The Florida Senate

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Committee on Transportation | Senator James E. "Jim" King, Jr., President

INNOVATIVE TRANSPORTATION TECHNOLOGIES

SUMMARY

In response to highway congestion and related surface transportation concerns, transportation agencies are increasingly looking to innovative technologies and techniques for answers. For example, a number of agencies are utilizing innovative technologies/ techniques such as intelligent transportation systems, road pricing strategies, and open road tolling systems to increase the operational efficiency of existing highways. Similarly, agencies are evaluating the feasibility of new types of user-financed highways and alternative construction techniques that expedite the delivery of additional highway capacity.

As a fast growing, highly urbanized state, Florida is well positioned to take advantage of many of these emerging technologies and techniques. Florida's state and local transportation agencies are increasingly deploying these technologies and techniques with beneficial results. As Florida moves forward with these projects it is critical that the Florida Department of Transportation and other transportation agencies ensure that these technologies are functionally integrated. Florida agencies must also recognize and address the inevitable technical and institutional challenges that will accompany these initiatives.

BACKGROUND

Efficient and safe transportation is critical to Florida's economic well-being and quality of life. The state highway system's 12,053 centerline miles (40,451 lane miles) and 6,392 bridges constitute the backbone of Florida's surface transportation infrastructure. This infrastructure has facilitated Florida's tremendous growth in population, trade, and tourism. However, this continuing growth has, in turn, placed significant strain on Florida's highway system. Whether measured in terms of traffic density or travel time, highway congestion has increased significantly over the past decade. Left unchecked, the problem of highway congestion threatens to impair the state's overall mobility and productivity.

Congestion and Its Solutions

Highway congestion is a major concern in virtually every industrialized and developing nation in the world. Congestion is generally characterized as either recurring or non-recurring. *Recurring* congestion is caused by levels of recurring demand that occur almost everyday where road use exceeds the capacity. *Non-recurring* congestion is caused by accidents, disabled vehicles, weather conditions, work zones, special events, and other temporary disruptions. Indicators of congestion include reduced travel speeds, decreases in reliability of travel times, increased transportation costs, and higher risks for crashes.

In Florida, travel demand continues to outpace system capacity. During the period 1990-2000, the number of vehicle miles traveled in Florida increased by more than 32 percent, whereas the number of additional lane miles added to the state highway system increased by only 6.6 percent. According to the Florida Department of Transportation (FDOT), travel demand on the economically critical Florida Intrastate Highway System (FIHS) is increasing more than twice as fast as FDOT can add capacity. During the period 1990-2000, travel and congestion on the FIHS increased 30 percent, whereas capacity increased 13 percent. Based on projected funding needs, the FIHS will have a funding shortfall of $28 billion by 2020.[1]

Transportation agencies have employed a variety of strategies to address the challenges associated with highway congestion. Most of these strategies combine targeted capacity improvements with enhancements to the operational efficiency of existing systems. While opinions often differ regarding the proper balance of

[1] 2001-2002 Performance and Production Review of the Florida Department of Transportation, Florida Transportation Commission.

congestion relief measures, the consensus is the ultimate "solution" to the problem of highway congestion will require a combination of diverse strategies. Increasingly, transportation agencies are looking to innovative technologies and techniques to play a major role in this effort.

METHODOLOGY

This report identifies and evaluates a number of innovative technologies and techniques designed to improve surface or highway transportation. In preparing this report, staff undertook an extensive review of published and electronic sources. In addition, staff conducted interviews with numerous federal, state, and local transportation officials, industry representatives, transportation researchers, and other interested parties. Finally, staff conducted several site visits to observe the operations of certain transportation facilities firsthand. Readers should note recent technological innovations in air, water, and rail transportation, while significant, are outside of the scope of this report.

FINDINGS

In order to effectively address highway congestion and related mobility problems, transportation agencies must continue to provide additional capacity while, at the same time, maximizing the operational efficiency of existing highways. Fortunately, a host of innovative transportation technologies and techniques have emerged in recent years to aid in this effort. For example, through the application of intelligent transportation systems traffic throughput can be improved by 15 percent or more in major urban corridors. Similarly, transportation agencies are employing a variety of new contracting and construction techniques to deliver needed capacity.

Florida's transportation agencies are currently deploying a number of innovative technologies and techniques. State and local agencies are making significant investments in intelligent transportation systems, electronic toll collection systems, and related technologies. In addition, the Turnpike Enterprise and expressway authorities are proposing a host of new, capacity enhancing projects that incorporate a variety of innovative features, such as reversible lanes, variable pricing, and open road tolling. While these initiatives are promising, significant technical, institutional, and social challenges remain. It is critical that the state encourage and facilitate the use of such innovative technologies and techniques while, at the same time, ensuring public resources are invested wisely.

While much of the following discussion focuses on various innovative strategies that increase the operational efficiency and reliability of existing highway systems, it is important to note that investments in such strategies should not take place to the exclusion of additional capacity. Increased highway capacity, whether delivered through conventional or alternative means, remains an essential component of the congestion-solution equation.

An Overview of Innovative Technologies and Techniques

For purposes of this report, innovative transportation technologies and techniques are grouped into the following categories: (1) strategies to improve operational efficiency; and (2) techniques to enhance capacity or infrastructure. In reality, there is significant overlap and interdependence among many of these strategies.

Increased Efficiency – Continuing advances in communication and information technologies have facilitated a number of new transportation applications that increase the operational efficiency of existing highways. The following discussion examines several promising examples of this strategy, including: intelligent transportation systems, transportation demand management, and open road tolling.

Intelligent Transportation Systems (ITS) - This broadly defined field encompasses a range of technologies and applications. Fundamentally, ITS represents an effort to harness the capabilities of advanced technologies to improve transportation on many levels. ITS is intended to reduce congestion, enhance safety, mitigate the environmental impacts of transportation systems, enhance energy performance, and improve productivity.

Since its inception in the early 1990's, use of ITS has grown significantly. In 2000, the United States Department of Transportation (USDOT) determined most metropolitan areas had achieved a medium to high deployment of ITS. For example, in the 75 largest metropolitan areas, electronic toll collection had been installed on 73 percent of existing toll road mileage, and closed loop control had been installed at 49 percent of signalized intersections. Nationwide, a projected $209 billion will be invested in ITS between 2001 and the year 2011 - with 80 percent of that investment coming from the private sector in the form of consumer products and services.

The USDOT has documented a number of efficiency and safety benefits available through the deployment of ITS. For example, ramp metering systems have increased speeds on highways (by up to 60 percent in some cases) and significantly reduced crashes. Use of adaptive signal control on certain highways has reduced motorists delay by 14 to 40 percent. Similarly, improvements in traffic signal control systems in certain jurisdictions have reduced fuel consumption by up to 13 percent. Road weather information systems that combine pavement condition and other environmental sensors with driver advisories on dynamic message signs, have proven effective in lowering speeds and increasing safety during adverse driving conditions. Within the broad field of ITS, there are several applications that warrant closer inspection.

Traffic Management – This application represents a number of distinct elements that, when effectively coordinated, result in smoother traffic flow and fewer stops. In addition to increasing traffic throughput, this enhances safety by providing less speed variance and fewer opportunities for vehicle conflicts. Key components of this ITS application include:

- Traffic signal control systems that automatically adjust themselves to optimize traffic flow.
- Freeway management systems that provide information to motorists, detect problems for increased capacity and flow, and minimize congestion from crashes.
- Electronic toll collection that provides both drivers and transportation agencies with convenient and reliable automated transactions, dramatically improving traffic flow at toll plazas and increasing the operational efficiency of toll collecting.
- Incident management programs that enable communities to identify and respond to crashes or breakdowns with the best and quickest type of emergency services, minimizing clean-up and medical response time.

Commercial Vehicle Operations – This ITS application utilizes technologies which improve the flow of commercial vehicles, enhance safe operation, and minimize truck stops at weigh stations and ports of entry. Fewer stops reduce travel time, increase productivity, conserve fuel and reduce emissions. Currently, Commercial Vehicle Information Systems and Networks (CVISN) services and technologies consist of three key elements:

- Safety information exchange includes technologies to facilitate the collection, distribution, and retrieval of motor carrier safety information at the roadside.
- Electronic screening systems, which allow commercial vehicles that maintain good safety and legal status to bypass roadside inspection and weigh stations, saving time and money.
- Electronic credentialing systems for electronic submission, processing, approval, invoicing, payment, and issuance of credentials.

According to USDOT, eight states have completed the initiation of a CVISN and 34 others, including Florida, are in the process of establishing a CVISN. Results of testing have shown many positive outcomes, including a 75 percent reduction in the current cost of credential administration for both the states and industry. The USDOT has documented a benefit-to-cost savings for motor carriers ranging between 4:1 and 20:1, depending on carrier size.

Traveler Information Systems – Advanced Traveler Information Systems (ATIS) support the acquisition, analysis, and dissemination of information to assist travelers in making informed decisions regarding their travel options. Most of the road-based information is collected from surveillance equipment (vehicle detectors, cameras, automated vehicle location systems) and is processed by computers in traffic management centers for further distribution to traveler information systems. Two of the more promising examples of this application are the "511" traveler information phone number and road weather information systems.

- The "511" traveler information number allows motorists to call a voice recognition system to access information regarding highway conditions such as travel times/speeds, road/lane closures, construction, and accidents/incidents, as well as information on other modes of travel. Traveler information is collected through a number of different sources, to include cameras and speed sensors, processed and made available for dissemination through the 511 system.
- Road weather information systems that collect and disseminate environmental information are

an increasingly important tool for both transportation managers and motorists.

Four states, Minnesota, Nebraska, Utah, and Arizona currently operate statewide 511 systems. A number of other states, including Florida, are operating regional 511 systems. Benefits of traveler information systems include: promotion of travel mode selection based on real-time and accurate information; reduced overall travel times and delays; reduced emissions; and reduced risks for injuries and fatalities.

Intelligent Vehicles and Highways – The Intelligent Vehicle Initiative is an effort of the USDOT to support the development and commercialization of vehicle-based driver assistance products that warn drivers of dangerous situations, recommend actions, and even assume partial control of vehicles to avoid collisions. Examples of technologies either currently deployed or nearing deployment include the following: adaptive cruise control with safety warnings; roadway departure warning systems; front-end collision avoidance devices; and rollover warning and protection devices.

Automated highway systems represent the next step beyond intelligent vehicles. Depending on the degree of automation and infrastructure support, these systems could result in significant gains in traffic throughput because vehicles could be closely spaced and driven at high speed. Research and development of such systems continues under the auspices of various entities, including the USDOT and the National Automated Highway System Consortium. Research has focused on the following three operating environments:

- *Independent vehicles operating automatically* - This scenario assumes that fully automated vehicles operate along with manually-driven vehicles. Neither infrastructure assistance or communication with other vehicles would be necessary. However, because of mixed traffic and lack of coordination, tight-spacing of vehicles and high speeds would not be feasible, significantly reducing gains in throughput.
- *Cooperating fully automated vehicles* – This scenario envisions vehicles equipped with sensors and computers that would allow coordinated maneuvers and fully automated travel. Some infrastructure support such as radio repeaters and controllers would be necessary. However, only where dedicated lanes are utilized would major gains in throughput be realized.
- *Infrastructure supported or assisted fully automated driving* – This scenario assumes fully automated vehicles traveling on dedicated, infrastructure-supported lanes. The roadway itself would influence the movement of vehicles and overall traffic flows. This scenario would support faster vehicle speeds and closer spacing to increase throughput substantially, with vehicles moving in coordinated platoons of fully automated vehicles.

Although research and development on such "smart highways" continues with incremental progress, a host of technical, operational, safety, and legal considerations remain to be addressed.

Transportation Demand Management – This diverse set of techniques attempts to influence driver behavior, reduce or redistribute travel demand, and decrease motor vehicle dependency. Long-established examples of this strategy include carpooling, flexible working arrangements, telecommuting, and High Occupancy Vehicle (HOV) lanes. More recently, the concept of road pricing has gained wider attention and acceptance. This heightened interests in road pricing is due in part to the advent of electronic toll collection which has eliminated much of the inconvenience associated with tolls. The following discussion addresses three examples of road pricing: congestion pricing, value pricing, and variable pricing.

Congestion Pricing – This road pricing scheme is fundamentally designed to control demand and manage road capacity through the imposition of access or usage fees on certain motorists. For example, Singapore has long charged motorists for access to its central business district. Beginning in February of 2003, London will require non-exempt motorists entering the city center between 7:00 a.m. and 6:30 p.m. to pay a $7 fee. A network of 200 strategically placed cameras scanning 40,000 license plates an hour will enforce this pricing scheme.

Value Pricing – The underlying premise of this increasingly popular road pricing concept is that motorists are willing to pay a premium for faster, safer, and more reliable travel. In the United States, one notable example of this technique is the

California State Route (SR) 91 in Orange County. This privately built/operated toll road is located in the median of the existing eight-lane Riverside Freeway. Variable tolls are based on the time of day and expected congestion in the corridor. All tolls are collected electronically and users must be registered customers and carry identifying transponders.

Variable Pricing – This road pricing strategy, sometimes referred to as peak period pricing, involves charging a higher price during peak periods of demand. This approach encourages more efficient use of roads, with traffic reductions and increased vehicle speed in congested areas during peak periods, and increases in traffic during non-peak periods. This strategy has been effectively used in conjunction with conventional tolls, congestion pricing, and value pricing.

Historically, road pricing proposals in the United States have met with considerable opposition. This is especially true of congestion pricing schemes. This finding is likely due to the public perception that such proposals are unreasonably coercive given Americans dependence on the automobile. More recently, however, transportation authorities in the United States and elsewhere have shown growing interest in value and variable pricing strategies. Transportation researchers agree that as existing roads become increasingly congested, many motorists will be willing to pay for the capability to travel on reduced-congestion lanes.

Open Road Tolling (ORT) – This technique relies on a variety of technologies to provide a non-stop, high-speed method for collecting tolls on highways. Fundamentally, ORT expands upon electronic toll collection, which generally utilizes automatic vehicle identification technology and video enforcement systems to collect a portion of tolls, to provide an environment where *all vehicles* are identified for tolling purposes electronically while maintaining highway speeds. The potential benefits of ORT are significant, including: elimination of costly toll plazas; reduction of manpower to manually collect tolls; enhanced customer service through increased vehicle throughput; and reduced overall operating costs.

While elements of ORT are currently in place in many jurisdictions, including Florida, few agencies have implemented all electronic or cashless toll collection. One notable ORT application is the 407 Express Toll Route in Toronto. This 65-mile toll facility relies solely on electronic toll collection. Most of the 300,000 daily users of this facility utilize a transponder. Motorists who do not have a transponder are charged through a video identification and billing system. This system captures the motorist's license plate number through the use of high-speed cameras and optical character recognition technology. Non-transponder customers' addresses are obtained through the Canadian motor vehicle agency, and the users are billed directly for their toll plus a trip surcharge for the additional administrative expense of direct billing.

Capacity Enhancements – Additional highway capacity is essential in addressing the problem of congestion. According to the Texas Transportation Institute, improvements in operational efficiencies, transit usage, and land use patterns will only meet 30 percent of anticipated travel demand; the remaining 70 percent can only be met by building additional capacity. Fortunately, a number of innovative, capacity-enhancing proposals have emerged in recent years to supplement conventional road construction practices. Similarly, transportation agencies continue to improve the delivery of additional highway capacity through the use of innovative contracting and construction techniques. The following discussion examines a number of these capacity-enhancing proposals.

Toll Truckways – This proposal provides for the construction of dedicated toll truckways in existing interstate highway corridors to accommodate the operation of longer, heavier tractor-trailers (longer combination vehicles or LCVs). In addition to use by LCVs, these truckways would be open to conventional tractor-trailers, at their option. Such truckways, separated from regular traffic by concrete barriers, would significantly enhance safety by reducing the risk of car-truck collision. In addition, this proposal would generate significant productivity gains for commercial carriers and reduce wear and tear on existing highways.

Proponents maintain truckways could be financed by revenue bonds backed by toll revenues. Such bonds could be issued either by private firms under long-term franchise agreements or by state toll road authorities. Since tolls would be set at an amount that covers the cost of building and operating the lanes, trucks could potentially be exempted from federal and state fuel taxes for the miles driven on the truckway. Electronic toll collection systems would calculate the fuel tax rebate based on mileage driven and the fuel use characteristics of the individual vehicle. While no toll truckways are currently in operation in the United

States, several states, including Florida, are evaluating their feasibility.

High-Occupancy Toll Lanes – On a number of already heavily congested expressways, local authorities are considering opening underutilized High Occupancy Vehicle (HOV) lanes to paying customers as HOT (High-Occupancy-Toll) lanes. As implemented in California and Texas, HOT lanes accept both HOV and single occupancy vehicles if the latter pay a toll during peak hours. The toll is variable, and it is set high enough to keep traffic on such lanes low enough to permit rapid traffic flow. In the case of the SR-91 Express Lanes in California, the single-occupant vehicle toll for the 10-mile facility ranges from $1.00 to $4.75, depending on the time of day and traffic conditions.

Express Lanes – The term "express lanes" is used to describe various tolled lane projects that offer a premium level of service (i.e., reduced congestion) for a fee. Similar in function and operation to HOT lanes (converted HOV lanes), express lanes are generally purpose-built, self-supporting facilities. While a relatively small number of such facilities currently exist, a number of localities are evaluating the feasibility of express lanes for highly congested corridors. Many of these proposals incorporate innovative features, such as value pricing, reversible lanes, electronic toll collection, and, where space for at-grade lanes is not available in the existing highway median, elevated roadways.

Supporters of both HOT and express lanes argue these facilities can offer a high-speed peak-hour mobility alternative to those drivers willing to pay tolls, without forcing all those not willing to pay tolls to drive at other times. However, some critics have alleged that these facilities are elitist, allowing affluent motorists to bypass congestion while other motorists are relegated to adjacent general-purpose lanes. Although insufficient data is available to fully analyze this argument, data from HOT/express lanes in California suggest individuals at all income levels use the lanes when saving time is the paramount concern.

Innovative Contracting/Construction Techniques - During the past decade state transportation agencies have realized significant reductions in construction time and cost through the use of alternative contracting techniques. Unlike traditional highway construction projects, which are awarded on a low-bid basis, alternative contracting allows for consideration of other factors such as time, quality, and innovation. The most commonly used alternative contracting techniques include cost-plus-time bidding, design-build, lane rental, and warranty clauses.

Transportation agencies continue to refine contracting techniques and develop new approaches to improve product delivery. For example, a number of states and municipalities are using a new contracting method described as "indefinite quantity/indefinite delivery". Under this method, contractors bid on unit work items with the location to be determined under future work orders. An estimate of the total work over the life of the contract is provided in each contract. Similarly, in an effort to shorten the average eight-year schedule (concept through construction) of highway projects, many agencies are modifying their business practices to eliminate duplicative reviews and streamline construction procedures.

Innovative Technologies and Techniques in Florida

In recent years, Florida's transportation agencies have recognized the potential benefits available through the use of innovative technologies/techniques and are moving forward with the deployment of a variety of projects. For example, FDOT recently approved spending almost $500 million during the next decade in statewide ITS-related projects. This proposal will result in a comprehensive deployment of ITS on the states' major limited access highways, and set the stage for further operational improvements in Florida's surface transportation network. The following discussion briefly examines how many of the innovative transportation technologies and techniques previously identified are being implemented in Florida.

Intelligent Transportation Systems - With the creation of the ITS Office in 2000, FDOT acknowledged the growing importance of ITS and the need to better manage ITS resources. The Department's adoption in October of 2002 of the *Ten-Year Cost ITS Feasible Plan* represents a major commitment to the coordinated deployment of ITS in Florida. This plan, developed in cooperation with each of FDOT's seven district offices, Florida's Turnpike Enterprise, and toll agencies, focuses initially on ITS deployment on the state's five major limited-access corridors (I-4, I-10, I-75, I-95, and the Turnpike) of the FIHS. The plan builds on the existing ITS framework and is directed towards the following five applications:

- Freeway Management Systems that include telecommunication systems, video monitoring capabilities, traveler information via dynamic

message signs, incident management capabilities, and Road Ranger service patrols.
- Advanced Traveler Management Systems that provide synchronous traveler information, including travel times, delays, incident and road closures, and video of traffic conditions.
- Regional Traffic Management Centers in the following localities: Ft. Lauderdale, West Palm Beach, Ft. Myers, Sarasota, Tampa, Tallahassee, and Pensacola. This will complement existing centers in Jacksonville, Orlando, Miami, Pompano Beach and the Turkey Lake Service Plaza.
- Commercial Vehicle Information Systems and Networks that streamline licensing processes and automate safety inspections.
- Statewide Traffic Management Center Software Library System that provides a common operating system statewide, reducing development and maintenance costs.

According to FDOT, implementation of the plan will require the expenditure of $496 million in dedicated statewide ITS funds over a 10 year period. The Department estimates that this investment will save 120 lives, prevent 11,000 traffic-related injuries, prevent 26,000 accidents, and result in $3 billion in safety benefits and travel time savings.

Variable Pricing – Florida was one of the first states to implement a variable pricing program. This project in Lee County involves two toll bridges (the Midpoint and Cape Coral Bridges) crossing the Caloosahatchee River. These bridges are both primary commuter corridors for the area. The variable pricing project offers discounted (by 50 percent) tolls on these bridges just before and just after the peak traffic periods to entice commuters out of the peak periods. A 2001 evaluation of this project by the Center for Urban Transportation Research found this variable pricing scheme was well received by the public, with over 70 percent of survey participants rating the project favorably. In addition, the study found a significant portion of eligible drivers have altered their time of travel to obtain the toll discount. This finding is supported by FHWA-sponsored studies evaluating the use of variable pricing.

Electronic Toll Collection – Use of ETC systems in Florida has increased significantly since their inception in the mid-1990's. Currently, an estimated 1.2 million Floridians utilize the "SunPass" or an interoperable system. By 2008, the Turnpike Enterprise projects that 75 percent of all Turnpike transactions will be via SunPass transponders. The Turnpike Enterprise and expressway authorities are partnering with public and private sector interests to explore the possibility of using transponders for other purposes, such as transit and parking. These agencies are also evaluating other marketing opportunities, including the sale of transponders through kiosk and major retailers, and the use of low-cost, disposable transponders.

Open Road Tolling – In a November 2001 report entitled, *The Feasibility of Open Road Tolling in Florida*, the Center for Urban Transportation Research concluded that while there are a number of technical and social issues to be addressed, open road tolling is feasible in Florida. The report recommended Florida's toll agencies follow an evolutionary path toward the achievement of this goal. The first step in this process would be the expanded use of ETC. Second, the report recommends that as use of ETC increases, traditional toll plazas should be relocated from centers of mainline toll plazas to the outside lanes to expand the number of dedicated ETC lanes. Finally, the report emphasizes the need for institutional cooperation and public involvement and education in the development of ORT in Florida.

Florida agencies are currently evaluating a number of potential ORT applications. For example, the Turnpike Enterprise has proposed to convert several outdated conventional toll facilities to ORT within the next decade. Conversion to ORT would provide a number of benefits, including the elimination of delays, more equitable tolling, enhanced customer and employee safety, and reduced operating and maintenance costs. The initial cost of toll plaza demolition and installation of equipment would be offset by savings in the capital cost of future improvements.

Express Lanes – While the express lane concept is under review in more than a dozen states, two of the more interesting proposals are located in Florida. One such proposal is the Tampa-Hillsborough Expressway Authority's Brandon Parkway connecting I-75 near Brandon and downtown Tampa. This project provides for the construction of a nine-mile, reversible lane facility in the median of the existing Lee Roy Selmon Expressway. The use of reversible lanes will double its traffic-carrying capacity, reducing peak congestion. Because of the limited space available in the median, the three-lane roadway will be elevated. This bridge will be constructed in segments at an off-site factory and assembled at the construction site during off-peak times. The Expressway will also incorporate a number of innovative features, including electronic toll

collection, variable pricing, and an innovative wrong-way detection system.

In another proposed express lane project, FDOT and the Turnpike Enterprise are planning the construction of two to four express lanes in the median of the heavily congested I-4 corridor in central Florida. Motorists will enter and exit these express lanes through direct interchanges with cross streets and through interchanges with general use lanes, called slip ramps. Raised concrete barriers will separate the general use lanes and express lanes, except at designated interchanges. This project, referred to as the I-4 "Xpress Lanes", will also incorporate open road tolling and variable pricing.

Toll Truckways – In May of 2002, the Center for Urban Transportation Research published a report entitled, *The Potential for Reserved Truck Lanes and Truckways in Florida*. This report determined that while much of Florida's Interstate System appears to be suitable for the operation of exclusive truck facilities, the lack of adequate median represents a major constraint in many highway corridors. The report suggests that it may be more advisable to create traffic separation by excluding trucks from proposed express lanes. In addition, the report recommends that transportation officials evaluate various "truck-friendly" alternatives that would minimize the need for new construction.

Contracting and Construction Techniques – Florida's transportation agencies are employing a variety of new contracting and construction techniques to enhance the capacity and reliability of highways. For example, USDOT officials reported that FDOT is considered one of the leading states in the use of alternative contracting techniques. Data from FDOT indicates use of these techniques has reduced time overruns by 43 percent as compared to time overruns for all FDOT projects. Cost overruns have been reduced by 48 percent on average for all alternative techniques as compared to cost overruns for all FDOT projects.

While these findings are impressive, experience in other states suggest that there are additional contracting techniques that FDOT should explore. One example is pavement warranties. Following the example of European roadways, several states are using new pavement designs that require very strict specifications for materials in the asphalt mix but have the benefit of needing 20 percent less pavement than traditional American designs. Through the use of these types of designs some states have been able to require the contractor to guarantee the performance of the road for up to 20 years.

In addition to contracting techniques, Florida agencies have identified other strategies to decrease delivery time and reduce cost. For example, the Turnpike Enterprise has recently experimented with overlapping portions of the project development and environmental engineering phase with the design phase. Turnpike staff have calculated that concurrent performance of these phases could expedite project completion by up to a year and a half.

RECOMMENDATIONS

While recognizing that circumstances are unique to each agency and environment, interoperability of ITS systems is critical. We recommend that Florida's transportation agencies take the necessary steps to ensure that ITS systems are fully interoperable and adhere to the national ITS architecture and accepted standards.

A major component of the state's ITS systems is the proposed 2,200-mile statewide telecommunications network. This communication network will provide the necessary interconnectivity to support future ITS deployments. However, a number of events have delayed the selection of a core technology (i.e., fiber optic or wireless) for this network. We recommend that FDOT, in consultation with other affected agencies, evaluate the feasibility of a hybrid communications network that incorporates existing fiber optic assets with new wireless communications systems.

Many of the innovative proposals discussed in this report are being undertaken by Florida's toll agencies. It is critical that these agencies closely coordinate the development and deployment of new technologies/ techniques. We recommend that FDOT and the various toll agencies develop a mechanism to better disseminate information relating to the planning, delivery, and evaluation of these projects.

As some of the technologies/techniques discussed in this report evolve and near implementation, changes in statutory provisions will be necessary. We recommend that the appropriate agencies begin the process of identifying the needed changes in law and submit these proposals for legislative consideration.