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TELECOMMUNICATIONS AND ITS FUTURE ROLE IN THE PUBLIC TRANSPORTATION ARENA

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TELECOMMUNICATIONS AND ITS FUTURE ROLE IN THE PUBLIC TRANSPORTATION ARENA

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16.Abstract

The objective of this report is to investigate current conditions in the application of telecommunications to TDM programs that support public transportation statewide. The report provides the results of a survey of transit agencies nationwide to ascertain whether transit agencies are currently using or plan to use telecommuting and telecommunications in their program of services in the future. The research also identifies trends in the telecommunications industry that may have a bearing on travel behavior and subsequent public transit planning. The report provides recommendations on how transit and other transportation agencies can respond to changing conditions.

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Introduction

Under the direction of Governor Jeb Bush, the operations of the Florida Dept. of Transportation underwent review in 2000, for the purpose of increasing efficiency of government. According to the news article, *State workers: Transportation is next up for reorganization*, "Division directors, bureau chiefs and other managers will be looking at everything they do and asking, 'Do we need to continue to perform this function? If so, are we currently doing it in the best way?...'"[1].

In Florida and elsewhere, political leaders periodically ask for such review. This study suggests that in the case of telecommunications and telecommuting, government should also ask, are there new conditions that warrant government and public transportation providers to develop a new role? In the case of telecommuting and other applications of information and communications technologies, should FDOT and other local mobility managers take a more proactive approach toward such developments as they affect travel?

Given what appears to be a growing potential for telecommuting to alter physical travel patterns, this report proposes that transportation planning has an interest in telecommunications that goes beyond the development of telecommuting programs for government workers and the encouragement of telecommuting through commuter assistance programs. Using Florida as an example, local, regional and state level transportation planners should be looking for opportunities to influence the development and application of the technologies toward achieving transportation goals for the public good.

Graham and Marvin observe, "...telecommunications are not neutral technologies. They are not equally amenable to all users which can be envisaged; an inherent bias is already 'locked in' to them through the network design process"[2]. This observation suggests two things. First, the opportunities to use telecommunications for various purposes, including telecommuting, are not available to everyone[3]. A prime function of government is to ensure universal access to utilities. Secondly, the above observation reminds us that the goals for the ultimate usage of a product or service is what directs technology advancements.

Telecommunications technology development for the purposes of motor vehicle trip reduction and mobility enhancement has not been the goal that directs and drives the development of the technology. If it were, then perhaps there might now be new telecommunications products, services and capabilities that resoundingly alter travel behavior, reduce trips and improve mobility for everyone.

In addition to chronic traffic congestion problems for which telecommuting is looked to as a potential solution, recent events have renewed interest in its application for other reasons. The September 11th terrorist attack has catapulted the U.S. into a new war. One month after the event, the Research and Special Programs Administration of the USDOT put out a call for research on technologies and innovations to safeguard our transportation system. While the Request for Proposal did not specifically identify any particular technologies, it is possible that the use of information and communications technologies for telework and telecommerce could be incorporated as part of our defense strategy as a means of enabling the population to work and conduct business from home.

Given the growing traffic congestion problem for those who drive private vehicles and the lack of transportation for those who depend upon limited public transit services, telecommunications technologies may address the individual needs of both groups while addressing public concerns about air pollution, environmental degradation, regional economic development and job access for the unemployed.

The relationship of telecommunications advances and transit has, in fact, been considered by the transit industry. In October 1996, the American Public Transit Association (APTA) created a strategic planning task force to explore both the positive opportunities and the dangers ahead. It developed four scenarios, one of which was the "Community-Oriented Growth" scenario, which included telecommuting in its vision:

> "Telecommuting in many different forms grew steadily and reduced the demand for transportation. Rather than promoting a massive work-at-home movement with further low density sprawl, information technology had a wide variety of impacts including more off-peak commuting, more partial-work-at-home, more use of satellite business centers, and more office-to-office teleconferencing. Information technology was a key driver in [the continuing deconstruction of large corporations (downsizing, de-layering, decentralizing, outsourcing)] the rise of dispersed "virtual corporations," and the proliferation of local small businesses.
>
> "These technological developments, combined with changes in land use, produced a steady decline in automobile vehicle miles traveled after 2015, reinforcing and fostering new transit-oriented development patterns. A revolution occurred in transit service capabilities and customer satisfaction as routes expanded, quality improved, and transit providers customized their services to different customer groups and trip purposes. A revolution also occurred in system efficiency as transit became more entrepreneurial, paid its own way, and moved into profitable lines of business."[4]

Such a scenario by APTA suggests that a change in thinking is underway regarding the role of public transit. Through the use of developing scenarios, the APTA task force then crafted a vision statement that describes the preferred future of Task Force members. Included in this vision was the statement regarding telecommunications:

> "Universal access to the information superhighway has reduced the demand for transportation, allowing us to work, learn, shop, bank, and obtain medical services without leaving our homes."

This study examines whether transit agencies share a similar view or vision.

Few information sources were found in the literature review that link public transit agencies with telecommunications-related programs. One such source, *TCRP Report 21*, identified telecommuting centers as a means to increase travel options through the use of technical advancements and cited a demonstration project of the Los Angeles County Metropolitan Transportation Authority (LACMTA) to establish the Blue Line Televillage at a rail station. The Televillage would use excess capacity on LACMTA's fiber optic cables to provide electronic interactive capabilities for employment, distance-learning, access to government services, parent-teacher meetings and other functions. The case study cited two potential advantages to the transit authority for hosting a televillage: increased ridership from the new attractions in the televillage and new revenue from land and equipment-sharing agreements [5].

Perhaps more important to this investigation than the televillage case study, was the intent of *TCRP Report 21*, to provide information for those agencies seeking to make the transition from traditional transit operating agency to mobility manager, by starting with a definition: "A mobility manager is a transportation organization serving the general public that responds to and influences the demands of the market by undertaking actions and supportive strategies, directly or in collaboration with others, to provide a full range of options to the single-occupant automobile"[6].

This paper provides information about rates of telecommuting, telecommuting impacts on travel behavior and technological innovations that may lead to a new role for state departments of transportation and local transportation planning departments and wider applications and opportunities for transit agencies. Information is also provided regarding business trends regarding telecommunications and telecommuting as well as recent government initiatives.

A premise of this study is that public transportation agencies will find opportunities to better serve the mobility needs of the public by considering the possibilities of telecommunications.

Rates of Telecommuting

Data from three sources indicate that both working at home and telecommuting have been increasing during the last twenty years.

Table 1
Number of Workers Who Worked At Home
Source: U.S. Census

Year	Nationwide	% Increase From Previous Decade	Florida	% Increase From Previous Decade
1980	2.2 million	--	58,778	--
1990	3.4 million	55%	132,084	125%
2000	4.1 million	21%	222,473	68%

U.S. Census data indicate that the number of workers who worked at home increased by approximately 50 percent, from 2.0 to 3.0 percent of the total workforce between 1980 and 2000. The U.S. Census figures are based on the response to the Census survey question, "How did you usually get to work last week?" One response option is "Worked At Home." Usually is defined to mean the most number of days during the week; therefore if a person worked at home two out of five days per week, this would not be counted as a "worked at home" trip. As a result of the definition, Census data probably provides a more conservative estimate.[1]

Table 2
Number of Workers in Florida Who Traveled To Work By Public Transit
Source: U.S. Census

Year	Journey To Work By Public Transit	% Increase from Previous Decade
1980	106,546	--
1990	116,352	9%
2000	147,132	26%

In the State of Florida, the number of persons working at home surpassed public transportation in both the rate of growth and in absolute numbers.

[1] Information newly released by the U.S. Census Bureau in January 2002 reported that data collected during a four-month period from April to July 1997 indicate that 9.3 million people or 7 percent of the U.S. working-age population (age 16 and older), worked at least one full day at home during a typical week. The complete report can be found at http://www.census.gov/prod/2002pubs/p70-78.pdf

According to a survey by the market research firm FIND/SVP, the number of telecommuters in the U.S. rose from 11.1 million in 1997 to 15.7 million as of mid-year 1998. A third source, the International Telework Association and Council, provides data for the most recent years, showing a 47 percent increase in the number of teleworkers in just a one-year period.

Table 3
Number of Teleworkers
Source: Telework America National Telework Survey
International Telework Association and Council (ITAC)

Year	Number of Teleworkers	% Increase
1999	19.6 million	--
2000	28.8 million	47%

The ITAC Survey found that 19.6 million teleworkers typically work 9 days per month at home with an average of 3 hours per week during normal business hours. The wide difference in the U.S. Census figure (4.1 million worked at home) and the ITAC figure (28.8 million teleworkers) is partly a result of the difference in definitions.

The ITAC Survey provides an optimistic estimate because teleworkers in the ITAC survey are defined overall as employees or independent contractors who work at least one day per month at home during normal business hours. Telework is defined as any form of substitution of information technologies for work-related travel. Telecommuting, which is that portion of teleworking that applies to the daily commute to and from work, is a subset of telework [7].

What all surveys do indicate is that the rate of telecommuting has been increasing.

The ITAC Survey conducted in 2000 also provided some information about the profile of the average teleworker. This person more likely lives in the Northeast and Western regions of the U.S., is college educated, is 35-44 years of age, married and earns more than $40,000 annually.

Telecommuting Definitions

Work at Home	U.S. Census response option to the question: "How did you usually get to work last week?" Usually is defined to mean the most number of days during the week.
Telework	Any form of substitution of information technologies (telecommunications and computers) for work-related travel. Includes substitution for all work-related trips, not just the commute to and from work [Jack Nilles].
Telecommuting	That portion of teleworking that applies to the daily commute to and from work. A subset of telework [Jack Nilles]. An ongoing, regular arrangement of work done in paid status, at a location other than the usual place of work, such as home, satellite work center or telework center. Electronic communication takes the place of physical travel [ITAC].

The Center for Urban Transportation Research (CUTR) recently prepared the *Hillsborough County TDM Plan*, in which two modeling approaches were used to develop long range forecasts of telecommuting. The first approach used a linear regression model that assumes a constant growth rate. Using data from two market research firms, FIND/SVP and CyberDialogue, and assuming that telecommuting began in 1970, the model indicated that there would be 16.5 million telecommuters nationwide by the year 2025.[2]

CUTR also used the Bass model, which economists and market researchers often use to describe the rate adoption of new products or technologies. The results of this model indicated that the number of telecommuters would reach a peak nationally at 33 million by the year 2015, then drop off to 22 million telecommuters nationally by the year 2025.

The above review of available surveys conducted, as well as forecasts, consistently presents indications that the number of persons working at home and telecommuting is steadily rising.

[2] Teleworking operators of home businesses or self-employed teleworkers are not included in this telecommuting forecast.

The Impact Of Telecommuting On Travel Behavior

Due to reliable indications that telecommuting is increasing, transportation planners, researchers and policy makers want to understand the nature and magnitude of the impact on travel behavior. Several sources attempt to address this question.

In the past decade, efforts have been underway to develop transportation models that incorporate the impacts of telecommuting on travel demand. For example, the Travel Model Improvement Program (TMIP), a multi-year effort sponsored by the Bureau of Transportation Statistics and the U.S. Department of Transportation, seeks to improve the utility and reliability of transportation models for transportation planning purposes. The Activity-Based Modeling System for travel demand forecasting is a tool under development that attempts to incorporate the impacts of transportation demand management measures upon travel behavior.

In 1996, a conference, "Activity-Based Travel Forecasting," was convened in New Orleans for the purpose of developing recommendations for promoting the use of activity-based model systems (as opposed to traditional trip-based four-step models, such as the Urban Transportation Planning System highway network development planning and analysis technique commonly in use by MPOs). Activity-based model systems, of which there are many, are derived from the demand for activities and offer greater utility in analyzing the effects of transportation policies, including transportation demand management measures such as telecommuting [8].

Modeling tools that can analyze the impacts of telecommuting do exist but are not readily available to MPOs due to lack of funding to finance the transition from use of one methodology to another. Funding is needed to satisfy different data requirements of activity based modeling as well as to provide training in the use of the model systems. Partnerships between researchers and practitioners were identified as a means to encourage the use of the new models.

Since the conference, several activity model developments have been happening throughout the world. The use of the models has moved beyond the realm of academics but is currently not part of mainstream standard practice. Perhaps one of the closest examples of a simplified activity based model being tried in practice by an MPO is Portland Metro in Oregon. The model they are using can account for trip chaining, TDM and transportation control measures [9].

During the weekday peak hours of 6-9 a.m. and 3-7 p.m., work-related trip making accounts for 48.5 percent of the trips being made and 33.7 percent of the miles driven [10]. This underscores the importance of focusing upon work-related trip making to improve air quality, enhance mobility and reduce congestion. Telecommuting is a potential work trip substitute.

Among the most reliable sources of research regarding the travel impacts of telecommuting has been that which was developed by Patricia Mokhtarian of the

University of California at Davis. Her research indicates that as more people begin to telecommute, other telecommuters may discontinue it. As a result, the rate of increase in telecommuting may be lower than originally anticipated by earlier estimates of telecommuting growth in the U.S. even though, over time, it is anticipated that constraints to telecommuting will affect less workers as the workplace changes. These constraints include the employee's perception of job suitability, their potential lack of awareness of telecommuting as an option, and manager unwillingness to allow telecommuting [11].

Assuming that at some point in the future, 30 percent of the workforce *will be able to* telecommute, Mokhtarian estimates that the number of persons who *actually* telecommute at any given time would be 11.4 percent of the workforce and that 2.7 percent of the workforce would be telecommuting *on any given day* [12]. This 2.7 percent figure may be lesser or greater, depending upon the urban area. These estimates also do not include the impact of telecommunications on trips other than the journey to work.

Even the more conservative estimates, such as those generated by Mokhtarian, show an impact upon travel that can have a significant effect on local traffic conditions, even at just 2.7 percent of the workforce telecommuting on a given day.

Mokhtarian computed a range of from 0.48 miles per worker per weekday eliminated in the present to 0.56 miles per worker per weekday eliminated in the future as more telecommuting occurs. The VMT reduction due to telecommuting is estimated at 14 percent of a telecommuter's total weekday travel. The reduction in VMT due to telecommuting constitutes almost 2 percent of all workers' total weekday drive-alone VMT. Mokhtarian predicts that in the future, the net absolute reduction in VMT will be 0.25 miles per worker per weekday (as compared to 0.48-0.56 miles per worker per weekday) or at most about 44 percent of what would be assumed if stimulation effects (induced travel demand) were not taken into account [13].

While the desire from the transportation planning perspective is to reduce trips, telecommunications may also increase trips, as Mokhtarian recognizes. J. S. Niles writes that induced travel demand from telecommunications technologies can result from:

- Increased awareness of activities of interest
- Stimulation of economic growth, which stimulates travel
- An expanding network of personal and business relationships
- Geographical decentralization
- Increased customization and rapid response capability
- Reducing the disutility of travel by making travel time more productive
- Improving the efficiency of the transportation system [14]

Transportation-related research regarding telecommuting focuses on the impact upon the work trip and the impact upon travel by private motor vehicle rather than other modes.

The impact of telecommerce on nonwork-related trips is less known. In the realm of business travel, web conferencing can enable meetings to take place among many persons, while interactively sharing text, charts, maps, audio and video. It is currently not known how this will affect long distance travel. Little information exists about the travel impacts of distance learning but conceivably these developments may affect travel in some way.

Telecommunications advances and the increased application of the technologies is universally considered to be a positive trend in economic development. No discussion, to date, has been found that proposes to reduce telecommunications in some way to slow down its potential to increase trip making. Regardless of whether telecommunications decreases or increases trip making, what seems clear is that there is now and will continue to be some type of impact on travel behavior.

The above section of this report presents a review of attempts to model the travel impacts of telecommuting, attempts to measure reduction in vehicle miles traveled, and attempts to identify how telecommuting and telecommunications may actually induce travel demand rather than reduce it. The information that was found tends to lend support to the observations of Graham and Marvin, that the impacts of telecommunications will most likely be significant though incremental, complex, and different from one region to another [15]. Based on these predictions, transportation planners at the local, regional and state levels might consider actively monitoring the pulse of economic developments relating to telecommunications to position planning activities proactively rather than reactively.

The Impact of Technological Innovations on Business Practice and Travel

Transportation planners' interest in telework typically concerns itself with the home-to-work and work-to-home trips (telecommuting) because of their impact on peak hour traffic flow. However, this study also found discussion about how telecommunications technologies are affecting where business locates and how business is conducted. This influence may potentially encompass not only the home-to-work and work-to-home trips of employees, but also business-related travel, business-to-business commerce, and the movement of goods and services.

Studies deriving trends attempt to guess the impact of current and future advances in technology that may affect the rate of teleworking. These technological advances were most recently stimulated by the federal Telecommunications Act of 1996, which allowed private companies to enter into the local telephone business.

In 1998, local telephone companies began making Digital Subscriber Line (DSL) communications connections available to homes and businesses. At the same time, cable operators introduced cable modems. Both of these innovations allowed high speed, broadband connectivity over existing telephone and cable networks at affordable prices. "High speed broadband connectivity allowed individuals to work at speeds equal to or greater than they had within their traditional office LAN [local area network], at a price that was less than adding additional LAN capacity at the traditional business location...The ability to connect from any Internet Service Provider (ISP), through any modem connection, is the final piece of technology convergence that now allows anytime connectivity from anywhere. Because it utilizes the Internet "network of networks," the cost to the business or individual is now less than building a private network connection." [16].

While Mokhtarian identifies manager unwillingness as an external constraint to telecommuting, Miller and Self observe the opposite—how a changing workforce, combined with the need to find new ways to satisfy customer needs and cut business costs have led businesses to discover the potential of telework. "...telework is focused not on taking cars off the road or achieving personally motivated goals, but upon accomplishing specific business objectives."

If Miller and Self turn out to be right most of the time, then future practices for many business sectors may *require* telecommuting: "Telework and its associated technologies allow suppliers, vendors and customers to interact directly with a business's information centers. By providing secure portals, suppliers and vendors can take on the tasks of monitoring inventory levels, and providing just-in-time delivery. Customers can interact directly, taking time-consuming steps out of the purchasing process. Employees can support the needs of the business from wherever, whenever." [17].

Another use of telecommunications for meeting customer needs while eliminating the need to travel is the growing area of telemedicine. Telemedicine involves applying live

interactive and diagnostic quality video conferencing to the practice of medicine. Doctors and nurses can provide teleconsultations with patients and engage the expertise of specialists from long distances. Telemedicine includes the support of imaging applications and medical test analysis by computer and electronic transmittal of results. Benefits to patients include the comfort of remaining at home, reduced transportation costs, the availability of distance learning resources and the expediency and potentially life-saving benefit of real time health care, 24 hours a day.

It is currently unclear what the impact of telecommunications technologies has upon relocation of home and work sites. However, such relocations may have some impact on trip making and trip length. Miller and Self describe how telecommunications can change the decision making process regarding locating businesses and residences. "Just as access to the intercontinental rail lines displaced proximity to wagon trails, and the interstate highway system displaced proximity to local highways in importance to commercial development, access to the Information Superhighway is becoming the new driver of location. New commerce centers outfitted in advance with fiber optic networks, for example, are in extremely high demand...Migration to the new centers is reshaping urban areas." [18].

However, Pamela Blais, who has researched telecommunities for the Urban Land Institute writes, "Right now, telecommunities are the exception rather than the rule; however, the introduction and upgrading of high-capacity IT [information and telecommunications] infrastructure is proceeding at a pace that will soon make it universally available...soon, high-speed connections will be treated just as basic telephone service is treated today—as a standard utility." [19].

It is too early to tell what the impacts of wired communities will be regarding business and residential relocations. But once they are located, how will travel behavior differ from nonwired communities? Might wired communities require the measure of new trip generation rates? Would impact fees borne by developers decrease or increase? With more people working and conducting personal business from home, how will other types of trips increase, such as Federal Express and other delivery services?

Forbes magazine described the changing relationships emerging among companies that do business with each other via the Web. The goal to do business more efficiently to maximize profits and cut costs through utilization of the Worldwide Web is referred to as B2B, or business-to-business electronic commerce. Web marketplaces organized by industry are called vertical marketplaces. Cross-industry marketplaces are referred to as horizontal marketplaces. Examples are web marketplaces that aggregate vendor catalogs for supplies or web marketplaces that outsource business functions that are peripheral to a company, like utility bill paying. The editors developed a typology, presented below, of participants by function with real life examples of businesses that fit the function. This reconfiguration of business relationships may have impacts on trip making.

A Typology of Business-to-Business Commerce [20]

Buyer Exchange: A marketplace dominated by large buyers in an industry or a group of buyers aggregating purchases. Suppliers typically bid to fill contracts at the lowest price in what is often called a reverse auction. Examples: Covisint, Metique, FreeMarkets.

Supplier Exchange: Industry producers band together to create a marketplace to sell their goods online. Examples: GE Polymerland, ChipCenter, MetalSite.

Neutral Exchange: Independent marketplace dominated neither by buyers or sellers. Often set up by independent startups. Examples: PaperExchange.com, Gofish.com, Altra.

MRO-Catalog Hub: Marketplace that aggregates supplies used in maintenance, repair and operations, such as paint, desks, oil, paper clips. Examples: Grainger, EqualFooting.com, FacilityPro.com.

BPO (Business Process Outsourcer): Hubs and/or Applications Service Providers (ASP) that manage noncore functions for companies or exchanges, such as human resources, payroll, customer relationship management and facilities management. Examples: Employease, Cadence Network, GoCo-op.

Technology Enablers: The arms merchants of B2B. These companies provide the software, applications and expertise necessary to create business-to-business marketplaces. Examples: Ariba, Oracle, Commerce One, VerticalNet.

Financial Enablers: Like their techie cousins, these B2B evangelists finance and provide other resources for Web-enhanced commerce. Examples: Internet Capital Group, Accel Partners, Morgan Stanley.

According to one estimate, about half the trucks on roads in the United States are empty [21]. Considering that attention is turning toward the impact of truck freight on VMT ("Greater utilization of the highway network by truck-borne freight transportation also adds to VMT growth." [22]), there appears to be some potential for telecommerce to reduce the growth of truck-generated VMT.

For example, the National Transportation Exchange uses the Internet to collect and post daily information from truck fleet managers on origins, destinations and excess capacity, then arranges the sale of that capacity on-line. "Wireless Internet access will soon allow drivers to connect to the website on the move. This same model could be applied at the city scale to reduce truck travel in the city and region." [23]

What current research has not yet measured is the impacts of post-1998 technological developments. If Miller and Self are correctly describing business advantages, then significant increases in telework and telecommerce may arise in the short term, at rates that previous research has not anticipated.

The above review of the literature appears to indicate that information and telecommunications technologies are demonstrating their potential to accomplish business objectives, provide exemplary customer service, influence work site (and residential) location, revamp buyer and seller exchanges and achieve greater efficiencies in freight transport. These evolving conditions could all signal future potential shifts in travel patterns, including trip making and vehicle miles traveled. Overall VMT has appeared to level off in the past few years and telecommuting may have something to do with it.

Research from the University of California, Davis, just issued in December 2001, involving a nationwide time series analysis of the impacts of telecommuting on vehicle-miles traveled, indicates that telecommuting appears to have a modest but statistically significant effect on reducing travel. The report recommends that ..."better data is of paramount importance to a more precise determination of the true impact of telecommuting on VMT...Telecommuting appears to be an important enough trend to justify the cost and effort required to collect reliable data with respect to its adoption and frequency, on an annual basis." [24]

History of Government Involvement and Initiatives

The above discussion identified a trend of increasing rates of telecommuting and consequent impacts on travel behavior as well as the most recent technological innovations that have spurred changes in the way business is conducted. Information and communications technologies, of which telecommuting is a particular result, have become incorporated into the conduct of business and will continue to change business practices.

Federal, state and local governments have tended to operate in a traditionally reactive role rather than an enterprising role, regarding the advance of telecommunications in the economy. There are government initiatives that specifically address telecommuting, in recognition of the potential to harness telecommuting as a means to encourage economic development, reduce VMT and improve air quality. In addition, telecommunications and information technologies have resulted in intelligent transportation systems (ITS) designed to optimize roadway operating efficiency. Below is a summary of history and of recent main efforts. The discussion also includes observations about Florida's state transportation plan and its relationship to and consideration of telecommunications.

Federal Role

In the United States, the Communications Act of 1934 maintained communications monopolies, which were regulated by the Federal Communications Commission and the state Public Utilities Commissions. They determined, through licensing, what services could be provided where and what rates could be charged. One of the advantages of this system was the provision of universal coverage, especially to rural areas where the cost of providing service would have been very expensive to the consumer.

In 1984, long-distance telephone service was opened to competition and the Telecommunications Act of 1996 provided that long distance operators, local telephone providers and cable companies can compete in each other's markets. The purpose is to promote better quality and lower prices through competition.

State Role

Federal legislation usually requires states to implement the law. At the state level, this has caused state governments to redefine the roles of agencies. Several states have developed telecommunications plans.

Table 4
State Roles in Planning for Telecommunications [25]

State	Lead agency	Planning effort
Alaska	Telecommunications Information Council	Information system plan to meet state government needs and provide access to the public
Vermont	Dept. of Public Services	Plan for meeting future requirements for telecommunications services for use by government
Iowa	Iowa Telecommunications and Technology Commission	Created a state-owned utility service, the Iowa Communications Network, a state administered fiber-optics network for distance learning, telemedicine, and state and federal agency service needs
Washington	Governor's Telecommunication Policy Coordination Task Force	Conducted studies to address how to attract telecommunications companies to the state for better jobs and advanced networks. Topics include: ▪ Achieving regulatory consistency in converging industries ▪ Equalizing tax burdens among telecommunications providers ▪ Balancing local interests with state infrastructure needs ▪ Bringing infrastructure to rural areas ▪ Leveraging the state's role as a large purchaser, user, and provider of telecommunications services ▪ Encouraging local telephone competition
Georgia	Dept. of Administrative Services	Plan to consolidate state government telecommunications services and systems. Created a fund to provide universal service as a statewide shared use distance learning and telemedicine network
North Carolina	Dept. of Administration	North Carolina Integrated Information Network Purpose of Network is: ▪ Universal service access throughout state ▪ Geographically equalized rates ▪ Shared resources to eliminate duplication and encourage interoperability

		▪ Public/private partnership: private sector supplies the capital and the state provides the usage base. North Carolina Information Highway (NCIH) ▪ Provides distance learning, telemedicine, economic development services Agency for Public Telecommunications ▪ Provides media, teleconferencing and live programs for state government
Missouri	Dept. of Economic Development	The City of Nevada, MO partnered with the state to develop a Telecommunity Center

Other state agencies that take the lead in planning and implementing telecommunications plans, in addition to the ones listed in the table above, are state public utility commissions and public/private partnerships.

A study by the American Planning Association (APA) [26] found that general purposes of state government involvement in telecommunications have included:

1. Developing telecommunications infrastructure for the common good
2. Providing universal service access to all citizens
3. Promoting economic development, primarily tourism and global market development
4. Linking state agencies

The APA study also found that to serve the above purposes, typical roles of government have tended to be that of:

1. Large purchaser/consumer of services to run government
2. Service provider to create and administer state networks
3. Facilitator for making the business environment favorable to telecommunications development, for example, by changing state tax structure and funding the development of networks
4. Regulator as an issuer of licenses and franchises

Passing legislation for providing universal services, Georgia is an example where a state has assumed a leadership role in directing the development of telecommunications. The Departments of Transportation in the states of Maryland and Virginia both promote telecommuting and some, like Oregon, provide tax breaks.

Local Role

At the local level, telecommunications planning tends to exist in two areas. The first is in the area of land use for permitting telecommunications towers. The second area, and perhaps more interesting to this study, is the development of community networks. While state government has often been the guiding source in the development of new technologies, local communities have taken the lead in partnering with private industry to provide physical access and equipment to make it universally accessible, such as in the area of network building.

A community network is developed when computers in a local geographic area are interconnected via telephone lines to a central computer, that allows community residents to exchange information and services, encourage political involvement and encourage economic development. Examples that have received widespread public attention are the Blacksburg Electronic Village in Blacksburg, VA and the Seattle Community Network.

Other networks represent specific issues or services, such as:

- Libraries
- Health information
- Education and learning
- Economic development
- Information and referral
- Government information

These networks appear to operate more as information resources rather than as a means to actively engage in business. It has been found that while there are often funding grants and community interest to start a network, it is difficult to maintain the funding and commitment to keep it going.

While schools and public libraries have taken the lead on providing access to networks that provide information, a government agency, such as a public transit authority, might conceivably take the lead on developing networks that are highly interactive in nature to allow persons to do business: shopping, consultations with health care professionals, and to be hired and conduct work for pay—all accomplished by telecommuting. In this way, rather than a person traveling by public transit (or private car) to work, school and personal business, these activities would be brought to their homes.

In this way, a public transit agency would act as a mobility manager by providing access to work, school and personal business opportunities through other means than a bus ride.

To develop and support such a network, for example, a "telecommerce transportation management association" could be initiated by the local government, with all the necessary partners, such as the city, the county, the local community college or university, the school district or library system, the local phone company, delivery services, local grocery stores, medical services, pharmacies and employers.

Government Telecommuting Programs

Government involvement at the state and local levels, as described above, usually has been for purposes other than transportation-related applications. However, there have been research efforts at the national level and government telecommuting programs at federal, state and local levels, aimed at government employees.

For example, the National Environmental Policy Institute (NEPI) joined with the International Telework Association and Council (ITAC) to research the potential for an air emission trading program based upon reduced auto emissions from teleworking. The idea resulted in the passage of The National Telecommuting and Air Quality Act in October 1999, which authorizes the design of pilot programs in five cities to explore the feasibility of the concept, including Houston, Denver, Los Angeles, Philadelphia and Washington, D.C. Results of the pilot project are not yet available.

As part of the NEPI/ITAC project, a group of public and private sector experts in related fields studied telework cost effectiveness, the telework relation to energy conservation and to the concept of "Smart Growth," as well as enabling technologies. The report called for change: "...change in the definition of the word 'transportation,' including how infrastructure is administered, coordinated, and funded...No longer can 'transportation' be viewed simply as moving people and things from one place to another. The definition needs to be expanded to include 'moving intellectual property, data and information electronically'. In the 'Information Age,' nearly two-thirds of all U.S. economic activity is information based." [27].

An observation made in the NEPI/ITAC report is that most telecommuting program efforts are initiated by state departments of energy rather than transportation. The report recommended that state departments of transportation become more involved in telework initiatives.

Federal and State Initiatives

Federal and state governments have been active primarily in the development of telecommuting programs for government employees. At the federal level, President Clinton called for an increase in the number of federal government employees telecommuting from 4,000 to 60,000 by the end of fiscal year 1998. This effort has fallen short of the goal; the actual number of federal employee telecommuters is approximately 20,000. The intent behind this program was to encourage the more than 800,000 federal employees nationwide to telecommute. In the Washington, D.C. area, where there is a large concentration of federal workers, this program would have a potentially strong impact on trip reduction to address the traffic congestion problem of the greater Washington, D.C. metropolitan area.

The state of Florida has made some inroads in applying telecommuting through the use of a State Employee Telecommuting Program [28]. In 1990, the program was established and is administered by the Florida Department of Management Services. Interestingly, the program is not motivated by the desire to enhance mobility or reduce trip making but rather as part of the overall policy to recruit, develop and maintain an effective and responsible workforce.

Other states with state employee telecommuting programs include the states of Arizona, Connecticut, Minnesota (to reduce the costs associated with state office space) and Oregon.

Telecommuting Programs for the General Public

Telecommuting programs have also been instituted by states for other purposes, such as for trip reduction (Arizona, Illinois, New Jersey, North Carolina, Washington), tax incentives (Colorado, Washington, Oregon, Arizona, California), emissions reduction (Texas), and as a work initiative with Aid to Families with Dependent Children (AFDC)(Missouri). Oregon has also initiated a review of the state building code for the purpose of establishing viable standards for providing advanced telecommunications and cable service technology to newly constructed homes. The goal of this initiative is to improve opportunities to telecommute.

In the state of Maryland, MDOT developed the "Telework Partnership with Employers (TPE)" program, for the purpose of reducing traffic congestion and improving air quality. Through TPE, technical assistance to start telecommuting programs is being provided to Maryland employers by the Metropolitan Washington Council of Governments and the Baltimore Metropolitan Council. This program was begun in October 1998 through a $600,000 grant from the state. In addition, the state of Maryland has also implemented a telework program for every state agency. MDOT's goal is to eliminate eight million vehicle trips annually through teleworking.

Table 5
Government-Sponsored Telecommuting Programs

Location	Purpose
Federal	
USA federal government	Trip reduction
Northwestern European nations	Trip reduction, economic development
States (USA)	
Florida	Recruit, develop and maintain competitive state government work force
Arizona, Illinois, New Jersey, North Carolina, Maryland, Washington	Trip reduction
Texas	Emissions reduction
Missouri	AFDC work initiative
Minnesota	State office space reduction
Oregon	Review state building code standards to promote telework
Cities	
Toronto, Canada	Reduce truck travel, trip reduction, economic development

International Initiatives

Other nations have also explored telecommunications applications to transportation. For example, in Canada, the City of Toronto commissioned a study as part of the development of an economic plan. The study contains recommendations for studying the use of information and communications technologies not only to develop policies and initiatives to encourage telecommuting, but also to reduce business related travel, such as using video conferencing and on-line service delivery. This would also include supplier and customer-related travel. Strategies to be developed are web sites, on-line supply chain management, on-line services, and on-line shopping. The plan calls for "dematerializing" physical products that are largely information, such as network-delivered call answer services and downloadable MP3 technology for CDs and tapes. Another strategy was to use information and communications technology to reduce truck travel [29].

European nations that are studying and promoting telework for economic development and for traffic congestion reduction include The Netherlands, the United Kingdom, France, Denmark, Austria, Belgium, Luxembourg, Finland, Portugal and Ireland [30].

Other Applications of Telecommunications for Other Transportation Purposes

Telecommunications has the potential to affect travel behavior, not only through telecommuting programs, but also through intelligent transportation systems (ITS), with applications for advanced traffic control devices, roadside message signs, traveler information web sites and kiosks, automated tollbooths, and sophisticated traffic monitoring systems. Rather than telecommuting programs, ITS has been a major area of government involvement for telecommunications planning at both the local and state level in Florida. However, ITS is primarily for optimizing highway traffic flow.

For example, the Florida Department of Transportation in coordination with the Florida Department of Management Services, sought proposals in Spring 2000 for a lease of limited-access right-of-way in exchange for the design, construction/installation, and maintenance of a fiber optic network infrastructure. Called the Florida Fiber Network (FFN), it would be deployed over approximately 2,000 miles of limited-access highway. The FFN is envisioned as an optical transport network, to provide the network infrastructure necessary to support intelligent transportation system initiatives and other communication programs.

Public Transit Agency Use of Information and Communications Technologies

Applications of telecommunications on transportation go beyond the use of ITS for roadway traffic flow improvements. There are a few instances of public transit agencies and local government transportation departments beginning to purchase and apply these telecommunications technologies. Two such examples are described below.

According to one observer, "...buses are getting high-tech makeovers that speed them past other traffic under the guidance of computer-aided dispatching systems...Perhaps most impressive, information from these systems is becoming accessible to riders through simple interfaces on the Web and even on cell phones, which could allow some buses to offer the efficiency of trains combined with the convenience of taxis." [31] This is known as wireless applications protocol (WAP), which can link mobile phones to the Internet. As a result, a person will not necessarily need to be sitting in front of a PC to search for information, but rather can pull up data from anywhere.

Montgomery County, Maryland is in the forefront of developing an entirely integrated traffic and bus management system. The County equipped 250 buses with global positioning system receivers and communications gear. Field supervisors operating these systems can receive firsthand reports on traffic flow and accidents throughout the County from bus operators and ensure that buses stay on schedule by directing bus drivers to go ahead of buses full of passengers, skip stops or take a different route. System operators also have the capability to extend the green phase of traffic signal cycles to ease congestion at intersection approaches and allow a bus to go through.

The Regional Transportation Commission of Southern Nevada (Las Vegas area) has purchased ten optically guided buses that require smaller right-of-way, making buses capable of traveling along road shoulders, across narrow bridges and along tunnel median strips. The buses can also dock within two inches of the curb so that all the doors line up with the platform, eliminating the use of slow wheelchair ramps. These features add up to faster, more convenient and much less expensive bus service. The location of buses equipped with global positioning system receivers can be tracked and relayed to displays at bus stops so that passengers know exactly when the next bus will arrive [32].

Innovations in communications and information technologies seem to occur daily. There is much speculation regarding how these innovations will change how people do business. Don Smith, head of optical networks at Nortel predicts, "Internet usage has grown tenfold each year. The total bandwidth in the entire network—voice, video, data, everything on a global basis—in the next four years will need to grow from 100 to 200 times its current total capacity." [33].

As with the above example of the optically-guided bus, research departments of telecommunications companies are racing to develop an all-optical network (eliminating

electronic switches and routers) that will result in a faster system having almost limitless bandwidth.

It is predicted by industry analysts that such a network will redefine the technologies that transmit data, voice, music, video and Web sites. Optics will also change personal computers, making them more reliable, inexpensive, more compact and with the power of a supercomputer [34].

Beyond a fiber optic network that runs through cables, other research is focused upon wireless optics, which uses light and lasers to send data. Terabeam in Seattle plans to create wireless networks in one hundred cities by 2004 [35].

What these observations amount to is:

- ✓ The interface of telecommunications and computer technologies are now being applied to transportation for the purposes of optimizing highway operations (ITS), the benefits of which should positively affect all highway users, including the performance of public transportation system buses that travel on highways and busways. These technology developments reinforce and preserve the status quo of reliance upon highway use and upon physical travel.

- ✓ The application of telecommunications and computer technologies are beginning to be used by local governments to improve bus system performance. While the above examples of Montgomery County, MD and the Las Vegas seem to hold great potential, it is hard to say whether these improvements will be enough to shift private motorists to using bus service, considering that ITS is also being applied to improve highway conditions. As a senior manager of the Montgomery County Transportation Department in Maryland said, "When you get to the point of total gridlock, that's when people start riding public transportation...We don't start making changes unless we've choked ourselves." [36].

That is, unless there are some great advantages to not traveling at all, as described in the previous section on impacts to business practice and travel. Telework as a mobility management strategy, requires policy making advocacy at the state and local levels. The NEPI/ITAC report [37] recommended ways in which telework programs can be supported. These included:

- Initiation of legislation to prevent covenants and local zoning regulations from unreasonably prohibiting an employee from teleworking from a home office.

- The continued moratorium on Internet taxes to encourage the wider use of computers, the primary tool of teleworkers.

- Resistance to the imposition of cable "Right of Way" fees, taxes or levies by local governments—essentially a backdoor Internet tax, which discourages

telecommunication companies making bandwidth available to rural and disadvantaged (including urban) areas.

- Accelerated tax allowances on telework enabling investments—hardware, software, and office furniture.

As the above section on the application of information and communications technologies for other transportation purposes suggests, the use of such technologies will tend to go first toward improving, thereby reinforcing, existing habits of physical travel. It will take advocacy at the policy making level to guide the use of these technologies toward maximizing the advantages of telework.

Survey Development and Results

In addition to the above literature review, a survey of transit agency general managers was conducted to ascertain the attitudes, opinions and plans regarding the current and potential future use of telecommunications-related services as part of mobility management strategies offered by public transit agencies.

As part of the effort to design the survey, CUTR research associates of the Transportation Demand Management Program assembled to brainstorm and develop a list of potential service strategies to be used for and by transit agencies. This exercise incorporated the assumption that the overriding purpose of public transportation providers, operating as mobility managers, is to provide access for customers to employment, education, shopping and personal business opportunities. This assumption is comprehensive enough to include traditional bus transit service and also telecommunications-related services within the scope of potential services offered by transit agencies.

The brainstorming exercise employed a creative thinking exercise, the results of which were used to augment the final list of service strategies provided as part of a question in the survey. The respondent was asked to individually rate 22 service strategies as to whether these would satisfy the future needs of existing and potential customers over the next ten years. Seven of these strategies were telecommunications-related options.

The Public Transit Service Development Survey was sent by email and administered via the NCTR web site, http://www.nctr.usf.edu/surveytelecom.htm
during December 2001. The survey was accompanied by an introductory cover letter from the director of the National Center for Transit Research. A copy of the survey is included in the Appendix.

The targeted group for completing the survey was executive directors and general managers of public transit agencies, or key personnel of public transit agencies who have leadership and decision making authority regarding the development of services. This group constituted 290 contacts through a database of members of the American Public Transportation Association (APTA).

From the 290 public transit agencies contacted, 44 responses were received, or a 15 percent response rate. Because of the relatively low response rate, it is not possible to make generalizations about attitudes toward service development across the entire population of public transit agency managers. However, it is observed that there was a consistency in the responses of the 44 completed surveys regarding the current direction of public transit service development.

The transit agencies that responded to the survey represented almost all areas of the United States, with the majority of respondents located in the Northeast, the Midwest, Florida and California. There was a larger representation of respondents representing transit agencies of either smaller towns or larger cities, rather than medium-size cities.

Table 6
Public Transit Service Development Survey Respondents

Transit Agency	City	State
Eastern Contra Costa Transit Authority	Antioch	CA
Golden Gate Transit	San Rafael	CA
Monterey-Salinas Transit	Monterey	CA
Riverside Transit Agency	Riverside	CA
Southern California Regional Rail Authority	Los Angeles	CA
Torrance Transit System	Torrance	CA
Connecticut Department of Transportation	Newington	CT
Greater Hartford Transit District	Hartford	CT
Broward County Mass Transit Division	Pompano Beach	FL
Central Florida Regional Transportation Authority	Orlando	FL
Sarasota County Area Transit	Sarasota	FL
VOTRAN	South Daytona	FL
City and County of Honolulu	Honolulu	HI
Iowa City Transit	Iowa City	IA
Knoxville Area Transit	Knoxville	KY
TA of Northern Kentucky	Fort Wright	KY
Umass Transit Service	Amherst	MA
Ann Arbor Transportation Authority	Ann Arbor	MI
Capital Area Transportation Authority	Lansing	MI
Saginaw Transit Authority Regional Services	Saginaw	MI
SMART	Detroit	MI
VPSI, Inc.	Troy	MI
Duluth Transit Authority	Duluth	MN
Minnesota Valley Transit	Burnsville	MN
Plymouth Metrolink	Plymouth	MN
City Utilities Transit	Springfield	MO
Missoula Urban Transportation District	Missoula	MT
Regional Transportation Commission of Southern Nevada	Las Vegas	NV

Niagara Frontier Transportation Authority	Buffalo	NY
Rochester Genessee Regional Transportation	Rochester	NY
Tompkins Consolidated Area Transit	Ithaca	NY
Stark Area Regional Transit Authority	Canton	OH
Toledo Area Regional Transit Authority	Toledo	OH
Tulsa Transit	Tulsa	OK
Lehigh and Northampton Transportation	Allentown	PA
Red Rose Transit Authority	Lancaster	PA
VIA Metropolitan Transit	San Antonio	TX
City of Fairfax, DPW	Fairfax	VA
Potomac and Rappahannock Transportation	Woodbridge	VA
C-TRAN	Vancouver	WA
Ozaukee County Transit	Port Washington	WI
Waukesha Metro Transit	Waukesha	WI

The survey asked the respondents to provide the mission statements of their transit agencies. The purpose of reviewing the mission statements is to determine the degree of specificity regarding the role of the transit agency. Do the mission statements emphasize bus operation or are the statements more results-oriented, allowing greater leeway for more diversified service provision? A review of the mission statements indicates that most contained phrases that emphasized the physical transport of persons, but in addition, contained clauses that included the following ideas:

- Developing innovative means to meet customers' needs
- Providing safe, reliable, and efficient mobility choices
- Being responsive to changing needs and by focusing on customer service
- Providing a structure under which a wide variety of transportation services can be delivered
- Appealing to an ever-increasing number of people
- Using advanced technologies

The survey provided a list of service strategies, including traditional services, such as fixed route bus service, and diversified service options, such as bikes-on-bus service and vanpooling. The list also included nontraditional services, such as providing assistance to telecommuters and operating telecommuting centers. The respondents were asked to rate each service strategy from 5 (most desired by customers) to 1 (least desired by customers), according to which strategies would satisfy both existing and potential customers over the next ten years.

The respondents resoundingly selected fixed route bus service as most desired by customers.

Regarding providing assistance to help commuters telecommute, 22 respondents rated this as least desired by customers although six respondents rated this strategy a "3" and four respondents rated this strategy a "4."

Similarly, regarding the service strategy of providing guidance to employers who offer telecommuting and operating telecommuting centers, at least half the respondents rated these strategies as least desired by customers, however, there were always some respondents who rated these strategies as either "3" or "4."

The survey also asked the respondents to select the five highest priority service strategies. Again, the highest priority selected was fixed route bus service. However, telecommunications-related strategies were rated by a few transit agencies as 4th and 5th highest priorities. For example, two transit agencies rated "Provide mobile units equipped with computers and modems ("cybermobiles") to augment access of telecommunications technologies to residents of disadvantaged communities" as a 4th and a 5th highest priority. Two more transit agencies rated "Provide any other telecommunications-related services" as a 4th and a 5th highest priority. One of these transit agencies described the service as "Provide ports for laptop computers at selected bus stops and transfer facilities."

One transit agency rated "Provide guidance to employers offering telecommuting programs" as a 5th highest priority.

The survey also asked respondents to indicate whether their transit agencies were currently providing telecommunications-related services. Four transit agencies indicated that they are currently providing assistance to help commuters telecommute, six transit agencies indicated that they are currently providing guidance to employers offering telecommuting programs, two transit agencies indicated that they are currently providing telecommuting centers, nine transit agencies indicated that they currently support the development of wired communities, and six transit agencies indicated that they currently provide other telecommunications-related services.

The survey asked respondents to list obstacles to implementing telecommunications-related services. There was a consistency in the responses to this question, most of them variations on the themes listed below.

- Customer base not interested in telecommunications-related services
- Other agencies at local and state level, libraries and the private sector are already or should be currently filling this need
- Not the focus or mission of our transit agency
- No funding, staff resources or expertise to pursue telecommunications-related services

- Employment characteristics of customer base not conducive to telecommuting
- Telecommunications services not needed in rural community
- Commuter trips not long enough to warrant interest in telecommuting

Lastly, there was a section at the end of the survey to provide comments. The main ideas include those below.

- It would be a challenge to convince the general public that transit agencies have a role to play in telecommuting.
- The current transit focus on telecommunications is on ITS operational solutions and on providing customers with real-time information.
- It is difficult enough to meet the basic transit needs of customers without dealing with telecommunications.
- It is difficult to answer the survey questions without first surveying the people who use the service. This could be addressed using a TDP on-board survey.

Survey Conclusions

While respondents never rated telecommunications-related services among the most highly desired services by customers, several transit agencies did give them a rating of something higher than "least desired." This is an indication that some survey respondents believe that there might be some degree of interest on the part of customers to be offered telecommunications-related services. Surprisingly, some transit agencies rated telecommunications-related services within their five highest service priorities.

The survey also indicates that a few transit agencies already provide telecommuting assistance to commuters, guidance to employers who provide telecommuting programs and operate telecommuting centers. Survey results indicated that most transit agency directors do not see providing telecommunications-related services as within the scope of their mission. They believe this is already or should be within the purview of other agencies or the private sector.

While transit agency mission statements appear to incorporate the recognition that addressing the needs of customers sometimes involves innovations in services, transit agency directors cite the lack of funds, staff resources, expertise, community support and customer interest for not getting involved in the provision of telecommunications-related services.

Where Do We Go From Here?

Customer Interest

It appears that public transit agency general managers do not believe their ridership is interested in telework opportunities. The lowest-income bus patrons may be employed in positions that require their physical presence on the job site. However, it is suggested by this report that such persons would seem to have the most to gain from opportunities to advance toward information-based employment. Automobile commuters who already hold entry-level data-processing jobs may be spending an inordinate portion of their income on car ownership, just to get to and from their suburban jobs, where transit service may not yet be available.

This suggests that more focused attention should be upon identifying the segment of the population (and not necessarily just the population of transit patrons) that would desire telework opportunities but who don't have such opportunities now.

Other survey comments included that persons in rural areas would not have a need for or interest in telecommunications-related services. Results from a recent study conducted by the National Telecommunications and Information Administration indicate that actually the opposite is true [38].

Public Transit Agency Attitudes

The survey responses appear to indicate that there is some interest and current involvement on the part of a few transit agencies to explore telecommunications-related services. A next step after this study might be to revisit these particular transit agencies to develop case studies highlighting their efforts.

However, the general tone of the majority of survey responses was that telecommunications-related services should not receive attention by transit agencies. One transit agency respondent commented that, "The essence of good marketing is finding a profitable fit between the company's ability to produce or serve and the customer's needs. In the case of telecommuting there is no such fit and in our area there is little consciousness of unmet telecommuting needs (no needs) outside the capabilities of the phone and cable companies."

Another transit agency respondent was even angered by the survey because "It appears that this 'survey' is really about a marketing study for a telecommuting equipment or service provider...[the survey] does not apply to this agency's services."

It is understood that the most common positive experiences resulting from marketing efforts are the relatively minor changes that have been made to existing services that resulted in significant increases in ridership or customer satisfaction. However, the survey responses would seem to indicate that some transit agencies view their services as

unchanging and that staff expertise and resources will also not change. This view is possibly exacerbated by the severe budget constraints suffered by a large portion of public transit agencies across the nation ("We have enough difficulty providing transit service.")

It could be a state public transportation agency role to provide leadership, funding and policy direction to encourage more consideration of alternative service strategies, in keeping with the concept of public transit agencies filling the role of mobility managers, even if those strategies are not now considered traditionally within the realm of public transit.

The notion that public transit agencies could venture into telecommunications-related services does not have to mean that they would or should be in direct competition with telecommuting equipment or service providers, but rather that there may be opportunities for mutually beneficial partnerships between public transit agencies and service providers.

Community Support

Some public transit agencies raised an interesting point in that the general public might not support the idea that public transit agencies venture into nontraditional services. This could be initially addressed by emphasizing in public dialogue and in community visioning processes and other forums:

- The widespread employee interest and desire for telework opportunities
- The worsening problems of traffic congestion and lack of mobility for many
- The role of public transit agencies as mobility managers

These messages would help begin to change the way the public views mobility and the potential roles that public transit agencies can play in providing it.

Lastly, state and local transportation agencies, in partnership with economic development agencies, should seek to provide guidance and encouragement for employers to reap the business advantages of converting more of their jobs into those that can be accomplished by telework.

Telecommunications Planning

There are several initiatives underway statewide and across the nation, which seek to promote sustainable community development. This is a time of heightened public awareness in which the average person is becoming familiar with the issue of urban sprawl. Traffic congestion regularly is reported upon in the media.

The American Planning Association (APA) has initiated a program called "Growing Smart," the purpose of which is to encourage and give technical support to state government to update their planning and growth management legislation, if they have it. One of their aids is a legislative guidebook that contains "Model Statutes for Planning and the Management of Change." [39]

It is interesting to note that the APA study recommends the use of "functional plans," which include the usual plans for land use, transportation, economic development, and housing, but also adds telecommunications. Here, telecommunications is treated as a separate functional plan.

APA concludes that it is important that state and local governments include telecommunications planning as part of the overall planning process and recommends that local governments should have a telecommunications plan for the following goals [40]:

- Establishing guidelines, standards and timelines for review of telecommunications facilities
- Minimizing unnecessary regulation
- Maintaining community character
- Maintaining local control
- Encouraging competition in the marketplace
- Providing access to public rights-of-way while the locality gets a fair compensation for its use
- Investing in the most advanced technology
- Protecting public health, safety and welfare

According to APA, a plan at the state level should include:

- Defining the state's role in encouraging competition in the telecommunications industry, universal access statewide, and affordable rates for telecommunications services.

- Encouraging investment in the most advanced telecommunications technologies while protecting the public health, safety and general welfare.

- Acknowledging the economic development and transportation potential of telecommunications for the state.

- Coordinating telecommunications initiatives with other related programs.
- Providing guidance to local governments in the preparation of telecommunications components to local comprehensive plans.
- Assessing and establishing short term and long term telecommunications service and infrastructure needs for industry, state government, and for the general public.
- Establishing clear guidelines for regulation, standards, performance and conduct of private firms operating in the state.
- Establishing basic levels of service that meet industry, government and public needs.
- Documenting current levels of service statewide.

While APA recommends that state and local governments develop a "telecommunications functional plan" that, among many other things, acknowledges the transportation potential of telecommunications, this study recommends that the use of telecommunications for transportation purposes could be better focused upon trip reduction and eliminating the need to travel if it were developed as an element within the transportation plan itself. While transportation systems management and ITS elements within transportation plans focus upon ensuring a faster car trip and a faster bus ride, a telecommunications element would focus upon the goal of ensuring that people physically travel only when necessary or desirable.

Study Conclusions

This study provides a review of the literature regarding rates of telecommuting, impacts upon travel, recent developments in the field of telecommunications as they relate to transportation, and existing roles of government regarding the use of telecommunications for transportation purposes. Data from three sources indicate that telecommuting has been increasing during the last twenty years. There is some evidence that telecommuting and telecommerce have the effect of both increasing and decreasing trip making. What seems clear is that telecommuting and telecommerce have great potential to impact both personal and commercial travel behavior in complex ways that may be different from one region to another.

Considering that there is interest that public transit agencies diversify their services to evolve into mobility managers rather than remaining bus system operators only, this study took a particular look at existing attitudes of transit agency top managers regarding their agencies' potential role as a provider of telecommunications-related services. Through the conduct of a Public Transit Development Survey of 290 transit agency general managers nationwide, the general results from the 44 responses indicate that just a few transit agencies are currently now involved in or are considering telecommunications-related services as a mobility management strategy.

Because schools and public libraries are perceived as having taken the lead on providing computer and Internet access to the public, transit agency heads do not see it as their role to venture into this area, according to survey results. Other agencies cited lack of funding and authority to take a lead role and that such mobility management services involving telecommunications could only ever be considered supplementary to the core mission of providing bus service.

It is observed that in the private sector, businesses may start out providing a particular product or service, then as the company matures, they begin to diversify into other areas of business for the purposes of maintaining growth and maximizing profits. Ultimately, the key products and services may be different from those the company provided initially. Taking to heart the Community-Oriented Growth Scenario envisioned by APTA's M21 Task Force, the end result included transit systems that are "entrepreneurial" and "...moving into profitable lines of business."

If transit agencies viewed themselves first as mobility managers, then an opportunity to diversify services, such as telecommunications initiatives (and other strategies), could be viewed as a potential means to better accomplish the agency's mission. It seems implausible that other mobility management strategies could ever replace bus service. Bus transit will probably always be a critical service, but in the future, it may be conceivable that other functions will take an important place within a menu of services that better meet the mobility needs of customers. In order for this change to take place, most transit agencies will need some assistance. A starting point may be the institution of a change in the mission of the department of transportation at the state level.

Consider Revising the Department of Transportation Mission Statement

Consider again the NEPI/ITAC call for a change in the definition of transportation:

> "... including how infrastructure is administered, coordinated, and funded...No longer can 'transportation' be viewed simply as moving people and things from one place to another. The definition needs to be expanded to include 'moving intellectual property, data and information electronically...'

If we use the State of Florida as an example, the Florida Department of Transportation mission statement currently reads:

> "The Department will provide a safe, interconnected statewide transportation system for Florida's citizens and visitors that ensures the mobility of people and goods, while enhancing economic prosperity and sustaining quality of our environment."

A simple change to include telecommunications could be incorporated thus:

> "The Department will provide a safe, interconnected statewide transportation system for Florida's citizens and visitors that ensures the mobility of people, goods ***and information***, while enhancing economic prosperity and sustaining quality of our environment."

This minor revision could have the potential to set transportation planning and service provision on a whole new course, and influence public transit agencies to consider alternative service strategies.

Consider a Telecommunications Element Within the Transportation Plan

The Growing Smart Legislative Guidance of the American Planning Association recommends the development of "functional plans" divided by topic in the list below.

- Land use
- Transportation
- Housing
- Economic development
- Telecommunications

This would seem to reinforce the notion that telecommunications is and should be wholly separate from transportation. This may have a potentially limiting effect on the use of telecommunications for transportation purposes. Those states that have already developed telecommunications plans have typically put it under a department of administrative services or a department of energy. These departmental purviews tend to

direct the use of telecommunications for the purposes of developing state networks to help run government or to reduce energy consumption, rather than to improve public access and mobility.

A telecommunications planning element developed by a department of transportation, and incorporated as a separate mode of transportation, might focus, recharge and organize efforts in the areas of:

- ✓ Influencing and directing technology development for strengthening telecommuting and telecommerce, in addition to the traditional goals of using the technology for enhancing physical travel through highway and bus transit system optimization.
- ✓ Ensuring universal access to opportunities for telecommerce and telecommuting.
- ✓ Defining the role of telecommuting and telecommerce as they address transportation-related issues. For example, an argument could be made that telecommerce and telecommuting can play a role in the issues listed in the 2020 Florida Transportation Plan, including:

    - Global economic competitiveness
    - Growth management
    - Environmental sustainability
    - Role and responsibilities of the public and private sectors
    - Mobility
    - Transportation system condition
    - Transportation funding

- ✓ Forging new partnerships with private sector technology providers, other government departments and utility commissions.
- ✓ Providing the authority, motivation and funding to public transit agencies to serve as providers.
- ✓ Funding transportation, in both the manner in which revenues for transportation are raised and the manner in which transportation funds are allocated.

Miller and Self observe from the business standpoint, that "...building ingress and egress to the information superhighway is less capital intensive and has a lower recurring cost to use and maintain than any other preceding mechanism of commercial transportation. Because of these economies, more developers and businesses are using foresight, rather than afterthought with regard to telecommunications infrastructures." [41]

If the private sector is beginning to consider these factors, then the public sector transportation planners should also be monitoring how telecommunications is altering or taking the place of travel in the future and direct investments accordingly. However, for example, the Florida Transportation Plan notes that "Reduced reliance on the automobile will also decrease transportation revenues derived from motor fuel taxes." During the

fiscal year 2001, Florida state and local motor fuel tax receipts totaled more than $2.4 billion [42]. Might traditional funding structures be holding us back?

If departments of transportation took on the movement of information as part of their mission, then how might transportation be funded differently? Currently, travel is measured in vehicle trips; the impact of telecommunications is invisible. How should the impact of telecommunications be counted to better allocate resources for infrastructure?

Table 7
Proposed Modal Elements of a Transportation Plan

Roadway
Bus Transit
Rail
Pedestrian
Bicycle
Transportation Demand Management
Transportation Systems Management
Telecommunications

Additional Considerations

In addition to the recommendations above to consider adding "moving information" to the department of transportation mission statement and to consider adding a telecommunications element to the transportation plan, the list below contains 24 additional government actions to consider regarding telework and telecommerce, listed according to that level of government that might be in the best position to carry them out.

These considerations, as the ones above, are offered in the spirit of encouraging renewed thinking about what the mission of public transportation departments and public transit agencies should be. Before acting upon these considerations, each agency will have to evaluate the possibilities against its own unique strengths and weaknesses, the composition of the current and future customer base, cost/benefit analyses, and other factors.

However, the purpose of this report has been to help encourage public transportation toward fresh thinking about its future direction. As the transit industry strives continually for funding and public support, there may be new business opportunities in light of a changing world. Applying a business approach found in The Drucker Foundation Self-Assessment Tool for Nonprofit Organizations [43], public transportation agencies would have much to gain from setting aside old assumptions and looking anew at their missions, their customers, what their customers consider value, and what the results of their programs have been in order to recharge and focus the resources of their agencies. The considerations below provide ideas for moving in one direction that may have great future potential.

State Government

1. Provide technical assistance grants to employers to start telecommuting programs.

2. Attract telecommunications companies to the state for better jobs and advanced networks for use by the community.

MPOs

3. Seek funding to encourage partnerships between researchers and practitioners to develop, use and satisfy data requirements of activity based models. These have the capability to measure the impact of TDM strategies such as telecommuting.

State, Regional and Local Governments

4. Study how the development of a wireless Internet "bulletin board" of truck departure and arrival times and locations can reduce regional truck travel and optimize regional freight movement through consolidation of trips.

State and Local Government

5. Harness the use of information and communications technologies through coordinated efforts by various government departments, such as the:

Department of Energy
Department of Transportation
Department of Commerce/Economic Development
Department of Administrative Services
Public libraries/public schools and community colleges

There is a trend in which goals and areas of influence are converging among government departments, which complements interdisciplinary approaches to problems. Consequently, the goals of a local government long range transportation plan should be consistent with and supported by the goals of other departments.

6. Explore the advantages, feasibility, impacts and funding opportunities for the development of a network for distance learning, telemedicine, and government service needs.

State and Local Governments, Transit Agencies

7a. Explore opportunities to influence the development and application of information and communication technologies toward achieving transportation goals.

7b. Incorporate questions about the desire for telecommunications-related services into transit development plans.

Regional Government

8. Establish the MPO as a host site for the testing of activity-based modeling and for training in the use of the model systems. Such models can account for trip chaining, transportation control measures, and TDM, including telecommuting.

Regional and Local Government

9. Develop policies and initiatives to encourage telecommuting as well as telecommerce to influence supplier and customer-related travel. Strategies to be explored are web sites, on-line supply chain management, on-line service delivery, video conferencing, on-line shopping, and the "dematerializing" of physical products that are largely information.

10. Search for opportunities to share fibers and trenches with private entities for a regional or areawide fiber network.

11. Seek proposals for the lease of limited-access right-of-way in exchange for the design, construction/installation, and maintenance of a fiber optic network infrastructure to support intelligent transportation system initiatives and other communication programs.

12. Partner with private industry to create an urban area wireless optic network.

13. Seek collaborative partnerships with the federal Department of Commerce, National Telecommunications and Information Administration (NTIA) and coordinate with schools and libraries to pursue this new direction.

Local Government

14. Explore the development of a "Telecommerce TMA," with partners such as the MPO, the county, local community colleges and universities, the school district, the library system, the local telephone company, delivery services, local grocery stores, medical services, pharmacies and employers.

15. Coordinate with the land use planning element of the local government comprehensive plan to:

- Prevent covenants and local zoning regulations from unreasonably prohibiting an employee from teleworking from a home office.
- Prevent or limit cable "right of way" fees, taxes or levies that discourage telecommunication companies from making bandwidth available.

16. Establish planning guidelines by the land development department for the application of fiber optic networks in commerce centers.

17. Review the local building code for the purpose of establishing viable standards for providing advanced telecommunications and cable service technology to newly constructed homes to encourage telecommuting.

18. Ensure that all local efforts for the development of ITS infrastructure are linked and integrated to allow for real-time information (e.g., voice, video, and data) exchange between agencies responsible for providing mobility and safety, and transportation system users.

19. Establish a countywide employee telecommuting program for the purpose of recruiting, developing and maintaining an effective and responsible workforce and as a means of leading by example.

20a. Incorporate telecommunications as a mode in the transportation element of the long range transportation plan, which would incorporate the following goals:

- Establish guidelines, standards and timelines for review of telecommunications facilities
- Minimize unnecessary regulation
- Maintain community character
- Maintain local control
- Encourage competition in the marketplace
- Provide access to public rights-of-way while locality gets a fair compensation for its use
- Invest in the most advanced technology
- Protect public health, safety and welfare

20b. Pilot test the concept of the urban televillage—place telework centers in areas as substitutes for providing transportation to jobs.

Transit Agencies or Local Government Transportation Departments

21. Consider these actions:

A. Purchase at reduced government rates:
- Telephone service
- Computer hardware, software
- Computer servicing and maintenance

B. Establish a computer equipment recycling program, similar to a program that has been run in Phoenix, Arizona.

C. Distribute for free or selling at cost to targeted groups:
- Telephone service
- New and/or used computer hardware, software
- Computer servicing and maintenance
- Computer training, in-home set-up and ongoing assistance

D. Establish programs for local employers to institute telework arrangements.

E. Establish programs to prepare and provide ongoing assistance for employees to be successful teleworkers.

F. Serve as a "broker," linking companies who want teleworkers with people who want to telework.

G. Develop an interactive public mobility network, available to subscribers, not only for accessing email and the Internet, but also to enable persons to conduct business electronically.

Transit Agency

22. Revise the mission and goal statements of the local transit agency to put emphasis on providing services that achieve a desired end result for people, rather than running a transit system. For example, such wording might include: "Enable customers to access economic, education, and personal opportunities safely, efficiently, and comfortably."

23. Serve as community access centers to provide computers and Internet access. Transit agencies today already have an infrastructure that includes transit transfer centers and commuter centers.

24. Pilot test a "cybermobile" (a bus retrofitted with telephones, computers and modems) that would enable customers to accomplish personal business by accessing work, educational and other opportunities through telework and telecommerce.

Considerations Developed from Survey Results

Lastly, based upon the results of the Public Transit Service Development Survey, four more recommendations for consideration are offered:

- The state should further investigate and identify that segment of the population that would desire telework opportunities but who do not have such opportunities now.
- The state government should provide leadership, funding and policy direction to encourage public transit agencies to consider alternative service strategies, such as telecommunications-related services, and to search for mutually beneficial partnerships with the private sector, such as telecommunications service providers.
- Use public forums, such as visioning processes, to inform the public about the evolving role of public transit agencies to serve as mobility managers.
- State and local transportation agencies, in partnership with economic development agencies, should provide guidance and encouragement for employers to reap the business advantages of converting more jobs to those that can be accomplished by telework.

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Appendix

Survey

Public Transit Service Development
National Center for Transit Research

Survey

Public Transit Service Development

National Center for Transit Research

Dear Transit Agency Director:

The National Center for Transit Research at the University of South Florida, Tampa, is conducting this survey under a grant from the U.S. Department of Transportation and the Florida Department of Transportation. Your completion of this survey may result in the development of potential new roles and services that transit agencies may choose to provide, to meet the evolving needs of their customer markets and build public and political support for their transit agencies.

The results of all survey respondents will be presented in aggregate in a final report, distributed to the public. Your employment title and agency name may be used in the report, but your individual name will not be used.

We prefer the survey be completed by the transit agency director or senior staff specifically responsible for providing the vision and leadership that will shape future service development of that transit agency.

Please take 10-15 minutes to share your agency's experiences by completing this survey and submitting it by **Friday, December 21, 2001.**

Instructions for completing the online survey:

1. Please use the **<TAB>** key or your computer's mouse to move from question to question. Pressing the **<ENTER>** key will result in an incomplete survey being submitted.
2. Please be sure to click on the **Submit** button at the bottom of the survey form when you are finished.
3. If preferred, you may also print this survey out and return by fax to the attention of Sara Hendricks, (813) 974-5168.

Thank you in advance for your time!

Public Transit Service Development Survey

1. Transit Agency Director completing the survey:

Your name	
Title	
Transit agency	
Address	

Address (cont.)	
City	
State	
Zip Code	
Email	
Phone	
Fax	

☐ **Check here if you would like us to send you a copy of the final report.**

2. What is your transit agency's official mission statement?

3. Please rate all of the following service strategies from **1 (Least desired by customers) to 5 (Most desired by customers)** to determine which of these services will satisfy the needs of existing and potential customers over the next ten years.

	Least Desired By Customers				Most Desired By Customers
	1	2	3	4	5
a. Provide more fixed route bus service	O	O	O	O	O
b. Provide more flexible service (e.g., route deviation, point deviation, etc.)	O	O	O	O	O
c. Operate vanpool programs	O	O	O	O	O
d. Offer subsidies to vanpoolers	O	O	O	O	O
e. Provide guaranteed or emergency ride home program	O	O	O	O	O
f. Operate shuttles funded by the private sector	O	O	O	O	O
g. Provide subscription bus service	O	O	O	O	O
h. Influence transit-friendly development	O	O	O	O	O
i. Provide collaborative trip planning services with rideshare agencies	O	O	O	O	O
j. Provide bikes on bus service	O	O	O	O	O
k. Pursue partnerships programs with the private sector for fare programs and information campaigns	O	O	O	O	O
l. Provide real-time travel information via phone, Internet or at major stations	O	O	O	O	O
m. Provide educational classes/entertainment aboard buses	O	O	O	O	O
n. Provide a "car sharing" program for					

n. Provide a "car sharing" program for the occasional driver, which provides neighborhoods with access to a fleet of rental vehicles at a lower cost than typical rental agencies	O	O	O	O	O
o. Offer an electronic payment option	O	O	O	O	O
p. Provide assistance to help commuters telecommute	O	O	O	O	O
q. Provide guidance to employers offering telecommuting programs	O	O	O	O	O
r. Operate telecommuting centers	O	O	O	O	O
s. Support the installation of fiber optic cable into residential communities	O	O	O	O	O
t. Provide mobile units equipped with computers and modems ("cybermobiles") to augment access of telecommunications technologies to residents of disadvantaged communities	O	O	O	O	O
u. Provide subscriber access to email and the Internet via an electronic freenet maintained by the transit agency	O	O	O	O	O
v. Provide any other telecommunications-related services (please specify)	O	O	O	O	O
w. Other (please specify)	O	O	O	O	O
x. Other (please specify)	O	O	O	O	O
☐ y. Other (please specify)	O	O	O	O	O

4. Of the service strategies above that you checked, please prioritize them below by **writing the letter designation** of the service strategy, as listed above in question #2, listing the highest priority service strategy first. (e.g., enter "c" if you believe " Operate vanpool programs" is one of your highest priorities)

Highest priority

2nd highest priority

3rd highest priority

4th highest priority

5th highest priority

5. Please fill in the boxes in the following table. If you are filling out a hard copy and need more space to write responses please use the back of the page or attach a separate sheet.

Does your transit agency:	Check Yes or No	If no, but if this strategy would satisfy future needs of customers (as checked in question #2 above), please list potential obstacles to implementation	If no, and if this strategy does not fit future vision for service development, please list reasons why.
...currently provide assistance to help commuters telecommute (option 2p above)?	O Yes O No	*Enter potential obstacles to implementation here*	*Enter reasons why here*
...currently provide guidance to employers offering telecommuting programs (option 2q above)?	O Yes O No	*Enter potential obstacles to implementation here*	*Enter reasons why here*
... telecommuting centers (option 2r above)?	O Yes O No	*Enter potential obstacles to implementation here*	*Enter reasons why here*
...currently support the development of wired communities (option 2s above)?	O Yes O No	*Enter potential obstacles to implementation here*	*Enter reasons why here*
...currently provide neighborhoods with mobile units equipped with computers and modems ("cybermobiles") (option 2t above)?	O Yes O No	*Enter potential obstacles to implementation here*	*Enter reasons why here*
...currently provide subscriber access to email and the Internet via a freenet (option 2u above)?	O Yes O No	*Enter potential obstacles to implementation here*	*Enter reasons why here*
...currently provide any other telecommunication-related services (option 2v above)?	O Yes O No	*Enter potential obstacles to implementation here*	*Enter reasons why here*

6. Any additional comments/observations you'd like to make:

If you are responding to this survey on the Web, please click the "Submit" button below or email it to hendrick@cutr.usf.edu.

If you prefer, you may FAX this survey to the attention of Sara Hendricks at CUTR, (813) 974-5168 or mail it to: Sara J. Hendricks, Center for Urban Transportation Research, University of South Florida, 4202 E.

Fowler Avenue, CUT100, Tampa, FL 33620-5375.

Thank you for your time and assistance!

Submit Reset