers, Queens Center, Queens Place, and the Shops at Atlas Park, are reachable within an eight-minute drive time. Mary decided to go to the nearby Rego Center, allowing her more time to pick a birthday present for her husband.

In addition to being useful to Mary for the purpose of shopping for a birthday present, these drive-time areas are useful for economic development analysis. Mary's work location is a major employment center. Businesses that cater to office workers on their lunch breaks (or on their trips to or from work) will be keenly interested in knowing who can reach them within a three- or eight-minute drive. Furthermore, economic development officials will be interested in knowing what kinds of businesses might be attracted to concentrations of employees who can patronize these businesses during lunch breaks or on trips to and from work.

The drive-time polygons have an irregular shape because the travel speed varies with the streets. The polygons stretch out along major streets where travel speeds tend to be higher.

Figure 6-5. Shopping Centers within a three-minute drive time (yellow area) from Mary's office (eight-minute drive-time areas also shown, in orange). Data displayed in screenshots of Esri Business Analyst are courtesy of Esri; US Census Bureau; Infogroup; Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK MRI; and Market Planning Solutions, Inc.

The transport link

Before identifying the travel mode, it's important to determine the transport link upon which an individual travels, whether it is a street, highway, or railroad segment. When a transport link is heavily used and congested, it becomes a traffic bottleneck that lengthens the journey-to-work time and imposes transportation constraints on economic development in urban areas.

Sophisticated techniques match GPS streams to transport links. The basic idea is to find the transport link that most closely coincides with a given GPS stream. A simple example is here. On day two, Mary walked on Seventy-First Avenue from the subway station to her workplace in the morning (the green stream of GPS points at the lower-right corner of figure 6-3a). When viewed in detail, as in figure 6-6, the GPS points appear mostly

Figure 6-6. Mary's trace from the subway station at Queens Boulevard to her work place on 113th Street on day two. Data displayed in screenshots of Esri Business Analyst are courtesy of Esri; US Census Bureau; Infogroup; Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK MRI; and Market Planning Solutions, Inc.

Table

Day2Trip1S3

VALID	LATITUDE	LONGITUDE	SPEEDKMH	HDOP	NSATUSED	NEAR_FID	NEAR_DIST	NEAR_FC
DGPS	40.722197	-73.842289	5.04	1.3	7	53	0.000139	71stAVE
DGPS	40.722203	-73.842277	4.376	0.97	8	53	0.00014	71stAVE
DGPS	40.722214	-73.842259	4.944	1.3	7	53	0.000145	71stAVE
DGPS	40.722213	-73.842244	4.154	1.3	7	53	0.000139	71stAVE
DGPS	40.722218	-73.842224	5.42	1.9	6	53	0.000137	71stAVE
DGPS	40.722226	-73.842199	6.011	1.9	6	53	0.000136	71stAVE
DGPS	40.722234	-73.842174	6.771	1.9	6	53	0.000135	71stAVE
DGPS	40.72224	-73.842145	7.669	1.9	6	53	0.000131	71stAVE
DGPS	40.722251	-73.842122	6.237	1.2	7	53	0.000134	71stAVE
DGPS	40.722251	-73.842111	5.971	1.9	6	53	0.00013	71stAVE
DGPS	40.72226	-73.842101	4.747	1.2	7	53	0.000135	71stAVE
DGPS	40.722269	-73.842087	5.211	1.9	6	53	0.000139	71stAVE
DGPS	40.722274	-73.842065	6.388	1.9	6	53	0.000137	71stAVE

0 (0 out of 375 Selected)

Day2Trip1S3

Figure 6-7. Output of the Near tool analysis applied to Mary's trace to work on day two. Data displayed in screenshots of Esri Business Analyst are courtesy of Esri; US Census Bureau; Infogroup; Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK MRI; and Market Planning Solutions, Inc.

between Seventieth Avenue and Seventy-First Avenue because of the urban canyon effect. Figure 6-6 shows the GPS points in solid light green dots within the section bounded by Seventieth Avenue, Seventy-First Avenue, Queens Boulevard, and 113th Street.

The GPS points can be matched to a street segment using the **Near tool**—one of the proximity tools in the ArcToolbox. This tool is used in the analysis in chapter 8. Using Near tool analysis, almost all GPS points were matched to Seventy-First Avenue, indicating that Mary traveled from the subway station to her workplace via Seventy-First Avenue. The output of the Near tool is shown in figure 6-7.

Travel mode

The transportation mode that people take to travel to work, whether it is walking, driving, or taking a bus or subway, is an important component of journey-to-work information. Different travel modes reveal their unique patterns in the GPS traces, making it possible for the analyst to use GIS to decipher which mode was used. A number of attributes can be used to help make this determination. First, *speed* provides information about the travel mode. For example, driving is much faster than walking. The average driving speed in New York City is 16.4 miles/hour, or 7.3 meters/second (24 feet/second), while the average walking speed is only 3.5 miles/hour, or 1.6 meters/second (5.2 feet/second). [18]

Figure 6-8 shows Mary's travel near her workplace on day one (the more widely spaced blue points represent driving) and day two (the green points represent walking). In general, the blue points are farther apart than the green points since the GPS logger was set to record locations in one-second intervals; the results reflect the faster travel speeds inherent to driving. Using the **Measure tool** in ArcGIS, it can be determined that the two blue points in the middle of figure 6-8 are approximately 12.2 meters apart, reflecting a travel speed of 12.2 meters/second (39.7 feet/second)—this is much closer to the average driving speed (7.3) than walking speed (1.6) in New York City.

Where GPS traces contain significant lengths of missing data, it can be assumed that the trip included some time spent on an underground train. Driving through a tunnel by car would also cause a brief loss of GPS signals, usually about five to ten minutes, depending on the length of the tunnel, but this signal gap is much shorter than that for the subway mode. Comparing Mary's journey-to-work trip on both days shows that there are no GPS signal gaps on day one (figure 6-2), since Mary drove her car to work, while there are lengthy GPS signal gaps on day two (figures 6-3a and 6-3b) when she took the subway to work.

Mary's trip from her workplace to home on day two can be used as an example to explore this further (figure 6-3b). The reproduced map in figure 6-9 includes selected subway stops (yellow dots). The first stream of blue GPS points at the bottom of the map shows Mary walking from her workplace to the Forest Hills subway station. The

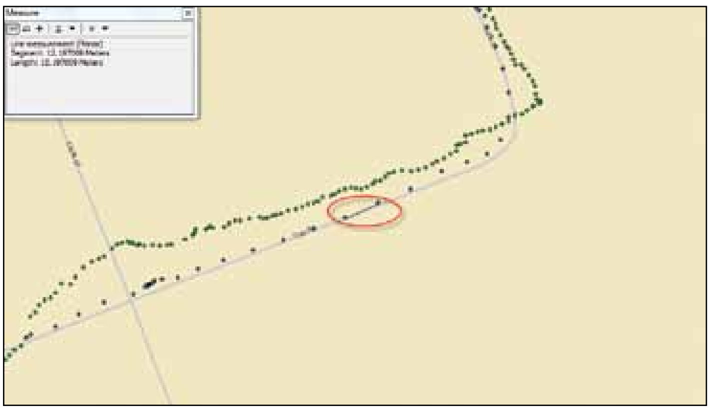


Figure 6-8. Using the Measure tool to determine speed, in this case, the speed of Mary's travels near her workplace. Data displayed in screenshots of Esri Business Analyst are courtesy of Esri; US Census Bureau; Infogroup; Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK MRI; and Market Planning Solutions, Inc.

Figure 6-9. Understanding Mary's traces (in blue) for the day two trip from work (red circle) to home (green circle) via subway, with a shopping stop at Rego Center (purple square). Data displayed in screenshots of Esri Business Analyst are courtesy of Esri; US Census Bureau; Infogroup; Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK MRI; and Market Planning Solutions, Inc.

Figure 6-10. Changes in the speed of the subway indicated by the spacing of GPS trace points (in blue). Data displayed in screenshots of Esri Business Analyst are courtesy of Esri; US Census Bureau; Infogroup; Bureau of Labor Statistics; Applied Geographic Solutions, Inc.; Directory of Major Malls, Inc.; GfK MRI; and Market Planning Solutions, Inc.

GPS traces disappear between the Forest Hills station and the Rego Park station (in purple) since Mary was in an underground train and the GPS logger could not establish latitude and longitude coordinates from the satellites. The second stream of GPS points shows a short trip between the Rego Park station and the Rego Center, when Mary got off the subway and went to the shopping center to exchange the birthday present purchased on day one. The GPS signal was lost again between the Rego Park station and the Roosevelt station, shown on the left side of the map, until Mary transferred to a subway line whose path includes elevated tracks above ground level. The GPS logged the third stream of points on the elevated train until it went to the underground Flushing station, showing a brief GPS signal loss right before Mary exited the subway at Flushing station. The last stream of GPS points indicate that Mary walked home from the Flushing station.

GPS points are closer to each other near the stations as the train slows down when approaching the stations and speeds up when departing the stations (as shown in figure 6-10 for selected stations on the elevated portion of Mary's day two return home). These same patterns can be found for above-ground trains (commuter trains or elevated subway trains) or buses in the proximity of stations or stops. This can be differentiated from driving or walking since there are no regular stops with such modes. If a car or pedestrian does stop (for example, to wait for a traffic signal to turn green), this usually happens at street intersections.

The Geographic Approach: Act

This chapter showed through example how GPS can be used to study journey-to-work travels and urban transportation infrastructure for economic development. As GPS and GIS technologies continue to advance, the accuracy of GPS will minimize urban canyon effect, and GIS will offer better tools to derive more travel information from the GPS data. When cell phone towers and wi-fi can be used to supplement satellites to provide location information underground and smart phones equipped with GPS become more widely used, GPS will increasingly become an essential tool for understanding journey-to-work patterns and regional jobs-housing balance. This is evident in the increasing use of smart phones. Adam Smith, in the article "Phone Wars" in *Time* magazine (August 24, 2009), noted that the share of mobile phones that were also smart phones had doubled in three years.

Business Analyst provides many details about the demographic and economic characteristics of drive-time areas, as indicated in the materials in the appendix.

Summary

This chapter examined the intersection of two technologies, GIS and GPS. The combination of GPS and GIS holds great promise for economic development analysis. GPS increases the accuracy and lowers the cost of economic analysis involving data about commuting. GIS makes possible the analysis of these data by economic development officials. Together, these technologies can help economic development officials account for commuting, mitigate the effects of congestion, and limit wasteful commuting.

Appendix

This appendix presents two of the many reports that can be generated by Business Analyst: the Executive Summary report for the three-minute and eight-minute drive-time areas from Mary's work location and the Tapestry Segmentation report for the same drive-time areas.

The Executive Summary gives an overview of the demographic and economic characteristics of the area for the two drive-time areas.

Executive Summary

Drive Time Areas 1 — Prepared By Business Analyst Desktop

Latitude: 40.723126

Drive Time: 3, 8 minutes — Longitude: -73.83817

	0 - 3 minutes	0 - 8 minutes
Population		
1990 Population	92,270	1,289,011
2000 Population	98,895	1,508,134
2010 Population	99,825	1,555,913
2015 Population	100,729	1,580,047
1990-2000 Annual Rate	0.70%	1.58%
2000-2010 Annual Rate	0.09%	0.30%
2010-2015 Annual Rate	0.18%	0.31%
2010 Male Population	47.2%	48.8%
2010 Female Population	52.8%	51.2%
2010 Median Age	42.9	36.3

In the identified market area, the current year population is 1,555,913. In 2000, the Census count in the market area was 1,508,134. The rate of change since 2000 was 0.30 percent annually. The five-year projection for the population in the market area is 1,580,047, representing a change of 0.31 percent annually from 2010 to 2015. Currently, the population is 48.8 percent male and 51.2 percent female.

Population by Employment

Currently, 89.1 percent of the civilian labor force in the indentified market area is employed and 10.9 percent are unemployed. In comparison, 89.2 percent of the U.S. civilian labor force is employed, and 10.8 percent are unemployed. In five years the rate of employment in the market area will be 91.0 percent of the civilian labor force, and unemployment will be 9.0 percent. The percentage of the U.S. civilian labor force that will be employed in five years is 91.2 percent, and 8.8 percent will be unemployed. In 2000, 58.0 percent of the population aged 16 years or older in the market area participated in the labor force, and 0.0 percent were in the Armed Forces.

In the current year, the occupational distribution of the employed population is:

57.0 percent in white collar jobs (compared to 61.6 percent of the U.S. employment)
23.9 percent in service jobs (compared to 17.3 percent of U.S. employment)
19.1 percent in blue collar jobs (compared to 21.1 percent of U.S. employment)

In 2000, 31.0 percent of the market area population drove alone to work, and 1.8 percent worked at home. The average travel time to work in 2000 was 42.5 minutes in the market area, compared to the U.S average of 25.5 minutes.

Population by Education

In the current year, the educational attainment of the population aged 25 years or older in the market area was distributed as follows:

21.2 percent had not earned a high school diploma (14.8 percent in the U.S)
30.2 percent were high school graduates only (29.6 percent in the U.S.)
6.9 percent had completed an Associate degree (7.7 percent in the U.S.)
18.3 percent had a Bachelor's degree (17.7 percent in the U.S.)
9.9 percent had earned a Master's/Professional/Doctorate Degree (10.4 percent in the U.S.)

	0 - 3 minutes	0 - 8 minutes
Per Capita Income		
1990 Per Capita Income	$23,170	$14,752
2000 Per Capita Income	$29,459	$18,085
2010 Per Capita Income	$35,182	$22,453
2015 Per Capita Income	$41,412	$26,140
1990-2000 Annual Rate	2.43%	2.06%
2000-2010 Annual Rate	1.75%	2.13%
2010-2015 Annual Rate	3.31%	3.09%
Households		
1990 Households	44,935	469,683
2000 Households	46,308	513,208
2010 Total Households	46,076	518,350
2015 Total Households	46,275	523,682
1990-2000 Annual Rate	0.30%	0.89%
2000-2010 Annual Rate	-0.05%	0.10%
2010-2015 Annual Rate	0.09%	0.20%
2010 Average Household Size	2.14	2.97

The household count in this market area has changed from 513,208 in 2000 to 518,350 in the current year, a change of 0.10 percent annually. The five-year projection of households is 523,682, a change of 0.20 percent annually from the current year total. Average household size is currently 2.97, compared to 2.91 in the year 2000. The number of families in the current year is 362,121 in the market area.

Data Note: Income is expressed in current dollars
Source: U.S. Bureau and Census, 2000 Census of Population and Housing, ESRI forecast for 2010 and 2015. ESRI converted 1990 Census data into 2000 geography.

August 14, 2011

Made with ESRI Business Analyst

Drive Time Areas 1 | Prepared By Business Analyst Desktop
Latitude: 40.723126
Drive Time: 3, 8 minutes | Longitude: -73.83817

	0 - 3 minutes	0 - 8 minutes
Households by Income		

Current median household income is $55,507 in the market area, compared to $54,442 for all U.S. households. Median household income is projected to be $65,950 in five years. In 2000, median household income was $41,530.

Current average household income is $66,918 in this market area, compared to $70,173 for all U.S households. Average household income is projected to be $78,331 in five years. In 2000, average household income was $52,522, compared to $40,049 in 1990.

Current per capita income is $22,453 in the market area, compared to the U.S. per capita income of $26,739. The per capita income is projected to be $26,140 in five years. In 2000, the per capita income was $18,085, compared to $14,752 in 1990.

	0 - 3 minutes	0 - 8 minutes
Median Household Income		
2000 Median Household Income	$48,803	$41,530
2010 Median Household Income	$62,068	$55,507
2015 Median Household Income	$73,781	$65,950
2000-2010 Annual Rate	2.37%	2.87%
2010-2015 Annual Rate	3.52%	3.51%
Average Household Income		
1990 Average Household Income	$47,474	$40,049
2000 Average Household Income	$62,762	$52,522
2010 Average Household Income	$76,122	$66,918
2015 Average Household Income	$90,069	$78,331
1990-2000 Annual Rate	2.83%	2.75%
2000-2010 Annual Rate	1.90%	2.39%
2010-2015 Annual Rate	3.42%	3.20%
2010 Housing		
1990 Total Housing Units	47,302	491,415
2000 Total Housing Units	48,016	535,913
2010 Total Housing Units	48,742	552,889
2015 Total Housing Units	49,078	560,199
1990 Owner Occupied Housing Units	16,055	188,490
1990 Renter Occupied Housing Units	28,880	281,193
1990 Vacant Housing Units	2,387	21,748
2000 Owner Occupied Housing Units	17,565	207,037
2000 Renter Occupied Housing Units	28,743	306,171
2000 Vacant Housing Units	1,722	22,732
2010 Owner Occupied Housing Units	17,623	208,958
2010 Renter Occupied Housing Units	28,454	309,392
2010 Vacant Housing Units	2,665	34,539
2015 Owner Occupied Housing Units	17,810	211,967
2015 Renter Occupied Housing Units	28,464	311,715
2015 Vacant Housing Units	2,803	36,517

Currently, 37.8 percent of the 552,889 housing units in the market area are owner occupied; 56.0 percent, renter occupied; and 6.2 are vacant. In 2000, there were 535,913 housing units - 38.6 percent owner occupied, 57.1. percent renter occupied, and 4.2 percent vacant. The rate of change in housing units since 2000 is 0.30 percent. Median home value in the market area is $378,885, compared to a median home value of $157,913 for the U.S. In five years, median value is projected to change by 4.49 percent annually to $472,030. From 2000 to the current year, median home value change by 6.16 percent annually.

Data Note: Income is expressed in current dollars
Source: U.S. Bureau and Census, 2000 Census of Population and Housing, ESRI forecast for 2010 and 2015. ESRI converted 1990 Census data into 2000 geography.

August 14, 2011

	Whole Layer (Drive Time Areas 1)
Population	
1990 Population	1,381,281
2000 Population	1,607,029
2010 Population	1,655,738
2015 Population	1,680,776
1990-2000 Annual Rate	1.53%
2000-2010 Annual Rate	0.29%
2010-2015 Annual Rate	0.30%
2010 Male Population	48.7%
2010 Female Population	51.3%
2010 Median Age	36.7

In the identified market area, the current year population is 1,655,738. In 2000, the Census count in the market area was 1,607,029. The rate of change since 2000 was 0.29 percent annually. The five-year projection for the population in the market area is 1,680,776, representing a change of 0.30 percent annually from 2010 to 2015. Currently, the population is 48.7 percent male and 51.3 percent female.

Population by Employment

Currently, 89.3 percent of the civilian labor force in the indentified market area is employed and 10.7 percent are unemployed. In comparison, 89.2 percent of the U.S. civilian labor force is employed, and 10.8 percent are unemployed. In five years the rate of employment in the market area will be 91.2 percent of the civilian labor force, and unemployment will be 8.8 percent. The percentage of the U.S. civilian labor force that will be employed in five years is 91.2 percent, and 8.8 percent will be unemployed. In 2000, 58.1 percent of the population aged 16 years or older in the market area participated in the labor force, and 0.0 percent were in the Armed Forces.

In the current year, the occupational distribution of the employed population is:

58.5 percent in white collar jobs (compared to 61.6 percent of the U.S. employment)
23.1 percent in service jobs (compared to 17.3 percent of U.S. employment)
18.4 percent in blue collar jobs (compared to 21.1 percent of U.S. employment)

In 2000, 30.7 percent of the market area population drove alone to work, and 1.9 percent worked at home. The average travel time to work in 2000 was 42.4 minutes in the market area, compared to the U.S average of 25.5 minutes.

Population by Education

In the current year, the educational attainment of the population aged 25 years or older in the market area was distributed as follows:

20.3 percent had not earned a high school diploma (14.8 percent in the U.S)
29.5 percent were high school graduates only (29.6 percent in the U.S.)
6.9 percent had completed an Associate degree (7.7 percent in the U.S.)
19.2 percent had a Bachelor's degree (17.7 percent in the U.S.)
10.7 percent had earned a Master's/Professional/Doctorate Degree (10.4 percent in the U.S.)

Per Capita Income	
1990 Per Capita Income	$15,313
2000 Per Capita Income	$18,785
2010 Per Capita Income	$23,220
2015 Per Capita Income	$27,055
1990-2000 Annual Rate	2.06%
2000-2010 Annual Rate	2.09%
2010-2015 Annual Rate	3.10%
Households	
1990 Households	514,618
2000 Households	559,516
2010 Total Households	564,426
2015 Total Households	569,957
1990-2000 Annual Rate	0.84%
2000-2010 Annual Rate	0.09%
2010-2015 Annual Rate	0.20%
2010 Average Household Size	2.91

The household count in this market area has changed from 559,516 in 2000 to 564,426 in the current year, a change of 0.09 percent annually. The five-year projection of households is 569,957, a change of 0.20 percent annually from the current year total. Average household size is currently 2.91, compared to 2.84 in the year 2000. The number of families in the current year is 386,900 in the market area.

Data Note: Income is expressed in current dollars
Source: U.S. Bureau and Census, 2000 Census of Population and Housing, ESRI forecast for 2010 and 2015. ESRI converted 1990 Census data into 2000 geography.

August 14, 2011

Whole Layer (Drive Time Areas 1)

Households by Income

Current median household income is $56,064 in the market area, compared to $54,442 for all U.S. households. Median household income is projected to be $66,517 in five years. In 2000, median household income was $42,078.

Current average household income is $67,669 in this market area, compared to $70,173 for all U.S households. Average household income is projected to be $79,284 in five years. In 2000, average household income was $53,368, compared to $40,699 in 1990.

Current per capita income is $23,220 in the market area, compared to the U.S. per capita income of $26,739. The per capita income is projected to be $27,055 in five years. In 2000, the per capita income was $18,785, compared to $15,313 in 1990.

Median Household Income	
2000 Median Household Income	$42,078
2010 Median Household Income	$56,064
2015 Median Household Income	$66,517
2000-2010 Annual Rate	2.84%
2010-2015 Annual Rate	3.48%
Average Household Income	
1990 Average Household Income	$40,699
2000 Average Household Income	$53,368
2010 Average Household Income	$67,669
2015 Average Household Income	$79,284
1990-2000 Annual Rate	2.75%
2000-2010 Annual Rate	2.34%
2010-2015 Annual Rate	3.22%
2010 Housing	
1990 Total Housing Units	538,717
2000 Total Housing Units	583,929
2010 Total Housing Units	601,631
2015 Total Housing Units	609,277
1990 Owner Occupied Housing Units	204,545
1990 Renter Occupied Housing Units	310,074
1990 Vacant Housing Units	24,136
2000 Owner Occupied Housing Units	224,603
2000 Renter Occupied Housing Units	334,913
2000 Vacant Housing Units	24,454
2010 Owner Occupied Housing Units	226,581
2010 Renter Occupied Housing Units	337,845
2010 Vacant Housing Units	37,204
2015 Owner Occupied Housing Units	229,777
2015 Renter Occupied Housing Units	340,179
2015 Vacant Housing Units	39,320

Currently, 37.7 percent of the 601,631 housing units in the market area are owner occupied; 56.2 percent, renter occupied; and 6.2 are vacant. In 2000, there were 583,929 housing units - 38.5 percent owner occupied, 57.4. percent renter occupied, and 4.2 percent vacant. The rate of change in housing units since 2000 is 0.29 percent. Median home value in the market area is $377,232, compared to a median home value of $157,913 for the U.S. In five years, median value is projected to change by 4.56 percent annually to $471,476. From 2000 to the current year, median home value change by 6.20 percent annually.

Data Note: Income is expressed in current dollars
Source: U.S. Bureau and Census, 2000 Census of Population and Housing, ESRI forecast for 2010 and 2015. ESRI converted 1990 Census data into 2000 geography.

The Tapestry Segmentation report is based on a categorization of the population of these drive-time areas.

Tapestry Segmentation Area Profile

Drive Time Areas 1

Drive Time: 3 minutes

Prepared By Business Analyst Desktop

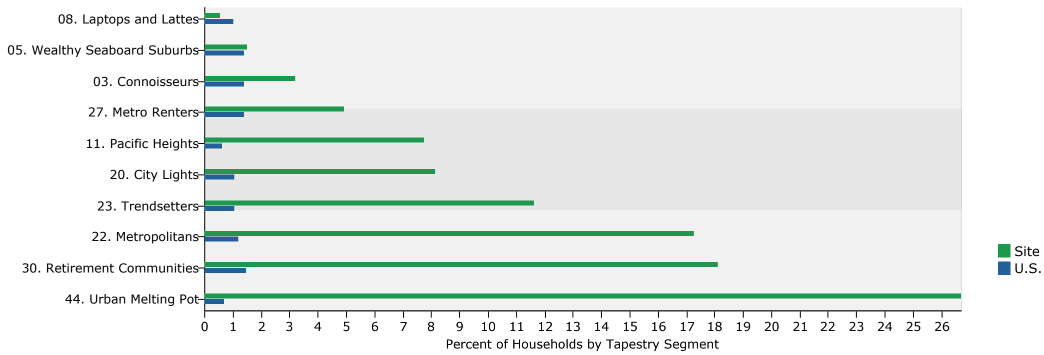
Latitude: 40.723126

Longitude: -73.83817

Top Twenty Tapestry Segments (Tapestry descriptions can be found at: http://www.esri.com/library/whitepapers/pdfs/community-tapestry.pdf)

		Households		U.S. Households		
			Cumulative		Cumulative	
Rank	**Tapestry Segment**	**Percent**	**Percent**	**Percent**	**Percent**	**Index**
1	44. Urban Melting Pot	26.7%	26.7%	0.7%	0.7%	3981
2	30. Retirement Communities	18.1%	44.8%	1.5%	2.1%	1245
3	22. Metropolitans	17.3%	62.0%	1.2%	3.3%	1455
4	23. Trendsetters	11.6%	73.6%	1.1%	4.4%	1100
5	20. City Lights	8.1%	81.8%	1.0%	5.4%	785
	Subtotal	**81.8%**		**5.4%**		
6	11. Pacific Heights	7.7%	89.5%	0.6%	6.0%	1252
7	27. Metro Renters	4.9%	94.4%	1.4%	7.4%	359
8	03. Connoisseurs	3.2%	97.6%	1.4%	8.8%	229
9	05. Wealthy Seaboard Suburbs	1.5%	99.1%	1.4%	10.1%	107
10	08. Laptops and Lattes	0.5%	99.6%	1.0%	11.2%	53
	Subtotal	**17.8%**		**5.8%**		
11	09. Urban Chic	0.4%	100.0%	1.3%	12.5%	31
12	01. Top Rung	0.0%	100.0%	0.7%	13.2%	0
13	02. Suburban Splendor	0.0%	100.0%	1.7%	14.9%	0
14	04. Boomburbs	0.0%	100.0%	2.3%	17.2%	0
15	06. Sophisticated Squires	0.0%	100.0%	2.7%	19.9%	0
	Subtotal	**0.4%**		**8.8%**		
16	07. Exurbanites	0.0%	100.0%	2.5%	22.5%	0
17	10. Pleasant-Ville	0.0%	100.0%	1.7%	24.2%	0
18	12. Up and Coming Families	0.0%	100.0%	3.5%	27.7%	0
19	13. In Style	0.0%	100.0%	2.5%	30.2%	0
20	14. Prosperous Empty Nesters	0.0%	100.0%	1.8%	32.0%	0
	Subtotal	**0.0%**		**12.0%**		
	Total	**100.0%**		**32.0%**		**313**

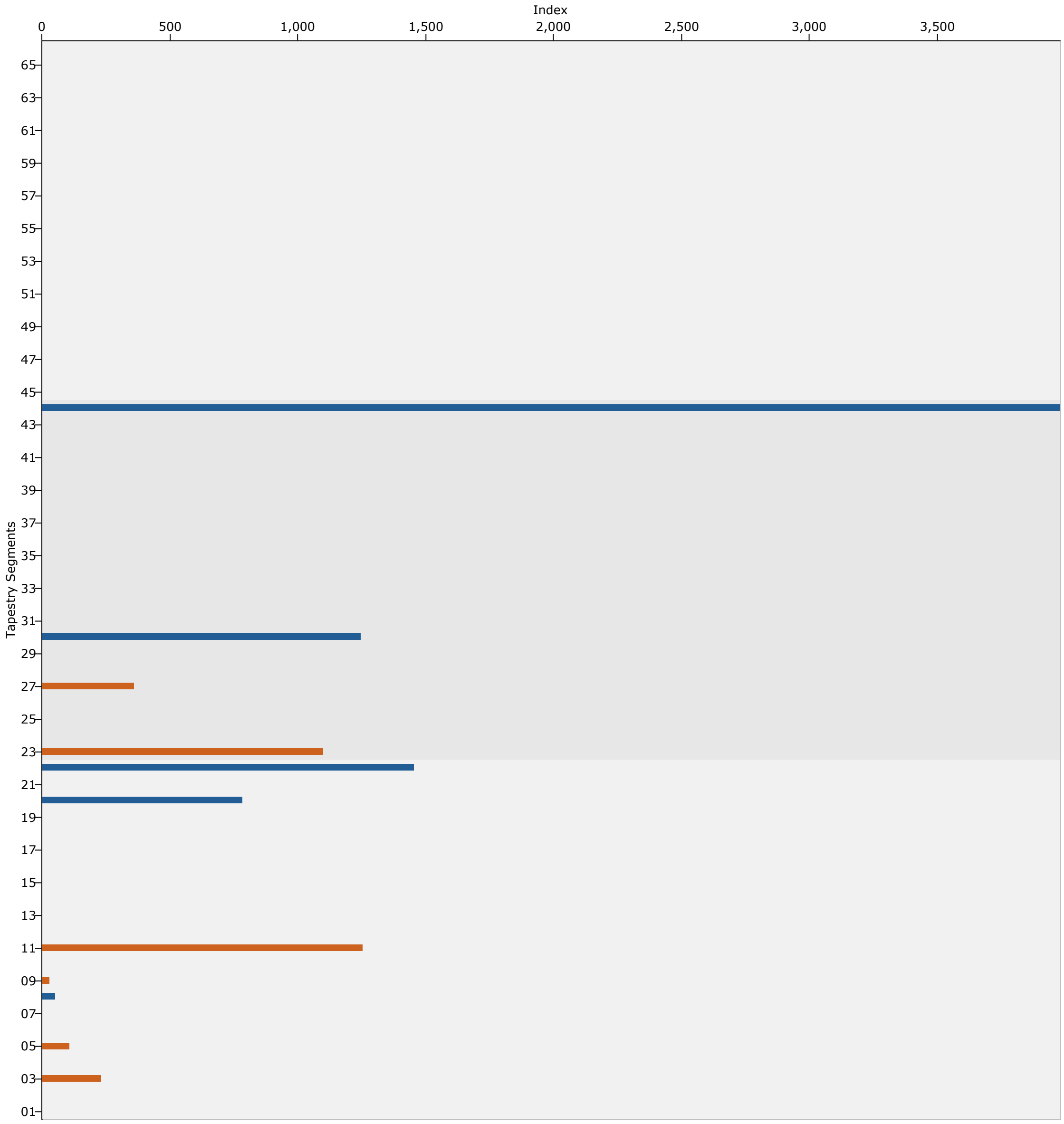
Top Ten Tapestry Segments Site vs. U.S.



Source: ESRI

August 14, 2011

Tapestry Indexes by Households



Source: ESRI

Tapestry Segmentation Area Profile

Drive Time Areas 1 | Prepared By Business Analyst Desktop
Latitude: 40.723126
Drive Time: 3 minutes | Longitude: -73.83817

Tapestry LifeMode Groups	2010 Households		
	Number	Percent	Index
Total:	46,077	100.0%	
L1. High Society	**2,145**	**4.7%**	**37**
01 Top Rung	0	0.0%	0
02 Suburban Splendor	0	0.0%	0
03 Connoisseurs	1,464	3.2%	229
04 Boomburbs	0	0.0%	0
05 Wealthy Seaboard Suburbs	681	1.5%	107
06 Sophisticated Squires	0	0.0%	0
07 Exurbanites	0	0.0%	0
L2. Upscale Avenues	**3,753**	**8.1%**	**59**
09 Urban Chic	190	0.4%	31
10 Pleasant-Ville	0	0.0%	0
11 Pacific Heights	3,563	7.7%	1252
13 In Style	0	0.0%	0
16 Enterprising Professionals	0	0.0%	0
17 Green Acres	0	0.0%	0
18 Cozy and Comfortable	0	0.0%	0
L3. Metropolis	**11,686**	**25.4%**	**484**
20 City Lights	3,736	8.1%	785
22 Metropolitans	7,950	17.3%	1455
45 City Strivers	0	0.0%	0
51 Metro City Edge	0	0.0%	0
54 Urban Rows	0	0.0%	0
62 Modest Income Homes	0	0.0%	0
L4. Solo Acts	**7,861**	**17.1%**	**251**
08 Laptops and Lattes	246	0.5%	53
23 Trendsetters	5,353	11.6%	1100
27 Metro Renters	2,262	4.9%	359
36 Old and Newcomers	0	0.0%	0
39 Young and Restless	0	0.0%	0
L5. Senior Styles	**8,338**	**18.1%**	**147**
14 Prosperous Empty Nesters	0	0.0%	0
15 Silver and Gold	0	0.0%	0
29 Rustbelt Retirees	0	0.0%	0
30 Retirement Communities	8,338	18.1%	1245
43 The Elders	0	0.0%	0
49 Senior Sun Seekers	0	0.0%	0
50 Heartland Communities	0	0.0%	0
57 Simple Living	0	0.0%	0
65 Social Security Set	0	0.0%	0
L6. Scholars & Patriots	**0**	**0.0%**	**0**
40 Military Proximity	0	0.0%	0
55 College Towns	0	0.0%	0
63 Dorms to Diplomas	0	0.0%	0

Source: ESRI

August 14, 2011

Tapestry Segmentation Area Profile

Drive Time Areas 1

Drive Time: 3 minutes

Prepared By Business Analyst Desktop
Latitude: 40.723126
Longitude: -73.83817

Tapestry LifeMode Groups	2010 Households		
	Number	Percent	Index
Total:	46,077	100.0%	
L7. High Hopes	**0**	**0.0%**	**0**
28 Aspiring Young Families	0	0.0%	0
48 Great Expectations	0	0.0%	0
L8. Global Roots	12,294	26.7%	326
35 International Marketplace	0	0.0%	0
38 Industrious Urban Fringe	0	0.0%	0
44 Urban Melting Pot	12,294	26.7%	3981
47 Las Casas	0	0.0%	0
52 Inner City Tenants	0	0.0%	0
58 NeWest Residents	0	0.0%	0
60 City Dimensions	0	0.0%	0
61 High Rise Renters	0	0.0%	0
L9. Family Portrait	**0**	**0.0%**	**0**
12 Up and Coming Families	0	0.0%	0
19 Milk and Cookies	0	0.0%	0
21 Urban Villages	0	0.0%	0
59 Southwestern Families	0	0.0%	0
64 City Commons	0	0.0%	0
L10. Traditional Living	**0**	**0.0%**	**0**
24 Main Street, USA	0	0.0%	0
32 Rustbelt Traditions	0	0.0%	0
33 Midlife Junction	0	0.0%	0
34 Family Foundations	0	0.0%	0
L11. Factories & Farms	**0**	**0.0%**	**0**
25 Salt of the Earth	0	0.0%	0
37 Prairie Living	0	0.0%	0
42 Southern Satellites	0	0.0%	0
53 Home Town	0	0.0%	0
56 Rural Bypasses	0	0.0%	0
L12. American Quilt	**0**	**0.0%**	**0**
26 Midland Crowd	0	0.0%	0
31 Rural Resort Dwellers	0	0.0%	0
41 Crossroads	0	0.0%	0
46 Rooted Rural	0	0.0%	0
66 Unclassified	0	0.0%	0

Source: ESRI

August 14, 2011

Tapestry Segmentation Area Profile

Drive Time Areas 1

Drive Time: 3 minutes

Prepared By Business Analyst Desktop
Latitude: 40.723126
Longitude: -73.83817

Tapestry Urbanization Groups	2010 Households		
	Number	Percent	Index
Total:	46,077	100.0%	
U1. Principal Urban Centers I	**27,454**	**59.6%**	**761**
08 Laptops and Lattes	246	0.5%	53
11 Pacific Heights	3,563	7.7%	1252
20 City Lights	3,736	8.1%	785
21 Urban Villages	0	0.0%	0
23 Trendsetters	5,353	11.6%	1100
27 Metro Renters	2,262	4.9%	359
35 International Marketplace	0	0.0%	0
44 Urban Melting Pot	12,294	26.7%	3981
U2. Principal Urban Centers II	**0**	**0.0%**	**0**
45 City Strivers	0	0.0%	0
47 Las Casas	0	0.0%	0
54 Urban Rows	0	0.0%	0
58 NeWest Residents	0	0.0%	0
61 High Rise Renters	0	0.0%	0
64 City Commons	0	0.0%	0
65 Social Security Set	0	0.0%	0
U3. Metro Cities I	**10,285**	**22.3%**	**197**
01 Top Rung	0	0.0%	0
03 Connoisseurs	1,464	3.2%	229
05 Wealthy Seaboard Suburbs	681	1.5%	107
09 Urban Chic	190	0.4%	31
10 Pleasant-Ville	0	0.0%	0
16 Enterprising Professionals	0	0.0%	0
19 Milk and Cookies	0	0.0%	0
22 Metropolitans	7,950	17.3%	1455
U4. Metro Cities II	**8,338**	**18.1%**	**167**
28 Aspiring Young Families	0	0.0%	0
30 Retirement Communities	8,338	18.1%	1245
34 Family Foundations	0	0.0%	0
36 Old and Newcomers	0	0.0%	0
39 Young and Restless	0	0.0%	0
52 Inner City Tenants	0	0.0%	0
60 City Dimensions	0	0.0%	0
63 Dorms to Diplomas	0	0.0%	0
U5. Urban Outskirts I	**0**	**0.0%**	**0**
04 Boomburbs	0	0.0%	0
24 Main Street, USA	0	0.0%	0
32 Rustbelt Traditions	0	0.0%	0
38 Industrious Urban Fringe	0	0.0%	0
48 Great Expectations	0	0.0%	0

Source: ESRI

August 14, 2011

Tapestry Urbanization Groups	2010 Households		
	Number	**Percent**	**Index**
Total:	46,077	100.0%	
U6. Urban Outskirts II	**0**	**0.0%**	**0**
51 Metro City Edge	0	0.0%	0
55 College Towns	0	0.0%	0
57 Simple Living	0	0.0%	0
59 Southwestern Families	0	0.0%	0
62 Modest Income Homes	0	0.0%	0
U7. Suburban Periphery I	**0**	**0.0%**	**0**
02 Suburban Splendor	0	0.0%	0
06 Sophisticated Squires	0	0.0%	0
07 Exurbanites	0	0.0%	0
12 Up and Coming Families	0	0.0%	0
13 In Style	0	0.0%	0
14 Prosperous Empty Nesters	0	0.0%	0
15 Silver and Gold	0	0.0%	0
U8. Suburban Periphery II	**0**	**0.0%**	**0**
18 Cozy and Comfortable	0	0.0%	0
29 Rustbelt Retirees	0	0.0%	0
33 Midlife Junction	0	0.0%	0
40 Military Proximity	0	0.0%	0
43 The Elders	0	0.0%	0
53 Home Town	0	0.0%	0
U9. Small Towns	**0**	**0.0%**	**0**
41 Crossroads	0	0.0%	0
49 Senior Sun Seekers	0	0.0%	0
50 Heartland Communities	0	0.0%	0
U10. Rural I	**0**	**0.0%**	**0**
17 Green Acres	0	0.0%	0
25 Salt of the Earth	0	0.0%	0
26 Midland Crowd	0	0.0%	0
31 Rural Resort Dwellers	0	0.0%	0
U11. Rural II	**0**	**0.0%**	**0**
37 Prairie Living	0	0.0%	0
42 Southern Satellites	0	0.0%	0
46 Rooted Rural	0	0.0%	0
56 Rural Bypasses	0	0.0%	0
66 Unclassified	0	0.0%	0

Data Note: This report identifies neighborhood segments in the area, and describes the socioeconomic quality of the immediate neighborhood. The index is a comparison of the percent of households or population in the area, by Tapestry segment, to the percent of households or population in the United States, by segment. An index of 100 is the US average.
Source: ESRI

Drive Time Areas 1

Prepared By Business Analyst Desktop

Latitude: 40.723126

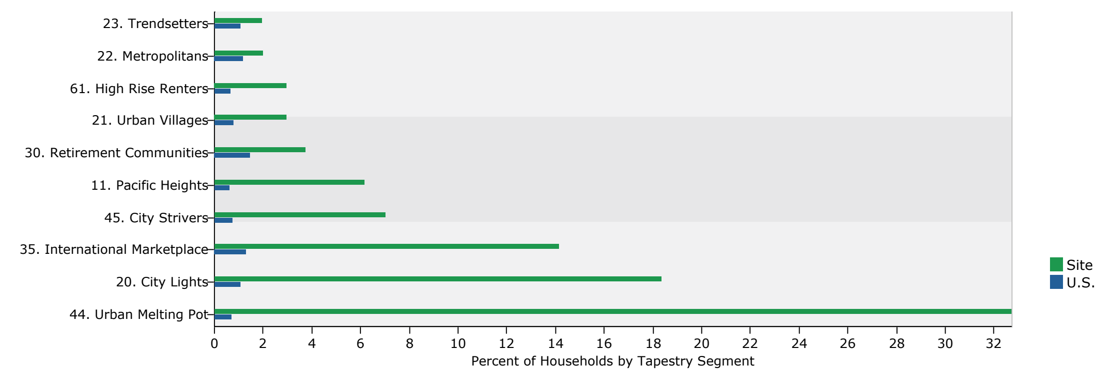
Drive Time: 8 minutes

Longitude: -73.83817

Top Twenty Tapestry Segments (Tapestry descriptions can be found at: http://www.esri.com/library/whitepapers/pdfs/community-tapestry.pdf)

		Households		U.S. Households		
			Cumulative		Cumulative	
Rank	**Tapestry Segment**	**Percent**	**Percent**	**Percent**	**Percent**	**Index**
1	44. Urban Melting Pot	32.7%	32.7%	0.7%	0.7%	4882
2	20. City Lights	18.4%	51.1%	1.0%	1.7%	1776
3	35. International Marketplace	14.1%	65.2%	1.3%	3.0%	1090
4	45. City Strivers	7.0%	72.2%	0.7%	3.7%	946
5	11. Pacific Heights	6.2%	78.4%	0.6%	4.4%	999
	Subtotal	**78.4%**		**4.4%**		
6	30. Retirement Communities	3.7%	82.1%	1.5%	5.8%	255
7	21. Urban Villages	2.9%	85.1%	0.8%	6.6%	381
8	61. High Rise Renters	2.9%	88.0%	0.7%	7.3%	441
9	22. Metropolitans	2.0%	90.0%	1.2%	8.4%	169
10	23. Trendsetters	2.0%	92.0%	1.1%	9.5%	186
	Subtotal	**13.6%**		**5.1%**		
11	05. Wealthy Seaboard Suburbs	1.4%	93.4%	1.4%	10.9%	101
12	47. Las Casas	1.0%	94.4%	0.8%	11.6%	138
13	34. Family Foundations	1.0%	95.4%	0.8%	12.5%	116
14	10. Pleasant-Ville	0.9%	96.2%	1.7%	14.2%	52
15	03. Connoisseurs	0.9%	97.1%	1.4%	15.6%	62
	Subtotal	**5.1%**		**6.1%**		
16	29. Rustbelt Retirees	0.6%	97.7%	2.1%	17.6%	30
17	58. NeWest Residents	0.5%	98.2%	0.9%	18.5%	58
18	27. Metro Renters	0.4%	98.7%	1.4%	19.9%	32
19	36. Old and Newcomers	0.4%	99.0%	1.9%	21.8%	19
20	65. Social Security Set	0.3%	99.3%	0.6%	22.5%	41
	Subtotal	**2.2%**		**6.9%**		
	Total	**99.3%**		**22.5%**		**442**

Top Ten Tapestry Segments Site vs. U.S.



Source: ESRI

August 14, 2011

Drive Time Areas 1

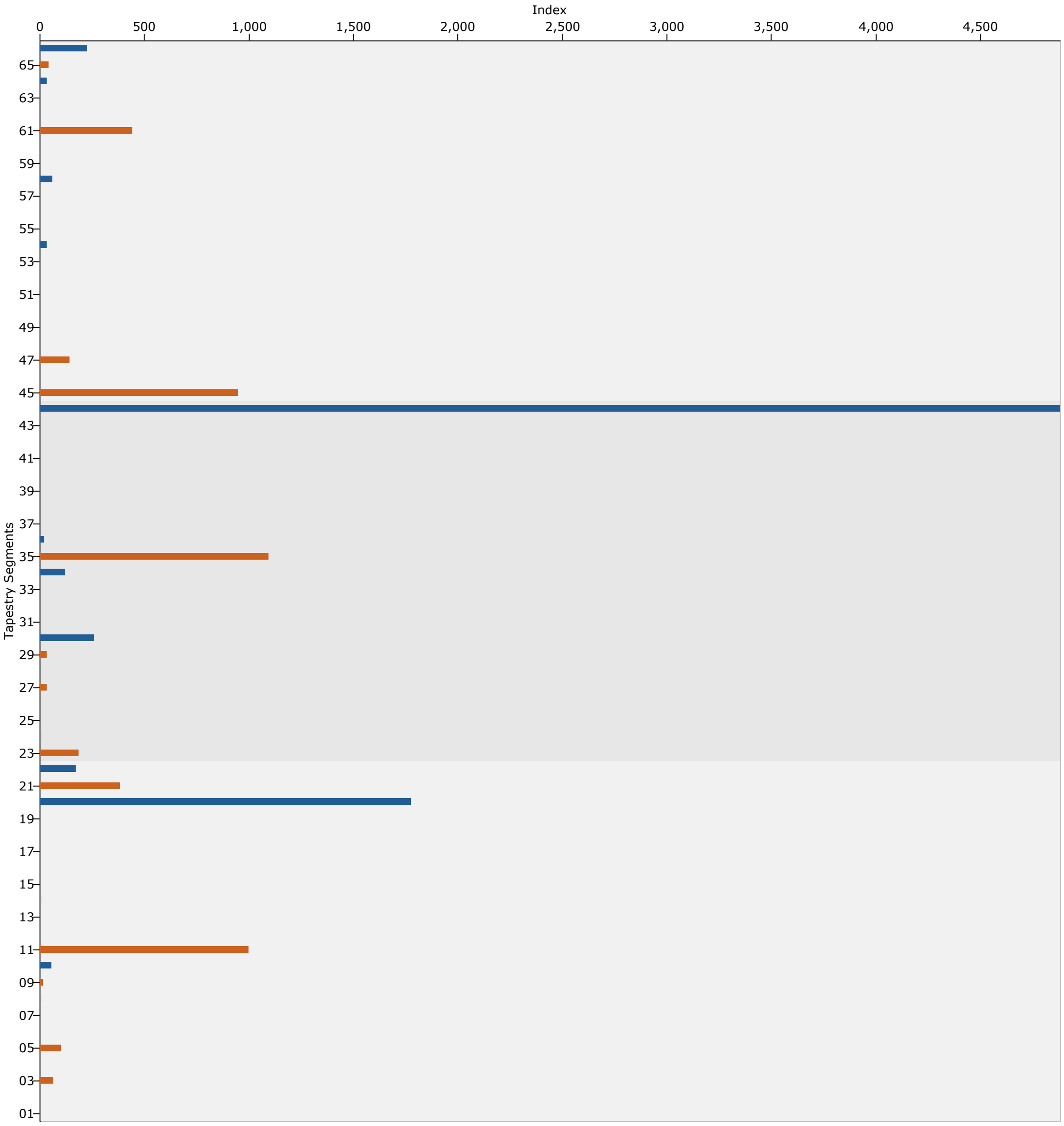
Prepared By Business Analyst Desktop

Latitude: 40.723126

Drive Time: 8 minutes

Longitude: -73.83817

Tapestry Indexes by Households



Source: ESRI

August 14, 2011

Tapestry Segmentation Area Profile

Drive Time Areas 1

Prepared By Business Analyst Desktop

Latitude: 40.723126

Drive Time: 8 minutes

Longitude: -73.83817

Tapestry LifeMode Groups	2010 Households		
	Number	Percent	Index
Total:	518,349	100.0%	
L1. High Society	**11,633**	**2.2%**	**18**
01 Top Rung	0	0.0%	0
02 Suburban Splendor	0	0.0%	0
03 Connoisseurs	4,427	0.9%	62
04 Boomburbs	0	0.0%	0
05 Wealthy Seaboard Suburbs	7,206	1.4%	101
06 Sophisticated Squires	0	0.0%	0
07 Exurbanites	0	0.0%	0
L2. Upscale Avenues	**37,349**	**7.2%**	**52**
09 Urban Chic	819	0.2%	12
10 Pleasant-Ville	4,557	0.9%	52
11 Pacific Heights	31,973	6.2%	999
13 In Style	0	0.0%	0
16 Enterprising Professionals	0	0.0%	0
17 Green Acres	0	0.0%	0
18 Cozy and Comfortable	0	0.0%	0
L3. Metropolis	**142,448**	**27.5%**	**524**
20 City Lights	95,144	18.4%	1776
22 Metropolitans	10,364	2.0%	169
45 City Strivers	36,381	7.0%	946
51 Metro City Edge	0	0.0%	0
54 Urban Rows	559	0.1%	31
62 Modest Income Homes	0	0.0%	0
L4. Solo Acts	**14,553**	**2.8%**	**41**
08 Laptops and Lattes	246	0.0%	5
23 Trendsetters	10,178	2.0%	186
27 Metro Renters	2,262	0.4%	32
36 Old and Newcomers	1,867	0.4%	19
39 Young and Restless	0	0.0%	0
L5. Senior Styles	**24,163**	**4.7%**	**38**
14 Prosperous Empty Nesters	332	0.1%	3
15 Silver and Gold	0	0.0%	0
29 Rustbelt Retirees	3,232	0.6%	30
30 Retirement Communities	19,233	3.7%	255
43 The Elders	0	0.0%	0
49 Senior Sun Seekers	0	0.0%	0
50 Heartland Communities	0	0.0%	0
57 Simple Living	0	0.0%	0
65 Social Security Set	1,366	0.3%	41
L6. Scholars & Patriots	**0**	**0.0%**	**0**
40 Military Proximity	0	0.0%	0
55 College Towns	0	0.0%	0
63 Dorms to Diplomas	0	0.0%	0

Source: ESRI

August 14, 2011

Tapestry Segmentation Area Profile

Drive Time Areas 1

Drive Time: 8 minutes

Prepared By Business Analyst Desktop
Latitude: 40.723126
Longitude: -73.83817

Tapestry LifeMode Groups	2010 Households		
	Number	Percent	Index
Total:	518,349	100.0%	
L7. High Hopes	**0**	**0.0%**	**0**
28 Aspiring Young Families	0	0.0%	0
48 Great Expectations	0	0.0%	0
L8. Global Roots	266,186	51.4%	627
35 International Marketplace	73,314	14.1%	1090
38 Industrious Urban Fringe	0	0.0%	0
44 Urban Melting Pot	169,589	32.7%	4882
47 Las Casas	5,388	1.0%	138
52 Inner City Tenants	0	0.0%	0
58 NeWest Residents	2,659	0.5%	58
60 City Dimensions	0	0.0%	0
61 High Rise Renters	15,236	2.9%	441
L9. Family Portrait	**16,405**	**3.2%**	**40**
12 Up and Coming Families	0	0.0%	0
19 Milk and Cookies	0	0.0%	0
21 Urban Villages	15,274	2.9%	381
59 Southwestern Families	0	0.0%	0
64 City Commons	1,131	0.2%	32
L10. Traditional Living	**5,587**	**1.1%**	**12**
24 Main Street, USA	515	0.1%	4
32 Rustbelt Traditions	0	0.0%	0
33 Midlife Junction	0	0.0%	0
34 Family Foundations	5,072	1.0%	116
L11. Factories & Farms	**0**	**0.0%**	**0**
25 Salt of the Earth	0	0.0%	0
37 Prairie Living	0	0.0%	0
42 Southern Satellites	0	0.0%	0
53 Home Town	0	0.0%	0
56 Rural Bypasses	0	0.0%	0
L12. American Quilt	**0**	**0.0%**	**0**
26 Midland Crowd	0	0.0%	0
31 Rural Resort Dwellers	0	0.0%	0
41 Crossroads	0	0.0%	0
46 Rooted Rural	0	0.0%	0
66 Unclassified	25	0.0%	224

Source: ESRI

August 14, 2011

Drive Time Areas 1 | Prepared By Business Analyst Desktop
Latitude: 40.723126
Drive Time: 8 minutes | Longitude: -73.83817

Tapestry Urbanization Groups	2010 Households		
	Number	**Percent**	**Index**
Total:	518,349	100.0%	
U1. Principal Urban Centers I	**397,980**	**76.8%**	**981**
08 Laptops and Lattes	246	0.0%	5
11 Pacific Heights	31,973	6.2%	999
20 City Lights	95,144	18.4%	1776
21 Urban Villages	15,274	2.9%	381
23 Trendsetters	10,178	2.0%	186
27 Metro Renters	2,262	0.4%	32
35 International Marketplace	73,314	14.1%	1090
44 Urban Melting Pot	169,589	32.7%	4882
U2. Principal Urban Centers II	**62,720**	**12.1%**	**256**
45 City Strivers	36,381	7.0%	946
47 Las Casas	5,388	1.0%	138
54 Urban Rows	559	0.1%	31
58 NeWest Residents	2,659	0.5%	58
61 High Rise Renters	15,236	2.9%	441
64 City Commons	1,131	0.2%	32
65 Social Security Set	1,366	0.3%	41
U3. Metro Cities I	**27,373**	**5.3%**	**47**
01 Top Rung	0	0.0%	0
03 Connoisseurs	4,427	0.9%	62
05 Wealthy Seaboard Suburbs	7,206	1.4%	101
09 Urban Chic	819	0.2%	12
10 Pleasant-Ville	4,557	0.9%	52
16 Enterprising Professionals	0	0.0%	0
19 Milk and Cookies	0	0.0%	0
22 Metropolitans	10,364	2.0%	169
U4. Metro Cities II	**26,172**	**5.0%**	**47**
28 Aspiring Young Families	0	0.0%	0
30 Retirement Communities	19,233	3.7%	255
34 Family Foundations	5,072	1.0%	116
36 Old and Newcomers	1,867	0.4%	19
39 Young and Restless	0	0.0%	0
52 Inner City Tenants	0	0.0%	0
60 City Dimensions	0	0.0%	0
63 Dorms to Diplomas	0	0.0%	0
U5. Urban Outskirts I	**515**	**0.1%**	**1**
04 Boomburbs	0	0.0%	0
24 Main Street, USA	515	0.1%	4
32 Rustbelt Traditions	0	0.0%	0
38 Industrious Urban Fringe	0	0.0%	0
48 Great Expectations	0	0.0%	0

Source: ESRI

August 14, 2011

Drive Time Areas 1

Drive Time: 8 minutes

Prepared By Business Analyst Desktop
Latitude: 40.723126
Longitude: -73.83817

Tapestry Urbanization Groups	2010 Households		
	Number	Percent	Index
Total:	518,349	100.0%	
U6. Urban Outskirts II	**0**	**0.0%**	**0**
51 Metro City Edge	0	0.0%	0
55 College Towns	0	0.0%	0
57 Simple Living	0	0.0%	0
59 Southwestern Families	0	0.0%	0
62 Modest Income Homes	0	0.0%	0
U7. Suburban Periphery I	**332**	**0.1%**	**0**
02 Suburban Splendor	0	0.0%	0
06 Sophisticated Squires	0	0.0%	0
07 Exurbanites	0	0.0%	0
12 Up and Coming Families	0	0.0%	0
13 In Style	0	0.0%	0
14 Prosperous Empty Nesters	332	0.1%	3
15 Silver and Gold	0	0.0%	0
U8. Suburban Periphery II	**3,232**	**0.6%**	**6**
18 Cozy and Comfortable	0	0.0%	0
29 Rustbelt Retirees	3,232	0.6%	30
33 Midlife Junction	0	0.0%	0
40 Military Proximity	0	0.0%	0
43 The Elders	0	0.0%	0
53 Home Town	0	0.0%	0
U9. Small Towns	**0**	**0.0%**	**0**
41 Crossroads	0	0.0%	0
49 Senior Sun Seekers	0	0.0%	0
50 Heartland Communities	0	0.0%	0
U10. Rural I	**0**	**0.0%**	**0**
17 Green Acres	0	0.0%	0
25 Salt of the Earth	0	0.0%	0
26 Midland Crowd	0	0.0%	0
31 Rural Resort Dwellers	0	0.0%	0
U11. Rural II	**0**	**0.0%**	**0**
37 Prairie Living	0	0.0%	0
42 Southern Satellites	0	0.0%	0
46 Rooted Rural	0	0.0%	0
56 Rural Bypasses	0	0.0%	0
66 Unclassified	25	0.0%	224

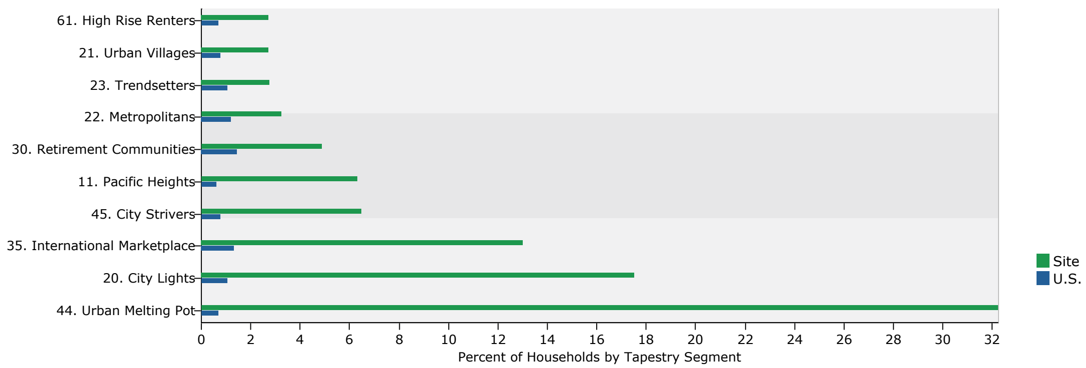
Data Note: This report identifies neighborhood segments in the area, and describes the socioeconomic quality of the immediate neighborhood. The index is a comparison of the percent of households or population in the area, by Tapestry segment, to the percent of households or population in the United States, by segment. An index of 100 is the US average.

Source: ESRI

Top Twenty Tapestry Segments (Tapestry descriptions can be found at: http://www.esri.com/library/whitepapers/pdfs/community-tapestry.pdf)

		Households		U.S. Households		
			Cumulative		Cumulative	
Rank	**Tapestry Segment**	**Percent**	**Percent**	**Percent**	**Percent**	**Index**
1	44. Urban Melting Pot	32.2%	32.2%	0.7%	0.7%	4808
2	20. City Lights	17.5%	49.7%	1.0%	1.7%	1695
3	35. International Marketplace	13.0%	62.7%	1.3%	3.0%	1001
4	45. City Strivers	6.4%	69.2%	0.7%	3.7%	868
5	11. Pacific Heights	6.3%	75.5%	0.6%	4.4%	1019
	Subtotal	**75.5%**		**4.4%**		
6	30. Retirement Communities	4.9%	80.4%	1.5%	5.8%	336
7	22. Metropolitans	3.2%	83.6%	1.2%	7.0%	274
8	23. Trendsetters	2.8%	86.4%	1.1%	8.1%	260
9	21. Urban Villages	2.7%	89.1%	0.8%	8.8%	350
10	61. High Rise Renters	2.7%	91.8%	0.7%	9.5%	405
	Subtotal	**16.3%**		**5.1%**		
11	05. Wealthy Seaboard Suburbs	1.4%	93.2%	1.4%	10.9%	101
12	03. Connoisseurs	1.0%	94.2%	1.4%	12.3%	75
13	47. Las Casas	1.0%	95.2%	0.8%	13.0%	126
14	34. Family Foundations	0.9%	96.1%	0.8%	13.9%	107
15	10. Pleasant-Ville	0.8%	96.9%	1.7%	15.6%	48
	Subtotal	**5.1%**		**6.1%**		
16	27. Metro Renters	0.8%	97.7%	1.4%	16.9%	59
17	29. Rustbelt Retirees	0.6%	98.2%	2.1%	19.0%	28
18	58. NeWest Residents	0.5%	98.7%	0.9%	19.9%	53
19	36. Old and Newcomers	0.3%	99.0%	1.9%	21.8%	17
20	65. Social Security Set	0.2%	99.3%	0.6%	22.5%	37
	Subtotal	**2.4%**		**6.9%**		
	Total	**99.3%**		**22.5%**		**442**

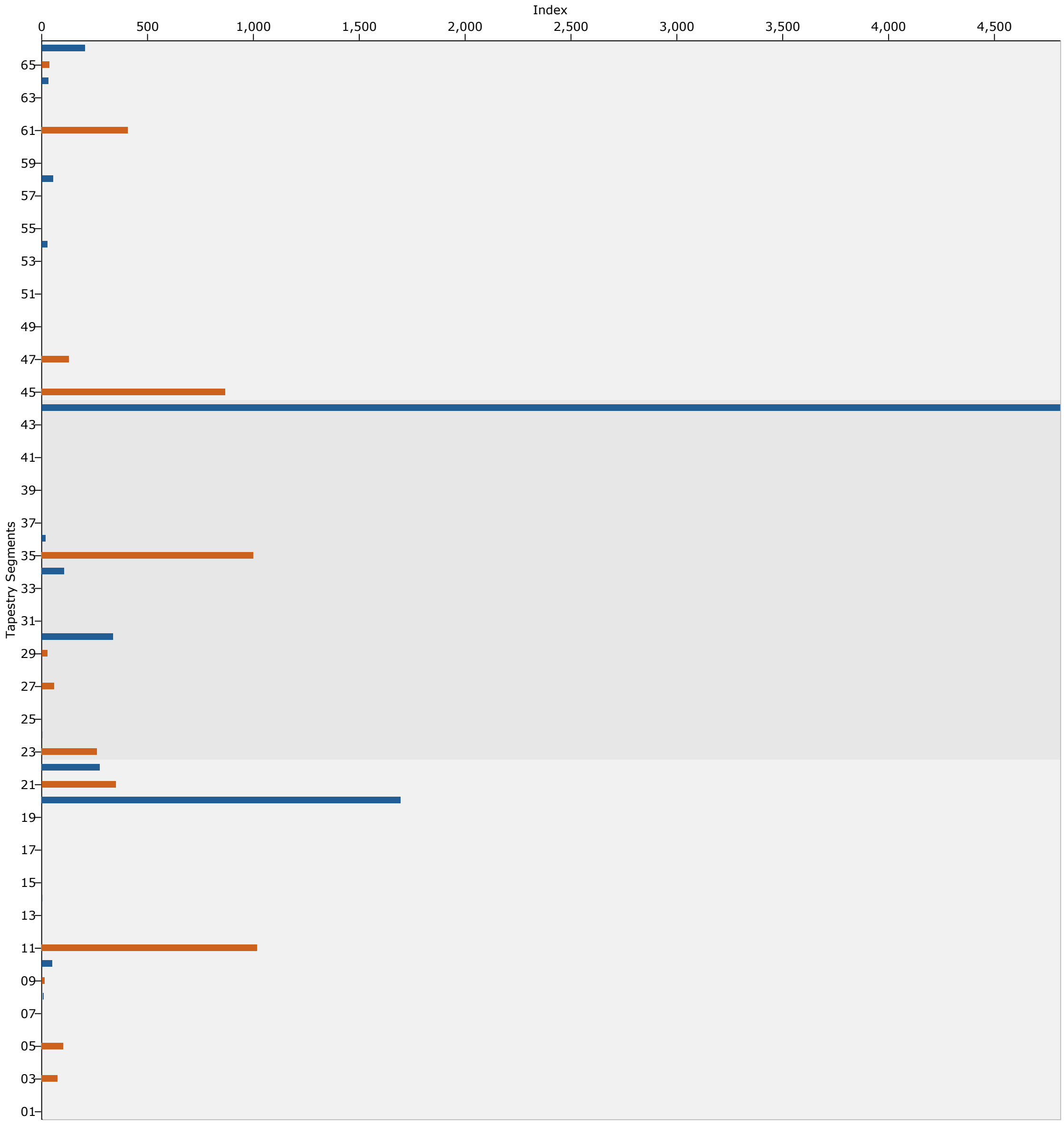
Top Ten Tapestry Segments Site vs. U.S.



Source: ESRI

August 14, 2011

Tapestry Indexes by Households



Source: ESRI

Tapestry LifeMode Groups	2010 Households		
	Number	Percent	Index
Total:	564,426	100.0%	
L1. High Society	**13,778**	**2.4%**	**19**
01 Top Rung	0	0.0%	0
02 Suburban Splendor	0	0.0%	0
03 Connoisseurs	5,891	1.0%	75
04 Boomburbs	0	0.0%	0
05 Wealthy Seaboard Suburbs	7,887	1.4%	101
06 Sophisticated Squires	0	0.0%	0
07 Exurbanites	0	0.0%	0
L2. Upscale Avenues	**41,102**	**7.3%**	**53**
09 Urban Chic	1,009	0.2%	13
10 Pleasant-Ville	4,557	0.8%	48
11 Pacific Heights	35,536	6.3%	1019
13 In Style	0	0.0%	0
16 Enterprising Professionals	0	0.0%	0
17 Green Acres	0	0.0%	0
18 Cozy and Comfortable	0	0.0%	0
L3. Metropolis	**154,133**	**27.3%**	**521**
20 City Lights	98,879	17.5%	1695
22 Metropolitans	18,314	3.2%	274
45 City Strivers	36,381	6.4%	868
51 Metro City Edge	0	0.0%	0
54 Urban Rows	559	0.1%	29
62 Modest Income Homes	0	0.0%	0
L4. Solo Acts	**22,414**	**4.0%**	**58**
08 Laptops and Lattes	492	0.1%	9
23 Trendsetters	15,531	2.8%	260
27 Metro Renters	4,524	0.8%	59
36 Old and Newcomers	1,867	0.3%	17
39 Young and Restless	0	0.0%	0
L5. Senior Styles	**32,501**	**5.8%**	**47**
14 Prosperous Empty Nesters	332	0.1%	3
15 Silver and Gold	0	0.0%	0
29 Rustbelt Retirees	3,232	0.6%	28
30 Retirement Communities	27,571	4.9%	336
43 The Elders	0	0.0%	0
49 Senior Sun Seekers	0	0.0%	0
50 Heartland Communities	0	0.0%	0
57 Simple Living	0	0.0%	0
65 Social Security Set	1,366	0.2%	37
L6. Scholars & Patriots	**0**	**0.0%**	**0**
40 Military Proximity	0	0.0%	0
55 College Towns	0	0.0%	0
63 Dorms to Diplomas	0	0.0%	0

Source: ESRI

Tapestry LifeMode Groups	2010 Households		
	Number	Percent	Index
Total:	564,426	100.0%	
L7. High Hopes	**0**	**0.0%**	**0**
28 Aspiring Young Families	0	0.0%	0
48 Great Expectations	0	0.0%	0
L8. Global Roots	278,481	49.3%	603
35 International Marketplace	73,314	13.0%	1001
38 Industrious Urban Fringe	0	0.0%	0
44 Urban Melting Pot	181,884	32.2%	4808
47 Las Casas	5,388	1.0%	126
52 Inner City Tenants	0	0.0%	0
58 NeWest Residents	2,659	0.5%	53
60 City Dimensions	0	0.0%	0
61 High Rise Renters	15,236	2.7%	405
L9. Family Portrait	**16,405**	**2.9%**	**37**
12 Up and Coming Families	0	0.0%	0
19 Milk and Cookies	0	0.0%	0
21 Urban Villages	15,274	2.7%	350
59 Southwestern Families	0	0.0%	0
64 City Commons	1,131	0.2%	30
L10. Traditional Living	**5,587**	**1.0%**	**11**
24 Main Street, USA	515	0.1%	4
32 Rustbelt Traditions	0	0.0%	0
33 Midlife Junction	0	0.0%	0
34 Family Foundations	5,072	0.9%	107
L11. Factories & Farms	**0**	**0.0%**	**0**
25 Salt of the Earth	0	0.0%	0
37 Prairie Living	0	0.0%	0
42 Southern Satellites	0	0.0%	0
53 Home Town	0	0.0%	0
56 Rural Bypasses	0	0.0%	0
L12. American Quilt	**0**	**0.0%**	**0**
26 Midland Crowd	0	0.0%	0
31 Rural Resort Dwellers	0	0.0%	0
41 Crossroads	0	0.0%	0
46 Rooted Rural	0	0.0%	0
66 Unclassified	25	0.0%	206

Source: ESRI

Tapestry Urbanization Groups	2010 Households		
	Number	Percent	Index
Total:	564,426	100.0%	
U1. Principal Urban Centers I	**425,434**	**75.4%**	**963**
08 Laptops and Lattes	492	0.1%	9
11 Pacific Heights	35,536	6.3%	1019
20 City Lights	98,879	17.5%	1695
21 Urban Villages	15,274	2.7%	350
23 Trendsetters	15,531	2.8%	260
27 Metro Renters	4,524	0.8%	59
35 International Marketplace	73,314	13.0%	1001
44 Urban Melting Pot	181,884	32.2%	4808
U2. Principal Urban Centers II	**62,720**	**11.1%**	**235**
45 City Strivers	36,381	6.4%	868
47 Las Casas	5,388	1.0%	126
54 Urban Rows	559	0.1%	29
58 NeWest Residents	2,659	0.5%	53
61 High Rise Renters	15,236	2.7%	405
64 City Commons	1,131	0.2%	30
65 Social Security Set	1,366	0.2%	37
U3. Metro Cities I	**37,658**	**6.7%**	**59**
01 Top Rung	0	0.0%	0
03 Connoisseurs	5,891	1.0%	75
05 Wealthy Seaboard Suburbs	7,887	1.4%	101
09 Urban Chic	1,009	0.2%	13
10 Pleasant-Ville	4,557	0.8%	48
16 Enterprising Professionals	0	0.0%	0
19 Milk and Cookies	0	0.0%	0
22 Metropolitans	18,314	3.2%	274
U4. Metro Cities II	**34,510**	**6.1%**	**56**
28 Aspiring Young Families	0	0.0%	0
30 Retirement Communities	27,571	4.9%	336
34 Family Foundations	5,072	0.9%	107
36 Old and Newcomers	1,867	0.3%	17
39 Young and Restless	0	0.0%	0
52 Inner City Tenants	0	0.0%	0
60 City Dimensions	0	0.0%	0
63 Dorms to Diplomas	0	0.0%	0
U5. Urban Outskirts I	**515**	**0.1%**	**1**
04 Boomburbs	0	0.0%	0
24 Main Street, USA	515	0.1%	4
32 Rustbelt Traditions	0	0.0%	0
38 Industrious Urban Fringe	0	0.0%	0
48 Great Expectations	0	0.0%	0

Source: ESRI

Tapestry Urbanization Groups	2010 Households		
	Number	Percent	Index
Total:	564,426	100.0%	
U6. Urban Outskirts II	**0**	**0.0%**	**0**
51 Metro City Edge	0	0.0%	0
55 College Towns	0	0.0%	0
57 Simple Living	0	0.0%	0
59 Southwestern Families	0	0.0%	0
62 Modest Income Homes	0	0.0%	0
U7. Suburban Periphery I	**332**	**0.1%**	**0**
02 Suburban Splendor	0	0.0%	0
06 Sophisticated Squires	0	0.0%	0
07 Exurbanites	0	0.0%	0
12 Up and Coming Families	0	0.0%	0
13 In Style	0	0.0%	0
14 Prosperous Empty Nesters	332	0.1%	3
15 Silver and Gold	0	0.0%	0
U8. Suburban Periphery II	**3,232**	**0.6%**	**6**
18 Cozy and Comfortable	0	0.0%	0
29 Rustbelt Retirees	3,232	0.6%	28
33 Midlife Junction	0	0.0%	0
40 Military Proximity	0	0.0%	0
43 The Elders	0	0.0%	0
53 Home Town	0	0.0%	0
U9. Small Towns	**0**	**0.0%**	**0**
41 Crossroads	0	0.0%	0
49 Senior Sun Seekers	0	0.0%	0
50 Heartland Communities	0	0.0%	0
U10. Rural I	**0**	**0.0%**	**0**
17 Green Acres	0	0.0%	0
25 Salt of the Earth	0	0.0%	0
26 Midland Crowd	0	0.0%	0
31 Rural Resort Dwellers	0	0.0%	0
U11. Rural II	**0**	**0.0%**	**0**
37 Prairie Living	0	0.0%	0
42 Southern Satellites	0	0.0%	0
46 Rooted Rural	0	0.0%	0
56 Rural Bypasses	0	0.0%	0
66 Unclassified	25	0.0%	206

Data Note: This report identifies neighborhood segments in the area, and describes the socioeconomic quality of the immediate neighborhood. The index is a comparison of the percent of households or population in the area, by Tapestry segment, to the percent of households or population in the United States, by segment. An index of 100 is the US average.
Source: ESRI

Notes

[1] See http://www.nextbus.com for an example.

[2] P. Stopher and S. P. Greavers, "Housing Travel Surveys: Where are we going?" *Transportation Research Part A: Policy and Practice* v. 41 (2007): 367–381.

[3] The paper by Catherine T. Lawson, Cynthia Chen, Hongmian Gong, Sowmya Karthikeyan, and Alain Kornhauser, "GPS Pilot Project—Phase One: Literature and Product Review," prepared for New York Metropolitan Transportation Council (2007).

[4] Clara Reschovsky, "Journey to Work: 2000," *Census 2000 Brief* (March 2004): 5.

[5] Robert Cervero, "Jobs-Housing Balancing and Regional Mobility," *Journal of American Planning Association* 55(2) (Spring 1989): 136–150.

[6] See J. M. Pogodzinski and Tim Sass, "The Theory and Estimation of Endogenous Zoning," *Regional Science and Urban Economics* 24 (1994): 601–630.

[7] Antonio M. Bento, Maureen L. Cropper, Ahmed Mushfiq Mobarak, and Katja Vinha, "The Effects of Urban Spatial Structure on Travel Demand in the United States," *The Review of Economics and Statistics* 87(3) (August 2005): 466–478.

[8] Clara Reschovsky, *Census 2000 Brief* (March 2004): 5, US Department of Commerce, Economics and Statistics Administration, Washington, DC.

[9] Kenneth P. Johnson and Lyle Spatz, "BEA Economic Areas: A Progress Report on Redefinition—Bureau of Economic Analysis," *Survey of Current Business* (November 1993), 77–79.

[10] Genevieve Giuliano, "Is Jobs-Housing Balance a Transportation Issue?" *Transportation Research Record*, no. 1305 (1991): 305–312.

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[12] Bruce W Hamilton, "Wasteful Commuting," *Journal of Political Economy* 90(5) (1982); "Wasteful Commuting Again," Journal of Political Economy 97(6) (1989): 1497–1504.

[13] Michelle J. White, "Urban Commuting Journeys are not 'Wasteful,'" *Journal of Political Economy* 96(5) (1988): 1097–1110.

[14] Mark W. Horner and Bernadette M. Marion, "A Spatial Dissimilarity-Based Index of the Jobs Housing Balance: Conceptual Framework and Empirical Tests," *Urban Studies* 46(3) (2009): 499–517.

[15] Jean Wolf, Randall Guensler, and William Bachman, "Elimination of the Travel Diary: An Experiment to Derive Trip Purpose from GPS Travel Data," *Transportation Research Record* no. 1768 (2001): 125–134.

[16] Eui-Hwan Chung and Amer Shalaby, "A Trip Reconstruction Tool for GPS-Based Personal Travel Surveys," *Transportation Planning and Technology* 28(5) (2005): 381–401.

[17] Hongmian Gong, Cynthia Chen, Evan Bialostozky, and Catherine T. Lawson, "A GPS/GIS Method for Travel Mode Detection in New York City," *Computers, Environment and Urban System* (2011). doi:10.1016/j.compenvurbsys.2011.05.003.

[18] Parsons Brinckerhoff Quade & Douglas, Inc., and NuStats International, "General Final Report for the RT-HIS: Regional Travel—Household Interview Survey," prepared for the New York Metropolitan Transportation Council and the North Jersey Transportation Planning Authority, Inc. (February 2000).

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