Transportation and land use are two intrinsically linked systems. A land use change or a change in the transportation network will result in consequences that are visible in the other in a very short time. These changes are happening every day as new development occurs or as transportation routes are modified. It is important that the link in the planning process is just as strong and relevant as the relationship that exists between land use and transportation in the real world.

Land use changes are obvious to local residents in the form of new buildings or redevelopment. Every land use generates traffic and, thus, increases or decreases traffic on roads or other modes of travel. Transportation improvements have near immediate impacts as they increase the locational value of some sites over competing sites. This triggers new development in the areas experiencing the improved access. Changes in transportation have short- and long-term impacts on quality of life. A change in the network might eliminate cut-through traffic in a neighborhood or bring new traffic to a neighborhood currently experiencing little cut-through traffic. For these reasons, there needs to be consideration of or dialogue between land use and transportation.

Historically, the relationship between land use and transportation has been fractured and, until recently, very few transportation projects considered the resulting land use changes and vice versa. This is beginning to be addressed at the national level as Congress, in 1991, recognized the danger to existing farmland, natural habitats, and open space by including policy goals in ISTEA that required state Departments of Transportation and Metropolitan Planning Organizations to do land use planning along with transportation planning. The norm had been that each of these planning activities was done in isolation without any cooperation or even communication. The result was large expenditures of funds to solve transportation problems caused by incompatible and often conflicting land uses. The cost of retrofitting or compensating for the mistakes of the past can often exceed the price of the original transportation improvement. It is critical that these obvious errors of the past are not repeated as Annapolis considers its future – both for land use and transportation.

In discussing transportation, there are eight modes of travel: air, heavy rail, light rail, bus, car, bicycle, foot, and water. In Annapolis, bus, car, bicycle, foot, and water transportation modes are all available to varying degrees. Commuter passenger service or heavy rail stopped servicing the City in the 1950s and freight traffic ceased in 1968. In looking at modes of travel, there are several factors that need to be considered. Among the most important are range, speed, and flexibility. Range and speed are generally linked. As speed increases, range increases, as well. The pedestrian mode is the slowest, and, while one can walk from Florida to Maine, the range of comfortable walking is a quarter-mile or 10 to 15 minutes. Bicycles go faster than pedestrians, and most of Annapolis is within a reasonable bicycling distance. Buses, then light rail (trolleys), automobiles, and heavy rail operate at increasing average speeds, and the radius that can be served increases. Flexibility is another important aspect of travel modes. All the modes that depend upon fixed routes are less flexible, both in terms of locations served and in terms of convenience. All the transit modes are entirely or largely fixed route. They are also a two-mode system that requires one mode to get to a stop and another mode to take the trip; thus, the area served is roughly a quarter-mile either side of bus or trolley lines or a half-mile radius around rail stops for heavy rail. It is likely that there will be areas outside easy walking distance that are not effectively served. The second aspect of flexibility is convenience. The pedestrian or bicyclist can decide to leave on the spur of the moment and change routes. Transit has a schedule, so one may have to wait a long time to be able to board the transit vehicle. The term headway is used to describe the time between vehicles arriving at a given stop. Not surprisingly, if a person has choice, they will choose the mode of travel that is convenient.

Figure 1
Impact of Cars on an Urban Street

Annapolis is a nearly ideal city for transit – it has high densities, major employers, and tourists that are essential to support transit and an existing system. While the non-automotive mode shares are higher than the national average, the vast majority of work trips are by single-occupancy automobile. Transportation was the focus of most of the negative complaints of most groups involved in Let's Talk Annapolis and many people that have met with the consultant team. In approaching the problem of transportation, it is important to understand constraints. Parking is closely linked to the mode of travel and transportation. Parking, particularly in the historic district with its very narrow streets, is also a land use and community character issue. **Figure 1, Impact of Cars on an Urban Street,** shows the impact of the car on what is an ideal urban street. How much more attractive this would be if cars did not line the street nearly continuously? This paper seeks to outline critical elements of the transportation problem as it relates to land use.

The travel modes that seem to need most discussion in terms of decision-making are automobile, bus, pedestrian, and bicycle.

As this paper turns to possible strategies, we have not limited the discussion to traditional planning. This is a 20-year plan, but, with regard to transportation, it can seek to lay out the issue far into the future. Thus, while some of the discussion is clearly not feasible in the short term, it may well be feasible or essential in the future. For example, global environmental issues such as global warming and energy have the potential to reshape the future during the lifetime of this plan. The average European is used to paying the market rate for fuel, which is $5.00 or more per gallon of gas. While our current energy policies in the U.S. create artificially low prices, it is possible that higher market prices for all energy sources will occur in the future. Thus, the team has put forth for discussion a wider array of ideas than are normally found in the early stages of a comprehensive plan.

The City of Annapolis has a multi-modal transportation system, which offers its residents several common modes of transportation including walk, bike, transit, and water taxi, as well as cars. However, the choices are still limited due to a lack of integrated network systems in and among individual modes. Sidewalks are prevalent in the City, but the quality of sidewalks is uneven and there are missing pieces in the street system. There are designated bike lanes and routes, but they are limited and fragmented. The transit system has shown good performances compared with similar sized system elsewhere in the country, but the system is currently troubled by the lack of funding.

Transportation Issues

Major transportation issues in the Annapolis area have been identified through a variety of planning activities and studies, including, most recently, the Annapolis Regional Transportation Vision and Master Plan (ARTVaMP). In this comprehensive plan process, similar key transportation issues have also been echoed through the Citizens Advisory Committee and general public input. These issues can be organized into three basic threads: transportation system performance, balance of transportation modes, and land use-transportation linkage.

Transportation System Performance

Traffic congestion along major gateways is the most cited transportation issue in the area. Congestion and heavy traffic occur primarily in the peak periods along Forest Drive, West Street, US50/US301, and Riva Road. Major intersections in Parole also experience delays.

- Forest Drive from Hilltop Lane to Chinquapin Round Road. The latest 2006 traffic count recorded a traffic volume of approximately 70,000 Average Daily Traffic (ADT) at Forest Drive, east of the intersection with Chinquapin Round Road and Aris T. Allen Boulevard. This is the most heavily used road segment in the study area besides US50/US301. The highest hourly volume occurred between 7:00 and 8:00 in the morning for northbound traffic, carrying 3,100 vehicles in November 2006 and between 5:45 and 6:45 in the evening for southbound traffic, with 2,700 vehicles. Commuter traffic appears to be a major contributor to traffic congestion in this road segment, as confirmed by both the temporal distribution of daily traffic and Census data, which are to be discussed later. To complicate the traffic situation, a major shopping center is situated in the heavily congested road segment.

- West Street from Riva Road to Chinquapin Round Road is a typical commercial strip with numerous access points and different traffic patterns from Forest Drive. West of Chinquapin Round Road, it recorded an equivalent ADT of 35,000 in 2006, with an evening peak hour volume of 1,500 on the eastbound and 1,300 on the westbound in 2006. It has a more even temporal distribution of traffic than Forest Drive.
- US 50 /US 301 from MD450 to Rowe Boulevard is a major gateway that connects Annapolis with Baltimore, Washington, and the Eastern Shore. Its congestion is especially severe during the PM rush hours and during the weekends in the summer. Heavy congestion has spillover effects on the local street system.

Transportation-Land Use Linkage

The socioeconomic characteristics of the City of Annapolis and its surrounding areas have had profound impacts on the transportation system performance.

There are a significant number of people who are transportation disadvantaged groups in the City—16 percent households do not have vehicle, 10 percent families living in poverty, 12 percent of individuals are senior citizens, and 22 percent of individuals are juniors (17 years and younger). These groups of people have special transportation needs, which are different from the auto-dependent public. They are potentially dependent on transit.

Job-household imbalance is evident in the City and the study area as a whole and will likely continue based on the socioeconomic forecast. The study area is a major employment center consisting of the City, the Naval Academy, and the Parole Growth Management Area. The job household ratio is 2.72 for the study area, compared with 1.66 for the County as a whole. This job-household imbalance dictates the commuting patterns in the study area.

Based on the 2000 Census, the City resident workers accounted for only 30 percent of the employment in the City. Approximately 70 percent of city workers commuted from outside of the City, notably 46.6 percent from the rest of Anne Arundel County. Compared with jurisdictions in Maryland, the City of Annapolis would rank lower than Howard County, which had 42.7 percent of its jobs held by its resident workers, the lowest in the State. This high job to household ratio means that there are more people commuting into the area for work.

The City of Annapolis is also a bedroom community. Less than half of city resident workers took jobs in the City in 2000, which is similar to Carroll and Harford Counties. More than half (53.2 percent) of city resident workers commuted out of the City to their work places elsewhere in 2000. In the morning rush hours, 11,500 commuters from the City found themselves competing for space on one of only four major gateways out of the City— Forest Drive, West Street, Roscoe Rowe Boulevard, and US Naval Academy Bridge. Furthermore, 2,800 commuters from the Outer Neck at the tip of Annapolis Neck, which is part of Anne Arundel County, had no other way to get out of the Annapolis Neck except for the four gateways, particularly Forest Drive. **Table 1, Commutation Patterns,** indicates the overall commutation pattern.

Table 1
Commutation Patterns

Places	Annapolis Residents: Working Places	City Workers: Living Places
Annapolis City	46.8%	30.5%
Parole and Broadneck	13.5%	17.3%
Glen Burnie/East of I-97 Area	7.0%	15.4%
West AA County/West of I-97 Area	7.0%	5.9%
South AA County/South of US 50 Area	2.2%	8.0%
Prince George County	5.2%	3.9%
Queen Annes County	0.8%	4.2%
D.C.	5.5%	0.4%
Baltimore City	3.6%	3.1%
Baltimore County	1.0%	2.8%
Howard County	1.8%	1.8%
Other Places	5.6%	6.7%
Total	100.0%	100.0%

Source: Baker compiled from Census for Transportation Planning Package 2000

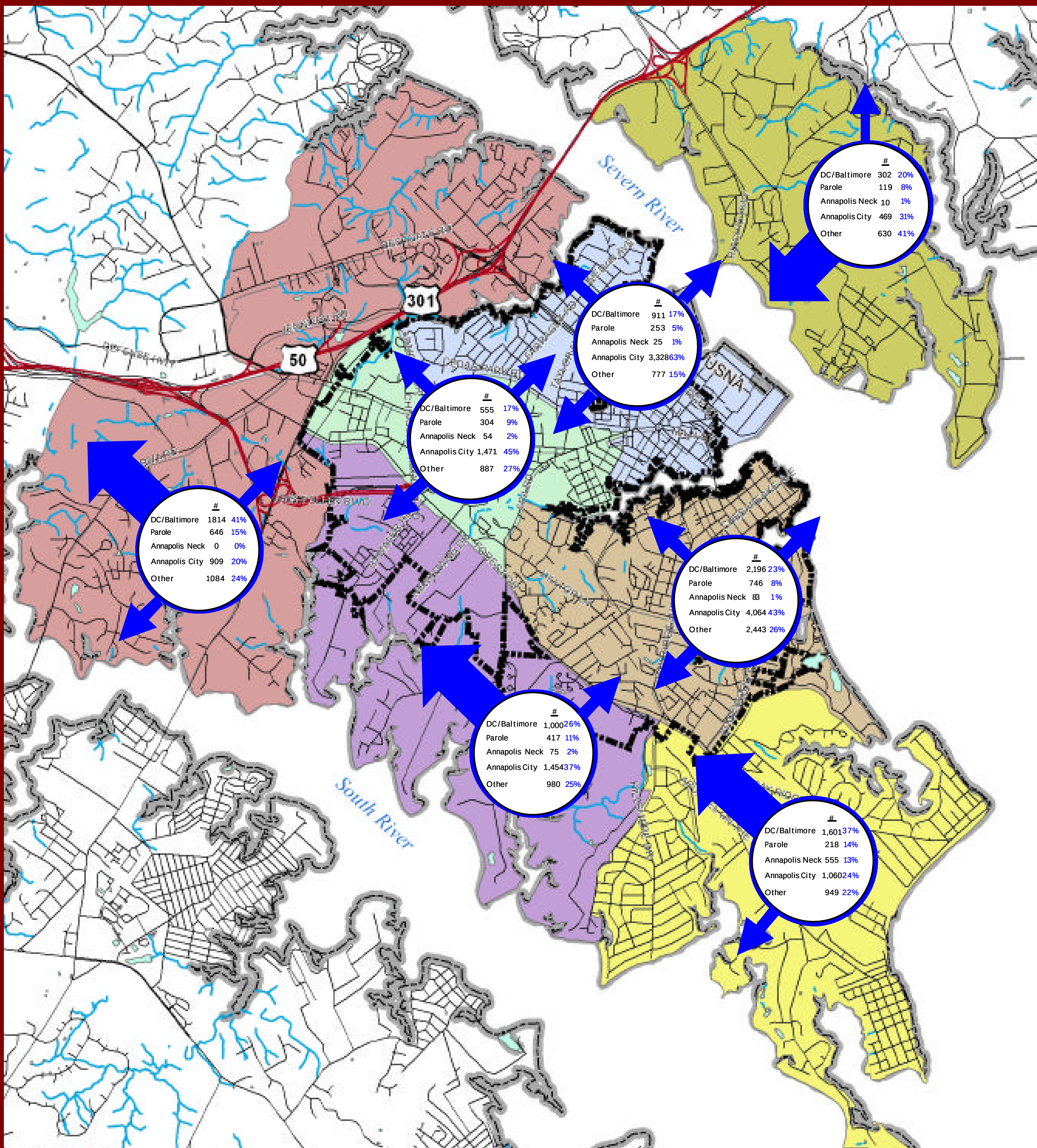
A closer look at the Census Transportation Planning Package (CTPP) data at the Travel Analysis Zone (TAZ) level paints a clear picture of the commuting patterns in the study area. Approximately 7,100 commuters from the City and 2,100 commuters from the Outer Neck area worked in the Washington D.C. and Baltimore metropolitan areas, including western and southern Anne Arundel County. These commuters will most likely use US50 westbound and I-97 northbound as their gateways to their work places. The rest of the out-commuters worked in Glen Burnie, Broadneck, the Eastern Shore, and other areas. Their gateways are US 50 eastbound, Route 2 northbound, or I-97 northbound. In summary, more than 9,000 commuters would use Forest Drive as the major commuter gateway to get out of the Neck to work elsewhere.

Various parts of the City and study area have different commuting patterns as compiled in **Figure 2, Commuting Patterns in the Study Area**. It is noteworthy that 55 percent of approximately 5,300 resident workers in the north section of the City (including downtown and Rowe Boulevard corridor) worked in the same area and an additional 14.5 percent of resident workers worked in the other parts of the study area. For the study area as a whole, 51.6 percent of resident workers worked and lived in the study area in 2000.

This data also sheds light on the Forest Drive problem. The residents most removed from the metro areas of Baltimore and Washington send a greater portion of their residents to these areas than do residents of the City. Only the Parole area has a higher percentage of people traveling to these destinations. Further, there are no real alternatives. Many City residents have several alternative routes to reach the major arterial network. Thus, the choice of residence and work place is largely responsible for the congestion of Forest Drive.

Figure 2

Commuting Patterns in the Study Area



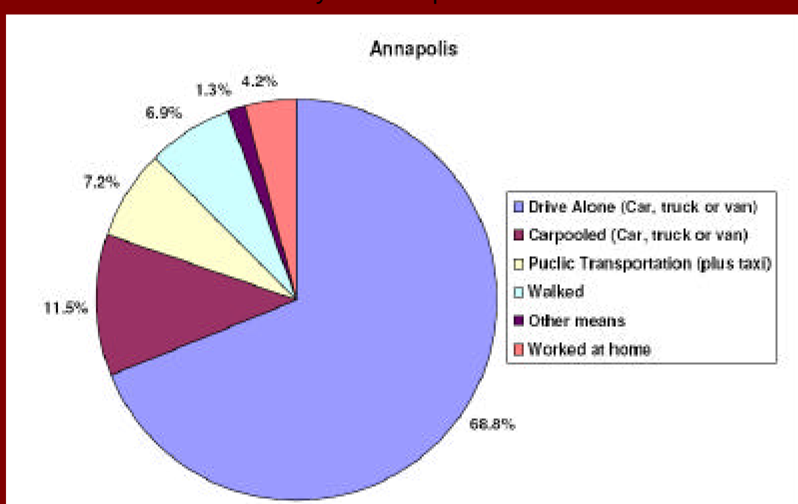
Source: Census for Transportation Planning Package 2000

Automobile Mode

The invention of automobiles and construction of interstate systems greatly expanded the space and speed of travel. US 50, also called “The Backbone of America,” was upgraded to a freeway between Washington, D.C. and Annapolis in 1957 and was named the John Hanson Highway. Since then, US 50 has served as a major gateway to the beach destinations along the Atlantic Ocean coast such as Ocean City. Additionally, US 50 increasingly serves the commuting needs of growing communities on Kent Island and the Eastern Shore to Annapolis and the rest of the metropolitan area. Some of the beach traffic has spill-over effect on the City of Annapolis during the summer. Another interstate highway, I-97 was completed in 1993, connecting Baltimore and Annapolis.

The geography and development patterns of Annapolis place a great constraint on the transportation system and how people travel, particularly in the automobile era. The City is situated in the Annapolis Neck Peninsula, surrounded on three sides by the South River to the south, Severn River to the north, and the Chesapeake Bay to the east. It is further constrained by Parole, a suburban center, to the immediate west. The gateways into and out of Annapolis are limited to four major arterials: MD655 (Aris T. Allen Boulevard)/Forest Drive, MD450 (Defense Highway and West Street), MD 70 (Rowe Boulevard), and US Naval Academy Bridge and Governor Ritchie Highway (MD450).

Figure 3
Means of Transportation for Resident Commuters
in the City of Annapolis in 2000



Source: Baker compiled from Census 2000

The single-occupancy automobile is the most prevalent method of travel in Annapolis commuting patterns as indicated in **Figure 3, Means of Transportation for Resident Commuters in the City of Annapolis in 2000**. By and large, residents of Annapolis work elsewhere and a large percentage of the workers in the City commute to jobs with the State, County, Naval Academy, and St. Johns.

Table 2, Mode of Transportation to Work, shows the current mode of transportation to work. While this is only a fraction of the daily trips, it is indicative of the methods used. Trips for food shopping are even more likely to be made by automobile. Many school or recreation trips may also be to locations that are beyond walking distance. Added to these local trips are those made by tourists moving around the community.

Annapolis is a mature community with relatively little vacant land, and a significant portion of development over the past decade was redevelopment. This has profound implications for improving the road system. The ability to make improvements, whether it is additional turn lanes or traffic circles or a new travel lane, is exceedingly limited. It can be done in coordination with major development when the developers control enough land to make it happen as part of the development process. However, restricted rights-of-way, high land costs, and the possibility of having to relocate or buy out building owners means that most options are exceedingly limited. There are limits as to what can be achieved with improved signalization.

Table 2
Mode of Transportation to Work

Mode of Commuting	Workers	Percent
Car, truck, or van – drove alone	13,200	68.8
Car, truck, or van – carpooled	2,202	11.5
Public transportation (including taxi)	1,388	7.2
Walked	1,318	6.9
Other means	254	1.3
Worked at home	812	4.2
Workers 16 years and over	**19,174**	**100**

Source: Baker compiled from Census 2000

Figure 4

Existing Annapolis Transit Routes

Source: City of Annapolis

Bus Mode

Bus service is present in the City and immediately surrounding County land, but has limitations on the area it serves. Major destinations in the planning area include downtown, state offices, the mall, hospital, campuses, county offices, and high school as shown in **Figure 4, Existing Annapolis Transit Routes**. In addition, the Naval Academy Stadium is a major staging area for tourists and special events. The current bus services serve most of these areas.

There is a significant amount of traffic going to various government offices for business purposes. What does it take to get these people to opt for riding the bus?

A major issue with trying to attract more riders is the frequency of buses (headways). A change in frequency of bus service creates an increase or decrease in ridership. Elasticity[1] is a measure of the response, with a positive elasticity indicating a gain and negative indicating a loss. Data from

[1] Elasticity is often cited as Arc Elasticity or Arc (Midpoint) Elasticity. We have shortened the term to avoid confusion.

Table 3
Elasticity

Headway	Elasticity: Decreased Service	Elasticity: Increase Service
<10 minutes	0.22	0.28
10 to 50 minutes	0.46	0.85
>50 minute	0.58	1.38

Source: TRB (2004), TCRP Report 95 Travelers Response to Transportation System Changes.

Massachusetts from the 1970s when bus service was declining is shown in **Table 3, Elasticity**. The figure also includes the elasticity that would have been achieved by a corresponding increase in service. The biggest gains are made with long headways, service increasing from once an hour to the half hour. As one approaches 10-minute headways, there are smaller gains. More recent studies form the 1990s provide a number of studies on the changes of service ranging from -.47 to +1.03. These are shown in Table 4. In Annapolis, the current service is less than hourly, so large improvements can be expected from a major increase in service. The tourists and government related trips also represent a potential to increase ridership, particularly in areas where the destinations are important to these groups.

Although survey results varied between regions, the general finding is that a ten percent improvement in bus headway time results in a five percent ridership increase.

People going to work at any large employment area have the same desires for timely service -- a sentiment illustrated in **Figure 5, Improvements Desired by Bus Riders**. While the worker going to work in the morning has the ability to stay on schedule, the timeliness is important. Nobody wants to have to go to work 45 minutes early because the bus schedule is not timely. However, short headways are costly. Thus, there is a major chicken and egg situation -- can the City afford to acquire sufficient buses and staff to provide short headways in hopes that ridership will increase? This is a major question for Annapolis to consider as this process continues.

Table 4
Bus Service Elasticities for Frequency Changes Observed in the 1980s/90s

Transit System or Route	Time Span	Headway Change (Minutes)	Service Measure	Arc Elasticity	Notes and Comments
Vancouver, WA to Portland, OR	1980	Mixed, e.g., 19-23 to 10-15; AM peak	Peak buses	+0.33 (all hours)	See description below
Charlottesville [VA] Transit System	1980-1981	From 60 to 30 in peak periods	Vehicle miles	+0.33 (all hours)	See description below
Mt. Pleasant bus route, Toronto, ON	Sept.-Nov. 1987	From 10 to 15 in peak periods and 15 to 30 evening	Headway	-0.47 pk. -0.29 off-peak	See description below and case study
Tasta to central Stavanger, Norway	early 1990s	From 30 to 15	Headway	-0.26	Headway measure gives negative sign
Santa Clarita [CA] Transit (local fixed route system)	1992/93 - 1997/98	Primarily 60 to 30 with service hours enhancements	Service (bus) hours	+1.14 (all hours)	See description below and case study
Foothill Transit, L.A., CA (system)	1993-96	Various, plus new weekend service	Service hours	+1.03 (all hours)	Frequency upped on all lines
Community Transit (Snohomish County system, WA)	1994-96	Primarily 60 to 30 plus new services as well	Service hours	Over +1.0 (see notes)	Confounding factors include U of W "U-Pass" introduction
Santa Monica, CA Big Blue Bus system	1996-98	Various, plus some new service	Service hours	+0.82 (all hours)	See description below
Lincoln Blvd. route Santa Monica, CA	March - Sept. 1998	20 to 10 (40 to 10 on link to LAX)	Service hours	+0.97	6AM-6PM; see description below

Source: TRB (2004), TCRP Report 95 Travelers Response to Transportation System Changes.

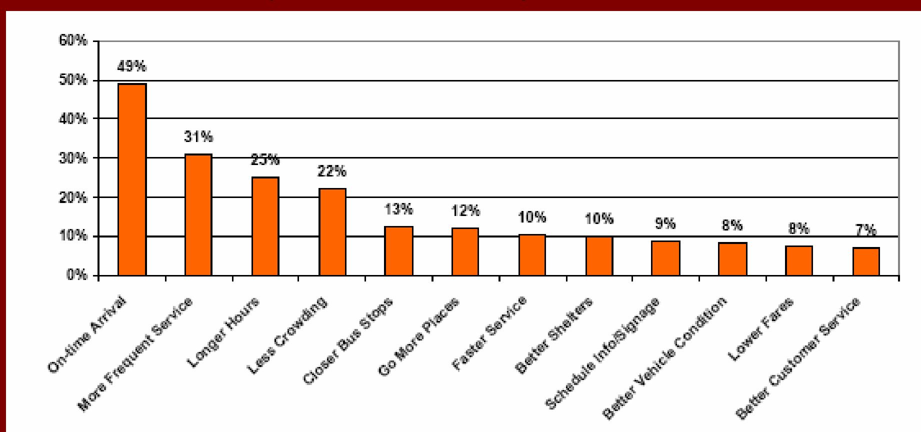
Transportation investments should facilitate the ability to "live locally," at least for the four or five average daily trips that are not job commutes. Quality of life is well served by modal choice and by connectors that distribute economic activity

Annapolis' investments should encourage compact development, especially around transit nodes. Transit-oriented development is based upon developing a series of quality bus, light rail, or commuter rail stations.

throughout every community. As urbanized areas decentralize farther and farther out, commutes get longer, traffic becomes more congested and the environment – air, water, and recharge areas -- are negatively impacted.

One thing the City can do to encourage transit is to concentrate land uses in *nodes* where transit exists to provide a large pool of riders. This includes higher density residential, office, hotel locations, shopping, and entertainment uses. The same would be true in the County, where there needs to be an effort to contain new high intensity uses in corridors that have transit and not permit them to scatter to locations that are dependent on automobiles. The concept of transit service and density appears in **Table 5, Transit Services and Residential Density**. This is one intersection of transportation and land use where the land use densities must be present in sufficient quantities to support the ridership for different levels of transit service. Additional ridership strategies are listed in **Table 6, List of Potential Transit Strategies for Building Ridership**.

Figure 5
Improvements Desired by Bus Riders



Source: WMATA Regional Bus Study (2003)

Table 5
Transit Services and Residential Density

Service	Frequency	Coverage	Dwelling Units/Acre
Rapid Transit (Rail)	5 min pk headway	100-150 sq mi corridor	12
Light Rail	5 min pk headway	25-100 sq mi corridor	9
Bus-Frequent Service	120 buses/day	½ mi between routes	15
Bus-Intermediate Service	40 buses/day	½ mi between routes	7
Bus-Minimal Service	20 buses/day	½ mi between routes	4

Source: Pushkarev and Jeffrey Zupan (1982).

Table 6

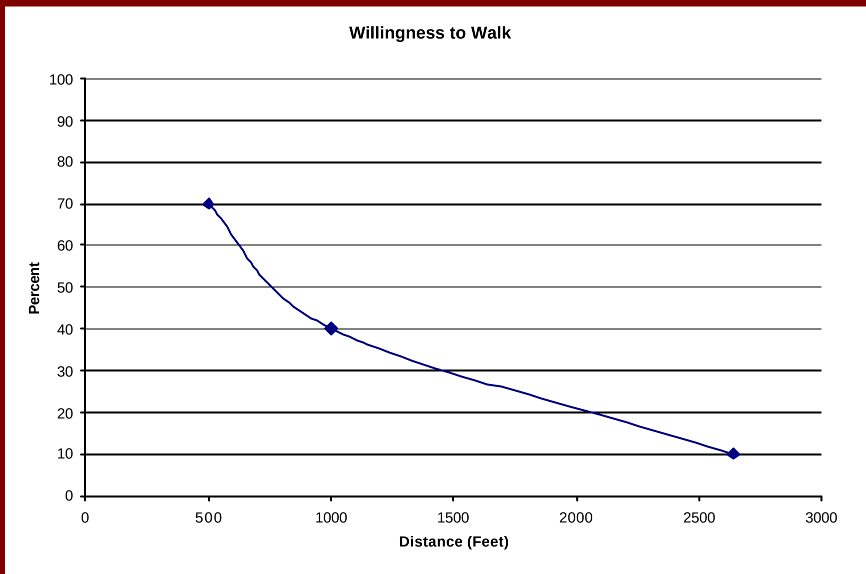
List of Potential Transit Strategies for Building Ridership

Category	Type	Strategies
Service improvements	General	Increased route structure Increased frequency Service cutbacks Dynamic scheduling Increased speed Improved security Improved comfort Increased capacity
	Suburb to suburb	High-occupancy vehicle lanes/facilities Transportation demand management programs Suburban activity centers
	Suburb to central city	Feeder services Fare integration Service coordination (timed transfers) Unitickets Station parking provisions
	Within central city	Core services
Information to customers	Real time information services	Location Schedules
	Low technology	Tailored schedules Bus stop information
	Medium technology	Computerized information systems Kiosks
Marketing and promotion		Fare incentives Education New resident promotion Image advertising Cooperative promotions
Public policy changes		User side subsidies Parking pricing/regulation Income taxes Fuel/carbon taxes Dedicated operating support Land use policy Local area bus services
Road pricing		Various

Source: TCRP Report 27, Building Transit Ridership: An Exploration of Transit's Market Share and the Public Policies That Influence It (1997), p. 8.

Figure 6

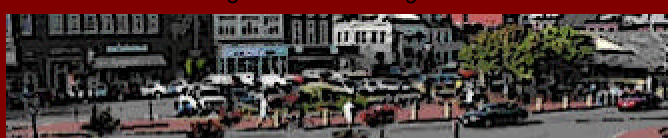
People's Willingness to Walk with Respect to Distance



Source: National Personal Transportation Survey (1995)

Figure 7

Creating Walkable Neighborhoods



1. Mixed land uses in close proximity to one another;
2. Building entries that front directly onto the street without parking between entries and the public right-of-way;
3. Building, landscape, and thoroughfare design that is pedestrian-scale; in other words, it provides architectural and urban design detail with size and design appreciated by persons who are traveling slowly and observing from the street level;
4. Relatively compact developments (both residential and commercial);
5. A highly-connected, multimodal circulation network, usually with a fine "grain" created by relatively small blocks; and
6. Thoroughfares and other public spaces that contribute to "placemaking" -- the creation of unique locations that are compact, mixed-use, and pedestrian- and transit-oriented and have a strong civic character with lasting economic value.

Source: "Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities", Institute of Transportation Engineers (2006)

Pedestrian Mode

The pedestrian mode is governed by distance, access, amenities, and travel purpose. A majority of pedestrian trips are one-quarter mile or less, with one mile generally being the limit that most people are willing to travel on foot. In practical terms, most residents are willing to take a five- to ten-minute walk at a comfortable pace to reach a specific destination.[i] **Figure 6, People's Willingness to Walk with Respect to Distance,** shows a curve of people's willingness to walk with respect to distance to a destination. Weather is a limiting factor for pedestrians as walking in rain, snow, cold, or hot will reduce the desirability of walking. While many people can walk much longer distances, the weather is important; one does not want to arrive at a destination uncomfortable. The purpose of the shopping trip is also important since non-work destinations represent the majority of the trips made every day. A pedestrian trip out to the drug store, for a book or magazine, or work is very achievable. However, a supermarket trip or taking children to various social or athletic programs is more likely to involve the automobile.

The land use pattern that is good for transit will also be good for pedestrians. Transportation

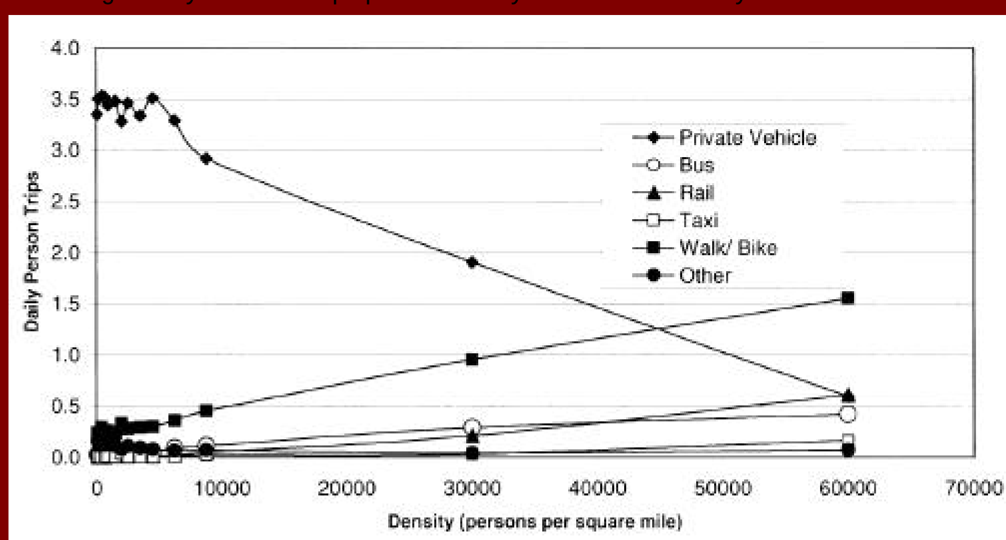
projects involving transit or near transit locations also need increased pedestrian investment priority. Transit riders are highly influenced by the surrounding pedestrian environment, and an increase in pedestrian accommodations near transit will also positively affect transit ridership.

Most cities spend the highest amount of their transportation dollars on street improvements for automobiles, leaving the most vulnerable travelers to fend for themselves. Parents, fearful of traffic hazards, are increasingly driving children to school, even when the trip is only a few blocks. Traffic congestion around schools creates hazards to children. Researchers estimate that 20 to 25 percent of morning traffic results from parents driving their children to school.[ii] Physical activity and independence is denied to the chauffeured children. It is important to recognize that pedestrian infrastructure improvements will improve health, physical activity, traffic flow, safety, and community involvement. The Center for Disease Control and Prevention recognizes that walking is a key source of physical activity that promotes good health and encourages healthy habits for the future.[iii] An investment in pedestrian infrastructure and amenities provides safe walking for children going to school and promotes healthy walking habits for the future.

An increase in walking trips will reduce the traffic congestion, air quality, and road maintenance costs that the Gty currently bears. This is especially important in Annapolis as water pollution and traffic congestion diminish the quality of life for residents and businesses. Such pedestrian transportation improvements benefit all residents, not just children, and may consist of sidewalk repair, traffic signs, curb cuts, new sidewalks, street furniture, crosswalks, pedestrian intersection controls, traffic calming, and similar pedestrian-oriented design measures.

Figure 8

Average Daily Person Trips per Person by Mode and Density in the United States



Source: TCRP Report 95 Travelers Response to Transportation System Changes

Figure 9

Essential Infrastructure: Bike Parking at Destinations

Bicycle Mode

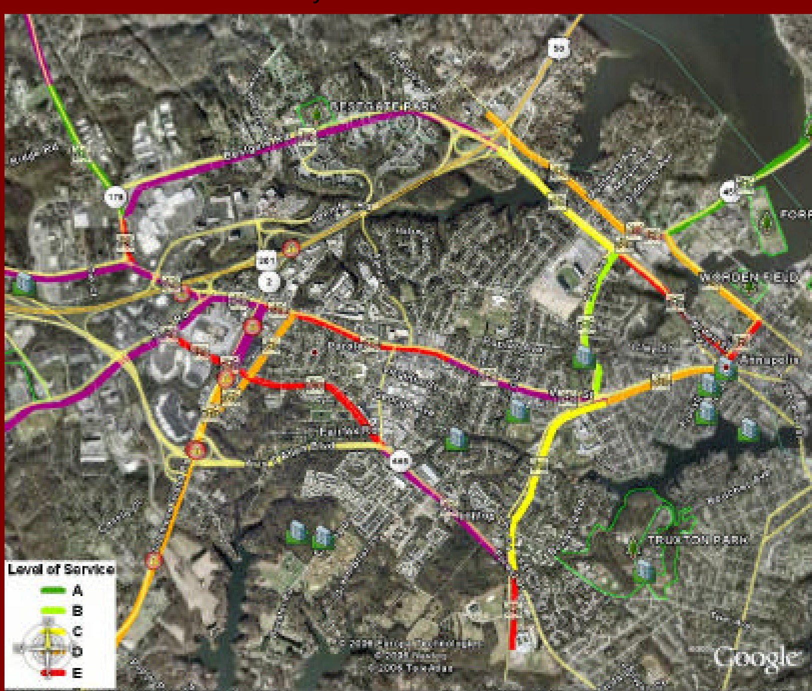
The bicycle extends the travel radius to several miles or more: a majority of bicycle trips are three miles or less - or about a 15-minute bike ride.[iv] There is also a great deal that needs to be done to improve the network for bicyclists in Annapolis as illustrated in **Figure 9, Essential Infrastructure: Bike Parking at Destinations.** Dedicated bike lanes are not common within the City. In the historic core and other older parts of the City, narrow streets make this more difficult. While the right-of-way (ROW) in the downtown areas is impractical to change, elsewhere in the City, consideration should be given to acquiring or adapting ROW for bicycle lanes.

Similar to the pedestrian mode, many of the infrastructure and amenities of biking are inexpensive and yet remain lacking as a continuous system.

An aggressive move to create a City-wide system that serves nonrecreational, as well as recreation, needs would enhance the potential. The other improvement that is needed is more bicycle parking as depicted in **Figure 10, Bicycle Level of Service** Safety for bikes is similar to security for cars – there needs to be a parking area at a destination so that bikes are not locked to gates, trees, or simply left unlocked on the sidewalk.

Figure 10

Bicycle Level of Service



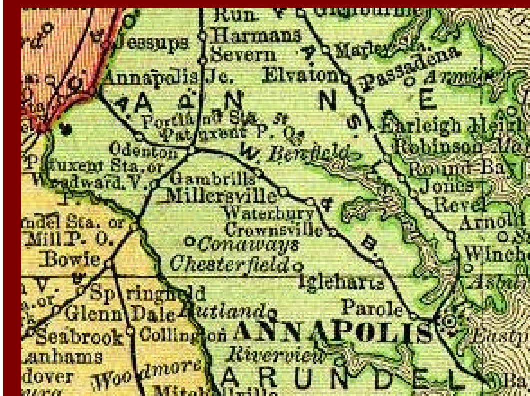
Source: Baltimore Metropolitan Council (2004), Bicycle Level of Service Evaluation Update & Pedestrian Level of Service Evaluation

Similarly, the concentration for bus or pedestrian travel works for bicyclists, as well. Bicycle investment near transit is a low-cost way to reduce the investment and land consumption necessary for additional auto lanes and parking. An increase in bicycle accommodations near transit will also positively affect transit ridership. Secure bicycle parking in the form of lockers, storage, and indoor bike racks will promote transit ridership among bicyclists. Future transit systems should provide bicycle parking at stations.

Rail Modes

While this is desirable, particularly for travel to D.C. or Baltimore, it is so far beyond the City's capability to influence in the short term that it is not worth much discussion. However, a single

Figure 11
Historic Rail Connections between Annapolis, Baltimore, and Washington (1890)



connection point for both destinations should be developed and planned where it connects to local transit. Other cities have bus access to park and ride facilities far out of town. It may be that starting such a service would promote eventual extension of heavy rail.

Historically, Annapolis was served by the Washington, Baltimore, and Annapolis Railroad (WB&A) for many years. Started in 1887, the freight and passenger line connected Annapolis with Baltimore, while serving almost two million passenger trips per year. The creation of highways and efficient road connections eventually sealed the fate of this commuter line. Portions of this line are used today as part of Baltimore's light rail line from Camden Yards to Ferndale and the 13.3-mile Baltimore-Annapolis Rail Trail.

PARKING

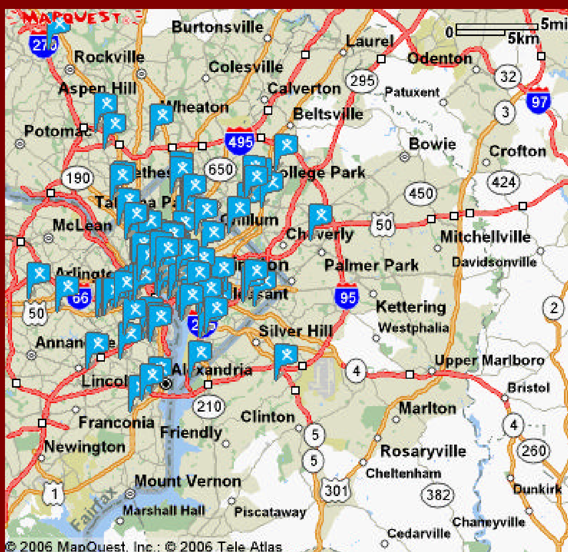
Parking and automobile traffic are closely related. The more people drive, the greater the demand for parking. The obvious method of solving both traffic and parking problems is to reduce the percentage of people who drive. That issue revolves primarily on a shift in the land use pattern to encourage more use of the other modes.

Remote Parking

There are some other strategies that focus on visitor parking, but which would also help transit, pedestrian, and bicycle modes. With tourism and commuters being a major source of traffic, getting visitors out of cars and into transit would take pressure off the major roads, particularly West Street and Rowe Boulevard. One approach which would have several benefits is a parking structure that handles all parking City-wide. The Naval Academy Stadium serves this function, but a single central place on Route 50 would be ideal. Shuttles would be provided to get tourists to their hotels. The hotels would need substantially less parking in the congested parts of town. Such a facility would serve state government, as well, getting much of that traffic off the local roads. To the extent that there is significant surface parking devoted for offices, hotels, or other major employers, land could be freed up for more development at existing nodes, which would provide greater ridership for bus service. The operation and enforcement of this is difficult and would take cooperation among the City, County, and private sectors.

A look at Nantucket, MA, is instructional. Downtown Nantucket cannot handle all the visitors so a short headway bus system is used to relieve the pressure. Nantucket has the advantage of being an island, but Annapolis's position on a peninsula has some similarities.

Figure 12
Flexcar Car Sharing Locations in the Washington Area



Source: Flexcar

Car Sharing

Car sharing programs such as Zipcar or Flexcar provide automobiles on an hourly rate for subscribers (usually about $8/hr). This system has vehicles parked at specific locations that can be picked up by customers for local errands where a car is necessary. While not useful for long trips, it is useful in urban areas for short trips and reduces total auto-ownership so that people use the leased vehicle for most activities and private automobiles only for longer distances or special trips. Typical destinations for car sharing trips can include dry cleaners, airport pick-up/drop off, grocery store, home goods store, and doctor visits.

The strategy would be to have local residents, state employees, and other business people use these cars for short errands -- the majority of trips in a household. This would reduce parking needs downtown, at the court house, and at other locations. To the extent that tourists also used this type of service, it would have even greater impact. It might also help some mobile people who do not own cars to travel to locations not served by bus. While initially there is a need for special parking, there should be an overall reduction in parking with this strategy. It is estimated that the presence of one car share parking space will result in the replacement of up to eight private auto parking spaces. More importantly, it allows residents the flexibility to live without owning as many cars or without the ability to use a car for essential trips.

Compact Parking Space

The vehicle footprint is another way to look at the parking problem. The average parallel parking space is 8 by 22 feet or 176 square feet. In perpendicular parking, the area increases to about 270 square feet including aisle space. Even so, the larger cars, SUVs, and pick-up trucks strain that envelope. The Mercedes SMART car is much smaller about 5 feet by 7 feet in length. Other similar cars are under development and, if this was the standard vehicle used in the City, parking capacity would be doubled. It would also slightly reduce congestion on the streets since the smaller cars would result in more vehicles per hour per lane mile due to the savings in vehicle length. To the extent that all vehicles are less than compact size, they would park at greater density. If a significant portion of the community were to switch to these very small cars and combine them with car sharing, the overall savings of space would be great.

Figure 13
List of Passenger Automobiles with Curb Weight over 4,500 lbs.

Make/Model	
Acura MDX	Land Rover Discovery
Acura SLX	Land Rover LR3
Audi Q7	Land Rover Range Rover
BMW X5	Lexus GX 470
Buick Rainier	Lexus LX 470
Buick Roadmaster	Lincoln Aviator
Cadillac Escalade	Lincoln Navigator
Chevrolet Express Van	Mercedes-Benz G Class
Chevrolet Suburban	Mercedes-Benz GL Class
Chevrolet Tahoe	Mercedes-Benz M Class
Chevrolet Trailblazer	Mercedes-Benz ML Class
Chrysler Pacifica	Mercedes-Benz R Class
Dodge Durango	Mercedes-Benz S600
Ford Bronco	Mercury Mountaineer
Ford Econoline Van	Mitsubishi Montero
Ford Excursion	Nissan Armada
Ford Expedition	Nissan Pathfinder
GMC Envoy	Oldsmobile Bravada
GMC Savana Van	Porsche Cayenne
GMC Suburban	Rolls Royce Phantom
GMC Yukon	Saab 9-7
GMC Yukon (Denali)	Toyota Land Cruiser
Hummer H1	Toyota Sequoia
Hummer H2	Volkswagon Eurovan
Hummer H3	Volkswagon Phaeton
Infiniti QX56	Volkswagon Touareg
Isuzu Ascender	Volvo XC 90
Jeep Commander	
Kia Sedona Van	

One model policy that uses economics to encourage smaller car ownership is the City of Chicago's car sticker program. In November 2003, legislation was passed by the Chicago City Council establishing a new sticker type (LP) for Large Passenger vehicles. Those passenger vehicles that have a curb weight of 4,500 lbs. and above are affected by this legislation. The cost of this sticker is $90.00 instead of a lower sticker price for regular-sized automobiles.[v]

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[i] National Personal Transportation Survey (1995)
[ii] Marin County Congestion Management Agency
[iii] "Physical Activity and Good Nutrition: Essential Elements to Prevent Chronic Diseases and Obesity 2002." CDC U.S. Centers for Disease Control and Prevention, Division of Nutrition & Physical Activity (Fiscal Year 2001) Available at http://www.cdc.gov/nccdphp/aag/aag_dnpa.htm
[iv] National Personal Transportation Survey (1995)
[v] Office of the Chicago City Clerk

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