Trends and Conditions Report – 2004

IMPACT OF TRANSPORTATION:
System Performance
November 2004
Contract BD-544-7

This "Trends and Conditions" report was prepared jointly by the Office of Policy Planning of the Florida Department of Transportation and the Center for Urban Transportation Research at the University of South Florida. It is part of a continuing process to support the needs of decision makers, transportation professionals and the interested public.

This and other reports are being maintained on the Internet at:
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System Performance

Introduction

The mission of the Florida Department of Transportation (FDOT) is to "provide a safe transportation system that ensures the mobility of people and goods enhances economic prosperity and preserves the quality of our environment and communities." Each part of the mission is discussed in the "Impact of Transportation" section of the Trends and Conditions (T&C) report series. The Department has established strategic goals that correspond with the mission, one of which is to "preserve and manage a safe, efficient transportation system." This report deals specifically with system preservation and system performance.

FDOT has developed a mobility performance measures program that deals with measuring various dimensions of mobility. These dimensions are grouped into quantity of travel, quality of travel, accessibility, and utilization. Quantity of travel is the magnitude of use of a facility or service and has been previously discussed in the "Transportation System" section of the T&C report series. Quality of travel describes travel conditions and the effects of congestion. Accessibility is a measure of the ease with which people can connect to the multimodal transportation system. Utilization is an indication of whether the system is properly sized and has the ability to accommodate growth.

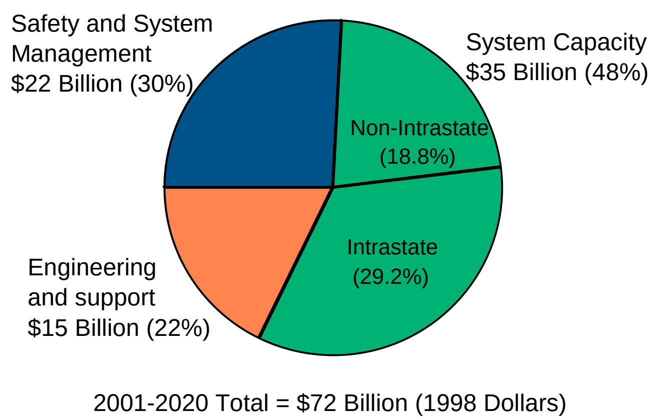
Each dimension has various performance measures that are different by mode. Many performance measures have been developed for highways, while other modes may not have standardized measures for each dimension of mobility. One reason for the variation is that FDOT owns and operates the State Highway System (SHS) while other transportation systems, including local roadways, transit systems, airports, seaports and railways, are owned primarily by local governments, public authorities and private companies. Therefore, FDOT is not responsible for building or maintaining these systems even though it may help fund some of the facilities.

The concept of performance measurement is implicitly related to program goals but, as implied above, there are a host of parties involved in establishing goals for transportation investments. The federal government both directly and indirectly outlines its program goals through process, regulation and resource programming. The Florida Department of Transportation's goals are established through the influence of the legislature, the executive branch, the Florida Transportation Commission, FDOT professional staff and others. Similarly, local communities and regional agencies such as Metropolitan Planning Organizations set goals that govern transportation policies and investment decisions. Port authorities, airports, transit agencies and others also have various goal sets. Thus, transportation system performance measurement attempts to identify measures that can capture common priorities of the myriad of stakeholders.

System Performance

The objective of this report is to provide an overview of the performance of Florida's transportation system. The summary is based on a series of measures that enable all modes in the system to be addressed.

Figure 1 - Planned Investments of State and Federal Funds, 2001-2020



Source: Florida Department of Transportation (Dec. 2000) 2020 Florida Transportation Plan

Figure 1 provides perspective on overall transportation investment goals by detailing the planned investment of state and federal funds from 2001 through 2020. About 48 percent of the funds will be spent on adding capacity, including adding new lanes and other construction on the state highway system and assisting airports, seaports, transit systems, rail, and intermodal initiatives. Another 30 percent is planned for safety and system management. This spending will focus on addressing safety issues, highway resurfacing, bridge repairs and replacements, and operation and maintenance of the state highway system.

The remainder of this report on system performance is broken down by mode of transportation. To the extent possible, the discussion of each mode will address system condition, accessibility and level of service.

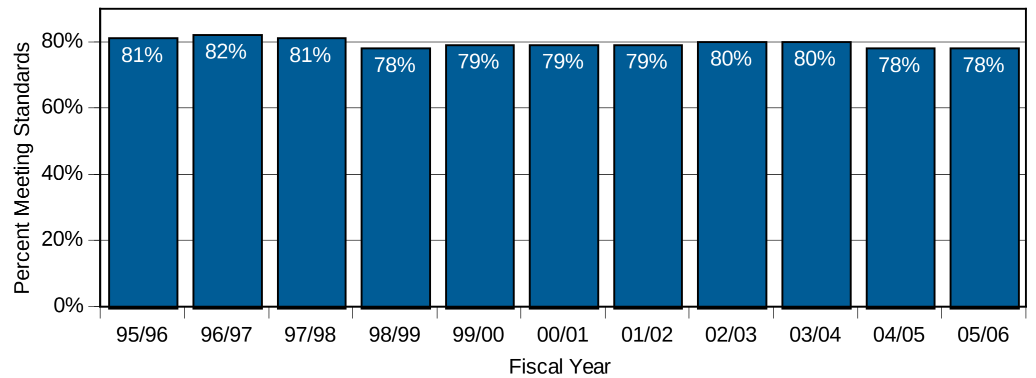
Roadways

The roadway system is comprised of roadways that serve various primary purposes ranging from intercity connection to local property access and the system elements are owned by various governments including local jurisdictions, counties and the state. The Florida Department of Transportation is responsible for the State Highway System (SHS). As discussed in the "Transportation System: Roadway System" report of this series, the State Highway System consists of less than 10 percent of all public road centerline miles in Florida, but carries two-thirds of the traffic. Most roadway performance measures for the roadway are developed for the SHS.

System Preservation

One of FDOT's main responsibilities is to meet the standards for physical condition of the State Highway System. To accomplish this, FDOT resurfaces roads, conducts routine maintenance, and repairs or replaces bridges. FDOT is committed to keeping the pavement on the State Highway System in acceptable condition to ensure that at least 80 percent of the lane miles meet FDOT standards. Figure 2 presents the share of highway lane miles meeting the standard from FY 1995-1996 through FY 2003-2004. Pavements are rated based on ride quality, crack severity and rutting. Ride quality is a measure of the smoothness of the ride. Crack severity refers to the structural deterioration of the pavement. Rutting measures the average depth of wheel paths, which are caused by heavy use. The State Materials Office conducts annual Pavement Condition Surveys (PCS) for 100 percent of the SHS. The pavements are rated on a scale from 1 to 10, with 10 being the best. FDOT standards are for pavements to rate 7 or above on this 10-point scale.

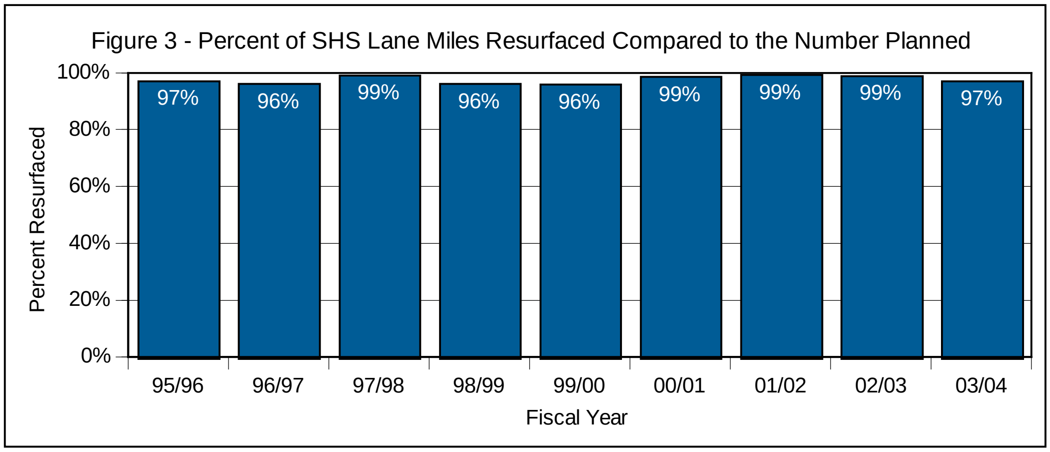
Figure 2 - Percent of Pavement Standard Achieved on the State Highway System



Source: FDOT Short Range Component

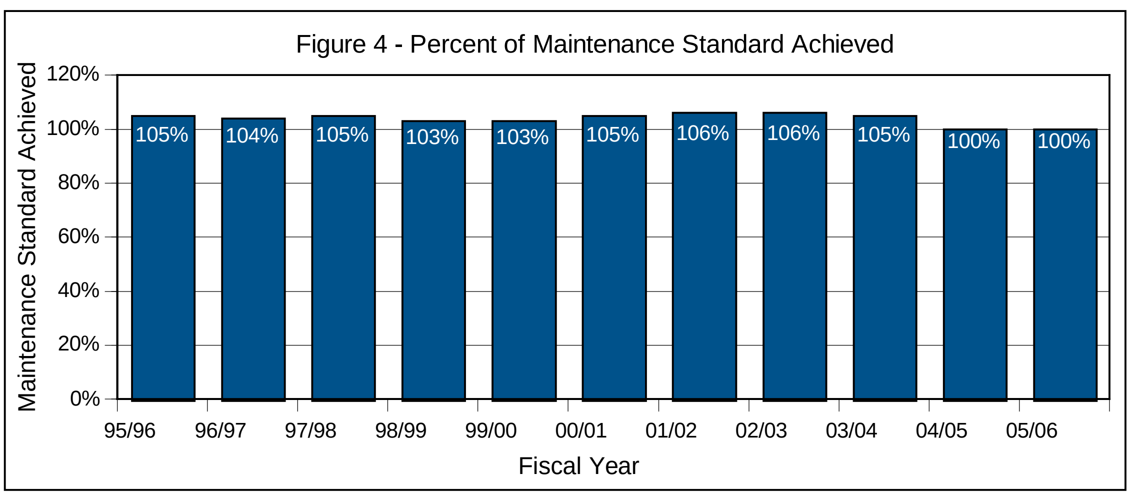
The type and volume of traffic are critical factors in determining the expected life of pavement. Heavy vehicles or truck traffic have a significant impact on pavement deterioration. FDOT attempts to limit the number of vehicles that exceed legal weight limits in order to reduce the impact to pavements and extend the useful life of the roadway system.

Another aspect of pavement preservation is roadway resurfacing. Pavements that do not meet FDOT standards are scheduled for repair in the Five-Year Work Program. Resurfacing pavements prolongs the useful life of the roadways and helps to prevent damage to the road base which otherwise would result in costly reconstruction. Each year approximately six percent or 2,200 lane miles on the SHS need to be resurfaced. Figure 3 shows the share of lane miles resurfaced during the year. The Department's objective is to resurface at least 95 percent of the scheduled lane miles each year.



Source: FTC Performance and Production Review

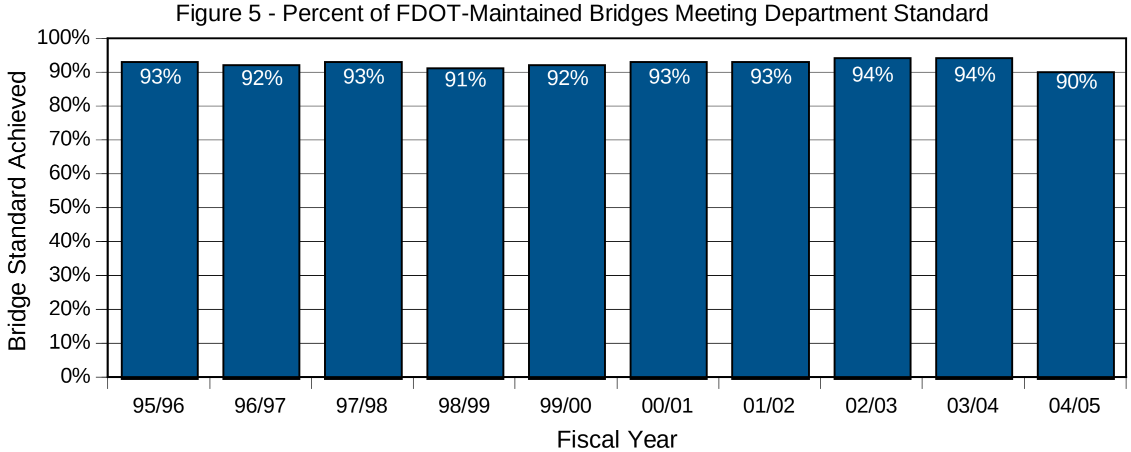
Roadway maintenance also is an integral part of preserving the SHS. Routine maintenance includes highway repairs, roadside upkeep, drainage management and traffic services. Through maintenance programs, rest stops are maintained, wildflowers are planted, potholes are filled, grass is mowed, ditches are cleaned out, signs are installed or replaced, and many other jobs are completed. These areas are critical to maintaining a safe and comfortable roadway system. Annual field evaluations are completed using the Maintenance Rating Program. FDOT attempts to achieve 100 percent of the acceptable maintenance standard on the SHS. The maintenance standard is a composite state score of 80 based on the five maintenance elements of the Maintenance Rating Program. Figure 4 shows the percent of maintenance standard achieved on the SHS. Since 1994, FDOT has met or exceeded the acceptable maintenance standard.



Source: FDOT Short Range Component

In addition to the SHS, FDOT is also responsible for 6,381 of the 11,395 bridges throughout Florida. All of these bridges are inspected at least once every two years. Bridges must not show evidence of structural deterioration, be limited by weight restrictions, or need preventive maintenance in order to meet FDOT standards. FDOT's objective is that 90 percent or more of the bridges meet the standards. The remaining 10 percent, while in need of repair or replacement, remain safe for public use. Figure 5 shows the share of bridges meeting the standards from FY 1995-1996 through FY 2003-2004.

Figure 5 - Percent of FDOT-Maintained Bridges Meeting Department Standard



Source: FDOT Short Range Component

Tables 1 and 2 present the number of bridges scheduled for repair or replacement compared to the number completed by fiscal year. The Department's objective is to repair or replace no less than 95 percent of the bridges planned for each fiscal year.

Table 1 – Number of FDOT Maintained Bridges Repaired

Fiscal Year	Plan	Actual	% of Plan	Advanced FY	Additions	Total
95/96	185	185	100%	5	9	199
96/97	358	342	96%	4	14	370
97/98	237	191	81%	43	45	279
98/99	132	101	77%	9	25	135
99/00	162	130	80%	3	48	181
00/01	134	120	90%	3	8	131
01/02	143	129	90%	2	54	185
02/03	125	115	92%	9	27	151
03/04	72	68	94%	4	12	84

Source: Office of Financial Development , FDOT
Note: If a bridge repair that was scheduled in a future year is advanced into the time window of the fiscal year being reported, it is reported as advanced from future years.

Table 2 – Number of FDOT Maintained Bridges Replaced

Fiscal Year	Plan	Actual	% of Plan	Advanced FY	Additions	Total
95/96	39	37	95%	0	7	44
96/97	34	24	71%	26	0	50
97/98	43	42	98%	0	0	42
98/99	56	55	98%	0	0	55
99/00	63	59	94%	0	0	59
00/01	42	39	93%	0	2	41
01/02	14	14	100%	4	3	21
02/03	20	19	95%	0	2	21
03/04	23	16	70%	0	1	17

Source: Office of Financial Development , FDOT
Note: If a bridge replacement that was scheduled in a future year is advanced into the time window of the fiscal year being reported, it is reported as advanced from future years.

Accessibility

A principal objective of the state transportation system is to connect centers of population and employment in a way that enables economic health and supports the public welfare by meeting the needs for emergency evacuation, military transportation, international commerce, and related public purposes. One measure of how well this is being carried out is by reporting on the accessibility of the population and employment to the roadway system. For purposes of analysis, the following information looks at the share of population and employment within a specific distance of the SHS. The larger the shares and numbers of persons and jobs in proximity to the SHS, the greater the opportunities they have to avail themselves of the performance of this system (as opposed to being restricted to travel on local roads). Accessibility is a prerequisite to mobility.

A first step to ensure quality roadway performance is to maintain the existing system. A comprehensive program with performance measures is in place to monitor the system condition.

Table 3 summarizes the share of Florida's population and employment that is located within a specified proximity of the various Florida roadway systems.

Table 3 – Florida Roadway System Accessibility

	SHS	FIHS	SIS	Estimated Statewide Totals
Lane Miles of System	40,970	16,194	14,881	
Population within Census Tracts within 1 Mile	13,238,776	5,192,123	5,100,038	17,019,068
Population within Census Tracts within 5 Miles	16,710,649	14,433,438	14,199,120	
Commercial Employment within 1 Mile	2,888,514	1,362,671	1,352,145	3,126,526
Commercial Employment within 5 Miles	3,085,835	2,799,289	2,774,762	
Commercial Square Footage of Development within 1 Mile	1,911,571,461	883,773,703	874,581,132	
Commercial Square Footage of Development within 5 Miles	2,066,162,253	1,859,862,660	1,841,406,027	

Source: Accessibility analysis by Armasi, 2004.

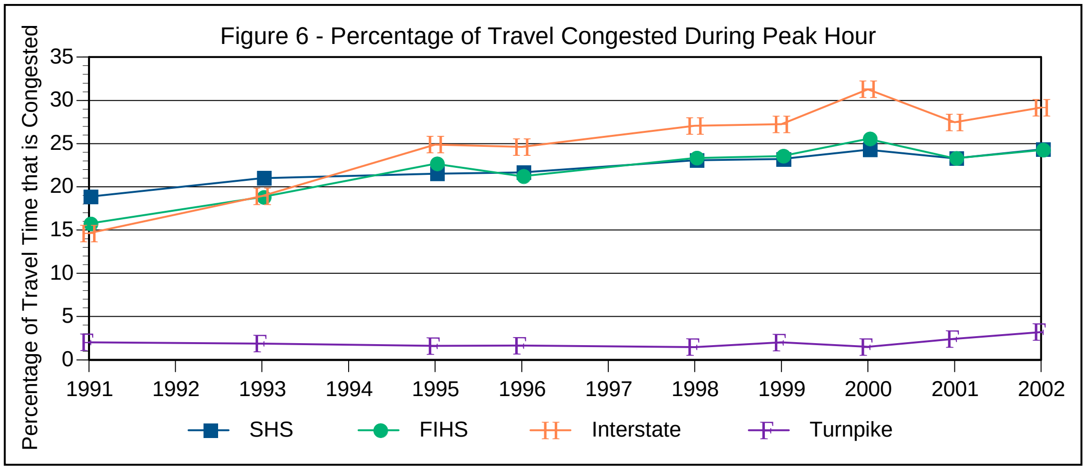
Note: SHS = State Highway System, FIHS = Florida Interstate Highway System, SIS = Strategic Intermodal System

As Table 3 indicates, the vast majority of the population and commercial employment are within five miles of the Florida highway system. While comparative national or time series data are not available for this comparison, the table nonetheless gives a sense of the accessibility of the Florida population to the roadway system. The roadway system, as the most pervasive mode of travel accommodating the vast majority of demand and providing a feeder/distributor mode for all other motorized modes, has the greatest accessibility. Local and connector streets complete the roadway network by providing direct access to individual land parcels.

Level of Service

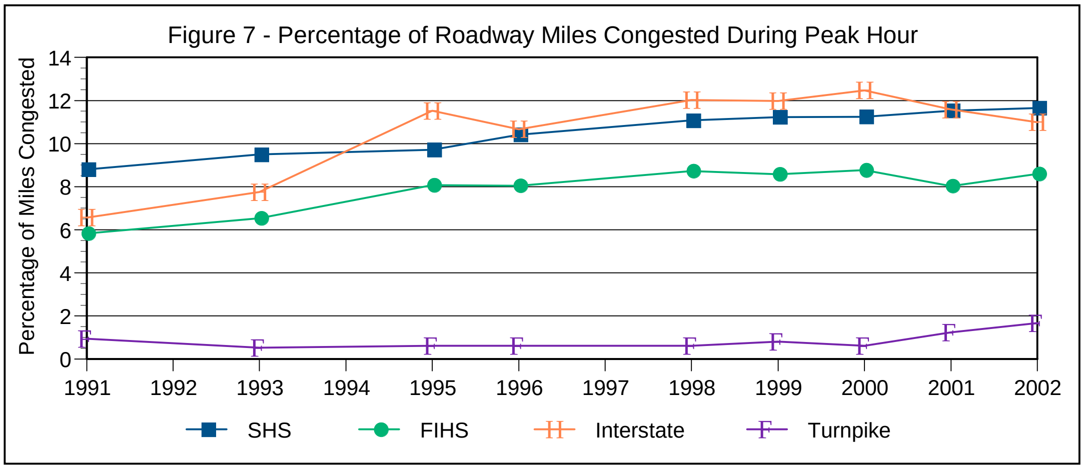
The third basic measure of performance that this report uses is the level of service of the respective mode. For this report, this is defined as the adequacy of capacity and can be measured in a number of ways that address the capacity as well as the quality of service or frequency of service availability. For roadway systems, capacity adequacy is best measured by understanding the extent to which congestion impacts travel speed.

The share of travel that is congested has increased since the early 1990s. Figure 6 presents the percentage of peak hour travel that is congested on the State Highway System. Florida's interstates have experienced the largest increases in the share of peak hour travel that is congested. The share of travel that is congested is defined as the number of vehicle miles traveled (VMT) during the peak hour that occur at a level of service E (operating conditions at or near the capacity level) or level of service F (forced or breakdown flow), divided by the total number of VMT during that hour.



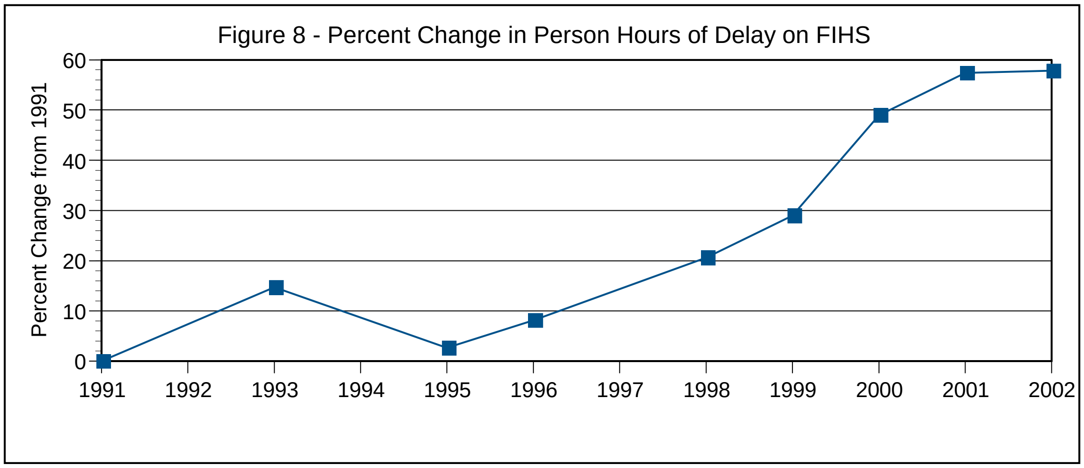
Source: 2003 Florida Highway Data Source Book

The percentage of roadway miles that are congested during the peak hour also have slightly increased since the early 1990s. This trend is displayed in Figure 7. As seen in Figure 7, the Turnpike has considerably less congestion as compared with the rest of the State Highway System.



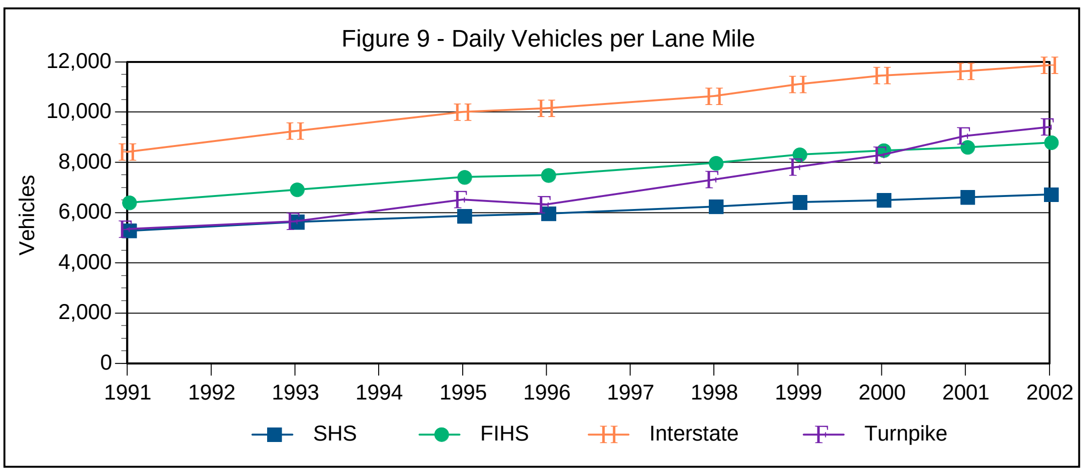
Source: 2003 Florida Highway Data Source Book

Person hours of delay on the FIHS also have increased. As shown in Figure 8, there has been a 58 percent increase of person hours of delay from 1991 and a total of 145,805 person hours of delay in 2002 on the FIHS.



Source: 2003 Florida Highway Data Source Book

The increased levels of congestion on Florida's roadways are consistent with the increases in the number of vehicles per lane mile on the State Highway System. Daily vehicles per lane mile are calculated by dividing the Vehicle Miles Traveled on a road segment by the number of lane miles on that segment. The number of vehicles per lane mile has gradually increased over the past decade. This trend is displayed in Figure 9.



Source: 2003 Florida Highway Data Source Book

Bike and Walk

Historically, performance measures for pedestrians and bicyclists have been limited to safety rates or a measure of the degree of discomfort to the user due to a crowded facility. Bike and walk facilities are typically located on local and collector roads and are the responsibility of the local jurisdictions. Thus, aggregate statewide data are far less available. Safety measures for bike and walk are discussed in the "Impact of Transportation: Transportation Safety" report of the T&C series. Statewide data on level of service performance measures for bike and walk modes currently are not collected. Discussion of what performance measures will be adopted by FDOT is still under way.

System Condition

There is no aggregate condition data for sidewalks or trails in the state. Data are maintained by local jurisdictions and not reported at the state level. The table below exemplifies the initiative of one jurisdiction in evaluating pedestrian system condition and needs. As the column headings indicate, a sophisticated scoring system is used to identify needs.

Table 4 – Sample Evaluation Data: Hillsborough County MPO Pedestrian System Needs Assessment

Road Name	From	To	Jur.	Len. (mi)	% Sidewalk Coverage		Roadside Ped Cond		100% Scale				Final Needs Priority			% of Sidewalk Needed	Cost per Segment ($)	Cumulative Cost ($)
					Both Sides	One Side Only	RPC Value	RPC Grade	RPC Grade Score	P-Fac. LDS Score	T-Fac. LDS Score	Public Input Score	Value	Rank	Level (I, V)			
ARMENIA	ALVA	OSBORNE	C	0.4	0	66	4.89	E	65	27	13	0	32	55	I	34	CAPlan	1,049,110
GUNN	NIXON	PLANTATI	C	0.6	0	0	5.18	E	69	27	0	0	32	55	I	100	60,000	1,109,110
HANNA	50TH ST	56TH ST	C	0.43	0	0	5.06	E	68	27	0	0	32	55	I	100	43,000	1,152,110
LYNN	ESSRIG	SCHEHRL	C	0.87	7	15	5.05	E	68	27	0	0	32	55	I	85	CIP	1,152,110
ORIENT	HILLSBOR	SLIGH	C	1	3	7	5.07	E	68	27	0	0	32	55	I	93	93,000	1,245,110
SLIGH	HARNEY	ORIENT	C	0.2	0	0	6.16	F	82	18	12	0	32	55	I	100	20,000	1,265,110
SLIGH	ORIENT	US 301	C	1.12	0	0	6.38	F	85	18	12	0	32	55	I	100	112,000	1,377,110
COLUMB	19TH AVE	50TH ST	C	0.53	56	68	4.69	E	63	27	0	0	31	64	I	32	16,960	1,394,070
HARNEY	SLIGH	78TH ST	C	1.04	0	0	5.81	F	78	18	12	0	31	64	I	100	104,000	1,498,070

Accessibility

While no comprehensive aggregate database exists for assessing the availability of bike and walk, the Florida Pedestrian and Bicycle Program develops initiatives and programs to improve the environment for safe, comfortable, and convenient walking and bicycling trips. In Florida, every public transit agency that operates buses provides bikes-on-bus service. The ability of bicyclists to use transit extends the potential range of travel for this group and increases the service coverage area for transit ridership.

Local data sources are the best source of the availability of pedestrian and bike facilities. Tables 5 and 6 provide select information that exemplifies the growing attention to bike and pedestrian travel needs.

Table 5 – Outdoor Recreation Facilities in Florida, 1998

Major Supplier	Bike Trails (paved)	Bike Trails (unpaved)
Federal	70.0 mi	297.3 mi
State	209.6 mi	718.3 mi
County	182.6 mi	341.9 mi
Municipal	402.5 mi	112.5 mi
Non-Government	108.2 mi	61.2 mi
Total	972.9 mi	1,531.2 mi

Source: Florida Department of Environmental Protection, Office of Park Planning. *Statewide Comprehensive Outdoor Recreation Plan 2000*

Table 6 – Florida Bikes on Transit Ridership Statistics

Agency	Bike Boardings	Bike Share
BCT, Fort Lauderdale	1,200 per day (2002)	1.10%
PSTA, St. Petersburg	10,000 per month (2002)	1.25%
HARTline, Tampa	9618 (April 2004)	1.29%
SCAT, Sarasota	175 per day	2.70%
MCAT, Bradenton	1,166 (April 1998)	1.80%

Source: BikeMap.com (accessed 3/24/04)

<u>Level of Service</u>

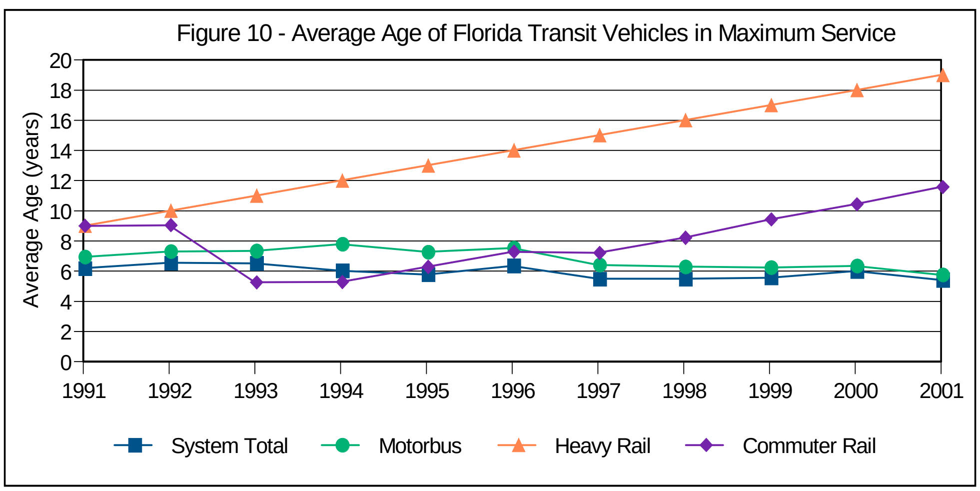
The State of Florida has been active in moving toward multimodal planning via development of multimodal Level of Service (LOS) measures. Measures describing crowding do not adequately capture all aspects of pedestrian trip quality in Florida according to a report by FDOT, the University of Florida, and Sprinkle Consulting, Inc. (SCI). This report, titled "Multi-Modal Level of Service (LOS) Analysis at a Planning Level," discusses an approach for analyzing the level of service for non-motorized modes, including bike and walk. Key factors for measuring bicycle level of service include presence of bike lane or paved shoulder; proximity of bicyclists to motorized vehicles; the volume, speed and type of motorized vehicles; pavement condition; and percent of on-street parking. Key factors affecting pedestrian quality of travel include the presence of a sidewalk, lateral separation of pedestrians and motorized vehicles, presence of physical barriers or buffers, and motorized vehicle volume and speed.

Public Transportation

Public transportation is a fundamentally different mode in that it is highly dependent on ongoing public operating support as well as the investment in and maintenance of the capital infrastructure required to provide services. Public resources from federal, state and local sources are combined with passenger fares and other locally-derived revenues to fund the overall program of operating and capital costs. Thus, for this mode more so than others, the performance of the system is impacted by both the condition of the capital infrastructure as well as the extent and stability of operating revenues. Performance reporting for public transportation is similarly complicated by the fact that the goal set for public transportation includes a host of considerations such as providing a mobility choice, providing a contingency mode, influencing land development patterns, and meeting the needs of individuals who do not have mobility alternatives. Thus, measuring performance in the context of this larger and perhaps more qualitative goal set becomes more difficult. This section uses a variety of available aggregate industry data to report on public transportation performance. The focus is on fixed route services.

System Preservation

The workhorse of the public transportation system is the fleet of buses responsible for moving the vast majority of passengers. In Florida, approximately 85 percent of public transit passengers are transported by bus. Buses of all sizes travel approximately 50,000 miles per year each transporting passengers. The age of the bus fleet is an indication of the condition of the fleet. Standard 35 to 40-foot long transit buses are designed to have a 12-year life. Smaller buses and vans have a shorter design life. Figure 10 shows the average age of transit vehicles in Florida. The younger average age of the bus fleet reflects a combination of success in keeping the fleet in good condition and the introduction of a larger share of smaller (and shorter-lived) small buses into Florida transit property fleets. Newer buses are typically able to provide higher reliability,

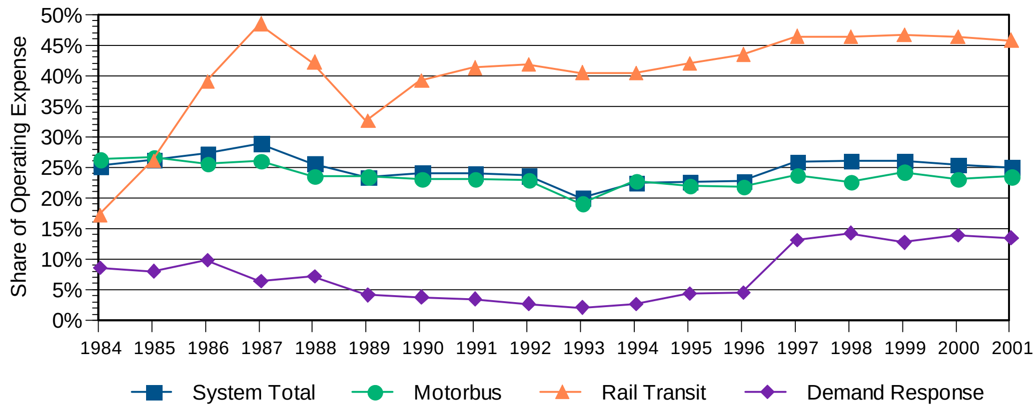


Source: Florida Transit Information System (FTIS) 2004

improvements in handicapped accessibility (ramps instead of lifts), new amenities, improved fuel efficiency, and cleaner emissions. Age data on the commuter rail vehicle fleet (Tri-Rail) and heavy rail fleet (Miami Metro) reflect the fact that these vehicles have longer lives. The Metro rail fleet is now undergoing a major mid-life overhaul that will enable it to continue efficient operations for the remainder of its 25-40 year life. Tri-Rail has added some new self-propelled rail cars that will serve to reduce the fleet age for commuter rail to well below the mid-point of their 25-50 year life.

The other major elements of transit infrastructure include the guideway systems such as Metro-rail, Metro-mover, Tri-Rail, the TECO Historic Trolley in Tampa, the Jacksonville Sky-Train system, and exclusive right-of-way for bus operations such as the Lymo system in Orlando and the Busway in Miami. In addition to these, transit operations require capital investment for a host of supporting infrastructure such as park-and-ride lots, transfer centers, maintenance facilities, operations and administration facilities, communications infrastructure, and signage and shelter for patrons. There is no aggregate metric of the condition of these facilities as they are managed by the 25 fixed route operators as well as by the multitude of other agencies and entities that provide specialized and paratransit services. Facility maintenance and upgrading is a regular expense as facilities age and new standards for environmental protection, worker safety, and productivity require regular modernizations. Improved shelter and bus stop accessibility (sidewalks) are frequently cited as a deterrent to transit ridership for Florida properties, and most communities work with local governments to programmatically address these needs as resources are available.

Figure 11 - Share of Operating Expense Devoted to Maintenance



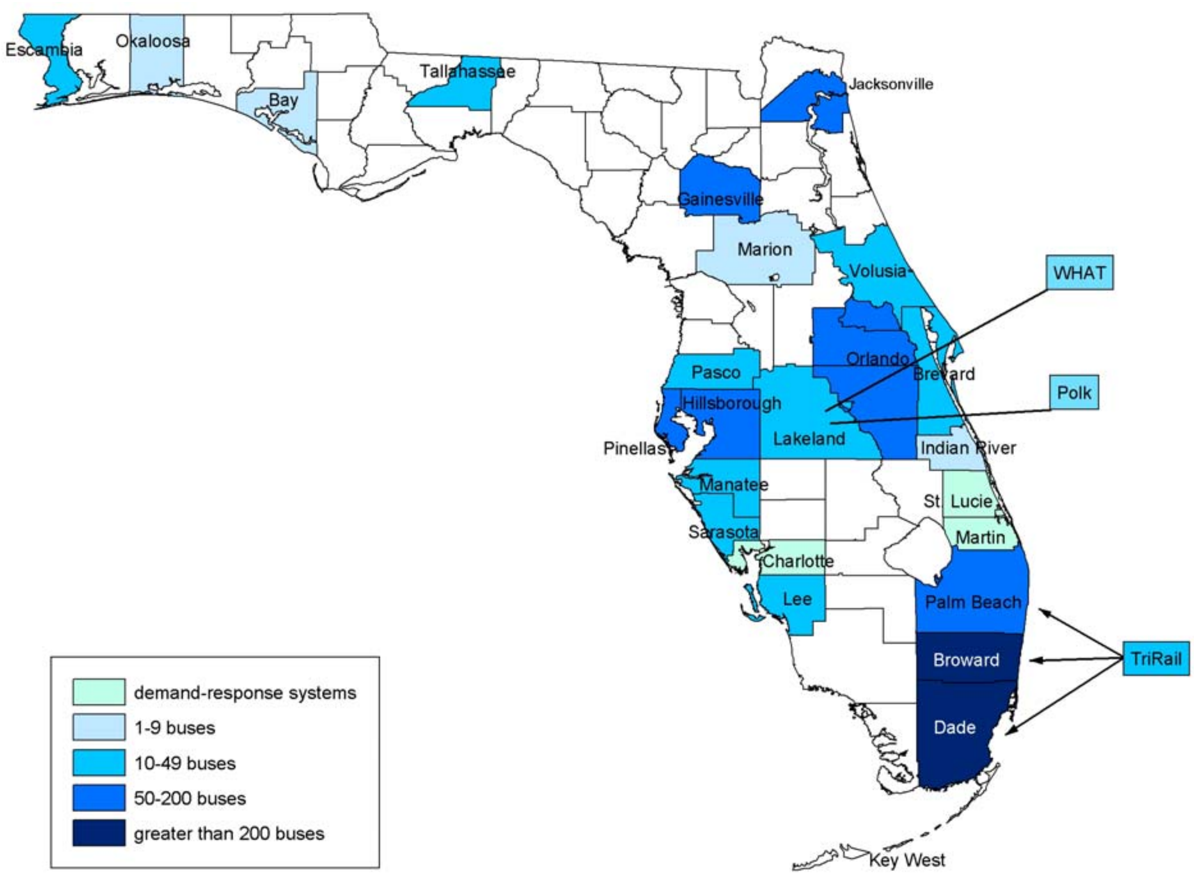
Source: FTIS 2004

Figure 11 provides aggregate data on the share of the operating budgets that transit agencies devote to routine (non-capitalized) infrastructure maintenance. For bus operations approximately 25 percent of the operating cost goes to vehicle and facility maintenance. For rail operations where there is more infrastructure and relatively less operating labor due to the operation of trains (which seat several hundred versus 20-60 persons in a bus), the maintenance share of operating costs is approximately 45 percent.

Accessibility

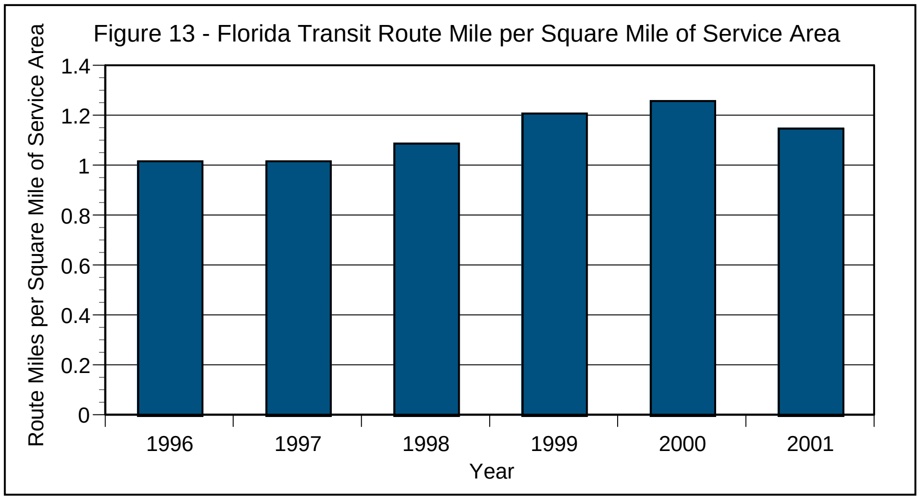
Accessibility of transit service can be characterized by a number of measures. As shown in Figure 12, the counties in Florida with concentrations of population are served by fixed route bus services. Measures of the share of population within a half-mile of fixed route bus service can be used to give a richer sense of the proximity of service to the population. Compiled data from Florida transit properties indicated that approximately 12 million people or 70 percent of the population of Florida lives within what might be considered walking distance of fixed route transit service (one-half mile). However, this measure does not indicate what share of destinations are within walking distance of service nor does it indicate the availability of service in terms of frequency of buses and hours of operation.

Figure 12 – Counties with Transit Accessibility in Florida



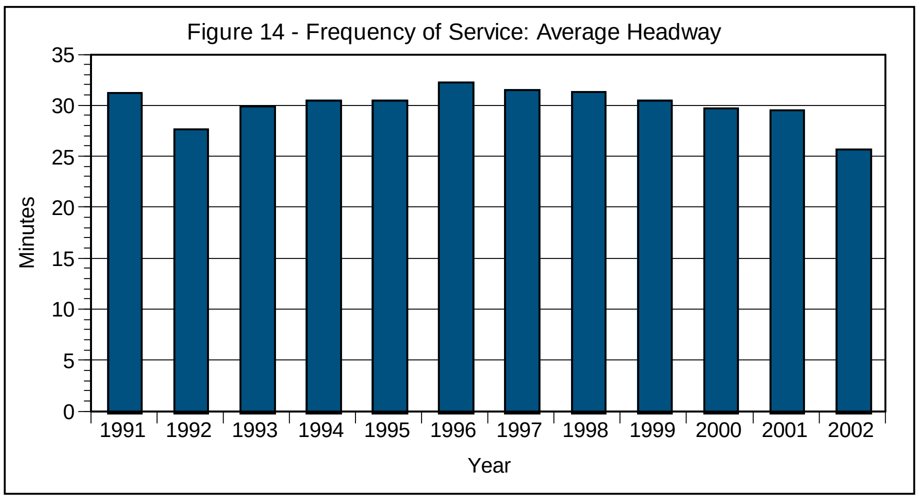
Source: National Transit Database (NTD), 2001
Note: This figure contains only transit agencies that are required to fill out NTD forms. Numbers are for motorbuses operated in maximum service, except for the demand-response systems that do not operate buses.

Figure 13 gives a measure of the coverage of transit service by noting the route miles of service per square mile of service area. This set of data indicates that for every square mile of land in a transit jurisdiction, there is a little over one mile of road with a bus route on it.



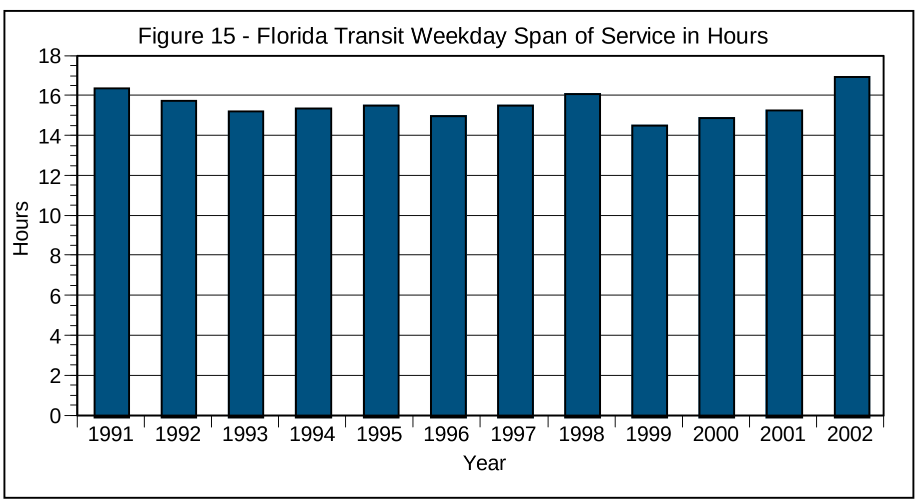
Source: FTIS 2004

Figure 14 indicates the average headway of bus routes in Florida. The decline in headways is a positive improvement as it indicates that buses are available more frequently, thus shortening the period of wait and increasing the convenience to the traveler.



Source: FTIS 2004

Figure 15 indicates the average span of service for fixed routes. The trend indicates fluctuations for the span of service, with the past three years showing a slight positive trend. Caution must be used as these numbers indicate only system averages. Many routes do not offer frequencies near the



Source: FTIS 2004, Fixed Route Transit

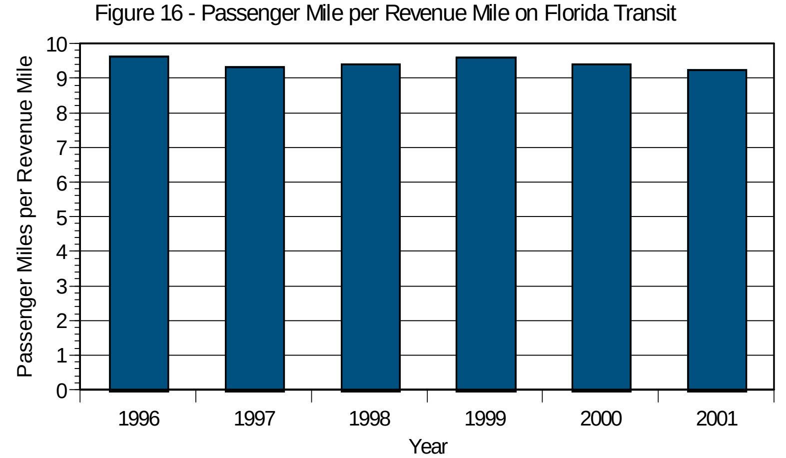
average, and many routes do not operate services on some routes as many hours of the day as their maximum used to develop the Figure 14 data. An additional measure of accessibility would be to consider service availability on weekends and holidays. Typically, Saturday service levels are approximately half or less than those on weekdays, and Sunday service levels are even lower.

Another element of transit availability relates to the physical ability to get to and from the bus stops. While there is no available aggregate measure of physical access to transit, this is a subject receiving increasing attention as urban development and transit planners increasingly realize the importance of the built environment to facilitating the use of alternative modes. Thus, the presence of sidewalks, curb cuts and other features to enable access to transit are being addressed in transit and urban design initiatives.

Level of Service

There are various strategies for addressing level of service for transit. Many of those consider service availability, as noted in the discussion above. Other measures address the adequacy of capacity and the comparative performance of transit with auto travel. The most readily available include measures of service utilization. These measures provide both a measure of the adequacy of capacity as well as a gauge of public demand for service. Figure 16 provides a measure, passenger miles per revenue mile of service, which equates to the occupancy of the transit vehicle. Thus, a vehicle has, on average, 9 passengers aboard (based on 2002 data for fixed route services reported in *Florida Transit Handbook 2003*). Given that a typical transit coach has approximately 40 seats, these data indicate that, on average, crowding is not a critical problem. The trend indicates that transit service capacity is growing as fast as or faster than demand.

Figure 16 - Passenger Mile per Revenue Mile on Florida Transit

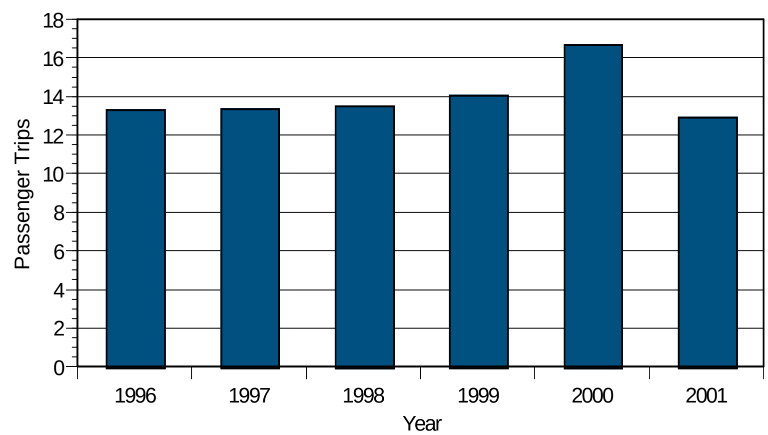


Source: FTIS 2004

Figure 17 provides a measure of transit trips per capita. This indicated that, on average, each Floridian takes 12 transit trips per year (considering many trips involve transfers and are thus counted as two transit trips, this equated to about 8 actual trips) out of a total of 1,000-1,500 trips per person per year.

The transit industry is continuing to work to develop other measures of service quality and level of service to better equate transit service with respect to other modes. Many individual properties monitor service quality with measures such as those shown above in addition to measures of vehicle cleanliness, service reliability, travel speed and quality of customer information. Similarly, paratransit service has a service-specific set of performance measures that track other features such as response time for calls, late arrivals, late deliveries, and other specific measures that address the quality of demand responsive services.

Figure 17 - Passenger Trips per Capita on Florida Transit



Source: FTIS 2004

Aviation (Passenger and Freight)

Aviation plays a critical role in interstate and intercity transportation for both persons and high-value products and materials. As a predominately private sector mode, market forces are critical in influencing service availability and cost. The greatest public sector role is in administering ground side infrastructure and access.

<u>System Preservation</u>

For aviation, an indicator of system preservation is the condition of an airport's runways and taxiways. System preservation is not only important to ensuring that airports remain competitive and operate safely and efficiently. The pavement condition of runways and taxiways directly impacts the ability of pilots to maneuver aircrafts safely, often at high speeds. Structural integrity of the pavement is important to avoid possible situations, including tire damage as a result of wide cracks or missing pavement, foreign object damage, water accumulation due to depressions, or rutting and skid problems from bleeding or polished aggregate.

The Federal Aviation Administration (FAA) has developed two Advisory Circulars regarding airport pavement management. AC 150/5380-6A, Guideline and Procedures for Maintenance of Airport Pavements, provides guidelines and procedures for the maintenance of rigid and flexible airport pavements. AC 150/5380-7 discusses the Pavement Management System concept. This system would provide consistent objectives and systematic procedures for pavement maintenance and rehabilitation, which would allow for effective allocation of available funding for improvements.

FDOT uses a Pavement Condition Index (PCI) to rate the condition of individual pavement sections. The PCI value ranges from 0 to 100 and is assigned to the section by well-trained and experienced inspectors. The PCI, which is fully documented by the FAA and ASTM (American Society for Testing and Materials), provides consistent and objective results. Software is available to evaluate data and determine maintenance and rehabilitation needs and costs.

Accessibility

According to the Florida Aviation System Plan 2000 (FASP), the state's aviation vision includes maintaining an accessible airport system. Accessibility is related to both air and ground access and is a measure of how easily a location can be reached.

Air access to airports is facilitated by working with the FAA. Airports in the system that are capable of supporting Part 135, 139 or 107 operations and have full precision approaches or at least some published approaches are high priorities in the FASP. Most large airports in Florida already have the most advanced approaches and navigation aids available. So while air access is important to these airports, it is not the top priority of planning initiatives. Another measure of air access is the number of weekly scheduled non-stop commercial flights. Table 7 details the average number of flights, seats and U.S. cities served for four time periods.

Table 7 – Florida's Domestic Nonstop Scheduled Service Summary, 2000-2003

	Summer 2000	Summer 2001	Fall 2001	Summer 2003
U.S. Cities Served	79	81	78	83
No. of Airlines Serving	33	32	31	42
Flights (average weekly)	11,584	11,437	9,689	10,021
Seats (average weekly)	1,241,223	1,289,002	1,137,941	1,202,686
Seats per Flight	107.1	112.7	117.4	120.0

Source: FASP Project Reports, *Air Service Study Update 2003*

Access to the airport from the ground is also part of the accessibility measure. Considerations for ground access include access to the highway system, a roadway network capable of serving the airport without undue user delay, multi-modal connection opportunities, signage, ground transportation services, and interfaces for ground/air cargo exchange.

Weaknesses of Florida's airport system, which relate to accessibility, consist of the lack of intermodal connections at airports and ground access constraints. Strengths of Florida's airport system include the number and distribution of the public-use airports. As discussed in the "Transportation System: Air Facilities -- Passengers and Freight" report of the T&C series, Florida has 131 public airports. Nineteen of these provide commercial service and are distributed across the state. Table 8 reports the share of Florida's population and employment within proximity of Florida's commercial airports. The strong tourist travel demand, the location of Florida as an appendage to the contiguous states, and the large population result in very attractive air travel service levels in Florida. A total of 92 percent of the population and 95 percent of the employment are within 40 miles of a commercial airport.

Table 8 – Florida Commercial Airport System Accessibility

System	Commercial Seaports	Estimated Statewide Totals
Population in Census Tracts within 20 Mile	12,637,610	17,019,068
Population in Census Tracts within 40 Miles	15,574,748	
Commercial Employment within 20 Miles	2,567,840	3,126,526
Commercial Employment within 40 Miles	2,958,244	

Source: Accessibility analysis by Armasi, 2004.

Level of Service

Among the level of service criteria that are traditionally used for air travel service is service availability, as shown in Table 7, where the connectivity and frequency of service to major destinations is noted, and other aspects of performance such as on-time statistics. Table 9 contains data on the historical trend of on-time performance. On-time performance is influenced by numerous factors, including weather and airport construction programs, but is significantly influenced by the willingness of the airlines to schedule services at times that have adequate airport/airfield capacity. The desire to accommodate passengers' preferred travel times often conflicts with available capacity and airlines, in conjunction with airports and the FAA, work to balance passenger preferred departures with airport and airspace capacity. The fact that the air travel system operates as a systems with delays in other locations affecting performance at Florida airports is also a consideration.

Table 9 – Major Airports in Florida On-Time Performance, 2000-2003

Percent of On-Time Departures				
	2000	2001	2002	2003
Miami (MIA)	78.82%	78.44%	85.70%	83.48%
Orlando (MCO)	80.14%	83.34%	87.39%	87.48%
Tampa (TPA)	80.48%	82.87%	85.90%	88.24%
Fort Lauderdale (FLL)	78.17%	80.86%	85.28%	85.76%
Percent of On-Time Arrival				
	2000	2001	2002	2003
Miami (MIA)	73.87%	75.50%	81.34%	79.87%
Orlando (MCO)	73.99%	78.47%	82.16%	82.65%
Tampa (TPA)	73.43%	77.57%	81.25%	83.11%
Fort Lauderdale (FLL)	72.80%	76.28%	79.05%	80.42%

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Airline On-Time Performance.
Note: Late is considered 15 minutes or more behind schedule.

Seaports

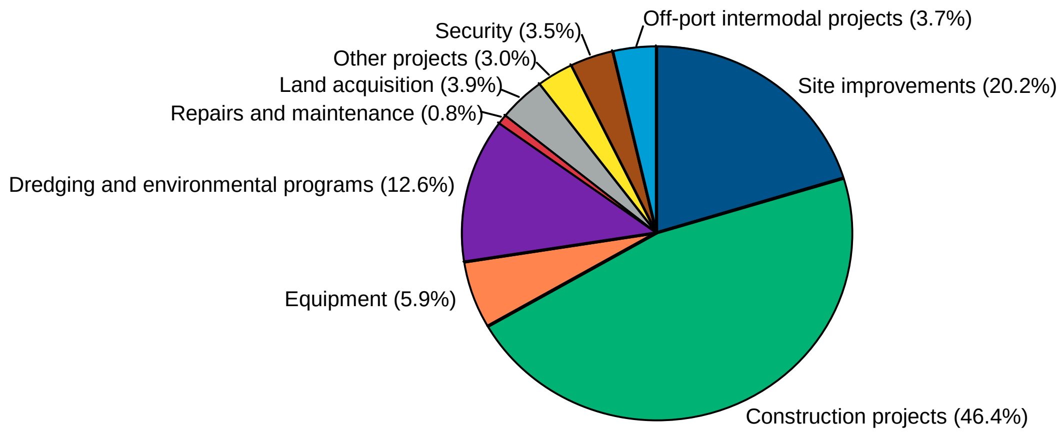
As discussed in "Transportation System: Seaports -- Freight and Cruise Activity," Florida has 14 deepwater seaports that are critical to the economy. To carry out their mission of "enhancing the economic vitality and quality of life in Florida by fostering the growth of domestic and international waterborne commerce," Florida's seaports strive to maintain and improve the performance of the marine transportation system. For more detail on Florida's seaports, review the *Executive Summary: A Five-Year Plan to Achieve the Mission of Florida's Seaports (2002/2003-2006/2007).*

System Preservation

Preserving and improving seaport facilities is an integral part of enabling Florida's seaports to remain competitive by efficiently moving passengers and freight. Industry parameters continue to require longer berths, larger terminals, deeper channels, and more sophisticated equipment. Historically, the largest share of capital expenditures is for construction projects that are essential for movement of goods and passengers through each port. These projects include bulkheads, cargo and cruise terminals, warehouses, and other structures. Over the next five years, Florida's seaports are expected to spend approximately $728 million on such projects.

Other capital improvement needs include general site improvements, construction projects, equipment, dredging and environmental programs, repairs and maintenance, land acquisition, security, off-port intermodal projects, and other projects. The total of these programs is expected to exceed $1.6 billion. Figure 18 presents the share of spending intended for each project category over the next five years. Site improvements, including roads, lighting, utilities, storage yards and other projects, represent the second largest share of needs. However, percentages shift annually as new demand arises. Current emphasis on security has deferred many capital expenditures.

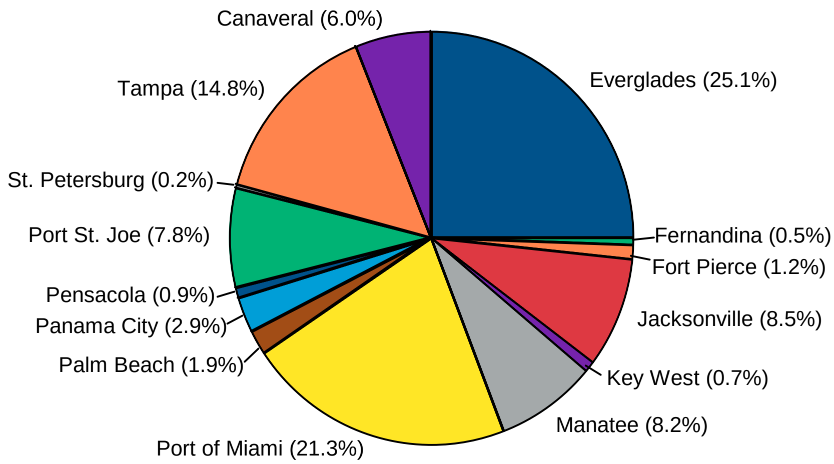
Figure 18 - Florida's Seaports Capital Improvement Needs by Catergory, FY 02/03 - FY 06/07



Source: Excecutive Summary: A Five-Year Plan to Achieve the Mission of Florida's Seaports (2002/2003 - 2006/2007)

Figure 19 shows how the capital improvements are distributed among the ports. The larger ports, including Everglades, Miami, Tampa, and Jacksonville, represent 70 percent of the total, while the next tier, including Canaveral, Manatee, and Palm Beach, totals 16 percent. The other seven ports share the remaining 14 percent.

Figure 19 - Florida's Seaports Capital Improvement Needs by Port, FY 02/03 - FY 06/07



Source: Excecutive Summary: A Five-Year Plan to Achieve the Mission of Florida's Seaports (2002/2003 - 2006/2007)

In the future, funding availability will be the determining factor of Florida's seaports preservation and expansion. The state-seaport funding partnership, created by Chapter 311, Florida Statutes (F.S.) and expanded by Chapter 320, F.S., has provided a financial framework for seaport improvements. The Florida Legislature has developed innovative funding mechanisms in response to Florida's freight transportation and trade corridor system needs.

Accessibility

Access is a critical determinant of how competitive Florida's seaports are in the global market. In Fiscal Year 2000-2001, Port Canaveral, Port Everglades, the Port of Jacksonville, Port Manatee, and the Port of Miami participated in a national survey of U.S. seaports. The purpose of the survey, which was conducted by the U.S. Maritime Administration, was to measure the existing access conditions and roadway, rail and waterside connectivity at U.S. seaports. The Florida Seaport's Mission Plan discusses findings from this survey that are significant to Florida. Although port access is generally acceptable today, continued cargo growth and international trade may pressure existing infrastructure. In the future, most ports anticipate doubling or tripling cargo flows. Unacceptable conditions most often occur at ports handling containerized cargo. Unacceptable conditions include congested access roads, at-grade railroad crossings, railroad access issues, inadequate channel depth, and lack of truck only routes. Container ports located in urban areas, such as Miami, Fort Lauderdale, Palm Beach and Jacksonville, are typically the first to experience intermodal access system stresses, because containerized cargo tends to be higher value and time sensitive.

The condition of other transportation systems, such as roadway or railway, directly impacts the accessibility of Florida's seaports for both passengers and freight. Current information regarding the conditions of these systems is previously discussed in this report. The access requirements of these systems require seaports to invest in these systems. Approximately 3.7 percent of Florida's seaport capital improvement program spending is dedicated to intermodal access projects over the next five years. Some seaports have other long-term intermodal infrastructure plans. For example, the Port of Miami has planned a $600 million access tunnel and connectors to improve overall access to the port, the Interstate System and Greater Miami downtown. Port Everglades also has a long-term plan for an airport-seaport connector to support cruise passenger transfers between the facilities.

Florida's seaports are striving to overcome challenges in access. FDOT is addressing access and connectivity issues through the Strategic Intermodal System (SIS). The SIS identifies transportation corridors, hubs and connectors for both freight and cargo across the state in an effort to efficiently fund and plan the transportation system. The SIS integrates all modes of transportation to address future needs.

Table 10 reports the accessibility of Florida seaports to employment. This gives an indication of the access of economic activity to Florida seaports. Proximity of seaports to population is less relevant, as cruise activity is predominately vacation travel and not dependent on access to resident population but rather accessibility to the intercity transportation system that provides access for cruise passengers. Sixty-nine percent of employment is within 40 miles of a commercial seaport.

Table 10 – Access of Commercial Seaports to Florida Employment

System	Commercial Seaports	Statewide Total
Commercial Employment within 20 Miles	1,802,789	3,126,526
Commercial Employment within 40 Miles	2,142,671	

Source: Accessibility analysis by Armasi, 2004.

Level of Service

As port activity is predominately a private sector function, the levels of service are driven by market conditions and the ability and willingness of the industry to respond by providing the levels of service that are attractive. As the dominant hub of cruise activity in the domestic market, Florida offers numerous cruise venues, year-round departure schedules, and frequent departure opportunities. The accessible venues are afforded by the geographic orientation of Florida relative to possible destinations.

Freight marine shipping levels of service also are influenced by the market conditions and demand. The commodity capabilities of each port, the number of shippers operating, and the destinations served are all influenced by the geographic orientation of the port, the nature of the facilities, and the volume of port activity. The large number of Florida ports provides good ground accessibility, but volume and specialization influences the attractiveness for various commodities.

Rail

As with other modes, the railway system serves both passenger transport and freight transportation needs. The rail system is dominated by freight activity and also is a private-sector-dominated segment of the transportation system. Both infrastructure and operations are predominately private sector owned and operated. Hence, system performance is primarily dependent on market conditions and the willingness of the private sector to invest in services and infrastructure. Rail passenger service is operated by Amtrak, an entity whose ability to operate is dependent on public resources. More descriptive information on the Florida rail system is presented in an earlier Trends and Conditions report, which can be found in the Florida Rail System Plan.

System Condition

While the condition of the rail system has been a private sector responsibility, there is a growing level of public involvement through various programs from grade crossing enhancement to facilitating intermodal connections to direct ownership of rail corridors, as in the case of southeast Florida where the State of Florida purchased the corridor to enable Tri-Rail passenger service to share the corridor with Amtrak and freight services. The importance of rail to the performance of the overall transportation system -- specifically, the opportunity it provides to reduce truck demand for major roadways -- creates a growing level of public interest in the condition and performance of the rail system. The extent of the rail system in Florida had declined over the past century, as is the case in most other states as the industry has consolidated. The Florida rail system comprised 2,871 miles of track in 2002, down approximately 1,000 miles from its peak system size.

One measure of system condition is the operating speed of the track. This is affected by the physical condition and the original design. Track condition is controlled by the private company that owns and operates the track subject to Federal Railway Administrations guidelines for operating speed. An inventory of operating speed for Florida's Trackage is not currently available.

Accessibility

The availability of rail service is dependent on the density of the network and the frequency of services. Florida's orientation with respect to the rest of the nation results in the Florida rail system being directed to serve Florida-specific needs rather than through traffic needs, as is the case in many other states where services passing through the state provide additional services and support additional infrastructure. Nonetheless, the amount of rail trackage in Florida per 100 square miles is slightly above the national average, with 5.5 miles of track versus 4.1 nationally and 4.5 for California. Table 11 shows that 83 percent of Florida population is within proximity of the Amtrak stations in Florida.

Table 11 – Access to Intercity Rail Passenger Services in Florida

System	42 Stations	Estimated Statewide Totals
Estimated Population within 20 Miles of an Amtrak Station	14,203,466	17,019,068

Source: Accessibility analysis by Armasi, 2004.

Capacity Adequacy

The adequacy of rail capacity is dependent on a number of factors, including the extent of growth in demand and the extent to which additional passenger travel demands, either for intercity travel or for local commuting and public transportation share use of existing facilities. Longer range forecasts of demand in freight travel indicate that additional track capacity may be required in the future. Analyses of freight volume density indicate the lack of overhead volumes result in Florida trackage serving Florida originating or destined freight. Thus, the need for capacity expansion is dependent on future demand growth.

Conclusions

This report on transportation system performance covers all modes by using a structure of performance measurement focusing on three main features: condition, accessibility, and level of service. For each mode, the availability of information and data varies and is not standard or consistent across modes. Nonetheless, the collective body of information, particularly in combination with the descriptive information in prior reports, provides an overview of the performance of the transportation system. A number of themes are clear, as follows:

- As overall travel demand for both freight and passenger movement has grown faster than infrastructure and services, there is pressure on all the modes to maintain adequate service capacity.
- Growing demand forces greater multimodal planning and attention to intermodal connectivity. As a given mode reaches capacity, other modes may need to absorb the demand. The growth in demand and performance of the various modes changes the competitive positions and may influence mode choices for both passenger and freight transportation. For example, crowded roads may enhance the competitive position of freight rail services.
- Private sector transportation services are increasingly of interest to the public sector as they play an important role in meeting overall demand.
- System physical condition, while a significant financial challenge, is relatively good for Florida. Florida is less burdened with massive aging infrastructure than some other parts of the country.
- System accessibility in Florida is generally good to very good. The density of Florida's transportation networks is above national averages as a result of its population size. The development pattern along the coasts with several large metropolitan areas has resulted in seaport and airport networks that are comparatively large and a reasonably well developed expressway system traversing the state.
- Ensuring sufficient capacity will be the largest single challenge to the performance of the transportation system in Florida. The projected continued growth in travel demand coupled with limited resources to provide capacity additions will continue to challenge the

performance of existing systems. Unless there are meaningful increases in efficiency or other resources or strategies for infrastructure and service expansion, conditions for person and freight travel are likely to deteriorate.

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Trends and Conditions Report – 2004

IMPACT OF TRANSPORTATION:

Transportation and Land Use

December 2004

Contract BD-544-7

This "Trends and Conditions" report was prepared jointly by the Office of Policy Planning of the Florida Department of Transportation and the Center for Urban Transportation Research at the University of South Florida. It is part of a continuing process to support the needs of decision makers, transportation professionals and the interested public.

This and other reports are being maintained on the Internet at:
www.dot.state.fl.us/planning/policy/trends

List of Tables and Figures

Transportation and land use are inextricably linked. Real estate professionals have been known to characterize the value of a property as being a function of "location, location, and location," which, to planners and transportation professionals that means "accessibility, accessibility, and accessibility." Transportation both enables and constrains the location, shape, size, intensity and overall pattern of land uses. At the same time, the type, capacity and usage of transportation systems depend on land uses.

The fundamental relationship between transportation and land development dates to the earliest evidence of civilization as pathways, waterways, and subsequently, rail lines, roadways and airports have substantially shaped settlement patterns.

In recent years, there has been a growing effort to more fully understand and leverage the transportation-land use relationship. There are several fundamental motivations for understanding this relationship:

1. **Land use** decisions can complement transportation investments by placing compatible activities adjacent to transportation infrastructure and by placing new activities at locations where transportation infrastructure and services exist or are planned.
2. **Land use** decisions can influence the amount of travel, the geographic location of travel demand, and the relative attractiveness and use of various modes of travel.
3. **Transportation investments** can complement land use goals by placing facilities appropriately so as to minimize impacts on adjacent sensitive land uses.
4. **Transportation investments** can complement land use goals and plans by locating capacity such that it stimulates development in desired locations.

This report will detail the relationship between transportation and land use in the State of Florida. This will include five major sections:

1. The Transportation-Land Use Relationship
2. Transportation as a Consumer of Land
3. Planning for Transportation and Land Use Coordination
4. Critical Transportation and Land Use Considerations in Florida
5. Conclusions

The Transportation-Land Use Relationship

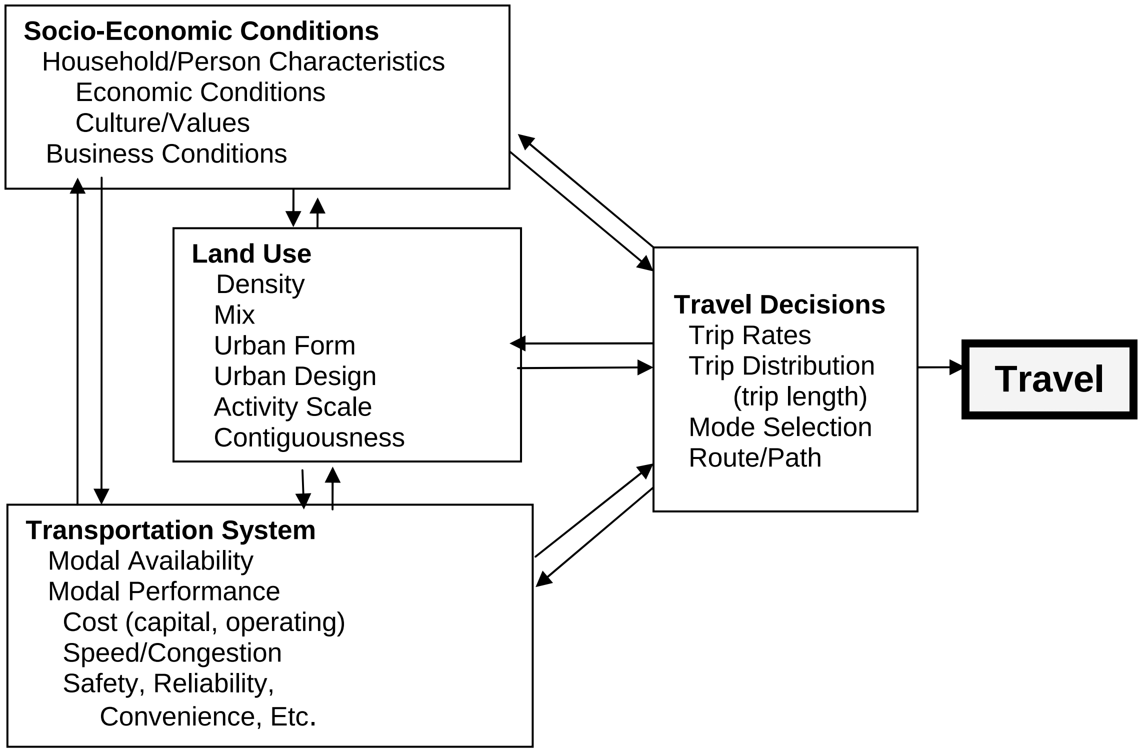
Development of transportation systems initially focused on connecting various land uses and activities with modest transportation infrastructure (two-lane road, single-track rail, limited air service, etc.). Over time, the density of the network of transportation facilities grew to reach most locations and provided increasingly direct connections. As development intensified, attention shifted to expanding link capacity as various links in the network became crowded. The simultaneous development of networks for other modes results in a dynamic complex network of transportation facilities and services that comprise the overall transportation system and define the relationship between land use and transportation.

The consequences of land development and design strategies on travel demand have been of interest for decades. In the 1970's, there were initiatives to understand this relationship to assess the energy use implications of urban development and transportation network patterns. The 1980's saw increased interest in the costs of sprawl, specifically the environmental and monetary costs of building and operating transportation infrastructure. In the 1990's, interest in the relationship between urban form and transportation demand intensified. Longer-term development and design solutions for moderating the growth of travel demand were considered. These included growing investment in transit systems, increasing levels of congestion, concerns about global warming and the environment, and the recognition that there are inadequate resources to keep pace with growing travel demand.

The books *Travel by Design, the Influence of Urban Form on Travel*,(Boarnet and Crane, 2001) and *Land Use and Site Design, Traveler Response to Transportation System Changes* (TCRP 95, 2003) provide a comprehensive overview of how land use influences travel demand.

The complex social, technical and political nature of the transportation-land use relationship combined with evolving culture, values and technologies results in a complex and dynamic set of interrelationships between transportation and land use that is not fully understood. Figure 1 presents a conceptual model of this relationship. The boxes on the left identify the range of factors that influence travel behavior. Each of these factors is known to play a role in influencing each of the fundamental travel decisions shown on the right. These decisions subsequently affect the demand for travel on the various modes. Thus, land use is identified as one of three major categories of factors influencing travel demand. However, it is not the only factor and the relative significance of land use in comparison to socio-economic conditions and transportation system conditions is subject to uncertainty and debate.

Figure 1 Conceptual Model of Factors That Affect Travel



The following land use characteristics or traits are linked to travel behavior and demand.

- **Development density or intensiveness:** Development density is measured with various parameters such as population, employment, dwelling units, floor area or square footage of development per unit of land. Independent of other factors, higher density creates higher total travel demand from a given geographic area, but it enables and encourages shorter auto trips and higher walk, bike and transit use due to the concentration of activities. Higher activity in one area also reduces the development in other areas. Conversely, low-density development creates lower total travel demand from a given geographic area precluding the efficient provision of transit and favoring auto use for trips to other zones.

- **Mix of uses:** Within a given area, the mix of uses influences the extent to which personal activity needs such as work, school, shopping, etc., can be served by development in the immediate area. Mixing of complementary land uses enables shorter trips where bike and walk may be viable options, reduces auto trip distances, and supports efficient transit operations. Large single-use developments require longer trips between activities, thus encouraging auto travel.

- **Urban form:** The broad overall geographic arrangement of land-use and transportation facilities determines urban form. Urban form embraces a host of characteristics that impact the comfort, speed, cost, convenience, attractiveness, and safety of movement between activities. It encompasses the nature of the transportation networks, whether grid, radial, or other, as well as the configuration of land use such as monocentric or polycentric. Urban form can favor one mode over others and may influence overall travel by changing the ease of use or accessibility of various modes of travel.

- **Urban design:** More detailed physical aspects of development are referred to as urban design or site design. The orientation of the building on a site relative to transportation infrastructure (parking, sidewalks, bus stops, etc.) can impact the choice of modes. Other design features such as covered walkways, seating, or other amenities can be part of site design. Collectively these design features can increase the safety, attractiveness and convenience of various modes. When urban design is targeted to favor walk, bike and transit services, it can help reduce auto travel.

- **Activity scale:** The scale of the activity at a given location determines the size of the market area served by the facility. Activity scale is determined by the nature of the activity and the business/market conditions. Larger-scale facilities result in longer access trips for employees and customers and reduce the probability of using walk and bike modes, thus producing greater vehicle travel. For some land uses, this may mean the difference between a retail store serving 4 square miles versus 10 square miles. In the case of activities such as manufacturing, higher education, or corporate administration, scale may influence employment access; however, the market area may be regional, national or global.

- **Contiguousness of development:** As areas grow, the edge of the developed area can be very irregular since various landowners choose different times to convert their vacant or agricultural land to more developed purposes. It is common, particularly at the outer edges of developed areas, to see a significant mix of undeveloped land interspersed with pockets of development. The skipped-over undeveloped land makes alternative transportation unworkable and requires external trips to or from the new development to be in motor vehicles, thus producing longer auto trips that increase vehicle travel.

Collectively, these land use characteristics - which are the consequences of myriad public and private decisions over a number of years - determine how land use influences travel demand and hence, transportation service and infrastructure needs.

For transportation providers, the significance of understanding land use development is in determining how transportation decisions influence land use characteristics which then influence future travel demand. Among the difficult and controversial policy issues are determining whether transportation decisions regarding the location, capacity and choice of modes should attempt to influence the location of development. These decisions have been and will remain critical to transportation investment and policy in Florida.

Transportation as a Consumer of Land

Transportation not only influences land use but is a consumer of land and impacts adjacent lands in various ways, from providing accessibility that adds value to creating air, noise and aesthetic impacts. Tables 1 and 2 provide a measure of the intensiveness of transportation by portraying the extent of transportation infrastructure in relationship to both population and land area. Table 1 shows that Florida has a relatively high level of lane miles per square mile compared to other states that are similar in terms of size, growth rate or geographic proximity. On the other hand, Florida has fewer lane miles per hundred persons than all but two of the other states. New Jersey, the most densely developed state, provides a perspective on how extensive the transportation network can become in a predominately urban state.

Table 1 Roadway Network Intensiveness

	2000 Total Land (sq mi)	2002 Population Estimate	2002 Public Road Lane Miles	Lane Miles per Sq Mi	Lane Miles per 100 Persons	2002 Total Public Road Centerline Miles	Centerline Miles per Sq Mi
Arizona	113,635	5,456,453	122,721	1.08	2.25	57,162	0.50
California	155,959	35,116,033	373,584	2.40	1.06	167,898	1.08
Florida	53,927	16,713,149	260,519	4.83	1.56	119,785	2.22
Georgia	57,906	8,560,310	244,068	4.21	2.85	115,777	2.00
Illinois	55,584	12,600,620	289,226	5.20	2.30	138,450	2.49
New York	47,214	19,157,532	241,526	5.12	1.26	114,020	2.41
North Carolina	48,711	8,320,146	213,517	4.38	2.57	101,743	2.09
Ohio	40,948	11,421,267	264,754	6.47	2.32	124,885	3.05
Texas	261,914	21,779,893	642,090	2.45	2.95	301,776	1.15
New Jersey	7,417	8,575,252	79,444	10.71	0.93	36,556	4.93
U.S.	3,537,438	288,368,698	8,295,168	2.34	2.88	3,966,485	1.12

Table 2 suggests that the rail network in Florida is less intensive than in many other states. This is expected, given Florida’s dramatic growth beyond the era of aggressive railroad development and Florida’s peripheral geographic location, which precludes thorough rail routes traversing the state. The intensiveness of commercial airports appears to be similar to the peer states, somewhat lower on a per capita basis but higher on a per square mile basis.

Table 2 Rail and Airport Intensiveness

	2000 Total Land Sq Mi	2002 Population Estimate	2002 Total Freight Rail Miles	Rail Miles per 100 Sq Mi	Rail Miles per 1000 Persons	Public Airports	Commercial Airports per 100,000 Persons	Commercial Airports per 1,000 Sq Mi
Arizona	113,635	5,456,453	1,912	1.68	0.35	82	1.503	0.722
California	155,959	35,116,033	7,607	4.88	0.22	263	0.749	1.686
Florida	53,927	16,713,149	2,957	5.48	0.18	140	0.838	2.596
Georgia	57,906	8,560,310	4,936	8.52	0.58	109	1.273	1.882
Illinois	55,584	12,600,620	9,669	17.40	0.77	119	0.944	2.141
New York	47,214	19,157,532	4,981	10.55	0.26	163	0.851	3.452
North Carolina	48,711	8,320,146	3,355	6.89	0.40	114	1.370	2.340
Ohio	40,948	11,421,267	6,645	16.23	0.58	175	1.532	4.274
Texas	261,914	21,779,893	14,192	5.42	0.65	391	1.795	1.493
New Jersey	7,417	8,575,252	2,353	31.72	0.27	48	0.560	6.472
U.S.	3,537,438	288,368,698	143,361	4.05	0.50			

Transportation is a consumer of land by virtue of the fact that roads, parking, airports, ports, sidewalks, etc., consume land. One can develop a sense of the share of land consumed by transportation by making estimates regarding space consumption of transportation infrastructure. Table 3 provides such assumptions. Pipelines and power lines, retention areas, paths and sidewalks, nonpublic roads, and a host of other transportation-related minor uses are not included. This estimate suggests that less than one percent of the land in Florida is dedicated to transportation infrastructure. In some core urban areas, it is known that roadway, sidewalk and parking consume up to 40 percent or more of the land area. In partially urbanized counties, transportation can consume five percent of the land area.

Table 3 Florida Land Used for Transportation

Mode	Units	Count	Land Use Assumptions	Area in Square Miles
Roadways	Centerline Miles	119,785	120’ ROW width	2,722.4
Parking	Registered Vehicles in State	13,963,596	3 spaces @ 10’ x 40’ each	600
Railroads	Track Miles	2,957	100’ ROW	56
Commercial Airports	Each	140	2 square miles	280
Ports	Each	14	5 square miles	70
Total land used by transportation				3,728.4
Florida land area				53,927
Percent of land used for transportation				0.7%

A national estimate suggests that approximately 1 percent of land is consumed by roadway and right of way (Foreman, 2001). Broader definitions such as counting land dedicated to vehicle sales and servicing, gas stations, scrap yards, trucking terminals, etc., could result in a higher share of the land indirectly supporting transportation. Given the linear corridor nature of much of the land used for transportation, the share of land directly adjacent to transportation purposes would be considerably larger. As virtually all actively used land is accessed by the roadway system, nearly 100 percent of land parcels are immediately adjacent to transportation land uses of some type.

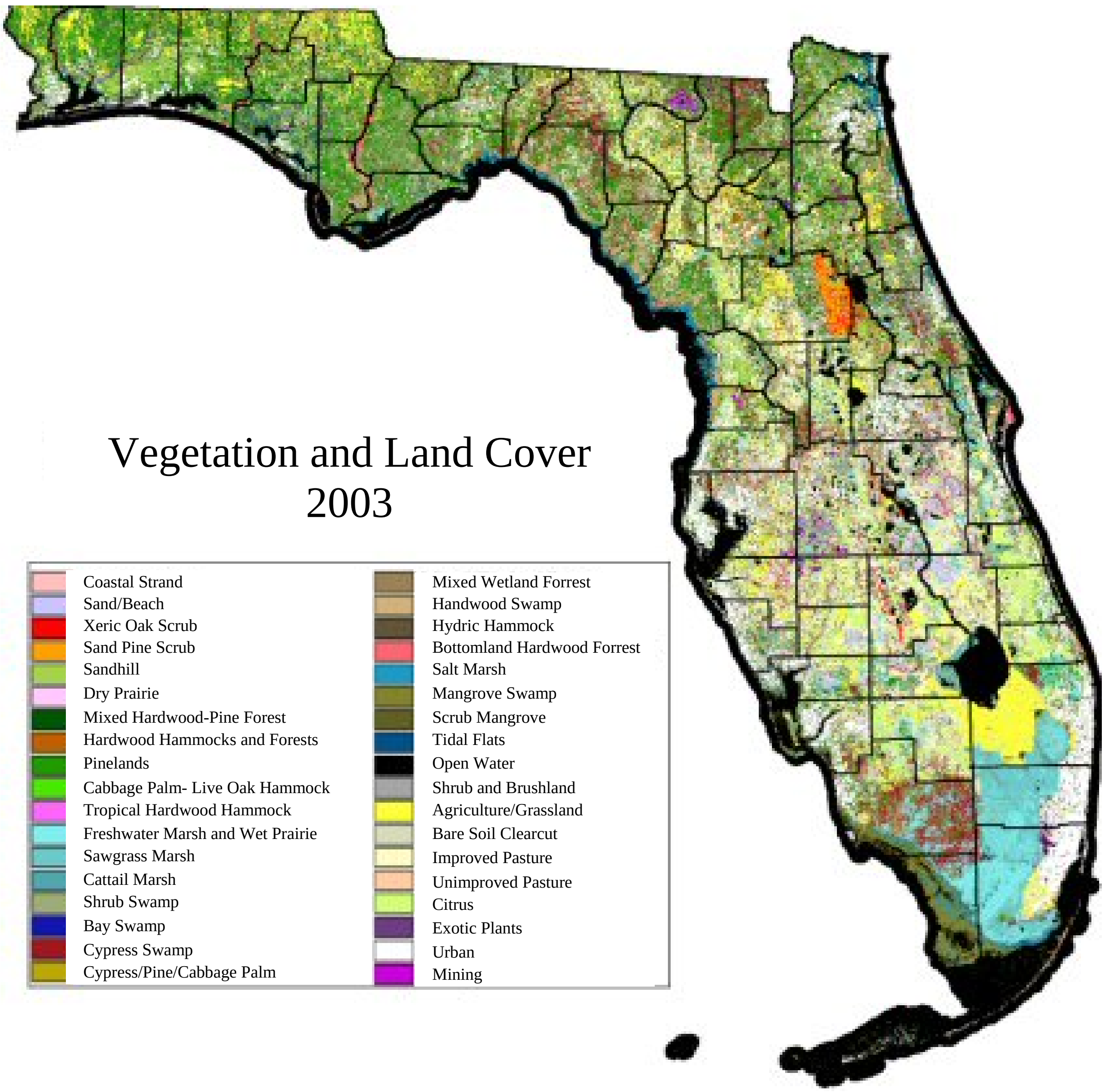
> ***Richard T. Foreman of Harvard University has estimated that approximately 1 percent of the country's land is devoted to transportation.***

The data on network density in Table 1 suggests that if Florida were as intensively developed as New Jersey, roadway miles per square mile would more than double. The table shows that only a few other states have a denser network of roadway centerline miles. The growth in new centerline miles is likely to be more modest than the growth in new lane miles as existing facilities are widened. This will be particularly true for higher functional class facilities. Thus, roadway infrastructure intensification is most likely to be comprised of network additions in undeveloped areas (new centerline miles) and capacity increases in developed areas (lane miles from widening). This is characteristic of the shift from "connectivity" to "capacity" goals for transportation as an area becomes more fully developed.

Summary of Florida Land Use -- Land use planning is predominately a local responsibility. Thus, land use classification reflects local practices and regulations as carried out by local governments. However, there are some aggregate classifications of land use that can provide a sense of the overall allocation of land use in Florida. The nature of land use and the extent to which urbanization is concentrated influences the amount and nature of transportation infrastructure required. The trend data for historical land use allocation are available only in aggregate terms as shown in Table 4. This table and Figure 2 provide a tabular and map presentation of the aggregate land use classification in Florida. Sample county level data shown in Appendix A gives greater insight into the changes in land use over time.

The abundance of non-urban land in Central Florida and the northern area of the state is apparent from Figure 2. Table 4 shows the trend based on data compiled from water management district data sources using the Florida Department of Transportation Florida Land Use, Cover and Forms Classification System (FLUCCS). Further information on this system can be found at http://www.dot.state.fl.us/surveyingandmapping/geographic.htm#fluccs. The change in the share of urbanized land between 1974 and 1995 indicates the urbanized area more than doubled and now comprises approximately 12 percent of the state's area.

Figure 2 Florida Land Cover in 2003



Source: The source of the above map as well as source for additional GIS data is the Florida Fish and Wildlife Conservation Commission: http://myfwc.com/oes/habitat_sec/GIS/gis_home.htm.

Appendix A provides an example of land use and development trends in selected Florida counties. This material provides a more detailed understanding of development trends.

Table 4 Florida Land Use Allocation

Year →	1974		1995	
Land Use	Area (sq. mi.)	Percent of Total Land	Area (sq. mi.)	Percent of Total Land
Total	59,444.6		61,273.4	
Urban	3,248.8	5.5%	7,590.3	12.4%
Agriculture	12,993.5	21.9%	12,737.7	20.8%
Rangeland	5,253.7	8.8%	2,185.6	3.6%
Upland Forest	17,744.4	29.9%	18,352.4	30.0%
Water	5,424.1	9.1%	2,576.6	4.2%
Wetland	12,899.2	21.7%	16,566.0	27.0%
Barren	1,409.5	2.4%	216.2	0.4%
Transportation, Communication, and Utilities	293.0	0.5%	717.9	1.2%
Other	471.5	0.8%	835.7	1.4%

Source: Data based on Water Management District land use allocations.
Note: Some reclassifications and refinements in definitions have occurred over time. There are minor overlapping areas. GIS land use data is available from the Department of Environmental Protection at: http://www.dep.state.fl.us/gis/ and at the individual Water Management District Web Sites. All data provided by these agencies is provided "as is" with various caveats regarding accuracy. Interested readers should view this information directly and contact DEP and/or WMD staff as appropriate for further details.

Planning for Transportation and Land Use Coordination

The fundamental linkages between transportation and land use have long been acknowledged and, in varying ways, addressed in the planning processes for transportation. A generalized planning-development process is an iterative process composed of an analysis of issues, identification and selection of alternatives, plan adoption and implementation, and evaluation and re-analysis. These actions rely on technical analyses and professionally approved methods guided by social, political and economic forces.

Transportation planning is based on traffic demand projections, which are derived from projections of land uses as well as socio-economic conditions. Planning for development and re-development must consider the need for supporting infrastructure, including transportation systems. Therefore, it is axiomatic that transportation planning considers land use and that land use planning considers transportation. Historically, these two planning efforts have been conducted independently and in a somewhat disjointed fashion, with principal responsibilities often at different levels of government or within different jurisdictions. Fortunately, the practical coordination of these traditionally separate planning activities has improved.

This section provides a brief history of relevant transportation and land use planning initiatives followed by a brief review of current planning programs. Opportunities and obstacles to coordinated planning are then discussed.

History – Land use and transportation planning practices have evolved from years of effort and changing conditions. Research has been conducted to attempt to understand the actual linkages between land use and transportation. Advancements in computer technology are enabling better analysis and forecasting capabilities.

Planning goals have responded to changing economic and geographic conditions; changes in central city economies; shifts to multi-centric urban areas and a suburbanization of population and industry; and geographic convergence of previously separate metropolitan areas. Other factors affecting planning goals are financial limitations that constrain the continued expansion of highways, availability of energy supplies and globalization of the economy.

Over 28 percent of Florida households do not have a worker; thus, deciding where to live may not be affected by employment access considerations.

Federal government actions have had a major impact on transportation for over half a century. The planning, funding and construction of the Interstate Highway System starting in the 1950's had a significant impact on land use patterns, particularly by enhancing the opportunity for urban dispersion. Population and employment dispersion, often referred to as sprawl, was also enabled by the post World War II population and economic boom, growing auto availability, concerns about personal safety and the quality of education in urban centers, government programs that facilitated single family homeownership, and other socio-economic considerations. Florida was particularly impacted by urban sprawl due to the massive in-migration of people seeking its attractive climate, landscapes and economic opportunities. The appeal of Florida for retirement has resulted in approximately 28 percent of Florida households not having a worker. Thus, location decisions for these households need not be based on access to employment opportunities. The State of Florida and local governments have been more disposed to encouraging growth rather than regulating it. It was not until the late 1960's and 1970's that the state and local governments began addressing the management of growth. Unbridled land speculation and development led to rapid growth, environmental intrusion, and the overburdening of infrastructure, particularly transportation and water.

The federal government began encouraging planning through the United States Housing Acts from the late 1940's through the early 1960's that required comprehensive planning in order to receive federal funds. The Federal-Aid Highway Act of 1962 initiated a number of significant policies. First, it established a continuing, comprehensive, and cooperative (3C) urban planning process. This planning process included economic analysis, land use and zoning, and social and community-value considerations, including environmental amenities and aesthetics. Second, it required that planning occur at the metropolitan-wide scale rather than individual jurisdictions in recognition of the regional components of transportation systems. Finally, intergovernmental coordination (and indirectly, coordination of transportation and land use planning) was strengthened through the A-95 Clearinghouse review process.

The 1960's and 1970's saw an increased emphasis on urban and environmental issues. Federal legislation that established the U.S. Department of Transportation also addressed the protection of natural and historic resources. The enactment of the National Environmental Policy Act of 1969 and the Endangered Species Act of 1973 at the federal level led to greater scrutiny of federally funded projects, such as highways and their impact on the environment. Metropolitan Planning Organizations (MPOs) were established in 1973. Finally, increased attention was directed towards impacts of transportation systems on urban systems (particularly central city development and urban dispersion). The Federal Clean Air Act (CAA), originally passed in 1963, is the core and driving force for all air pollution legislation in the United States. It significantly influences transportation planning and resource programming activities.

The State of Florida enacted the Florida Environmental Land and Water Management Act (Chapter 380 Florida Statutes) in 1972 to address Developments of Regional Impact and Areas of Critical State Concern followed in 1975 by the State Land Planning Act which required local government comprehensive planning. These state actions were intended to address many issues resulting from rapid growth including the transportation system.

The 1980's saw an increase in federalism under President Reagan. The A-95 process was eliminated in favor of providing more discretion to states for planning and coordination with federal programs, including urban transportation planning. The role of the Florida Department of Transportation (FDOT) as a planning and coordinating agency increased. In Florida, growth continued and stronger growth management was desirable. In 1985 and 1986, the Local Government Comprehensive Planning and Land Development Regulation Act instituted major changes to comprehensive planning in Florida. Of particular relevance was the establishment of minimum planning criteria which were to be enforced via state oversight, namely compliance reviews by the Department of Community Affairs (DCA). Second, there was the joint requirement that local governments establish financially feasible capital improvement programs to achieve and maintain adopted level of service standards for transportation and other infrastructure. This was to be enforced through a concurrency process whereby new development could not be approved unless level of service standards could be maintained. A third change was a hierarchical planning system whereby local government comprehensive plans were required to be consistent with regional plans adopted by Regional Planning Councils and the State Comprehensive Plan. Programs for intergovernmental coordination, including coordination with state and regional agencies were also included. These requirements provided a legal-planning framework for improved coordination.

Florida now had a planning apparatus by which land use plans and transportation plans would be coordinated. In theory, transportation systems would be planned and provided in a timely manner to accommodate new growth and concurrency regulations would not allow unplanned growth to overload the transportation system. Challenges included the lack of adequate funding, a multi-jurisdictional system for transportation planning, and conflicts between local governments' desires to attract growth irrespective of infrastructure capacity. One unintended outcome of concurrency was construction on the periphery of urban areas to take advantage of available roadway capacity and lower cost land.

At the federal level, the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 improved the coordination of transportation and land use planning. ISTEA required consideration of the effects of transportation plans and policies on land use plans. Further, a focus on intermodal planning, intergovernmental coordination, flexible funding (for either highway or transit projects), public participation, environmental impacts, and the global economy dovetailed with comprehensive planning efforts in Florida.

During the 1990's, numerous amendments were made to state laws to address the initial problems associated with transportation concurrency. Local governments were required to use level of service standards for the Florida Intrastate Highway System as adopted by FDOT. Exceptions were allowed to enable certain development opportunities despite level of service constraints. Finally, opportunities for multimodal transportation districts and area wide level of service standards were promoted.

At the state level, a hierarchical system of state, regional, and local government comprehensive plans has mandated the coordination of land use and transportation planning along with planning for other infrastructure as well as affordable housing and environmental protection. Nevertheless, in many respects these planning efforts remain parallel processes that are imperfectly integrated. The desire for transportation-land use coordination to play a meaningful role in minimizing both travel demand and the negative impacts of transportation on quality of life is more relevant than ever.

Current Planning Programs – Transportation planning is conducted by multiple governmental agencies. The federal government establishes overarching goals and programs for federal transportation funding. The Florida Department of Transportation promulgates overall transportation policy for the state. FDOT, in concert with Metropolitan Planning Organizations, are responsible for planning the State Transportation System. MPOs provide for coordinated planning within their individual regions. Local governments are responsible for jurisdiction-wide transportation plans within the context of a broader comprehensive plan.

The 2020 Florida Transportation Plan (FTP) (www.dot.state.fl.us/planning/2020ftp/) provides the overall goals and objectives for Florida's transportation systems. It is used to guide updates to plans of MPOs, regional planning councils, and local governments. A short-term State Transportation Improvement Program (STIP) identifies specific transportation projects.

There are 26 MPOs serving Florida's urbanized areas. MPO planning is required to address numerous policy and planning issues including land use plans, economic development, environmental protection, quality of life, and other social, economic and environmental factors. MPO plans and programs must be consistent to the maximum extent feasible with the approved local government comprehensive plans within the metropolitan planning area. MPOs produce three major documents: 1) Annual Unified Planning Work Program, 2) Long-Range Transportation Plan, (a 20-year plan updated every 5 years and required to be consistent with the FTP), and 3) Transportation Improvement Program (program of specific funded projects for a three year period, consistent with the STIP).

FDOT and MPOs in coordination with many other federal and state agencies including the Department of Community Affairs have strengthened the coordination of land use, environmental protection, and other concerns. Evolving planning processes and methods are enhancing the opportunity to more fully integrate land use considerations in transportation planning and more fully understand the impacts of transportation on land use. Such activities as aggressive public participation, utilization of GIS and other enhanced databases and planning tools, environmental justice considerations, economic development sensitivities, and ever more sophisticated planning models enable a greater sensitivity to land use issues. A good example of this coordination is the Efficient Transportation Decision Making (ETDM) process that allows multiple government agencies to screen transportation projects for potential impacts. For more information, see www.dot.state.fl.us/emo/.

All local governments in Florida are required to adopt, implement, and enforce comprehensive plans. These plans are intended to address a wide range of issues in an integrated and consistent fashion. Plan Elements address land use, transportation, housing, environmental protection, and infrastructure including water, sewer and storm water. The plans are intended to guide and control future development, facilitate the provision of adequate transportation and infrastructure, plan for community development, and protect and conserve natural resources. Intergovernmental coordination with other local governments and regional and state agencies is required. Plans necessarily restrict the development of some lands but must also respect private property rights.

The primary means by which plans accomplish these purposes are: 1) future land use maps and policies, 2) capital improvements planning, and 3) implementing regulations including zoning and concurrency. The Future Land Use Map (FLUM) designates what land uses can occur during the planning timeframe, a minimum of ten years but often 15-20 years. The Capital Improvements Element, in conjunction with the transportation and infrastructure elements establishes a financially feasible Five-Year Schedule of Capital Improvements. The Schedule is intended to ensure that transportation and infrastructure facilities will achieve and maintain adopted level of service standards. This is intended to be accomplished through the close coordination with the land use element.

Transportation planning in comprehensive plans varies depending on whether the local government jurisdiction lies in an urbanized area. Local governments within an MPO area must coordinate their transportation elements with the Future Land Use Element and the Long Range Transportation Plan (LRTP) of the MPO. This links comprehensive land use planning with transportation planning. Additionally, Transportation Elements must address multimodal transportation and promote land uses in support of planned public transit.

The establishment of adequate transportation level of service standards has been controversial. This has been addressed by requiring that level of service standards be established for the Florida Intrastate Highway System (FIHS) by FDOT. Concurrency regulations are established to ensure that growth does not overwhelm public facilities and degrade the level of service below the adopted standards.

Opportunities and Obstacles – As our knowledge grows of how transportation and land use relate to each other and to larger social, economic, and quality of life issues, the nature of this coordination has become more complex. Transportation and land use planning processes are both carried out within the context of economic, political and social institutions and forces as well as increasingly sophisticated technical methods and models. Opportunities and obstacles to improved coordination include the following.

<u>Political / Jurisdictional / Scale</u> – The goals of FDOT have a statewide focus. These goals focus on protection of the state transportation infrastructure, economic competitiveness, and mobility – to ensure a cost-effective and interconnected statewide transportation system. Local governments address a broader range of goals and are particularly attuned to the demands for new growth and the perceived advantages that new development would bring.

A defining characteristic of transportation systems is that they intersect and connect communities and therefore multi-jurisdictional coordination is imperative. This was recognized in the early federal directives to conduct metropolitan planning and establish MPOs. Regional transportation planning by MPOs and FDOT Districts helps to address these jurisdictional issues and conflicts. Regional Planning Councils, which house some MPOs, help coordination in a number of ways including the establishment of Strategic Regional Policy Plans (SRPP). Local government comprehensive plans are required to be consistent with SRPPs. Additionally, local governments are required to adopt Intergovernmental Coordination Elements in their comprehensive plans. Finally, metropolitan areas that were geographically separated when first established now adjoin each other with resultant increases in cross-MPO travel flows. This requires increased coordination between MPOs, which is now occurring both informally and via formal coordination agreements.

Timing – The transportation planning process of MPOs and FDOT coordinates the timing of the development of the various plans. Thus, the three-year TIPs and the 20-year LRTPs are developed in a fashion whereby they can be reviewed and compared in a timely manner prior to finalization. The same is not true for local government comprehensive plans. There is no coordination of schedules among local governments or with MPOs or Districts. Thus, the comprehensive plans are not always synchronized with the MPO and District plans.

Technical / Methods – Planning analysis that supports the development of goals, objectives, policies, maps and schedules is dependent upon assumptions and methods. Two critical areas are growth projections and the subsequent development of land use plans and transportation impacts based on the land use plans. Comprehensive land use plans are required to accommodate the projected need for growth. Plans are also required to discourage sprawl by not over-designating or over-allocating future land uses based on speculative forecasts. Finally, plans protect legally vested private property rights. In practice, the resulting plans have provided for future land uses (i.e., future development opportunities) far in excess of projected need. This results from a desire to provide opportunities for economic development and to not constrain the opportunities of land owners who seek to optimize the value of their land. This creates two problems. First, since transportation demands are calculated based on the future land use plan, this creates uncertainty as to where needs will actually materialize. Second, the presence of low-density development does not support multimodal transportation, particularly public transit.

Theory / Practice / Knowledge – Coordination of transportation and land use planning to achieve particular goals is dependent on what is known or theorized regarding the transportation-land use relationship. Achieving the planned results depends not just on having coordinated planning, but on the planned development and anticipated travel behavior actually materializing. As both land development and travel behavior are dynamic and influenced by a host of factors, developing a coordinated plan does not ensure the hoped-for consequences. In other words, even the “best laid plans” can go astray should implementation not occur or the impacts not materialize.

Critical Transportation and Land Use Considerations in Florida

This final section addresses some of the critical transportation land use policy issues that face Florida. While not unique to Florida, they portray some of the inherent conflicts between the multiple goals that the public has for transportation and land development.

Should transportation infrastructure provision be used as a stimulus or constraint to land development? – In acknowledging the relationship between transportation and land use, there is an apparent opportunity to use transportation as a tool to influence land use. Specific examples include attempts to spur economic development by providing or enhancing transportation services to areas that are targeted for economic stimulus. Transportation can, in fact, spur development both as a result of the stimulus of transportation spending and in cases where better transportation changes the economic competitiveness of the target area due to changes in the cost and speed of transportation for businesses and persons that might locate there. The significance of the stimulus effect is dependent on the inherent attractiveness of development in the target area and on the change in transportation costs that result from the improvements. Thus, transportation capacity cannot ensure development as it is one of several factors considered when land development decisions are made.

At the other end of the spectrum is the policy issue related to the roll of constraining transportation supply or quality as a tool in constraining development. A classic example in Florida is access to barrier islands. Those opposed to additional development of sensitive locations often target restraints on transportation capacity as a means to control the pressures for development. Inadequate transportation capacity can directly impact development demand by creating time or cost consequences for travelers that result in choosing not to travel to or locate in a specific area. Congestion may dampen traveler demand and subsequently impact the market for development. This might include constraints on air, port or roadway access. In addition, the absence of transportation capacity can be a critical factor in the development approval process. Often the absence of adequate transportation capacity is a condition that enables limitations of development rights. Thus, the provision of transportation capacity can have a direct impact on development.

Using transportation as a tool in controlling development can have other undesired consequences. The decision not to improve transportation, while perhaps forestalling development, can result in safety and quality of service impacts to existing travelers. Thus, the transportation and land use planners can face a difficult and controversial decision.

Can roadway capacity constraints influence mode choice or other aspects of travel behavior? – In many urban areas, the ability to continue to incrementally expand roadway capacity is being limited because decision makers are not willing to incur the cost or impact consequences of continuing roadway expansion. Right-of-way limitations and the more significant impacts of roadway expansion in terms of impacts on adjacent land uses create an unwillingness to incur the costs of mitigating these impacts and to expand capacity if it requires additional physical expansion of the transportation infrastructure. Thus, the expectation is that growth in travel demand in the corridor will have to be accommodated by alternative modes such as public transportation, or the growth in demand will divert to locations where capacity is available. In an effort to sustain the economic vitality of areas where roadway expansion is prohibitive and not to enhance development pressures on the periphery of the developed area, the hope is often that the demand can be shifted to public transportation. The range of factors that influence location choice and travel behavior is such that it is very difficult to fully assess the impacts of decisions not to expand roadway capacity.

Should select roadway capacity increases be rejected in favor of transit investments to encourage high capacity modes with less environmental impact? – Efforts to spur use of public transit modes and encourage concentration of development are often considered with the hope that individual travel behavior and development decisions will be influenced. This premise is attractive to those favoring smart growth efforts and regentrification of urban core areas. Strategies to shift investment from roadways to alternative modes are premised on significant changes in behaviors and could result in significant impacts on development and transportation. The initial transportation impacts would include lower levels of investment in roadways and growing costs for providing attractive public transportation services.

Does the limitation of transportation resources result in transportation investments being predominately reactive to travel demand, thus precluding them from being effective tools in influencing future land use patterns? – The ability to use transportation to influence land development is partially premised on the prospect that the presence of travel capacity can induce development to the location where capacity exists. In cases where the transportation resources are very limited, the expansion of transportation is dramatically more likely to be driven by the need to solve an existing crisis; thus, the investment is reactive. For example, in the case of roadway expansion, the investment comes at a point in time when a substantial share of the demand for the new capacity (actual and latent) is already in place from existing development – thus the common retort that the new lanes fill up immediately when built. Meanwhile, resources are not available to build capacity in locations where one might hope to induce future development.

Crisis congestion or safety conditions in some corridors create political pressures for transportation capacity expansion that may override what might be a more prudent decision to limit capacity additions in a given location. The current reality of getting to work on time or ensuring that the community does not develop a reputation for gridlock that translates into lower property values, tends to overwhelm longer range goals or more dispersed impacts such an environmental degradation or perpetuation of modes that are less safe and less conducive to quality urban environments. The opportunity for prudent investment decisions is far more challenging in situations where resource limitations have created crises.

Do we understand the transportation-land use relationship sufficiently to leverage this knowledge in our planning? – While some fundamental aspects of the transportation-land use relationship are well known and sufficiently reliable to be the basis for informed policy decisions, other aspects of the relationship are not as well understood and thus, introduce risk when making policy decisions premised on assumed casual relationships. It is well known that the absence of adequate transportation capacity can constrain travel and hence economic activity at the point of gridlock. However, the ability for demand to redistribute temporally and geographically over the network can dampen the direct impact of capacity constraints. The expansion of transportation capacity can encourage development but transportation supply absent a fundamental demand for access to a particular area will not, in and of itself, induce economic activity and demand. The ability for transportation supply and performance changes to influence the shift between modes is well researched but not necessarily highly predictable. Thus, the extent to which failing to provide roadway capacity will induce travelers to shift to alternative modes for local or intercity travel is more uncertain. There is a growing knowledge base about how site design and urban design can impact all aspects of travel (trip length, path and mode), but, again, the strength and ability to generalize these relationships are only partially understood.

Collectively, the body of knowledge on how land use and transportation interact and the impacts in terms of safety, quality of life, economic health, and the environment continues to grow.   Yet, there remain uncertainties, and caution is required in planning transportation actions whose benefits are highly dependent on a desired land use impact, or land use changes whose benefits are highly premised on a desired travel behavior response.

Conclusions

In Florida, where the population growth rate is more than twice the national rate, a large share of the growth in travel demand is attributable to new population and development. Historical data suggests that more than half of Florida's travel demand growth is attributable to new population with the remainder attributable to increased travel by the existing population. Thus, new growth enhances the opportunity to shape future land use and positively influence both travel behavior and the quality of life. Understanding the transportation-land use relationship and coordinating transportation and land use planning is more important and provides more opportunities in places like Florida where there is strong development growth.

Transportation and Land Use

Several phenomena continue to impact the dynamics of the transportation-land use relationship:

- Developable land inevitably becomes more scarce and redevelopment opportunities comparatively more common as infrastructure ages.
- The cost in impacts and dollars of incremental expansion of existing transportation infrastructure continues to outpace inflation and available resources.
- Development market forces continue to change as a result of a host of factors such as ageing baby boomers and the ongoing shift to a services economy.
- Changes in technology, such as cell phones (which facilitate multitasking while traveling), changes in household structure, and perhaps a fundamental change in the cost and availability of fuel, are collectively influencing location decisions and travel behavior.
- Transportation demand continues to outpace the supply of new capacity.

These factors set the stage for a growing desire to leverage the opportunities that transportation-land use coordination may offer in addressing transportation problems.

Travel behavior and land development are both very complex phenomenon governed by numerous considerations and influenced by massive existing infrastructure bases. Land use patterns cannot be expected to change rapidly and will have only modest impact on overall travel demand. Changes in transportation investment, even if aggressively targeted to influence land use, will only modestly influence the overall land use pattern. Yet, there is a compelling case for taking advantage of the transportation-land use relationship and seeking opportunities to influence the travel demand and the impacts of transportation and development on other quality of life attributes.

In some cases, tradeoffs will be required to capture these benefits, but in other cases there will be win-win opportunities where leveraging the relationship between transportation and land use can provide travel and quality of life benefits to the general public. No single action will solve the complex transportation challenges facing Florida and the country. A host of strategies including coordination of transportation and land use planning will be required.

Understanding the transportation-land use relationship and coordinating transportation and land use planning is more important and provides more opportunities in places like Florida where there is very rapid development and population growth.

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Examples of Land Use Allocation and Trends for Florida Counties

Miami-Dade County – Miami Dade County encompasses a large urban area that include some of the densest residential areas in Florida, a large and highly productive agricultural area, and a large area designated for conservation (the Everglades). This has produced a particularly competitive land use dynamic which has become increasingly intense as the urban area has expanded into the agricultural and natural areas of the county.

In 1980, developed urban land uses covered about 10.3 percent of the county. The largest urban land use was residential at 6.5 percent, and about 90 percent of the residential land use acreage was single family. This does not include transportation, communications and utilities which exist in both urban and rural areas and covered about 5.3 percent of the county. Streets and expressways (mostly in urban areas) consumed 3.5 percent of the land area. Undeveloped lands potentially available for future urban development covered 24 percent of the county. Agricultural areas occupied 7.6 percent of the county. The largest land use, by far, consisted of the Everglades National Park, Water Conservation Areas and Nature Preserves. These covered 51 percent of the county.

From 1980 to 1994, urban development consumed about 1,600 acres of land annually, not including expansion of parks and recreation facilities which expanded by over 11,000 acres (annualized to almost 800 acres). During this period, the percentage of residential acres in single-family land uses decreased to 87 percent from 90 percent in 1980 because 31percent of the new residential growth was for multi-family. Notwithstanding this statistic, the County reported that average county-wide residential density decreased from 8.12 dwelling units per acre in 1980 to 7.9 dwelling units per acre in 1995. Conservation areas increased by over 100,000 acres. These increases resulted in a decrease in available undeveloped land by about 150,000 acres. Agricultural lands decreased by about 5,400 acres, an annualized loss of 387 acres.

From 1994 to 2001, the growth of urban development slowed dramatically to about 1,100 acres annually (down from 1,600). The reduction in residential growth resulted from a lower consumption rate of land for multi-family residential while the expansion of single-family areas remained about the same. Also, parks and recreation did not grow substantially during this period. Conservation areas saw an increase of about 15,000 acres and agricultural areas decreased more rapidly by about 10,000 acres in the time period or an annualized loss of about 1,400 acres. The County reports that the reduction of agricultural lands is due to multiple factors including Hurricane Andrew, international competitiveness, citrus canker, flood events, and urban development.

In 2001, the developed urban land uses covered about 13.6 percent of the county. The largest urban land use was residential at 7.9 percent, and about 87 percent of the residential land use acreage was in single family development. Transportation, communications and utilities covered about 6.8 percent of the county. Streets and expressways (mostly in urban areas) consumed 4.6 percent of the land area. Undeveloped lands potentially available for future urban development used 10.8 percent of the county. Agricultural areas used 6.39 percent of the county. The largest land use by far consisted of the Everglades National Park, Water Conservation Areas and Nature Preserves. These covered 60 percent of the county. Table A1 shows these changes.

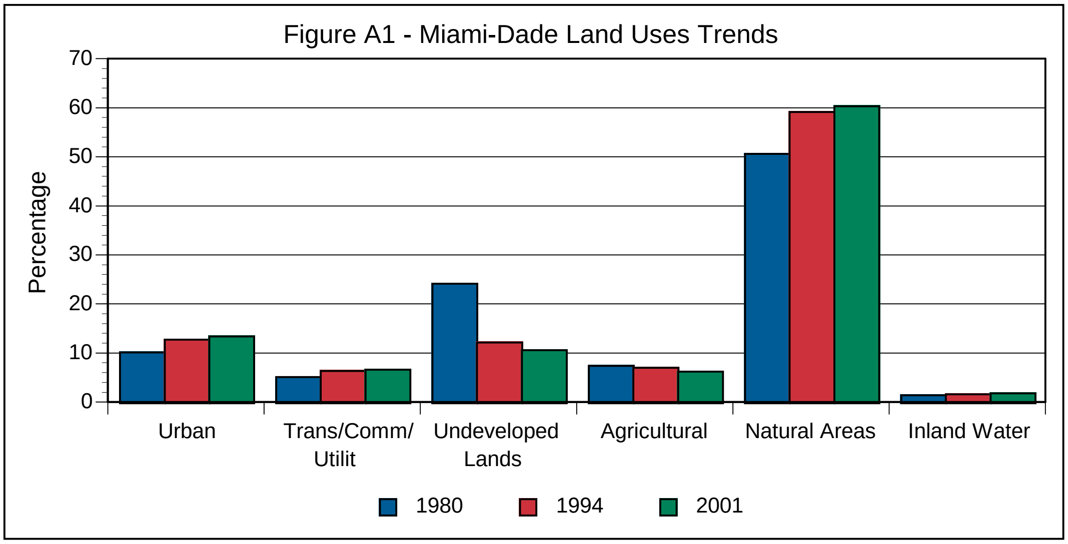
Table A1 Miami-Dade Land Use Allocation

Land Uses	1980	1994	2001
Urban	10.3%	12.94%	13.57%
Residential	6.5%	7.50%	7.90%
Single-Family	5.8%	6.51%	6.86%
Multi-Family	0.7%	0.99%	1.05%
Parks and Recreation	1.3%	2.15%	2.18%
Tans/Comm/Utilit*	5.3%	6.51%	6.84%
Roads and Expressways	3.5%	4.31%	4.58%
Undeveloped Lands	24.3%	12.29%	10.77%
Agricultural	7.6%	7.19%	6.39%
Natural Areas	50.8%	59.30%	60.46%
Inland Water	1.6%	1.79%	1.96%
Population	1,625,509	2,049,000	2,285,869

Source: Source, Metropolitan Dade County Comprehensive Development Master Plan Evaluation and Appraisal Reports for 1995 and 2003.
*Trans/Comm/Utilit refers to Transportation/Communication/Utilities

The pattern of land uses within the county reveals a fairly compact urban area separated from conservation and agricultural areas. The highest residential densities are in the older cities of Miami and Hialeah with neighborhoods ranging from 6 to 13 dwelling units per acre. The highest development densities are in the Miami central business district and in Miami Beach. The County states that “transportation improvements and multimodal transit centers have also created opportunities for increased concentrations of development throughout the county.”

The supply of vacant land available for development is dwindling. This is exacerbated by planned land uses that are at lower densities, e.g. about 4.5 dwelling units per acre. Yet, this residential density is higher than in most other developing areas of the state. Leap frog sprawl is discouraged and the County is actively promoting higher density, mixed use neighborhoods. As with other areas that approach full development of available land, development attention will increasingly turn toward redevelopment though some of the development demand may seek out other areas with lower development costs. Figure A1 graphs the changes over time.



Orange County – Orange County includes large urban and rural areas. The urban areas are expanding rapidly along with the transportation infrastructure. Environmental protection and urban sprawl are frequent issues of contention. Whereas Miami-Dade County has severe environmental and policy constraints on the geographic expansion of the urban area which practically forces increased development intensity and redevelopment, Orange County still has large land areas that are potentially suitable for development, if questions of environmental suitability and urban sprawl can be resolved.

Orange County completed existing land use inventories in 1987 and 1997. However, comparison of the results is not possible for many land uses due to differences in inventory methodology. The County has noted that the total acreage of the county decreased by 3,000 acres. Industrial uses have declined by over 2,000 acres. Further, the comparison indicates an increase in wetland land uses of over 30,000 acres. A possible explanation for this increase could be that wetlands were not correctly categorized in the 1987 inventory. The important point is that land use inventories are not perfectly accurate or precise. Therefore, the numbers reported here should be viewed with caution.

With regards to residential uses, it appears that total residential acreage increased from 63,870 acres to 77,996 acres from 1987 to 1997, an increase of 22 percent. Commercial and Office uses increased from 10,807 acres to 11,493 acres, an increase of only 6 percent.

Orange County has reported the following land use trends: 1) a trend toward decreasing density of single family housing; 2) some success in increased development of mixed uses; and 3) public resistance to higher density infill resulting in attempts to emphasize higher densities in newly developing areas. The following table displays the 1997 inventory.

Table A2 Orange County Land Use Allocation

Land Use	Total County Acreage	Percent Total Acreage	Percent Total Developed Acreage	Total Unincorporated Acreage	Percent Unincorporated Acreage	Total Incorporated Acreage	Percent Incorporated Acreage
UNDEVELOPED							
Water	62,834	9.8%	NA	52,027	10.1%	10,806	8.6%
Wetland	130,654	20.4%	NA	115,554	22.5%	15,100	12.1%
Agriculture	91,683	14.3%	NA	74,771	14.5%	16,911	13.5%
Undeveloped	174,970	27.4%	NA	148,732	28.9%	26,238	21.0%
DEVELOPED							
Low Density Residential (Less than 2 DU/AC)	26,295	4.1%	14.68%	23,494	4.6%	2,800	2.2%
Low-Medium Residential (Over 2 DU/AC. < Multifamily)	54,773	8.6%	30.59%	37,910	7.4%	16,863	13.5%
Medium (Multifamily)	8,352	1.3%	4.66%	4,500	0.9%	3,852	3.1%
Mobile Home	5,328	0.8%	2.98%	5,073	1.0%	255	0.2%
Mixed Residential	746	0.1%	0.42%	130	0.0%	616	0.5%
Other Residential Not Classified	8,556	1.3%	4.78%	6,888	1.3%	1,668	1.3%
Commercial/Office	23,448	3.7%	13.09%	11,493	2.2%	11,956	9.5%
Industrial	5,125	0.8%	2.86%	4,276	0.8%	849	0.7%
Institutional	7,478	1.2%	4.18%	3,992	0.8%	3,486	2.8%
Transportation & Utilities	26,427	4.1%	14.76%	17,910	3.5%	8,517	6.8%
Recreation	10,819	1.7%	6.04%	6,518	1.3%	4,301	3.4%
Other Urban Not Classified	1,730	0.3%	0.97%	711	0.1%	1,019	0.8%
Total Developed	179,078						
TOTAL	639,219	100.0%	100.00%	513,980	100.0%	125,238	100.0%

Source: Orange County Evaluation and Appraisal Report, 1998.

Using the data from this table, it is possible to identify some land use differences between incorporated and unincorporated areas. Approximately 76 percent of the unincorporated county is undeveloped compared to about 55 percent of the incorporated jurisdictions. In most counties in Florida, the unincorporated areas are more rural and undeveloped, so this is not unexpected. However, the fact that 24 percent of the unincorporated area is developed emphasizes the statistic that a great amount of urban growth is occurring in unincorporated areas, a distinct trend in many counties in the state.

Other differences between the incorporated and unincorporated areas include a distinct difference in the type and intensity of urban development. For example, an examination of the breakdown with the residential land uses reveals that the unincorporated area has a larger percentage of low density residential to total residential (30% verses 11%) while the incorporated area has a larger percentage of medium density residential to total residential (65% to 49%). Further, the total amount of commercial/office land uses in Orange County are split almost evenly between incorporated and unincorporated areas. However, the percentage of these uses is substantially higher in the incorporated area.

A PDF version of the 1997 Orange County Existing Land Use Map can be found at www.orangecountyfl.net/dept/growth/planning/GIS/Existing_Land_Use.pdf. The map is also available in GIS for downloading at www.orangecountyfl.net/dept/growth/planning/GIS/. The map and GIS database provide some insight into the overall pattern of development which summary statistics (excluding spatial statistics) cannot provide.

Orange County, as with most of the other larger metropolitan jurisdictions, is pursuing growth management strategies to produce more efficient and livable communities. In the unincorporated areas, sector planning is utilized. Sector planning includes both long-term conceptual plans as well as detail specific area plans. Information on sector planning can be found at the Department of Community Affairs web site:
www.dca.state.fl.us/fdcp/DCP/sectorplans/Optsectpln.htm

Orange County land use planning is seeking to improve the urban design aspects of land development. Projects of note include the Horizon West Plan and Avalon Park. Horizon West utilizes a “village” land use classification which provides for an integrated mix of uses as well as open space and a coordinated planning process for environmental, transportation and housing issues. Avalon Park endorses traditional neighborhood development concepts and includes a mixture of uses and design elements intended to protect environmentally sensitive areas associated with the Econlockatchee River. Further information can be found at:
www.orangecountyfl.net/dept/growth/planning/programs.htm#horizon.

Trends and Conditions Report – 2004

IMPACT OF TRANSPORTATION:
Transportation and the Economy
May 2004
Contract BD-544-7

This "Trends and Conditions" report was prepared jointly by the Office of Policy Planning of the Florida Department of Transportation and the Center for Urban Transportation Research at the University of South Florida. It is part of a continuing process to support the needs of decision makers, transportation professionals, and the interested public.

This and other reports are being maintained on the Internet at:
www.dot.state.fl.us/planning/policy/trends

List of Tables and Figures

Impact of Transportation: Transportation and the Economy

Introduction

Transportation is important to Florida's economy and our quality of life. It gets us to work and to play, to worship and to school, to shopping and to health care, to weddings and to funerals. The average American spends 75 minutes per day in travel. Every product in our home, on our dinner tables, and at our workplace depends on transportation. Transportation is the lifeblood of Florida tourism; fundamental to agriculture, forestry, and mining; indispensable to Florida's manufacturers; critical to the military, healthcare and education sectors; and an important element of virtually every sector of our economy and every aspect of personal lives.

> ***Every product in our home, on our dinner tables, and at our workplace depends on transportation.***

This report presents information on the importance of transportation to the economic health of Florida. This includes exploring how transportation directly influences the economic competitiveness of businesses and the spending patterns of households and how transportation indirectly affects the quality of life. The quality of life is critical to the economic health of the state, because it is a key factor in attracting visitors and employment opportunities to Florida. This report builds on four separate "Trends and Conditions" reports in this series that cover trends in travel demand in detail. Florida's transportation infrastructure and services are also addressed in detail in six other separate reports.

Transportation Supports Florida's Economy

Florida's transportation system plays an important role in maintaining the state's economic health. As Figure 1 illustrates, the relationship between travel demands and the adequacy of our transportation infrastructure and services determine how well the system performs. There are two major contributors to travel demands: person travel by the resident population and tourists, and commercial and freight transportation. For persons, the ease and cost they incur to travel affects their quality of life directly as a result of the time and money spent traveling. Their ability to access a broad choice of jobs, shopping, services and other activities also impacts their economic well being. For businesses, the economic impacts of transportation are even more obvious. While slow travel times and congestion are a frustration for individuals, for businesses they have a direct impact on the bottom line. A business that has to pay overtime or needs four trucks for a delivery schedule that three trucks could handle a few years ago very clearly feels the economic impact of transportation. For many Florida industries, transportation is critical to costs and customer service.

Figure 1 – The Role of Transportation in Florida's Economy

Be it for business or personal travel, the choice and quality of travel options is critical to successful participation in daily activities. In addition to providing mobility, transportation infrastructure influences the attractiveness of the human and natural environment; which in turn further impacts growth and the economic condition of the state. The bottom line is that Florida's economic health is directly and indirectly influenced by transportation.

Transportation, Economics, and Business

The location of Florida as a peninsula in the far corner of the continental United States and the fact that Florida is a global tourist destination and has an active agricultural, military, and mining sector create an economy very sensitive to the cost and quality of transportation. As the 22nd largest state geographically, with the fourth highest population, Florida requires extensive intrastate transportation to handle internal distribution and to support interconnection with the neighboring states. The nature of

Table 1 - Transportation Dependency of Florida's Key Industries

Florida Industry	**Reliance on Mode**				
	Airports	Seaport	Rail	Highway	Intercity Transit
Agriculture/ Forestry	○	◐	◐	●	○
Mining	○	●	●	◐	○
Distribution	◐	◐	●	●	○
High-Tech	●	◐	○	●	○
Universities	◐	○	○	●	○
Health Care	◐	○	○	◐	○
Tourism	●	●	◐	●	◐
Military	●	◐	◐	●	○
Importance: Less ○ → ◐ → ● More					

Source: FDOT, Steering Committee Final Report: Recommendations for Designating Florida's Strategic Intermodal System, December 2002.

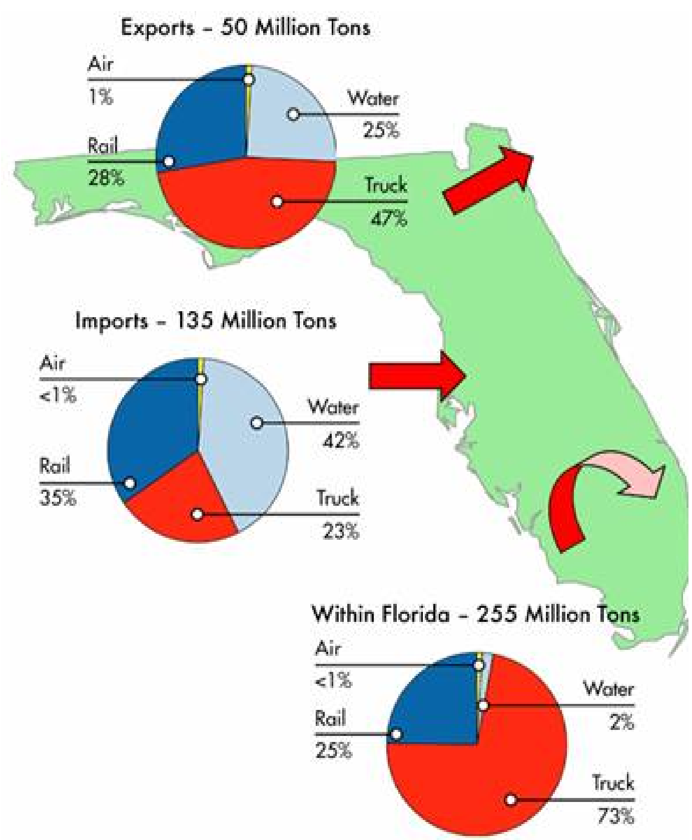
Impact of Transportation: Transportation and the Economy

Florida's appeal for tourists, combined with the opportunity Florida has as a portal to international locations, supports strong port and airport travel connections, as evidenced by the presence of 14 ports and 19 commercial airports. As shown in Table 1, a recent study of eight key Florida industries showed that, while some industries use primarily one or two types of transportation, other industries rely on several modes.

Over 110 million passengers travel through Florida's commercial airports to more than 160 domestic and inter-national destinations, making Florida the 3rd largest state in terms of passenger service. Florida's commercial airports carry almost 6 percent of the nation's air cargo.

Figure 2 portrays the volume of freight commerce into, within, and out of Florida by mode. Truck, water, and rail modes are all very important elements of the freight transportation system, particularly for heavier commodities. Air, critical for high value commodities, is less significant when measured in weight volume of activity. The presence of multiple major metropolitan areas throughout the state results in these modes having a significant presence across the whole state.

Figure 2 – Domestic and International Freight Flows To, From and Within Florida (Annual Volume)



Florida's cruise ship industry had almost 9.6 million cruise ship embarkations in 2002, according to the Florida Ports Council. Transportation of containerized goods has remained stable since 1999, with approximately 110 million tons of goods being shipped through Florida's ports.

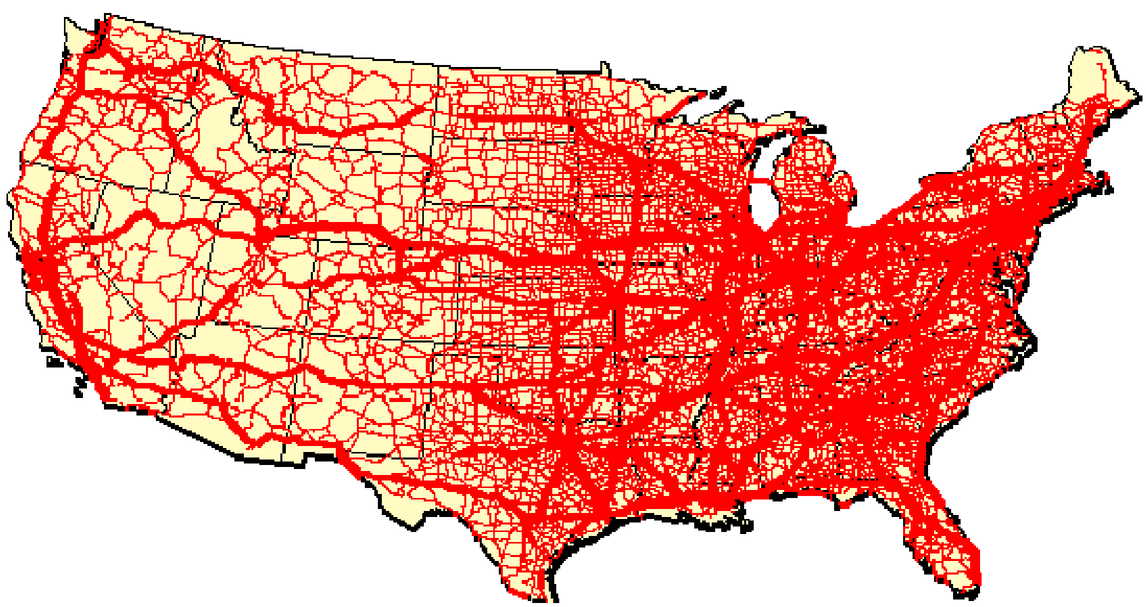
Source: Reebie and Associates TRANSEARCH database, 1998

Impact of Transportation: Transportation and the Economy

Figure 3 provides a perspective on freight flows via truck transportation. The visual image communicates the fact that Florida's location results in not having the surface transportation market accessibility advantages of a central location. A more central location provides easy access to help minimize product transportation costs. Central locations also provide the service advantages of high volumes of pass-through freight traffic enabling high service frequencies and economies of scale. Yet, Florida, due to the magnitude of the economic activity in the state, is a significant origin and destination of surface freight traffic.

In 2003, Florida's international merchandise trade was valued at $73.2 billion and is increasing at 3.3 percent annually since 1993. Of this amount, $25 billion of the goods either originated in Florida or had value-added in Florida, according to Enterprise Florida.

Figure 3 - Truck Freight Flows
(All commodities, all truck types; highway freight density in tons)



Source: From USDOT Presentation, Office of Freight Management and Operations, 1998 data.

To help offset the location disadvantage for surface transportation, it is critical that Florida strive to provide quality freight transportation options, both to meet intrastate shipping needs and to help minimize any competitive location-based disadvantage for domestic surface transportation. Furthermore, Florida can leverage its international location advantages for water and air transport by ensuring quality port and airport services and facilities well connected to the surface transportation system. Estimates by the Florida Chamber Foundation suggest that as many as half of the imports and exports handled by Florida's seaports and airports are neither produced nor consumed in the state, but are simply moving to and from other states throughout the United States. Seaports and airports in other states could handle these shipments if Florida does not remain competitive in providing a shorter and reliable time to market. To maintain its competitiveness in international commerce, Florida must ensure the efficiency of both the trade gateways themselves and the highway and rail corridors that serve them.

National data indicates that transportation represents a significant part of the cost of a product. Various studies suggest that transportation costs typically range from 10-15 percent of the cost of finished products for businesses, but for individual transportation intensive businesses can be much larger.

The importance of transportation to businesses is exemplified by understanding how various businesses rely on the transportation system.   Not only is transportation a significant cost element but it is a critical component of customer responsiveness as timely delivery of undamaged products is a critical service feature. This is even more important in an era of just-in-time manufacturing. More and more, businesses and consumers alike are relying on the freight transportation industry for the delivery of goods on demand, thus reducing the need for inventory stocks (Holguin-Veras et. al., 2003).

- ***Over 287 million boxes of citrus, primarily oranges and grapefruit, were produced in Florida during 2003, with 22.3 million cartons of fresh fruit and almost 35 million gallons of frozen concentrated orange and grapefruit juice shipped to other countries, primarily Canada and Japan.***
- ***A major agricultural export from Hillsborough County is live tropical fish air shipped to destinations across the U.S.***
- ***Seventy-five percent of the nation's and 25 percent of the world's demand for phosphate is provided by Florida. In 2002, 27.1 metric tons of phosphate was mined in Florida and processed into over a billion pounds of phosphate based products.***
- ***Walt Disney World estimates that approximately 25 percent of traffic in WDW is commercial vehicles, of which approximately half are delivering materials and supplies.***
- ***The Wal-Mart distribution center near Macclenny, Florida, opened in 2002 with 680 employees serving 83 supercenters in 3 states and Puerto Rico. The facility handles hundreds of semi-trailer trucks per day.***

As Table 2 indicates, Florida has a higher share of roadway vehicle miles of travel (VMT) via truck than the national average. Three factors contribute to the more modest level of rail infrastructure in Florida. First, Florida was not historically reliant on a manufacturing/industrial economic base. Second, its population growth was after the rail dependency era. Third, it has a geographically peripheral location minimizing through freight traffic and lessening the shipping volumes that historically justified rail services. Thus, there is greater reliance on truck freight movements.

Table 2 – Trucks Share of VMT on Highway System, 2002

	FL	US
Interstate Rural	19.01%	19.42%
Other Rural	12.24%	8.43%
Total Rural	15.03%	11.16%
Interstate Urban	10.48%	8.07%
Other Urban	5.87%	4.22%
Total Urban	7.12%	5.13%
Total	9.56%	7.51%

Source: For US, Highway Statistics Series 2002 Table VM-1, Florida TMT, Florida VMT, State Highway System Mileage Report 2002

Transportation, Economics, and Personal Mobility

Accessibility, the availability of destinations within proximity of a given location, and mobility, the ease with which one can use the transportation system, are important factors in people's decisions regarding where to live, work and participate in activities. These decisions may include such things as whether to purchase a home in one location or another or whether to vacation or relocate to Florida. Someone who spent their last visit to Florida stuck in traffic on a causeway bridge or airport access road rather than on the beach or enjoying Florida's weather is less likely to consider returning to Florida. The more time and money an individual has to spend on travel for a given trip, the less time or money they have to do other things or to travel to additional locations. If it is a hassle to go out to dinner, you will eat at home. If that more attractive job comes with a miserable commute, you may settle for the current position. If your travel required a larger share of your household spending, you will have less to spend on housing, shopping or other purposes. Bureau of Labor Statistics data on household spending in Table 3 show the distribution of spending on transportation.

Transportation spending is affected by a host of factors including personal desires in vehicle choice, life stage, income and other factors including the accessibility and mobility of the area. Quality local transportation, including adequate connectivity and capacity as well as a choice of travel options, enables an opportunity to minimize travel spending given current household priorities and values as well as ensuring affordable accessibility should fuel costs or availability change.

The more time and money an individual has to spend on travel for a given trip, the less time or money they have to do other things or to travel to additional locations.

Table 3 - Average Household Expenditures by Major Category: 2001-2002 (in current $)

	National (2002)		Tampa-St Petersburg	Miami
Average income (before taxes)	$49,430		$53,091	$46,846
Average annual expenditures	$40,677		$38,167	$41,850
Housing	$13,283	33%	$13,112	$15,622
Food	$5,375	13%	$3,888	$5,885
Apparel and services	$1,749	4%	$1,057	$1,720
Personal insurance and pensions	$3,899	10%	$4,107	$3,273
Health care	$2,350	6%	$2,282	$1,969
Other	$6,261	15%	$4,871	$5,764
Transportation	$7,759	19%	$8,850	$7,617
Private vehicle expenditures	$7,371		$8,623	$7,193
Vehicle purchases	*$3,665*		*$4,886*	*$3,097*
Gasoline and motor oil	*$1,235*		*$1,219*	*$1,315*
Other vehicle expenditures	*$2,471*		*$2,518*	*$2,781*
Public transportation expenditures	$389		$227	$424
Airline fares	*$244*			
Mass transit fares	*$50*			
Ship fares	*$30*			
Taxi fares	*$25*			
Intercity train fares	*$16*			
Local transportation on out-of-town trips	*$11*			
Intercity bus fares	*$11*			
School bus	*$2*			

Source: U.S. Department of Labor, Bureau of Labor Statistics, Consumer Expenditure Survey, 2003; and personal communication, December 2003.
Note: The other expenditure category includes entertainment, personal care products and services, education, reading, alcoholic beverages, tobacco products and smoking, cash contributions and miscellaneous.

The other element of personal spending on transportation is travel time. Table 4 and Figure 4 portray commuting travel times for Florida. Florida has gone from having a shorter average commute in 1990 to a slightly longer commute than the national average in 2000.

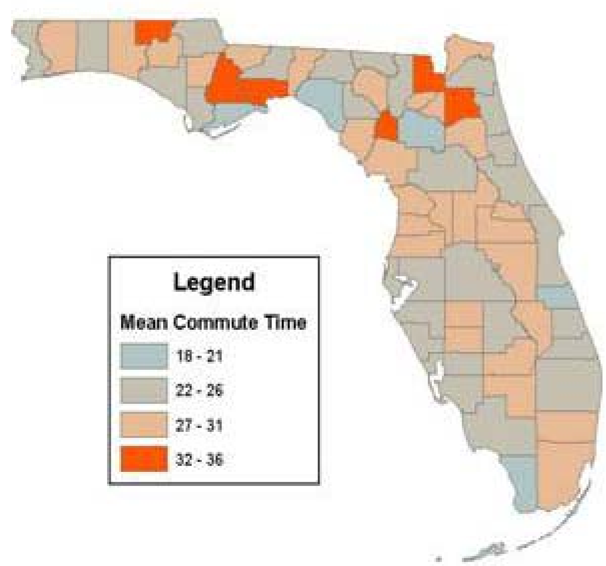
In addition to residents, Florida hosted about 76 million out-of-state tourists in 2003, including 6 million overseas and Canadian visitors, almost eight percent of the total. According to Visit Florida forecasts, the number of tourists is expected to exceed 100 million by 2020. About half of all tourists arrive in the state via air, half via car. All tourists arriving through the airports require some type of intermodal connection, which most often occurs via passenger car on the highway system.

Table 4 - Commute Time Comparisons

Mean Commute to Work Time	1990 (min)	2000 (min)	Change (min)
California	24.6	27.7	3.1
Georgia	22.7	27.7	5
Texas	22.2	25.4	3.2
Illinois	25.1	28	2.9
North Carolina	19.8	24	4.2
Wisconsin	18.3	20.8	2.5
Arizona	21.6	24.9	3.3
New York	28.6	31.7	3.1
South Carolina	20.5	24.3	3.8
Florida	21.8	26.2	4.4
U.S. Total	22.4	25.5	3.1

Source: CTPP, 2000

Figure 4 - Average Commute Time for Florida Counties



The impact of transportation on people's economic health is perhaps more subtle than in the case of businesses, but clearly the quality of transportation affects the economic condition of individuals. Lower time and money spending on travel is not necessarily an indication of better transportation enabling travelers to reduce transportation spending, but rather may result in travelers choosing to travel more with the resultant time or money savings. In any case, the cost and ease of travel clearly impacts the quality of life of residents and tourists and plays a role in their decisions to visit or reside in Florida.

Emerging Economic Trends and Their Implications for Transportation

Four major economic trends are anticipated to shape Florida's economy and therefore future transportation demand:

- **Continued strong population and economic growth** will lead to increases in demand for all forms of passenger and freight transportation.
- **A shift toward regional economic centers** will increase long-distance travel for passengers, freight and services within Florida and between Florida and neighboring states.
- **A shift toward global markets** will increase the importance of long-distance, intermodal flows of goods, services and visitors, particularly those moving through the state's seaports and airports.
- **A shift toward service and information industries** will increase the importance of efficient, reliable movement of business travelers and small, high-value freight shipments.

Population and Economic Growth

Between 1980 and 2000, Florida's population increased by 6.2 million residents, or 64 percent. Only two states, California and Texas, added more residents than Florida during this period (U.S. Census Bureau). Between 2000 and 2020, Florida is projected to add an additional 5.8 million residents, reaching a total population of 21.8 million. This represents growth of 36.4 percent from 2000 levels, twice the projected national growth of 18 percent (U.S. Census Bureau).

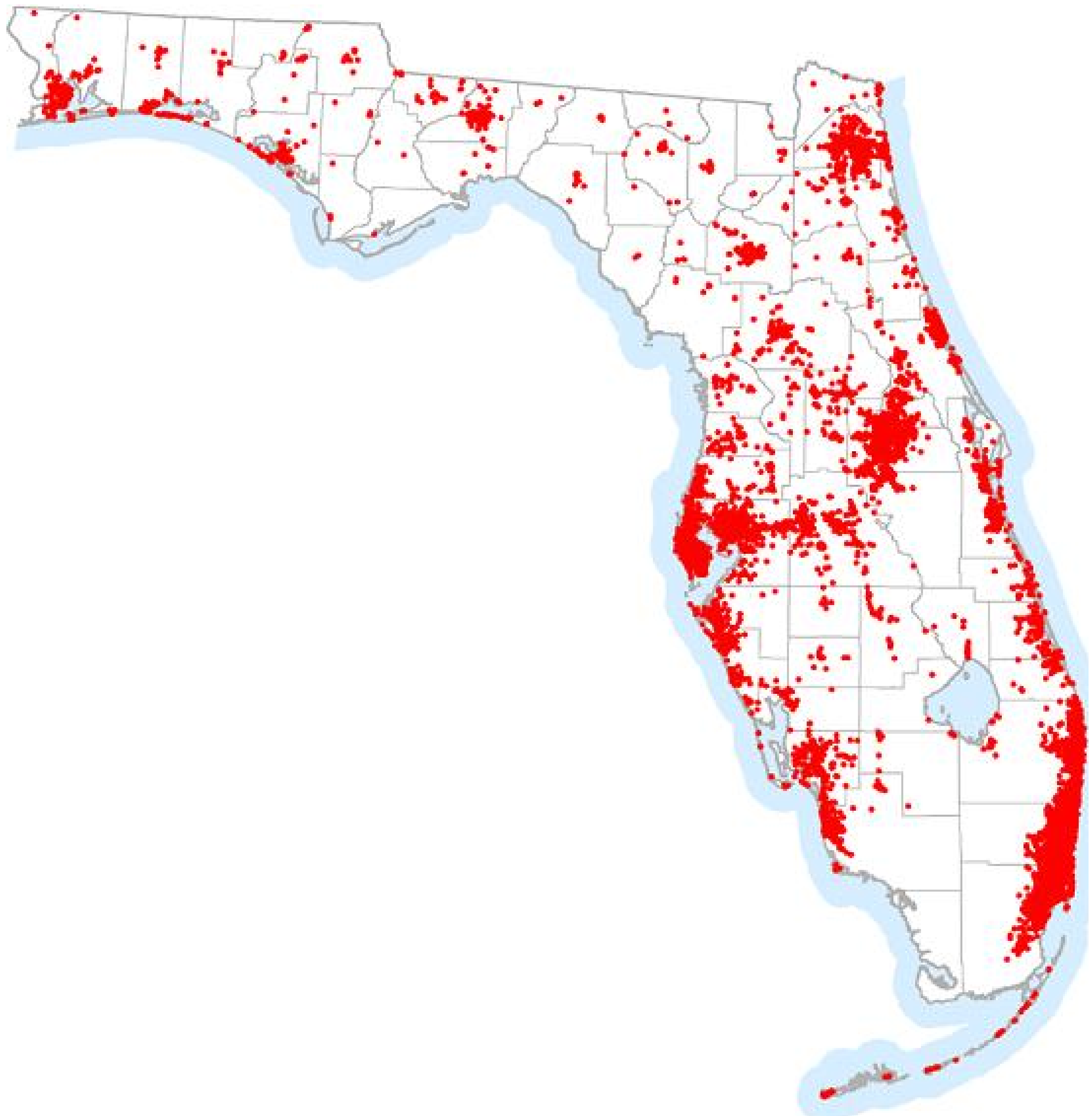
Similarly, Florida's gross regional product (GRP) is expected to grow at a more rapid rate than the Gross Domestic Product (GDP) of the United States over the next two decades, continuing the trend of rapid GRP growth in the state over the last several decades. Gross regional product measures the value of all goods and services produced in a region. As GRP grows, transportation demand by both businesses and consumers will also expand.

Shift toward Regional Economic Centers

As Florida's economy grows, the focal point of economic activity is shifting from individual cities and towns to economic regions that encompass multiple cities and counties. Labor, business and consumer markets in the State increasingly are organized at a regional level, as a result of connections between clusters of interrelated industries and other economic assets, such as universities, research labs and military bases. Florida's population clusters in proximity to employment. Travel patterns will be evolving as growth moves into new areas, such as the single economic region along the High-Tech Corridor from St. Petersburg to the Space Coast and the greater Jacksonville region. These existing regions are expected to continue to expand over the next 25 years and face growing concerns about transportation system capacity and bottlenecks. Figure 5 shows how large employers (defined as those with more than 100 employees) are clustered throughout the state.

As Florida's economy grows, the focal point of economic activity is shifting from individual cities and towns to economic regions that encompass multiple cities and counties.

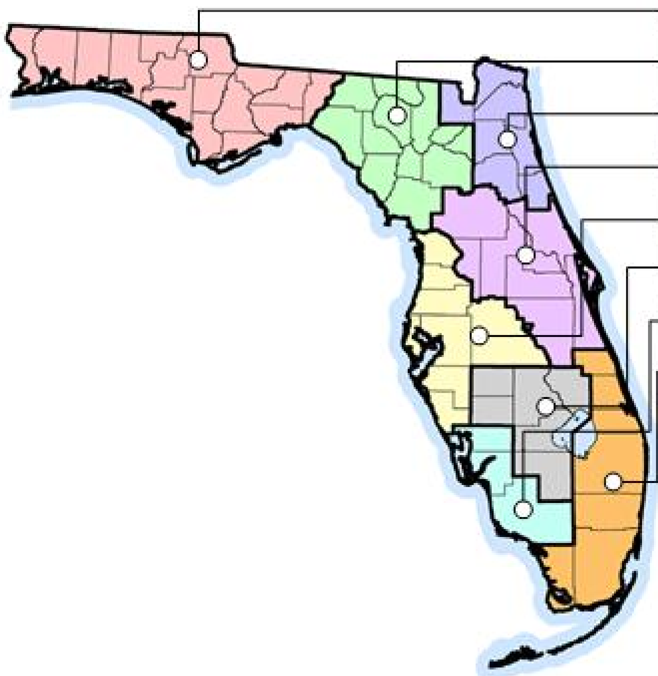
Figure 5 – Firms with More Than 100 Employees



Source: INFOUSA

Enterprise Florida has defined eight strategic planning regions in Florida's Strategic Plan for Economic Development. Figure 6 shows these regions and summarizes current projections for population growth in each.

Figure 6 – Forecast Population Growth by Region (2000-2020)



Region	Absolute Change	Percent Change
Northwest	+410,000	36%
North Central	+177,000	28%
Northeast	+551,000	44%
Central	+1,628,000	58%
Tampa Bay	+1,287,000	37%
Heartland	+105,000	46%
Southwest	+557,000	71%
Southeast	+2,350,000	44%

Source: Enterprise Florida, Florida's Strategic Plan for Economic Development; Florida Office of Economic and Demographic Research, 2000 Forecast; and U.S. Census Bureau, 2000 Forecast

This population growth as well as strengthening linkages among clusters of related industries will produce continued growth in interregional movements of both passengers and freight among these eight regions as well as interstate flows between Florida and other states. For example, interregional freight demand is forecast to increase more rapidly than population in all eight regions (FDOT, 2002).

Within these regions lie Florida's urbanized areas, which will continue to experience significant population growth, as well as a growing demand for new and expanded transportation facilities and services. The 2000 Census shows that 84.3 percent of Florida's total state population is located within urbanized areas, as compared to 78.7 percent residing in urbanized areas following the 1990 Census.

Shift toward Global Markets

While Florida's internal markets are organizing around the eight strategic planning regions identified by Enterprise Florida, its external markets increasingly are shifting from the southeastern United States to national and international destinations.

Domestic and international freight flows are expected to increase more than 70 percent by the year 2025, with strong gains anticipated in all modes. Growth in domestic freight flows to and from other states will increase freight demand on Florida's rail mainlines and major highways, including the Interstate system and other critical facilities with interstate connections. The value of international trade moving to and from Florida – exports and imports – doubled over the past decade to $73 billion and are expected to double again over the next 15 years (FSTEDC, 2002). In contrast to many states, where the majority of international trade moves over the surface transportation system to Canada or Mexico, the overwhelming share of Florida's international trade moves to and from Latin America and the Caribbean through the state's seaports and airports. Virtually all of these movements are intermodal in nature and require a connection to the highway or rail system.

Shift toward Service and Information Industries

Florida's economy is continuing to shift toward the service and information sectors. In the year 2000, the service sector accounted for 38 percent of all jobs in Florida, while the wholesale and retail trade sectors accounted for an additional 25 percent. Services are expected to be the fastest growing sector in Florida over the next decade (*New Cornerstone*, 2001).

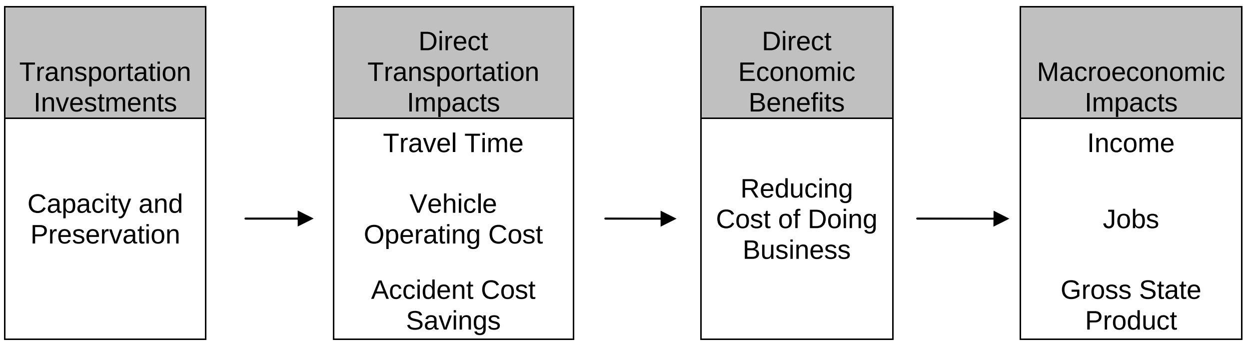
In the goods-producing sector, Florida's economy has shifted from basic, resource-oriented industries, such as citrus and phosphates, toward a more diverse industry mix including high value-added industries, such as electronics and biosciences. In turn, demand for moving goods is shifting from high-volume bulk movements via rail, truckload and water to small, higher-value shipments via air freight, courier and less-than-truckload transportation.

Collectively, these economic trends ensure a continued strong dependence of the economy on transportation in Florida.

Transportation Investment Contributes to the Economy

In addition to affecting the competitiveness for businesses and the quality of life for residents, Florida's investments in transportation services and infrastructure are a direct contributor to the economic health of the state. The pervasiveness of transportation in the economy results in spending on transportation being a significant contributor to jobs and economic activity in the state, both directly and indirectly. Figure 7 portrays a logic diagram for understanding and subsequently estimating the impacts of spending on transportation. In response to Florida statues, the Florida Department of Transportation has estimated the economic impacts of the work program of the department.

Figure 7 - Macroeconomic Analysis Framework



Source: *Macroeconomic Impacts of the Florida Department of Transportation Work Program, for FDOT by Cambridge Systematics, Inc, and Glaze Associates. February 2003.*

This analysis, carried out with a variety of analytical tools used to model and estimate the impacts for various categories of benefits, developed estimates of the impacts of the FDOT work program for the five year period starting with the 2002-2003 fiscal year program. This analysis reported the following impacts:

In 2004, the Florida Department of Transportation is programmed to spend $6.3 billion and will directly employ 8,045 people.

- Program investments in highways, transit, and rail over the next five years result in an increase of $44 billion in personal income for Florida residents and generate 88,000 new permanent jobs over the next 25 years.
- Work Program investments also yield significant direct user economic benefits to personal travel in terms of reduced travel time, vehicle operating costs, and accident costs. The direct benefits for personal travel over the 25-year analysis period are estimated to be $74 billion.
- Macroeconomic business benefits and personal travel benefits yield $5.50 worth of economic benefits for every $1.00 invested in the Work Program for highway, rail and transit in Florida.
- Based on studies conducted in Florida and other states, it is clear that the state's airports and seaports are critical to maintaining an effective multimodal transportation system and support very significant levels of economic activity. Available studies indicate that investments that increase the capacity or service at airports and seaports also can return benefits in the range of $2 to $13 for every dollar invested. Analysis tools to directly calculate benefits of Work Program investments in seaports and aviation, consistent with the approach used for other modes, were not available.

Impact of Transportation: Transportation and the Economy

It is certainly not surprising that spending approximately $5 billion annually will be instrumental in creating jobs and economic activity in the economy. In fiscal year 2002-2003, the Department's work program totaled $5.2 billion and supported 8,908 positions. The work program for fiscal year 2003-2004 totals $6.3 billion and supports 8,045 positions. These direct impacts are only one component of the overall economic influence of transportation. Companies, residents, and tourists all make substantial transportation spending commitments. While the FDOT work program accounts for the dollars that are routed through state government, significant investments in transportation occur at the individual level, via local governments including port and airport authorities, and through businesses that do everything from building roads for new developments to purchasing trucks to shipping products. The investment to buy, maintain and service the huge vehicle inventory is an obvious example of the magnitude of transportation spending by individuals and businesses. While different strategies and methodologies exist for measuring and defining the economic benefits of transportation spending, there is a strong consensus that the magnitude of spending on transportation is huge and the direct and indirect consequence to the economy is significant.

> ***"We don't just spend money on transportation or subsidize transportation, we invest in transportation."***
>
> ***Milton Pikarsky***

Conclusions

Florida's future economic health will depend on a transportation system that can successfully move growing numbers of residents and tourists and transport goods within Florida and to and from other domestic and international markets. The cost and quality of transportation directly impact the decisions of businesses, residents, and visitors. If transportation does not remain competitive in Florida, it will increase the costs and dampen the enthusiasm of future residents, employers, and visitors to move to, do business in, or visit Florida. To remain attractive and economically healthy will require that Florida have a well-planned and adequately funded transportation system that addresses accessibility and mobility needs. Transportation is a critical factor affecting Floridian's economic health and quality of life. Not only does transportation enable the economy to operate, but investment in transportation infrastructure and services directly supports many Floridians.

> ***"An efficient, interconnected transportation system is key to Florida's economic prosperity and its ability to compete in the domestic and global economies."***
>
> ***2020 Florida Transportation Plan***

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