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A Key Strategy in Southern California's Plan to Improve Mobility and Air Quality

Main Report

SOUTHERN CALIFORNIA ASSOCIATION of GOVERNMENTS

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Southern California Association of Governments
Mission Statement

To enhance the quality of life of all Southern Californians by working in partnership with all levels of government, the business sector, and the community at large to meet regional challenges and to resolve regional differences.

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We hope that you enjoy this electronic visit to the Southern California Telecommunications Deployment Strategy Report.

Regional Council Members

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Exhibits List

Introduction

This document describes a strategy for accelerating the deployment and use of telecommunications in the six Counties and 184 cities of the Southern California Region. Telecommunications means electro-optical communication of voices, graphics, data, or video over a distance. The counties are Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura.

One might ask, isn't telecommunications (including telephones, cellular, faxing, video conferencing, computer networks, and cable TV services) advancing quite fast enough? The answer is "yes" if we are talking about all telecommunications. The answer is "no" if we are talking about the particular characteristic of telecommunications that motivates this plan: communicating over a distance can sometimes provide people and organizations with alternatives to vehicle travel, thus reducing the number of vehicle trips and their associated exhaust emissions and traffic congestion. This strategy provides a process for isolating and emphasizing those telecommunications applications — as well as the technological, organizational, economic, and human factors that influence applications — that can lead to more trip substitution, shifting of travel out of peak periods, and other positive impacts that will improve air quality.

In addition, there are other economic benefits to accelerating telecommunications deployment, benefits such as creation of more new jobs, and increasing the ability of Southern Californians to prosper in an increasingly competitive world economy.

How to Read This Document:

1- The Strategy:

The Southern California telecommunications Deployment Strategy (TDS) is described in detail in the main body of the document, which is on this CD-ROM; and in brief in the Executive Summary.

2- The Appendices:

Along with the development of this strategy, a Telecommuting Outreach Program, designed by the Los Angeles County Metropolitan Transportation Authority (LACMTA) for Los Angeles County, is described in Appendix A. In addition, this Appendix A includes some of the products of the Outreach Program such as the news letters, and Chapter One of the Telecommuting - A Formula for Business Success manual. The other two Appendices describe information related to the TDS.

1. Telecommunications Background Overview & Issues Identification

Background

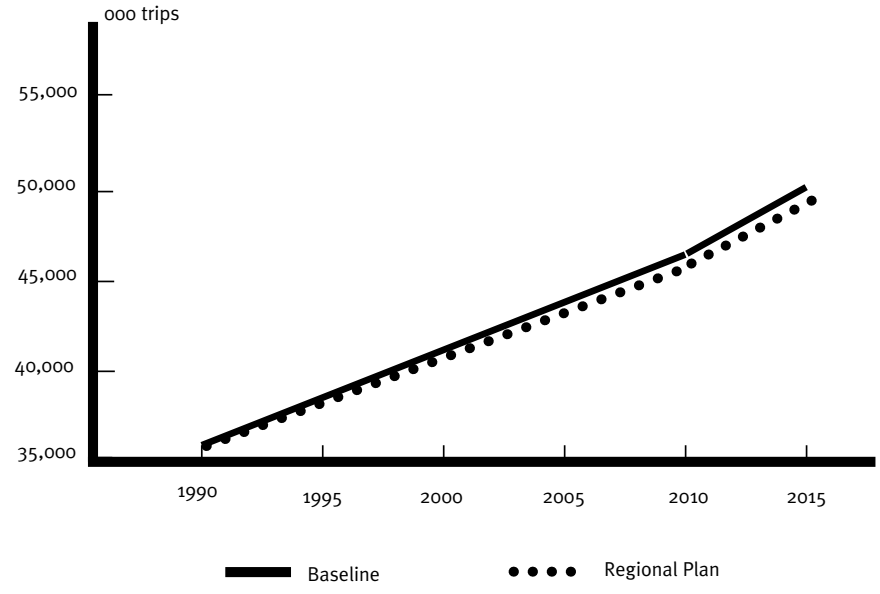
This document was prepared by consultants working under the direction of the Southern California Association of Governments, in support of the Southern California Economic Partnership. The consultant team from Ellen Williams and Associates, Inc. also benefited from review and advice from the Telecommunications Cluster Advisory Group of private and public sector managers, described below. The work that went into this document was partially funded by a contract between the Association and the State of California Department of Transportation.

The Association of Governments is a council of 184 city governments and six county governments serving 15 million people in 38,000 square miles of Southern California. It is the means by which local governments work in concert to solve problems that transcend political boundaries, such as mobility, access, air quality, and economic vitality. Under Federal law, Association of Governments has the assignment of planning the improvements to the regional system of transportation so that the system works to move people and goods efficiently, while at the same time complying with the Federal Clean Air Act. The Association fulfills this planning responsibility with the creation of a Regional Transportation Plan, reviewed and updated every three years. All road, highway, and rail construction projects fall under this plan, as well as other measures, such as expanding public transportation, new traffic signal control systems, and promotion of alternatives to traveling. Until this plan was begun, the only application of telecommunications that was considered in the Regional Transportation Plan is telecommuting, which means using the telephone, computer networks, and other telecommunications to work at home instead of commuting.

The latest version of the Regional Transportation Plan, issued in June 1994, paints a picture of growing traffic congestion: "Transportation demands continue to increase rapidly in Southern California as a result of both population growth and changes in travel patterns. Given the financial restrictions and environmental concerns, it appears unlikely that this demand can be accommodated without dramatic changes in travel behavior."1

Exhibit 1 illustrates these points by showing the latest forecast for average daily vehicle trips in Southern California for the years ahead, out to

Exhibit 1:
Baseline and Plan for Daily Vehicle Trips in Six Counties of Southern California



the year 2015. Note that the starting point for the growth shown is the 1990 average level of trips in the region: 35,416,000 trips per day! The solid line represents a forecast that assumes that there are no extraordinary public policy initiatives to reduce trip-making in the years ahead. The dotted line represents a forecast for a reduced amount of vehicle trips to result if the Regional Transportation Plan of new diamond lanes (HOV), more use of transit, road pricing, some more telecommuting, and other innovations is followed. The relatively small difference between the solid baseline and the dotted plan line -- about two percent in the year 2015 -- motivated the Association of Governments to seek additional useful steps to take, including the addition of Advanced Transportation Technologies to the Regional Transportation Plan, one of which is telecommunications.

As a partial response to the growing demand for vehicle travel which is causal to the severity of air pollution (the worst in the nation), as well as the increase in congestion in the Southern California region; the Southern California Economic Partnership was formed (The Partnership) by the Association of Governments as part of the 1994 Regional Transportation Plan. The Partnership is a business-government non-profit organization formed to accelerate the consumer use of five advanced transportation technologies: electric vehicles, alternative fuel vehicles, smart shuttle transit, intelligent transportation systems, and telecommunications. The Partnership's mission is to be a market development facilitator, helping the private sector to create a mass consumer market for technology based products that alleviate air pollution and traffic congestion, and produce local job growth and productivity improvement as well. The Partnership Board is composed of 26 members who are executives of private and public organizations which work on one or more of the five advanced transportation technology areas. **Exhibit 2** shows the members of this Board, and **Exhibit 3** provides the organizational structure of the Partnership.

The portion of the activity of the Economic Partnership that is directed toward telecommunications is called the Telecommunications Cluster, which operates in parallel with the Electric Vehicle Cluster, the Smart Shuttle Cluster, and the others. The Cluster is to do its work through a small staff of employees and contractors, plus a number of volunteer stakeholders from the private and public sectors whose organizations find participation to be useful to their mission. Note that the organizational mission in the case of government participants is some component of the public interest, while in the case of business organizations the mission is business related -- sales, serving customers, growth, shareholder value, profit, and so on.

This plan as well as the ongoing work of the Telecommunications Cluster is informed by expert input from an Advisory Group of telecommunications providers and government officials. **Exhibit 4** shows the charter members of the Advisory Group, which met six times in the period July, 1995 through January, 1996. This Advisory Group is scheduled to meet bimonthly starting in March of 1996. The membership of the Advisory Group is likely to change under the direction of Partnership management.

The Advisory Group and its meetings are an important part of the Cluster, but Cluster activity under this plan expands beyond the Advisory Group. A variety of future research and development projects that will be generated by this plan carried out by Partnership staff, Association staff, and contractors would also be part of the Cluster. Furthermore, in a way similar to the Smart Valley effort based in the Silicon Valley area of Northern California (see Appendix C), Cluster top management with the advice of the Advisory Group may choose to endorse and promote a number of ongoing telecommunications infrastructure upgrades or applications development projects taking place in the Southern California region. These projects could then be said to be "part of" the Telecommunications Cluster.

The California Department of Transportation (Caltrans) has a vision that Southern California driving can be improved considerably over the next ten years as a result of using advanced technologies. This agency sometimes refers to the use of telecommunications for trip substitution as telesubstitution. As one response to the challenge of rising travel demand and limited funds

Exhibit 2:
Southern California Economic Partnership

Board of Directors

Lloyd Armstrong
Provost
University of Southern California

Jim R. Browder
Chairman
California Consortium of Transportation Research & Development

Vikram S. Budhraja
Vice President of Planning & Technology,
Southern California Edison

Malcom Currie
Chairman Emeritus

Michael Daly
Director of the ATTI Deptment
College of the Desert

Tom Decker
Executive Vice President
Bank of America

Lynne Edgerton
Board of Directors
California Air Resources Board

Michael Gage
President
Calstart

Gary Hunt
Senior Vice President
The Irvine Company

Charles Imbrecht
Chairman
California Energy Commission

Ruben Jauregui
Principal
Vargas and Company

Don Larson
Chairman of the Board
Inland Empire Economic Partnership

Jim Lents
Executive Officer
South Coast Air Quality Management District

Marilyn Morton
Public Affairs Manager-Construction
Los Angeles Co. Metropolitan Transit Authority

George Peapples
Vice President of Government Relations
General Motors Corporation

Mark Pisano
Executive Director
Southern California Association of Governments

Cheri Ramey
President
Ramey Communicatios

Jack Reagen
Executive Director
Riverside County Transportation Commission

Norm Ross-*Vice Chairman*
Vice President and Area Manager
Parsons Brinkerhoff

William Rusnack
President
ARCO Products Company

Tom Sayles-*Chairman*
Vice President of Public Affairs
Southern California Gas Company

Gene Sherman
Vice President of External Affairs
Pacific Bell

John N. Stearns
Director
Project California

Ken Steele
District Director
Caltrans-District 7

Jim Wood
Secretary-Treasurer
Los Angeles County Federation of Labor

Dennis Zane
Executive Director
Coalition for Clean Air

Boardmember Staff/Representatives

Lee Wallace
External Affairs Manager
Southern California Gas Company

Minnie Lopez Baffo
Public Affairs Coordinator
The Gas Company

John Weber
Transportation Segment General Manager
The Gas Company

Raymond Buttacavolli
Regional Manager
General Motors Corporation

A. J. Donner
Executive Director, Public Affairs
Pacific Telesis Group

Zahi Faranesh
Chief, Regional Transportation Planning
Caltrans District 7

Jim Ortner
Manager Air Quality Program
Orange County Transportation Authority

Partnership Staff

John J. Cox
President
Southern California Economic Partnership

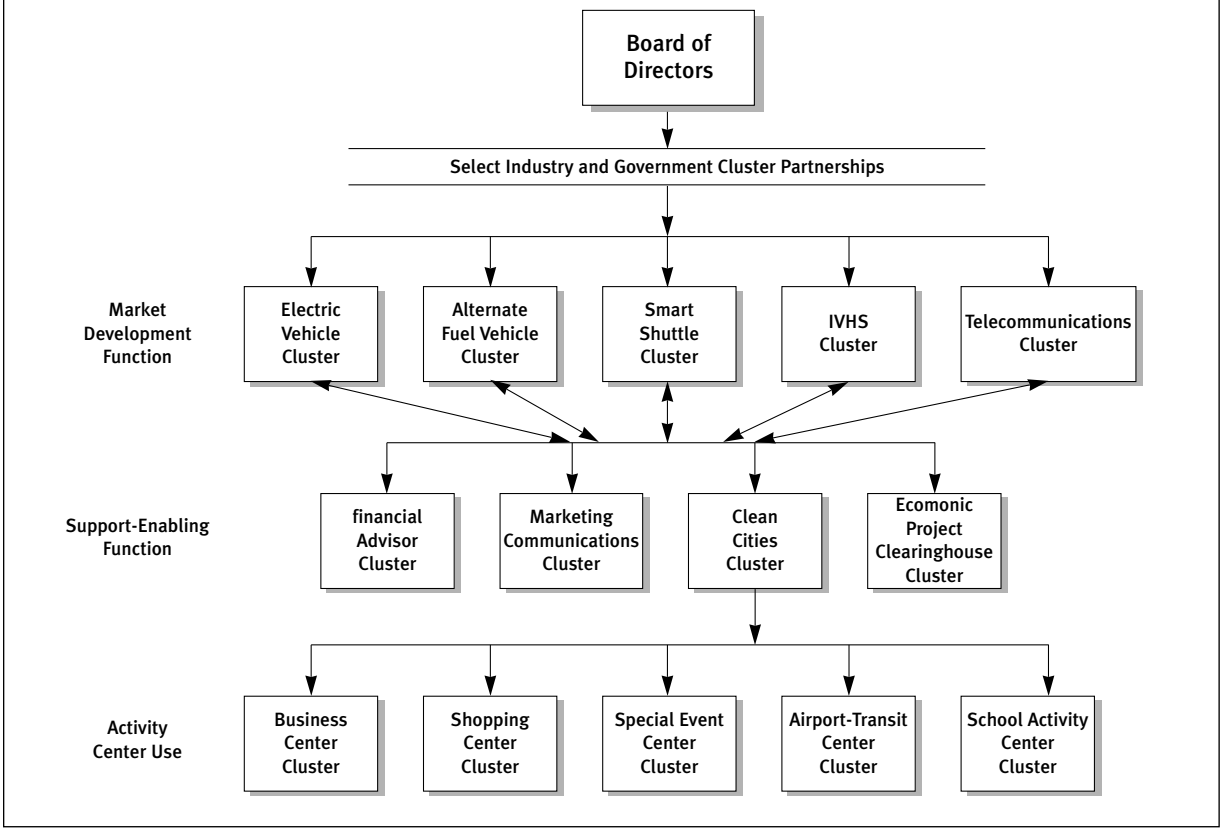
Grizelda D. Reed
Associate Administrative Officer
Southern California Economic Partnership

Marnie Tenden
Marketing Director
Southern California Economic Partnership

Jennifer Kemp
Communications Manager
Southern California Economic Partnership

Melissa Gisler
Marketing Research Manager
Southern California Economic Partnership

Exhibit 3:
Organizational Structure of the Partnership



for the construction of new roads and highways, public policy of the State of California is to work on increasing the use of telecommunications in order to move information instead of people and goods. Caltrans promotes the notion that telecommunications is a "mode of transportation" that moves information and services instead of people and goods. Caltrans is coordinating its own statewide telecommunications program with the Association and the Partnership, and has provided funding for the creation of this plan.

Other "telecommunications mobility projects" funded by Caltrans around the State of California include neighborhood telecenters, a community network serving Davis (see Appendix B), the Blue Line Televillage at the Compton transit center in Los Angeles, and a Smart Communities planning effort in San Diego County (see Appendix B & C). These projects are intended to provide research findings on the demand for telecommunications as a mobility mode, demonstrate the value of the telecommunications mode as a component of a full transportation system, and solve problems in partnership with the private sector and units of local government.

Another organization that is working on telesubstitution is the Southern California Telecommuting Partnership, founded by a grant from the Department of Energy, as part of the response to the January 17, 1994 Northridge earthquake, which closed major arterials for a period of time. This Partnership (distinct from the Economic Partnership described above) is a voluntary confederation of public, non-profit, and private entities which have joined together to facilitate the growth of telecommuting. As of early 1996, because of a needs assessment carried out in 1994-5, the Telecommuting Partnership is

Exhibit 4:
Charter Members of the Telecommunications Cluster Advisory Group of the Southern California Economic Partnership - Established July 1995

Bill Allin	District Manager, AT&T, San Francisco
Sky Dayton	President and CEO, Earthlink Network Inc., Los Angeles
Dilara El-Assaad	Project Manager, Southern California Association of Governments
Donald Girskis	General Manager, Nextel Communications, Orange
Evelyn Gutierrez	Chief, Office of Special Programs, Chief Administrative Office, Los Angeles County
Chuck Haas	INTEL, Santa Clara
Jim Hake	Principal, Access Media, Santa Monica
Jorge Jackson	Vice President, GTE Telephone Operations, Thousand Oaks
Kimberly Karambelas	Vice President, Pacific Lightwave, Riverside
Dr. Douglas Martin	ADA Coordinator, ADA Compliance Office, UCLA, Los Angeles
Larry McElroy	Director of Business Development, Performigence, Los Angeles
Perry Parks	President, Southern California Cable Association
Hon. Robert Pinzler	Councilmember, Redondo Beach City Council, Redondo Beach
Gene Sherman	Vice President, Pacific Telesis, Los Angeles
Kathy Wasikowski	Director of Transportation Programs, Southern California Air Quality

engaged in developing a training and marketing program to expand telecommuting in the Southern California region.

Telecommuting is already the most familiar trip-saving application of telecommunications. It is important because the single largest identifiable trip purpose is the daily journey to work. However, this present plan needs to go beyond telecommuting, because the journey to work is only 21 percent of trips in Southern California.

This document describes the Southern California Telecommunications Deployment Strategy (TDS). This Strategy is intended to provide a framework for the activities of the staff and stakeholders whose work comprises the Telecommunications Cluster of the Southern California Economic Partnership. Staff includes paid professionals at the Partnership and at the Southern California Association of Governments. Stakeholders include members of the Telecommunications Cluster Advisory Group and other professionals from business and government organizations working on telecommunications. These people will be authorized by their organizations to participate in working groups and task teams that implement Partnership initiatives.

All of this work on telecommunications deployment for improved mobility and access is also intended by the founders of the Southern California Economic Partnership to promote the growth and development of the Southern California economy. There is in fact little doubt that telecommunications deployment of any and all kinds in a market-driven framework provides economic benefits, including the expansion and creation of new enterprises, and the creation of new jobs. At the same time telecommunications along with computers and other information technologies promotes restructuring of the economy and some "creative destruction" of enterprises and jobs as new technologies and processes replace older ones that are less efficient and effective. The effect of telecommunications on the economy is discussed in a later section.

The point to be made here is that economic benefit from telecommunications deployment is rela-

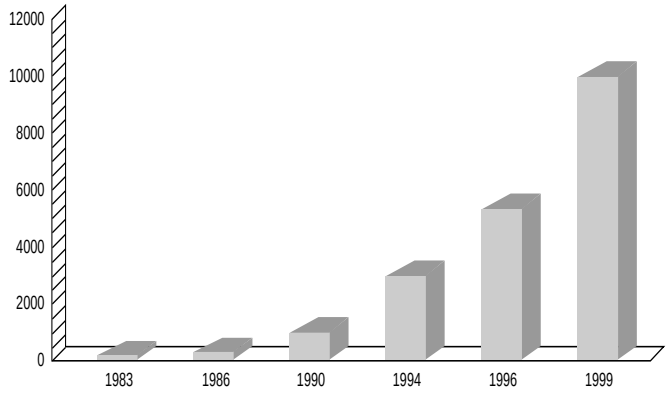
tively easy to achieve; it comes almost naturally as a matter of course. Mobility benefits, on the other hand, are harder to achieve. [5]. A narrower range of activities in telecommunications deployment promotes mobility enhancement than promotes economic development generally. That is the reason for the dominant and recurring focus on travel related issues in this Plan. Mobility enhancement is the narrower goal and will not be achieved automatically be promoting telecommunications infrastructure and applications generally. Once a plan for enhancing mobility through telecommunications is set in motion, the general economic benefits will also come along.

Overview and Issues Identification

At the same time that travel demand is rising steadily in Southern California, the power and reach of telecommunications is growing rapidly as well. Telecommunications encompasses the movement of voices, graphics, video, computer data, and other information over a distance using electromagnetic waves that travel through metal and glass cables or the air. Telephones, fax, broadcast and cable television, cellular, paging, computer communications like electronic mail and Internet, video-conferencing, and the myriad of new services coming over the "information highway" are all part of telecommunications.

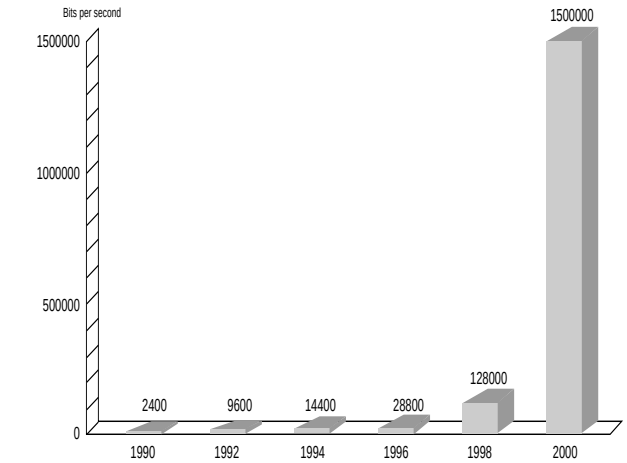
The graphics in **Exhibits 5** and **6** are just two out of many possible indications of the speed at which telecommunications technology is developing. The first figure illustrates the past and future growth in the power of microcomputers, which are essential components of modern telecommunications. The number of transistors on each chip is growing inexorably. The second figure illustrates the trend in dial-up data communications bandwidth -- expressed in bits per second -- available to homes and small businesses over the course of the 1990s. The 1990-96 figures represent typical modem speeds in each year, starting 2400 bits per second and progressing through 28,800 bits per second modems widely sold as of 1996 in computer stores and popular for Internet surfing. The 1998 figure represents the digital, no-modem connection speed of digital phone circuits (ISDN, integrated services digital network) that are growing in availability throughout California and elsewhere, and the year 2000 figure of 1.5 million bits per second represents an estimate of minimum data rates expected by many observers to be commonly available at the turn of the century through "cable modems" or other telecommunications technologies.

Exhibit 5:
Growing Number of Transistors in each Microcomputer Chip



Source: Business Week, Feb. 20,1995, p. 88

Exhibit 6:
Typical Data Communications Speeds Available for Homes and Small Business



Source: Global Telematics

TELECOMMUNICATIONS

Telecommunications means interactive communications and other conveyance of information over a distance by electronic and optical means. Telecommunications can be used even over short distances, as in the case of intercoms, local area networks (LANs), cordless phones, private branch exchanges (PBX), and master antenna TV services in apartment buildings. However, the Telecommunications Cluster will focus on distances of at least 1000 feet, the approximate span at which people begin to use vehicles for movement instead of walking.[2]

At the other extreme, while telecommunications can reach around the globe and out into deep space, the focus for the present plan will be on telecommunications that allows information movement within the Southern California region, up to around 300 miles. At the same time it is usually impossible to limit how far telecommunications can reach. The power of telecommunications as a channel for exporting and importing goods and services to and from Southern California is a key characteristic, as is the power of long-distance communications to influence the flow of people visiting the region by car, train, plane, and ship. The long-distance reach of telecommunications also permits the outsourcing of work and the export of jobs from the region. Since long-distance communications beyond the boundaries of the Southern California region affects the movement of people and goods within the boundaries, it is a characteristic that will need to be remembered throughout the work of the Telecommunications Cluster, although the main Cluster emphasis is on shorter-range telecommunications applications.

The telecommunications system is a network of networks, including telephones, cellular phones, satellite dishes, cable TV, broadcast services, computer networks, and other systems. Telecommunications technologies includes all of the following products and services shown in **Exhibit 7**. In simple terms telecommunications is

Exhibit 7:
Telecommunications Technology Inventory

800/900 Services	Groupware	Printers
Asynchronous Transfer Mode	Imaging	Remote Access
Audiotex	Intelligent Hubs	Routers
Bridges	Internet Access Providers	Security Software
Celluar Equipment	Internet Software Tools	Site Metering
Centrex	Inverse Multiplexers	SMDS
Client-Server Applications	ISDN	SONET
Cluster Controllers	Leased Lines	Switched Data
Communications Software	Local Area Networks	Systems Management Software
Database Servers	Mainframe Computers	Terminal Emulation Software
Desktop Publishing	Microcomputers	Terminals
Document Management	Middleware	Videoconferencing
DSU/CSU	Minicomputers	Virtual Networks
Electronic Data Exchange	Modems	Voice Mail
Electronic Mail	Multimedia	VSAT and other Satellite
Fax/Modem Boards	Multiplexers	Web Servers and Browsers
Firewalls	Network Management Software	Wireless Data Services
Frame Relay	Notebook Computers	Wireless Data Equipment
FT-1, T-1, T-3 Services	On-line Services	Word Processing Software
Gateways	PBXs	Workstations
Graphical User Interface	Personal Digital Assistants	

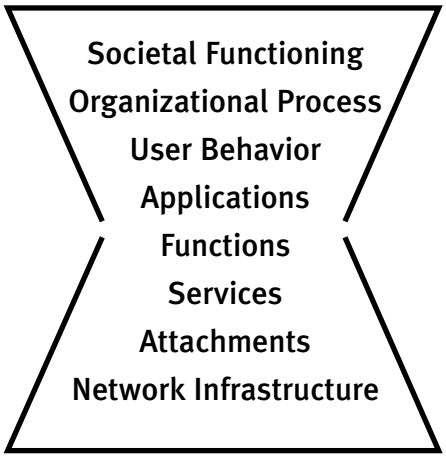
the combination of five familiar systems, the switched voice-data- video telephone system, cable TV systems, cellular and other wireless communications systems, satellite systems, and broadcast TV and radio. Large organizations often have private communications systems of enormous size and complexity, parts of which are generally leased or otherwise sourced out to telephone companies and other common carriers.

Computing is increasingly converging on telecommunications, yielding an advanced telecommunications that some give a new name such as telematics or telecomputing. This convergence shows up in several ways:

- An increasing share of telecommunications content originates as computer data.
- Automated response systems, where callers press buttons to generate tones that cause information to be sent back, such as electronic touch-tone banking, amounts to using the telephone as a computer terminal.
- Most other telecommunications traffic (voice, video, graphics) is digitized via computers for fast transmission via fiber optics. This computerization of information sometimes includes encoding and decoding for security, compression to remove redundant information, and conversion to discrete packets of information for transmission. Newer, faster, higher capacity telecommunications services such as frame relay and asynchronous transfer mode depend utterly on computers
- For the management of telecommunications processes, including setting up end-to-end circuits via switching, coordinating the many antennas used by cellular telephones, and monitoring telecommunications network performance, computers are integral.

Telecommunications is best analyzed by a logical layering that separates narrower causes and larger effects. One possible model that divides telecommunications into layers has been developed by Global Telematics. See **Exhibit 8.** The model stacks the more fundamental parts of the telecommunications milieu, such as infrastructure and network attachments, at the bottom of an

Exhibit 8:
Layers of Telecommunications



hourglass-shaped stack. The model puts the enabled, resulting effects of telecommunications, such as societal functioning, toward the top. The reason for the narrowing in the middle of the stack is to make the point that the relationship between the technology issues that comprise telecommunications and the external issues that lie outside of telecommunications, such as mobility, is easiest to understand in the middle of the stack. The following description covers each layer of the model, starting at the bottom. [3]

TELECOMMUNICATIONS

Network infrastructure is the physical facilities of networks that allow information to flow from place to place. Examples of network infrastructure are copper and fiberoptic cables, switches, earth satellites, satellite dish antennas, and cellular telephone antennas

A key characteristic of infrastructure is bandwidth, which means the amount of information that can flow through a single point in a given period of time. Bandwidth is expressed in bits of information per second. Higher bandwidth means faster data transmissions and higher quality video and graphical representations. With wires and cables, this bandwidth increase is achieved by changing the material out of which cables are made, typically from copper to glass fiber. With radio systems, the bandwidth is increased by

using ever smaller, computer coordinated transmission areas called cells, and then using the same frequencies over and over again in different cells that are not adjacent. With all kinds of infrastructure, there is a general technological trend to squeeze more and more bandwidth capability out of existing facilities. This is done with better electronics, some of which is aimed at signal compression, which raises bandwidth by eliminating the transmission of redundant information.

Furthermore, more bandwidth is not always better than less bandwidth in practical applications of telecommunications. It is sometimes asserted blithely that video is invariably an important addition to telework and teleservice applications, and higher bandwidth is important in making person to person video communications work successfully. However, there are many kinds of workgroup and customer/client communications in which video is a distraction in remote interaction. This is obviously the case when communicating while driving a car. But even when sitting at a desk, pure voice communications, or voice plus document sharing, works better than video. Voice and document sharing are low bandwidth applications that work over the telephone infrastructure of today. As another example, research shows that certain kinds of psychological counseling are more effective when delivered over the telephone than in face-to-face sessions, because visual information is distracting to the discussion of personal problems. While there is no denying that growing bandwidth will be offered to users in the future, the bandwidth available today works very well in many practical applications of telecommunications that would improve mobility. The larger issue in designing technology for human interaction is appropriate bandwidth, not more bandwidth.

Lack of a particular type of infrastructure is sometimes singled out by analysts and civic leaders a priori as a singular, key barrier to the deployment of more effective telecommunications applications. This is sometimes true, but not usually. The truth of this judgment in a particular circumstance depends on the nature of the applications, the state of readiness of users, the schedule under which the "missing" infrastructure is being installed as a result of market forces, the availability of alternative infrastructure either now or in the near future, the alternatives available in network attachments and associated software, and other factors including trends in functional interoperability. A case in point is the typical lack of fiber optic cabling to residential locations. Over the past decade, this "infrastructure gap" has been well mitigated by new technologies such as faster modems and new digital services that let the existing copper wiring system reach higher bandwidths, and by alternative infrastructures such as cable TV system retrofits and new small dish satellite antennas.

NETWORK ATTACHMENTS

Network attachments, sometimes called terminal devices or customer premises equipment are attached to telecommunications networks by users in order to send and receive communications. Examples of network attachments are telephones, fax machines, kiosks, pagers, and personal computers. Over time, more technically advanced network attachments can incrementally overcome some of the inadequacies in infrastructure.

NETWORK SERVICES

Telecommunications companies sell different kinds of telecommunications services to users. Examples of network services are local flat-rate telephone service, long distance toll service, centrex services (like call waiting and call forwarding), Integrated Services Digital Network (ISDN, a digital phone service that allows faster data transmission than through modems attached to typical analog phone lines), Asynchronous Transfer Mode (ATM, a very fast digital communications service just beginning to be used to connect organizations), voicemail, fax mailboxes, and video distribution. In some areas, cable TV companies are planning to sell Internet access service to consumers.

USER FUNCTIONS

User functions are activities that are carried out through the use of telecommunications. Examples of user functions are providing supervisory instructions to employees, watching the news,

interacting with peers, and searching for last weeks sports scores. There are seven generic categories of telecommunications user functions:

- Person-to-person real-time interactive com munications (pairwise or in groups), such as talking on the phone or participating in a video-conference.
- One way messaging from a person or organizational entity to one other person or to many people, such as sending an email or fax, leaving a voicemail, or a radio or television broadcast.
- Information retrieval through human interaction with a computer, such as searching and downloading from an online database.
- Transaction processing, such as buying or selling something with a credit card, or using an automatic teller machine to obtain cash.
- Remote process monitoring and controls, such as observing the status of freeway traffic via a map on the Internet, or checking the status of an arriving airline flight by calling an automated response system on the phone.
- Machine-to-machine communication (no-human intervention), such as managing traffic lights or electricity flows in a power system via networked computer-processing.
- Entertainment and recreation, which is mostly served now by one to many broadcasting, but will become more one to one and personalized.

TELECOMMUNICATIONS APPLICATIONS

A telecommunications application is the deployment and use by one or more organizations of networks, hardware, software, and telecommunications services to carry out an organizational purpose such as service delivery to customers, or support of employees in dispersed locations. Examples of telecommunications applications are telecommuting, telemarketing, community networking.

Telecommunications applications typically support combinations of user functions. For example, a telecommuting application may support verbal interaction with the supervisor and colleagues, linking in to the company computer network, and obtaining information from outside the organization.

USER BEHAVIOR

People behave differently as a result of telecommunications applications than they did before telecommunications came along. Issues of human interest and motivation as well as education and skill levels come into play here.

Examples of user behavior in this context are how people actually use the telephone or the Internet. The predilection of people to use a video-conference as opposed to just talking on the phone, meeting face-to-face comes in here. How peoples' behavior with respect to local vehicle travel are affected by telecommunications is the bottom line focus in this report.

ORGANIZATIONAL BEHAVIOR

Like people, organizations change how they operate as a result of telecommunications. Examples include the effects of telecommuting on how companies do their work through employees, and how firms change their operating procedures as a result of electronic mail and the Internet.

Organizations generate travel by their employees, some of which is paid time over which organizations have a normal economic motivation to control costs. When organization pay for travel time, they have an incentive to develop telecommunications applications which will reduce costs or achieve more benefit for the same resources.

SOCIETAL FUNCTIONING

At the top level of the layering we consider how organizations and people behave collectively in the socio-economic system as a result of all the lower layers of telecommunications operating in the context of the marketplace and the political system. In other words, the effect of the marketplace and the political system cut across all the layers in this representation, but we are showing by this layer that there is a net result in overall socio-economic functioning. The particular aspect of socio-economic functioning of most interest in

this Plan is the mix of physical travel and communicating in the Southern California Region that results from expanding telecommunications and growing traffic congestion. There are also economic results such as job and enterprise creation, and job and enterprise destruction. The economic results will happen in any event.

Government or private action to improve one layer does not automatically cause a change in another layer. There are many intervening variables. For example, causing telephone companies to install fiber optics to schools and libraries does not mean that people will universally become more educated and earn more money, or that people will take advantage of the information that flows through the fiber optic cables, or even that the fiber optic cables will be attached to a source that provides useful information.

Similarly, reducing trips to schools and libraries may not be promoted by improving the quality of the telecommunications infrastructure and services and equipment that serve these schools, if the major obstacle to trip reduction lies in a different direction. In education, for example, there is a deep set of motivations and traditional practices that cause daily travel by students and teachers to school buildings and campuses. Wiring the building may reinforce these practices, not change them. Electronic services that could replace trips to a library may come from people using electronic connections to places other than libraries, such as the central database that catalogs library holdings, or an on-line information provider in a different city, or a mail-order book seller.

Another reason for focusing public interest based intervention into the telecommunications marketplace on applications rather than on the lower, more technological layers relates to the complexity and difficulty in even understanding how telecommunications technology is evolving. Random excerpts from the telecommunications trade press shown in **Exhibit 9** illustrate the technical complexity around telecommunications technology. As will be shown later in this report, applications can be more easily analyzed in terms of travel impacts than the technology components of infrastructure, network attachments, and services.

Every different telecommunications application depends upon different institutional arrangements, systems of user training, methods of technical support, and levels of user acceptance. While these components can over time be generalized and addressed at the levels of user behavior, organizational behavior, or societal functioning, these components must initially be dealt with at the applications level. What is done in the way of institutional arrangements, training, and tech-

Exhibit 9:
Trade Press Quotations Illustrating High Level of Obscure Jargon:

"The ideal voice coder/decoder must meet the quantization distortion requirements of an international network connection. It must also support facsimile and modem transmission as well as take advantage of the latest in compression techniques to offer the highest level of bandwidth efficiency." from "Time for a shift in the public telephone network" by Martin Shum, Communications Week, January 22, 1996, page 39.

"Fast Ethernet and 100VG-AnyLAN could be the platform upon which VLANs are initially built, although architectural differences from ATM would make VLAN implementation on those networks much more complicated." from "Switches threaten router's role" by Luc Hatlestad, InfoWorld, January 22, 1996, page 53.

"The transport services packetize data and send it over the network via a WinSock-compliant TCP/IP stack. This is done in real time via the IETF Real-Time Transport Protocol. The software also ensures the network path is clear of interference and that multimedia traffic gets priority over less deterministic traffic. Precept's Multimedia Services run atop the transport services to compress, decompress and synchronize the data." from "Multimedia traffic without the ATM fuss" by Barb Cole, Network World, January 22, 1996, page 65.

nical support to gain user acceptance and widespread use of video-conferencing is likely to be different than what is done to implement electronic document retrieval, or medical image transmission.

Telecommunications Deployment

Telecommunications deployment for purposes of this report means increasing societal usage of voice, data, and video telecommunications. This deployment is related to the availability of hardware, software, and services from the private sector, and also the amount of such product that is actually bought. Deployment also bears a relationship to the way in which these products are used in households and in organizations.

There is a national, state, and local framework of legislation and regulation that shapes telecommunications deployment by making impacts on infrastructure and business practices. Consultants have reviewed policy-related materials from the California Public Utility Commission, Project California, the Governor's Council on Information Technology, the City of Los Angeles Special Advisory Committee on Technology Implementation, Joint Venture Silicon Valley, The Institute for Local Self Government (Sacramento), The National Information Infrastructure Advisory Council, the U.S. Department of Transportation, and the U.S. Department of Energy [4]. These reports and others contain a wealth of information on telecommunications deployment generally and in particular with respect to seeking overall economic effects. However, there is very little focus in these reports on the particular trip-making impacts of telecommunications, either positive or negative, except for references to telecommuting. When distance learning or telehealth is mentioned, the concern is on (as it should be) improving education or improving health care, as opposed to mobility impacts.

Outside of telecommuting applications and outside of the agencies and consultants that are already involved with the creation of this present plan, there is little focus on mobility impacts of telecommunications as a public benefit. The City of Los Angeles Information Technology Task Force report does not mention the word "telecommuting." The Project California *Blueprint for Energizing California's Economic Recovery* advocates the establishment of a telecommuting management training program as its single mobility related initiative.

The California Public Utilities Commission report "Enhancing California's Competitive Strength: A Strategy for Telecommunications Infrastructure" lists reducing traffic congestion and improving air quality as a major benefit. The report describes how the Commission intends to foster a telecommunications infrastructure which forms the foundation on which "commuters see their traveling time shrink or vanish" and "rural and remote consumers, electronically linked to employers, schools, health-care providers, businesses, government agencies and sources of entertainment and information, no longer face the potential limitations brought on by distance from urban centers." That is the total of what the report says on mobility enhancement.

The general pattern in these and other telecommunications policy reports is to list travel savings as an assumed benefit of telecommunications, and then assume that any policy steps that will improve telecommunications will also yield travel savings. A partial exception to this pattern is the Institute for Local Self Government's 1991 *Telecommunications Framework for Cities* which generally links travel savings to local government development of specific telecommunications applications. As was documented in a U.S. Department of Energy study, *Beyond Telecommuting* [5], the obvious linkage of telecommunications to travel savings is only half the story. There are as many items on the list of ways in which telecommunications increases travel as there is on the list of ways in which telecommunications reduces travel. More on this point below.

Within the constellation of "telecommunications mobility" projects funded by the California Department of Transportation, there has been some interest in travel effects measurement, namely the work of University of California at Davis on telecenters and on the Davis Community Network, and the telecommunications planning work of the Chancellor's Office of the California

Community Colleges. On the other hand, there has also been a clear thrust in the Caltrans sponsoring office to divert focus from the travel substitution issue, and instead focus on larger, non-mobility issues, such as economic competitiveness and quality of life. Caltrans may be operating within its mission by focusing on telecommunications deployment broadly, but if the main task at hand for the Association and The Partnership is to achieve benefits related to the physical mobility that causes air pollution, then the focus must be on specific ways of doing that.

From among the layers described earlier, telecommunications applications are the best organizing focus for changing the path of telecommunications deployment toward the goal of achieving an applications level benefit, such as mobility enhancement. Applications are easy to understand, offer leverage points, facilitate widespread participation, and integrate well with business marketing initiatives.

Exhibit 10 shows the complex relationship between telecommunications applications and telecommunications technology in the form of infrastructure, devices, and services. Down the left side of the matrix are a variety of telecommunications applications that would accomplish trip-making impacts. These applications are logically

Exhibit 10:
Linking Trip Purposes to Telecommunications Deployment

Travel Destination	Estimated Relative Share of Daily Trips	Telecom Applications for Trip Saving	Southern California Travel Saving Potential	Voice Phone Access to Computer Data	Voicemail	Mulipoint Audio Conferences	Home Computers Communi-cations Equipped	World Wide Web of the Internet	BRI ISDN (Digetal Phone Service) to Homes	Desktop Switched Video	Megabit Bandwidth to Homes	Public Kiosks	Electronic Data Interchange (EDI)	Broadcast Video Monitoring of Public Spaces	Wireless Data
				Contributing Infrastruture, Devices and Services											
Place of daily work	High	Telecomnuting	6.3% of Commute Trips		X	X	X		X	X	X				
Shopping Malls	High	Check stockouts, parking, & crowds before you go. Once there, use kiosks to avoid other stops.	TBD	X			X	X	X		X	X	X	X	
Off-site Work Meetings	Medium	All modes of teleconferencing	TBD			X		X		X	X				
College Campuses & High Schools	Medium	Networked electronic classrooms. Remote access to library resources	TBD	X		X		X	X	X	X	X			
Medical Offices	Medium	Remote consultation. In-home patient monitoring. Remote treatment.	TBD		X		X	X	X	X	X				X
Customers & Prospects in the Field (Industrial & Business Sales)	Low	Pre-visit remote monitoring & qualification. Electronic interaction for followup. Sales literature on line.	TBD		X		X	X	X	X					X
Grocery Stores	Low	Electronic ordering & home delivery	TBD				X	X	X		X		X		
Cinemas, Video Rentals, Arcades	Low	Enticing, in home alternatives to going out.	TBD				X	X	X	X	X			X	
Government Buildings	Low	Remote access to documents, services, hearings.	TBD			X		X	X	X	X		X	X	
Banks, Financial Services	Low	Teller machines in malls. Ekectronic deposit & bill pay. Loans by phone.	TBD	X			X	X	X	X		X	X		
Prospective Employers Job Hunt Stops	Low	Electronic access to current opportunities Video screening interviews.	TBD	X	X		X	X	X	X		X			
Houses for Sale with Listing Agents	Low	On-line photos for screening. Electronic signatures.	TBD	X	X	X	X	X	X	X	X		X		X

and necessarily divided by trip purpose, such as journey to work and shopping. Examples of particular telecommunications infrastructure, devices, and services that can underlie the potential applications are indicated by the matrix on the right hand side of the exhibit.

DEPLOYMENT

In general, telecommunications applications are implemented one at a time through what we call telecommunications application development and deployment (TADD) projects carried out by organizations. For example, an employer implements telecommuting, an on-line service provider works with a group of stores to set up electronic shopping, or a university sets up a distance learning system that lets students take classes from their homes and offices. A more complete listing of telecommunications applications than can fit in one column of a matrix is shown in **Exhibit 11.**

Exhibit 11:
Generic telecommunications applications with travel impacts, categorized by applications area or travel purpose

- ◆ **Telework (changing the location of workers)**
- Telecommuting from home
- Telecommuting from telework centers
- Telework facilities exchange
- Virtual office practices for sales, maintenance, and other mobile professionals
- Audio or video teleconference business meet ings within large multi-site organizations
- Audio or video teleconference business meetings between different organizations
- On-line design collaboration between networked studios using graphic workstations
- Inter-institutional networks for research and education collaboration
- Telemetry monitoring of remote instrumentation traditionally visited (air quality, water levels of streams)
- Initial employment interviews conducted via videoconference
- Remote monitoring, diagnosis, and even repair of complex machinery such as computers, photocopy machines, and automatic elevators
- Replacing a staff of employees (who all commute to a facility) with computers and other machines (elimination of telephone operator jobs, for example\; elimination of customer assistance staff with an interactive voicemail system)
- Remote translation services over the telephone
- ◆ **Information retrieval**
- Typical community networks such as Los Angeles and Orange County Free-Nets
- Typical home access to commercial on-line services like Compuserve, America On Line, Prodigy, and GENIE.
- Typical home Internet usage
- On-line library catalogs
- Real estate multiple listing databases with interior and exterior photos
- Electronic resume distribution and job postings
- Remote interactive access to career information
- On-line telephone directories like the French Minitel
- Fax-on-demand services for product information, real estate listings, etc.
- Remote access to citations, abstracts, and full-text on-line literature, eg, Dialog and LEXIS/NEXIS
- ◆ **Electronic entertainment**
- On-line wagering
- 500 channel cable TV in homes providing more coverage of events that people might otherwise attend in person (pet shows and fashion shows at the mall)
- On-line, interactive chat services

- Movies on demand delivered via cable or satellite dish

◆ **Distance learning**

- Videoconferencing between college classrooms
- On-line educational courses through student's computer
- University registration by phone or computer
- Adult education/training provided via one-way television
- Adult education/training provided via interactive videoconference
- Adult education/training provided via interactive computer-aided instruction in a kiosk
- Homework help lines
- On-line educational services and communications offered through bulletin boards, commercial on-line services, and the Internet.

◆ **Telehealth**

- Electronic medical records
- Remote consultation techniques between medical facilities\; includes teledentistry
- Remote diagnosis between medical facilities
- Remote participation in medical procedures, eg teledentistry and telesurgery
- Home monitoring of medical patients
- Electronic communications in support of home medical treatment
- Medical image transmission
- Teleconference meetings for support groups
- Remote access to psychological and other counseling
- Claims forms filed electronically
- Email and telephone for medical follow up.
- Automatic telephone calls to remind people to take medication
- Remote access to medical literature

◆ **Traveler information services**

- Airline ticketing by telephone
- Electronic "ticketless" ticketing
- Travel information received over the telephone or via personal computer
- Bus pass sales through bank ATM kiosks

◆ **Public safety applications**

- Videoconference arraignment of arrested crime suspects
- Interactive court services: electronic document filing, searching, and retrieval
- Electronic monitoring of home confinement
- Legal proceedings conducted by telephone audioconference
- Crime reports taken over the phone instead of in person
- Criminal justice information systems within the law enforcement and judicial community

◆ **Electronic government**

- Electronic benefits distribution
- Televising of government meetings and hearings
- Electronic filing of taxes, claims, and other forms
- On-line access to government documents through home computers
- On-line access to government documents through kiosks
- Government documents via fax-on-demand systems
- Licensing and permit transactions through kiosks and the internet, including obtaining permits and accessing information on regulations.
- Electronic voting

◆ **Teleshopping**

- On-line grocery shopping
- On-line gift shopping
- On-line automobile shopping
- On-line clothing shopping
- On-line shopping for consumer electronics and home appliances
- Telephone ordering of pizzas and other food for delivery

- Telephone and on-line ordering of tickets for events and for travel

◆ **On-line financial services**

- Cash machine ATMs in non-bank locations
- Electronic home banking
- Loan applications taken via videoconference kiosks
- On-line investment services for managing portfolios and making transactions in stocks, bonds, and mutual funds
- Direct bank deposit of employee paychecks

◆ **Telelogistics**

- Documents that are faxed or sent as computer files instead of ink on paper
- Personal or business correspondence by email or fax rather than by U.S. Postal service, overnight delivery, or local courier.
- Movement of digitized film clips between production locations
- In metro use of overnight package deliver like Federal Express
- Postage stamp sales through bank ATM kiosks
- Electronic data interchange (EDI) for commercial transactions between companies and government agencies
- Electronic distribution of software
- Electronic versions of newspapers and magazines
- Move page images from layout facilities to printing press locations electronically

2. Status of Telecommunications in Southern California

In the six county Southern California Region there are as of early 1996 thousands of telecommunications applications development and deployment projects in various stages ranging from conceptual discussion to economic justification analysis to work planning to implementation to testing to initial operation. Successful projects when completed turn into applications that can be studied for lessons helpful to others.

Because of the pervasiveness and changing nature of telecommunications, an assessment of the status of telecommunications in Southern California is necessarily based on sampling. It is easy to find many examples of fine telecommunications applications across the six counties of Southern California, a few of which are shown in **Exhibit 12**.

Another measure of the initiative that is being shown in Southern California telecommunications development lies in the 56 regional non-profits and government agencies that applied for funding under the U.S. Government's Telecommunications and Information Infrastructure Assistance Program (TIIAP) in 1995. See **Exhibit 13**. These are projects that the exemplify public interest goals of the Clinton-Gore National Information Infrastructure (Superhighway) program. There were 1800 applicants nationwide and 117 winners nationwide. Five of the winners were from the region, described in **Exhibit 14**. As usual, the goal of mobility improvement does not seem to be explicit in any of these projects. It should be added to the design through the influence of the Telecommunications Cluster.

Exhibit 12:
Examples of Existing Telecommunications Applications in Southern California

Imperial Co.	• LightLink Internet Access Server in El Centro. Provides Internet access to information from City of El Centro, public schools in that county, Imperial Valley Community College, and Imperial County businesses.
Los Angeles Co.	• A 1995 NII Awards Finalist, Kaleidospace is an application on the World Wide Web of the Internet that provides independent artists, musicians, and writers with a new outlet for promotion, distribution, and placement.
	• The Blue Line Televillage being set up by the Los Angeles County Metropolitan Transportation Authority at the Compton Transit Center is a community center where computers and telecommunications provide South Central Los Angeles residents with education and training, medical information and services, telework support, and access to government information and transaction processing.
	• CityTel network serving the City of Long Beach is the nation's first citywide ISDN telecommunications network. CityTel network links 21 departments at 200 locations with 4,500 employees. It offers both voice and data communications.
	• JobTrak Corporation of Los Angeles operates one of the largest online job recruitment services, used by more than 150,000 small and large employers to list openings for 300 college career centers nationwide.
	• Another 1995 NII Awards Finalist, the Santa Monica Public Electronic Network provides electronic mail, online conferencing, and public access to government information to all citizens, particularly those economically disadvantaged who would otherwise be excluded from participation in community life.
	• Ameritech will soon provide Los Angeles County Superior Court with interactive court services, enabling law firms to file and retrieve documents electronically, as well as search documents and civil indexes.
Orange Co.	• A 1995 NII Awards Finalist, the Internet Payment System created by First Virtual Holdings, Inc. of Huntington Beach provides a safe, easy, economical means for buying and selling information and goods over the Internet.
	• California Community Colleges have been offering televised courses over public television broadcasting stations and local cable channels since the 1970s.
	• The Irvine Unified School District is a pioneer in the use of interactive cable television for teaching classes of children who are distributed over many separate school buildings.

Riverside Co.	• CORNET, County of Riverside Internetwork, is an Internet-based electronic communications network that provides interagency t communications and information exchange among local governments and educational institutions.
	• The Consolidated and Coordinated Courts of Riverside County has established a cross-court document imaging system to allow document filings for any court to be made in any court facili ty countywide. A person who receives a traffic violation on one side of the county can pay in their hometown courthouse on the other side.
San Bernardino Co.	• A graduate-level, mentored on-line seminar has begun to be offered at the International School of Theology in San Bernardino via electronic mail. It demonstrates an alternative learning environment to the simulated lecture model of videoconferencing and the correspondence course model used in televised courses.
	• Video arraignment of charged criminal defendants has been used in the County of San Bernardino, as well as Riverside and Los Angeles Counties, since the 1980s. An interactive video signal links the jail and the courthouse, instead of having to transport prisoners to the judge.
Ventura Co.	• California State University Northridge has a distance learning program offered via video telecommunications at its satellite campus in Ventura and at the Antelope Valley Telecenter.
	• The City of Oxnard Police Department has provided each officer with immediate access to a gang offender tracking system, a database of information on Oxnard's 50 gangs. Also, an auto mated phone calling system warns neighborhood residents of crime patterns that they can defend themselves against.
Region-wide	• Banks such as First Interstate are deploying Automatic Teller Machines in an increasing number of locations in Southern California.
	• The InFoPeople Project provides public access to the Internet through Public Libraries through out California, including the six counties of the Southland.
	• The Association of Governments ACCESS project is in development to provide access to maps and the Internet in local government offices throughout Southern California. (See Appendix B for a detailed description.)

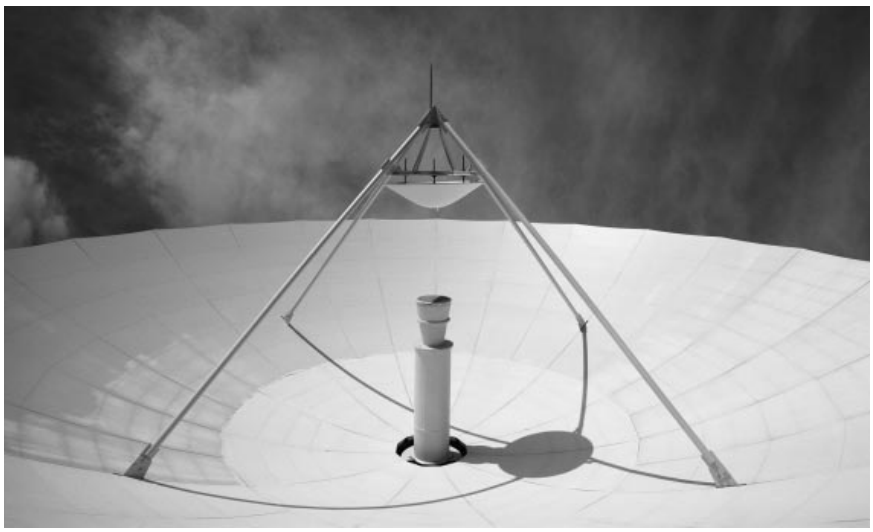


Exhibit 13:
Non-profit and government organizations in the Southern California region that applied for federal funding support of telecommunications development in 1995.

- City of Anaheim Public Utilities Department
- City of Burbank
- California State University-Dominguez Hills, School of Extended Education
- Tomas Rivera Center, Claremont
- Coast Community College District
- Los Angeles County Office of Education, Educational Telecommunications Network (ETN)
- County of Imperial
- Information and Referral Federation of Los Angeles
- LA Free-Net
- Hueneme School District
- California State University-Fullerton
- City of Glendale, Library Division/LNX Systems
- Irvine Unified School District
- Desert Community College District, Copper Mountain Campus
- California State University-Long Beach
- American Film Institute, Advanced Technology Programs
- C.O.A.C.H. Foundation, Los Angeles
- Center for Governmental Studies, Los Angeles
- CHARO Community Development Corporation, Enterprise Innovation Center, Los Angeles
- City of Los Angeles, Eighth Council District
- Community Coalition for Substance Abuse Prevention & Treatment, Los Angeles
- Crippled Children's Society of Southern California, Inc.
- Hobart Boulevard Elementary School, Los Angeles
- Korean Youth and Community Center, Los Angeles
- L.A. SHARES
- Los Angeles County Metropolitan Transportation Authority
- Los Angeles County Public Defender

Los Angeles Educational Partnership

Los Angeles Public Library

- Los Angeles Unified School District
- National Health Foundation, Los Angeles
- Otis College of Art and Design
- Public Counsel, Los Angeles
- UCLA Obstetrics & Gynecology Women's Health Division
- UCLA Institute of Archaeology
- USC School of Urban and Regional Planning
- USC School of Engineering
- Monrovia Unified School District
- Strathern Elementary School, North Hollywood
- Sponsorlink, Northridge
- Oxnard School District
- Oxnard Union High School District
- City of Palmdale, Public Safety Office
- Palmdale School District
- Pasadena City College
- California State Polytechnic University-Pomona
- Hueneme School District
- Redondo Beach Unified School District, ADTECH Consortium
- ECT Technolink Foundation, Inc., Riverside
- San Bernadino County Superintendent of Schools
- Hermandad Mexicana Nacional Legal Center, Santa Ana
- Orange County Environmental Management Agency
- Santa Ana Unified School District
- Los Angeles Mission College
- El Camino Community College
- San Gabriel Valley Commerce and Cities Consortium

Exhibit 14:
The five Southern California winners in the 1995 grant competition from the U.S. Department of Commerce, National Telecommunications and Information Administration Telecommunications Information Infrastructure Assistance Program.

Los Angeles County Office of Education Educational Telecommunications Network (ETN)	The Los Angeles County Office of Education will carry out a comprehensive telecommunications planning process for 82 K-12 school districts and 1.4 million K-12 students, 65% Hispanic and African-Americans. The outcome of this process will be a replicable planning model for schools to use in customizing their infrastructure design. As a result, schools will be able to plan for affordable access to applications such as reduced cost digital telephone service, Internet connectivity, and district local area access to County applications such as payroll and social service information. The project partners are the Los Angeles County Office of Education, 82 K-12 school districts, five P.T.A. districts within Los Angeles County, and the Los Angeles County Public Library.
Los Angeles Unified School District	This project will use grant funds to provide free Internet services and computer access to Los Angeles public school students and their families -- the majority of whom are minority, non-English speaking, and of mid- to low-socioeconomic status. This project will establish an Internet link with local, state and national museums and the city library, providing a free, interactive exchange of information among students, teachers and parents in central community facilities. The community partners for this project include the Afro-American Museum, the Gene Autry Western Museum, the Japanese American National Museum, the Museum of Science and Industry, and the Central City Library.
Hermandad Mexicana Nacional Legal Center Department of Information Services, Santa Ana	The Hermandad Mexicana Nacional will create a mobile interactive job placement process by developing a Mobile Job Bank to circulate in underserved Hispanic communities. Common community characteristics include substantial unemployment and underemployment, lack of access to job information resources, and communication obstacles. The mobile on-line service will provide job placement, training and counseling in partnership with existing municipal, county, state and private employment databases. The caravan will be a mobile kiosk utilizing multicultural icons on touch-screens to let applicants access updated employment opportunities, match skills to available jobs, and set up real-time job placement interviews.
Santa Ana Unified School District Support Services Division	The Santa Ana Unified School District will demonstrate how to use an existing cable television network to bring the resources of the Internet to over 50,000 low-income, limited English-speaking K-12 students. The district has a broadband network of coaxial cables called the INET, or Institutional Network. With the addition of computer technology, this network will connect information servers at 52 school sites, including all existing computer labs in each school, Rancho Santiago Community College, and numerous community agencies at City Hall. The District Technology Task Force, which includes the school district and the city government, also has numerous private sector contributors, such as Comcast, Cross Country Wireless, Apple Computers, and Featherstone Communications.
Information and Referral Federation of Los Angeles County	The INFO-LINE of Los Angeles will use grant funds to improve delivery and access to public welfare services. INFO-LINE regularly serves more than 200,000 individuals and families each year, but demands exceed twice that. Los Angeles County has more than 4,500 health and human services programs with hundreds of overlapping and conflicting geographically-based service areas. INFO-LINE will provide widespread, low-cost, high-speed access to a comprehensive, centralized and standardized database. The database will improve the capacity of local government and private non-profit organizations to serve the county at large and help individuals gain more information about the services available to them. To accomplish project goals, INFO-LINE will use Internet-based access and will be accessible from even the most basic of computers already in use at various health and human services organizations.

3. Trip Making Impacts of Telecommunications

Information received from a distance via telecommunications can affect trip-making in several ways: First and foremost, it can cause trips to be eliminated, substituted and or fulfilled, which will be covered in more detail below. But telecommunications can have other effects on trip making as well:

It can change the length of trips, making them either longer or shorter. An on-line information system could be designed to describe the nearest place to purchase a needed item, rather than driving to a familiar place that is farther away. In the longer term, telecommunications has been implicated as a cause in residential sprawl, because people can use telecommunications to let them telecommute or operate a home-based business, and thus eliminate daily commuting to a central office during peak traffic periods. The weekly trip to the supermarket, however, could be a much longer trip for a person living in a rural region surrounding a metropolis.

Telecommunications can also cause trips to be made at different times, perhaps avoiding peak periods. Telecommuters and other home workers with flexible schedules have more opportunity to do some necessary errands during off-peak periods, and stay put at home during the morning and evening rush. On the other hand, just-in-time delivery services like Federal Express, which are very much enabled by the technology and habits of the information age, generate vehicle traffic in evening rush hour in order to meet the deadlines that are part of their rapid service.

Telecommunications can furthermore cause the route of a trip to change. Good information about traffic conditions generated by Advanced Traveler Information Systems can be the motivation for staying off of a crowded corridor in peak, or driving into a crowded corridor that would typically be avoided in the absence of an information system that can now reveal that the traffic is free-flowing.

Finally, telecommunications can cause the mode of travel to change. An information system that provides accurate, real-time information on the exact time when a bus will arrive at a nearby bus stop, or a system that enables buses to make front door pickups, could cause more people to ride the bus rather than use their private automobiles.

The net effect of all of these changes that growing telecommunications can bring to metropolitan area travel patterns is very complex to understand, but there is no reason to assume that the overall effect is a net reduction in trip making. It is reasonable to assume that the price of travel in dollars and in time is also an influence on the balance between telecommunications and traveling that people and a society collectively reach. When telecommuting and telephone use surged in the days and weeks following the Northridge earthquake and the disruption of Southern California highways, the pattern was an example of what happens when travel becomes more costly relative to telecommunicating. As the roads are repaired and traffic delays return to normal, telecommuting and calling falls back some, because traveling has in effect become less expensive in time and money.

Looking at trip replacement now, telecommunications eliminates trips in the following ways:

The main method of trip elimination is that telecommunications lets people achieve enough of the functionality of going to a place without actually having to go there. Sufficient functionality is achieved from a distance by telecommunications allowing observation, transactions, communications, and information exchange. The use of telecommunications as a substitute for travel is called telesubstitution. Instead of driving to work, a worker stays home and telecommutes. Instead of registering for university classes on the campus, a student registers over the telephone.

An implication of telesubstitution is that telecommunications applications offer alternatives to accessibility for those who can use telesubstitution, and improvements in accessibility for the remainder of people who still need or want to travel.

Accessibility is defined in the 1994 RME as the ability or ease of all people to travel among various origins and destinations. Alternatives to accessibility means that some of the purposes of

travel become available through remote, electronic, telecommunications access in addition to physical access. This strategy recognizes that access to a service through telecommunications is likely to provide a quite different human experience than access by visiting a person or place, sometimes superior and sometimes inferior. There is a difference between being there and calling there. At the same time, telecommunications access alternatives can be designed to be functionally satisfactory in many service delivery and communications situations, especially where physical travel is difficult or impossible.

At the same time that alternatives to accessibility are being used, improved accessibility is a possibility for those who still need to travel. Improved accessibility means that physical transportation in vehicles is improved because fewer vehicles are on the road and there is less congestion in peak periods. To the degree that the use of alternative accessibility takes vehicles off the road in peak periods, there will be accessibility improvements for those who do not have satisfactory telecommunications alternatives. How many net vehicles telecommunications usage removes from the road must take into account both telecommunications substitution effects and latent transportation demand. Latent demand refers to the phenomenon of empty road space being filled by other vehicles and drivers taking advantage of the space left by vehicles that are removed.

Expanding alternatives to accessibility, and improving accessibility are together defined as mobility enhancements.

In addition to providing opportunities for telesubstitution, telecommunications also lets people call ahead to find out that it is not worth making a trip to get there. Instead of driving around to a variety of stores looking for a particular item to purchase, a shopper phones to a number of stores until the item is located, and then drives to one store directly. This effect is closely related to telecommunications changing the length of trips.

Accurate, up-to-date knowledge of conditions at the destination or on the journey can cause trips to be canceled as unnecessary with perhaps teleconferencing or other telesubstitution used instead of face-to-face presence. Joining the meeting by telephone is not so bad if the only freeway leading to the site of the meeting is blocked by an accident. This effect is closely related to the effect of telecommunication changing the timing or route of a trip, as discussed above.

Going beyond decision making by individuals, telecommunications allows the revision of organizational operations to eliminate passenger and freight trips that raise costs unnecessarily. Instead of a soft drink delivery truck driving to a heavily used Coke machine once every two days to fill it up (whether needed or not), wireless radio status reporting on the contents of the machine allow the bottler to visit as needed, which results in visits that calculate out to one visit every 3.3 days.

Going beyond direct functional substitution, a fourth source of travel saving comes from telecommunications providing opportunities to change leisure, recreational, and personal activity toward patterns that generate fewer trips. An example here is members of a household staying home to surf the Internet rather than going out to see a movie at the cinema. Instead of going to church on Sunday, a family stays home and watches a popular minister on a televised religious service.

Another way of looking at trip making impacts is to consider three kinds of effects, telework, teleservice, and telelogistics.

1. Telework is a use of telecommunications that changes the location of workers. Telecommuting is the most familiar form of telework, and the leading example of trip substitution. Telecommuting means working at home or closer to home, instead of commuting to the usual office. Extensive efforts are underway by the Southern California Telecommuting Partnership and the Southern California Association of Governments to raise the awareness and use of telecommuting. Growth in telecommuting has already been factored into the Regional Transportation Plan prepared by the Association of Governments. Other areas of trip substitution through telecommunications have not been.

The most common form of telework, though frequently unrecognized, is the movement of jobs

from central cities to suburbs. The dispersal of jobs into 24 Edge Cities[6] scattered around the Southern California region is only possible because of telecommunications.

Changing worker locations may or may not be the primary purpose of a telecommunications application that happens to change workers' locations. As the WorkSmart study, developed for Caltrans, by the Center for the New West reports [7], telework is motivated by the goals of organizations for mission performance as well as to meet the expectations of the work force. For example, better customer service and higher sales productivity may be motivating corporate efforts to push outside sales professionals into mobile, virtual office arrangements where these workers stop commuting to the company office each morning and instead drive directly to customer locations. Furthermore, a change in worker location because of telework may or may not be favorable to trip reduction efforts. It depends on how much the worker moves around across the total sum of commuting plus work-related trips.

2. Teleservice is a use of telecommunications that modifies the traditional location of customers receiving service. A bank automatic teller machine is a prime example of teleservice. As in telework, mobility impacts are not always a consideration in the design of teleservices by organizations.

3. Telelogistics is a use of telecommunications that reduces trips that move goods. A fax-on-demand system that provides product information to consumers and replaces some mailed material is an example of telelogistics; another example is mail order shopping.

The key notion in using telecommunications to reduce trip making is not the impossible and ridiculous task of stopping all the important and necessary travel that people do, but to provide opportunities to eliminate trips that people would rather not make, that organizations would rather not pay for, or that have pleasant alternatives to yield the same or even more functionality.

What is Holding Back Progress?

If telecommunications are growing rapidly and can eliminate and/or substitute trips, then why is trip-making showing so much growth as well?

There are several reasons:

- Applications of telecommunications technology by people and organizations always lag behind the potential power of the technology. New ways of doing things used by some generally take many years before being used by most.
- The financial resources of organizations and people are not always available to buy telecommunications products and services, and to organize their use into applications that solve problems.
- Many people simply do not have the awareness, knowledge, skill, or motivation to use telecommunications for the purpose of making or substituting trips.
- Apart from forward thinking policy leaders in organizations such as California Department of Transportation, the Southern California Association of Governments, the Southern California Economic Partnership, the South Coast Air Quality Management District, and the Southern California Telecommuting Partnership, most people in the region, including the majority of government and business leaders, are not planning telecommunications applications with mobility impacts as an explicit goal. Instead, telecommunications applications are implemented to enhance sales, improve customer service, cut costs, or increase productivity, all worthwhile goals, but not necessarily mobility-enhancing.

Perhaps the most serious threat to mobility enhancement from expanding telecommunications is the fact that it is a generator of trips as well as a means of reduction. Telecommunications does this through a number of dynamics:

- Telecommunications provides additional knowledge of opportunities that are available only by taking trips.
- Telecommunications expands the geographic scope of awareness and operations, as well as the number of contacts, and creates follow-up activity that requires travel.
- Telecommunications improves income, productivity, and wealth, some of which is used to take trips.
- Telecommunications facilitates geographic location changes, especially dispersion patterns such as suburbanization of residences and employment, which creates some additional travel demands.
- Telecommunications provides support to travelers, such as remote home security, and continuous contact with colleagues and loved ones.
- Telecommunications improves the performance of the transportation system through traveler information, traffic control services, and other forms of Intelligent Transportation Systems (ITS).

These issues are discussed in much more detail in the U.S. Department of Energy report, Beyond Telecommuting. Any strategy that accelerates telecommunications as a means of enhancing mobility must be designed to avoid the effects of telecommunications that are counterproductive to mobility.

4. Issues Summary

The main impetus for the Partnership is mobile source emissions that come from vehicle traffic. The Telecommunications Cluster's assigned way of reducing those emissions is to take steps to accelerate the deployment of telecommunications so as to provide popular alternatives to local driving.

A major issue is the determination of how the Telecommunications Cluster can make the interactions, transactions, and relationships that cause travel in Southern California more telecommunications intensive and less transportation intensive. Since resources for intervention are limited, the Cluster needs to identify and focus in on critical leverage points.

Telecommunications is a vast and changing domain, and the issue in achieving a narrow purpose like trip reduction is to define the actions that are most likely to make the purpose be achieved. The secondary Cluster goal of regional economic benefit is likely to be achieved no matter what aspect of telecommunications is promoted.

Civic leaders can stay above the turmoil of ongoing changes in technology and in industry participants by focusing on the development and deployment of applications. But which trip types and which applications of telecommunications should the Cluster focus on? Obviously, those which involve the most travel, and those which contain a potential for reducing travel would be the most attractive target.

Trip reduction is often not a major criterion addressed by those people responsible for applications development. However, trip reduction may be a byproduct of pursuing other benefits, such as cost reduction or providing convenience for customers. This logic suggests that the Cluster should focus on applications where stakeholders can realize other major benefits in addition to travel savings.

After the identification and analysis of critical telecommunications applications, the next issue is how to make these applications happen sooner, better, and more widely. This requires analyzing applications for barriers to deployment, and determining what to do about those barriers. An issue here is identifying barriers that lie on the critical path to solution, where intervention by the Telecommunications Cluster is truly useful.

5. A Strategy for the Southern California Region

Mission, Goals, and Objectives of the Strategy

MISSION STATEMENT

To accelerate the deployment of telecommunications, with an emphasis on improvement of mobility and access.

GOALS

The overall goal is to achieve an improvement in the present pattern of telecommunications deployment that result in a dramatic change in travel behavior in the region over the next 25 years.

1. Expand the market share of information exchange, transactions, interactions, and relationships that are fulfilled through telecommunications access instead of by vehicle
2. Reduce the barriers to -- and create new incentives for achieving -- the full market potential of telecommunications for mobility and access improvement.
3. Assist local government and organizations to design and implement applications that expand electronic access to services and work locations.
4. Assist organizations to design and implement applications that reduce vehicle trips in logistics systems.
5. Create an integrated, detailed understanding of how the quality and distribution of telecommunications infrastructure impacts air quality and the regional economy.

OBJECTIVES OF THE TELECOMMUNICATIONS DEPLOYMENT STRATEGY

The objective is a significant program of telecommunications deployment acceleration through the year 2020. The strategy continues the objective in the 1994 RTP of 10.4% for home to work trips in 2015 for telecommuting and working at home. In addition, the strategy aims to attain a higher reduction in daily person trips from all other telecommunications applications, based on policies, and actions that go beyond the 1994 plan. (The new numerical objective is evolving through the analysis of alternatives developed for the 1997 RTP).

1. Document mobility and access improvements from teleservice, telework, and telelogistics, as well as resulting emission reduction and energy conservation results.
2. Identify barriers to telecommunications deployment, and action(s) to eliminate or ameliorate.
3. Establish disaster preparation, travel saving telework and teleservice procedures that are well exercised routinely in normal conditions and which are immediately available to keep organizations operating in the aftermath of earthquakes, storms, and other transportation disturbances.
4. Assist transportation planners to begin using a telecommunications activity time series and forecast process that is comparable to the trip volume time series used by regional transportation planners.

6. Strategy Assumptions

The Telecommunications Deployment Strategy described in this document was formulated under a number of assumptions:

1. Telecommunications deployment is already occurring in Southern California, driven by organizations of all types seeking revenue enhancement, cost reduction, productivity improvement, or customer service gains through using telecommunications infrastructure, network attachments, and services that are offered by a dynamic and growing telecommunications sector.

2. As a result of organizations and individuals pursuing benefits in their own interest, telecommunications deployment can yield enhanced economic development, an improved quality of life, and other public benefits.

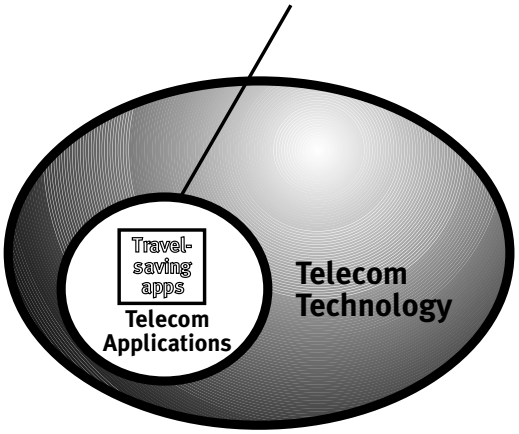
3. Mobility enhancement (improved accessibility and alternative accessibility) can be an important public benefit of telecommunications deployment.

4. But, mobility enhancement is usually not a sought goal in market-driven telecommunications deployment. Mobility enhancement is usually no more than a side effect, or incidental consequence. Other organizational and personal goals are usually the drivers, such as service improvements, lower costs, increased competitiveness, and greater worker productivity. This assumption is in line with the thrust of Caltrans' WorkSmart project, which finds business goals to be the main motivation for telework practices, and treats transportation impacts as consequences [8].

5. Even with those telecommunications applications that have not had mobility impacts considered in their design, positive or negative trip generation impacts are a frequent result. Thus any telecommunications application can be assessed for mobility impacts. The Telecommunications Deployment Strategy planned here can find unintended, unplanned mobility benefits in telecommunications applications, and seek ways to expand those kinds of applications. At the same time, the process described here seeks to avoid emphasizing telecommunications applications that tend to increase vehicle mobility demands, even those these applications may have other positive individual or organizational benefits.

6. The Southern California regional public interest lies in changing the presently ongoing path of telecommunications deployment to increase the focus on mobility enhancement. In order to save travel, telecommunications must be focused on those particular applications, such as telecommuting and certain kinds of teleservice, that actually replace trips, **Exhibit 15.**

Exhibit 15:
Sharp Focus Needed for Travel Savings from Telecommunications



7. Shared understanding by civic leadership and the general public of how the present path of telecommunications deployment is influencing access and mobility is generally lacking. For example, the words "telecommuting" and "telecommunications" are frequently confused. Beyond the officials in the organizations that have been involved in the development of this strategy, public policy leadership understanding is not now at a level sufficient to take wise action. An understanding of which parts of telecommunications need to be emphasized in order to achieve mobility benefits is a necessary first step in the strategy described here.

8. This strategy is targeted to an audience of people who are willing to deepen their understanding of the issue of telecom-travel interaction, and who are in a position to take action by initiating or supporting applications development/deployment projects. This audience would be those directly involved in telecommunications application development from any perspective, including professionals at all levels working in the information services (IS) functions of organizations, managers in client divisions and departments that are

serviced IS, higher-level managers and board members who make decisions regarding telecommunications deployment projects, consultants to such projects, and vendor-suppliers in all related telecommunications hardware, software, and services. Also, public sector officials who are in a position to remove or ameliorate identified roadblocks to such projects are to be engaged in implementing the strategy. The Strategy attempts to influence their thinking to include consideration of regional mobility effects.

9. Regional strategic action(s) can be designed to work broadly across many kinds of telecommunications technologies, users and trip purposes. While the wireless communications industry is associated with the support of physical mobility, there may be particular applications of wireless communications that tend to save on travel; these can be found and emphasized as part of the present strategy.

10. A regional strategic marketing process for telecommunications deployment acceleration can be implemented within the existing organizational structure for the Southern California Economic Partnership and the Telecommunications Cluster. There is no need for new organizational forms.

11. The Telecommunications Deployment Strategy (TDS) is designed to be effective at any level of resources, even a low level of resources, or a level that fluctuates. In addition, the strategy is to be upwardly scaleable to a relatively high level of resources, should leadership choose to emphasize telecommunications deployment in the years ahead.

The TDS influences and amplifies private sector telecommunications applications development and deployment activity. It supports the Association of Governments and the Economic Partnership professional staff working in an expandable broker role between organizations that can contribute part of a solution to Southern California traffic.

12. The TDS is to be designed to be effective even in the state of telecommunications industry uncertainty and likely turbulence that will be brought on by the impact of the recently enacted Federal Telecommunications Act of 1996.

The present Strategy's focus on telecommunications applications that meet the needs of user organizations is one way of remaining effective; these are likely to change more slowly than telecommunications industry products, services, and competition.

The strategy described here is based on a professional staff process of screening through existing telecommunications applications to find those with the strongest mobility enhancement effects. These applications would be analyzed and grouped to find common issues that the Telecommunications Cluster could address through the elimination of barriers and the initiation of marketing programs.

Alternatives considered

The Strategy presented here was chosen to be implemented ahead of other alternative approaches that have been discussed by regional and state policy leadership and that flow from different assumptions. These alternatives -- each of which may emerge later as appropriate for implementation by the Telecommunications Cluster as a result of analysis and discussion of the barriers to existing travel-saving applications -- include:

1. Creating comprehensive inventories of telecommunications products, telecommunications services, or telecommunications infrastructure in Southern California. Such inventories can be difficult and expensive to create, and they have a short period of usefulness. They should be conducted only when needed to solve a critical problem or illuminate a priority issue related to the advancement of mobility-enhancing telecommunications applications. As an example, an inventory of available modems in Southern California is important if the creation of such an inventory is pertinent to expanding the deployment of a class of telecommunications application that is important to telecommuting, teleshopping, or some other mobility enhancement that is selected for emphasis by the Telecommunications Cluster. Similarly, the work of compiling an inventory of fiberoptic or coaxial cable connections to Southern California residential premises should be delayed until the Telecommunications Cluster staff and Advisory Group determine that having such an inventory is directly pertinent to promot-

ing the deployment of mobility-improving telecommunications applications.

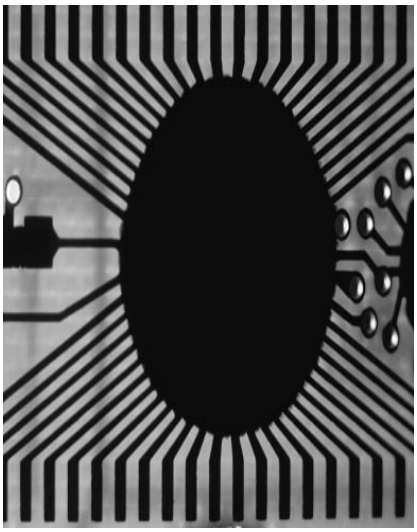
2. Immediately selecting particular telecommunications hardware items for inclusion in a consumer marketing plan. The selection of particular hardware for marketing emphasis by a government-sponsored partnership is premature until targeting judgments are made that focus on the telecommunications applications with the highest mobility impacts. Consumers and users make their choices in a market environment that is too complex for attempting a private-public partnership's consultant or committee choice of winners.

3. Immediately selecting particular network infrastructure components -- such as fiber optics, community networks, or telecenters -- for marketing and technical assistance efforts. Judgments on which infrastructure components are blocking the most important mobility-enhancing applications are premature until the most important mobility-enhancing applications are actually determined.

4. Immediately selecting particular user industries and associated applications (such as telehealth or distance learning) for focused technical and policy assistance. Instead, the recommended approach is to match applications with trip purposes that people would rather avoid, or that organizations find excessively costly, and let the applications and industries to be focused upon emerge from this process.

5. Establishing a broadly focused brokering function along the lines of Smart Valley in the San Francisco Bay area, the San Diego Cities of the Future program, or the Davis Community Network. These other groups pursue a variety of important community objectives through the connection of technology providers, service providers, applications developers, and end users. The origins of the Southern California Economic Partnership, on the other hand, are tightly connected to alternatives to vehicle travel, rather than the broad promotion of telecommunications. The work of the Economic Partnership is planned here to have a more precise targeting than the "smart regions" approaches taken elsewhere in California.

The Partnership's plan recognizes that the societal benefits of telecommunications deployment



go beyond mobility and access. Depending on the application, these additional benefits include more efficient, effective, and equitable health care, education, public safety, and general government services, overall regional competitiveness, job creation, local business opportunity, and quality of life generally. But the mobility and access goals are the narrower, more difficult goals to achieve, and if they are to be achieved, they need to be pursued directly and forthrightly. In many cases, telecommunications applications that yield travel savings and improved access also yield other societal benefits. The reverse is not as often true. It is easy to conceive of telecommunications applications that provide individual, organizational, or societal benefits while increasing the demand for physical travel. Cellular phones in automobiles, online networks that describe attractive places and events, and telecommunications access provided in locations physically remote from likely users are examples.

7. Description of the Strategy

The Telecommunications Deployment Strategy (TDS) amounts to selective, interventional engagement by public interests in ongoing, robust market activity to change the operation and result of that activity, for example, to help the telecommunications industry to cause more telecommuting applications to be purchased and used sooner and better than would be the case without the intervention. The public interest of mobility enhancement is represented and carried out by the professional staff at The Partnership and the Association of Governments, under the guidance of the SCAG Regional Council and The Partnership Board.

In response to the mobility challenges and the telecommunications deployment opportunity, the TDS establishes two parallel, mutually supporting processes: One is the Strategic marketing Process carried out by The Partnership. The other is an Analysis and Planning process performed by the Association of Governments. These two processes, shown in **Exhibit 22,** create policy to influence the ongoing market process of telecommunications development, through the emergence of a mass market of telecommunications that causes accelerated deployment of telecommunications, resulting in a new regional telecom-travel mix.

A Plan to Achieve the Vision

The Plan strives to motivate the private sector toward investing more in mobility enhancement. A simplified schematic of the telecommunications marketplace is shown in the **Exhibit 16.**

In white is the basic process flow of the industry: The value of products and services leads to sales. Sales result in profits that lead to opportunities for deciding on new investments that improve organizational performance. A track record of performance improvement leads to higher perceived value of the underlying products and services, and further sales.

The step in shading shows the opportunity for additional decision-making and incremental investment in the specific telecommunications products, services, infrastructure, and applications that explicitly achieve enhanced mobility and access, in addition to organizational performance benefits like customer service and lower costs. Causing user organizations and the telecommunications industry to focus on mobility enhancement is a key goal of the Strategy.

An important part of this focusing will be a research and analysis process that links telecommunications applications to changes in travel behavior. The scores of existing telecommunications applications (see **Exhibit 11**) need to be analyzed for their travel impact potential and a selection made of which applications to emphasize in Cluster activity. After an applications emphasis is chosen, the Cluster will work on a program of activity that accelerates the overall implementation of these particular applications.

The Strategy foundation is a growing understanding based on analysis of what is working in mobility-enhancing telecommunications applications, along with a well developed strategic marketing effort designed to meet the needs of this region.

The TDS sets up a process for collecting, organizing, analyzing, disseminating and otherwise responding to existing examples of telecommunications applications that enhance mobility. These examples of best practice are now being implemented in the marketplace in response to individual, household, business, and government demand for better performance that is largely uncoordinated with mobility issues.

To achieve a regional focus on mobility issues associated with telecommunications, the TDS is to build and use a common, shared Knowledge Base of telecommunications application experience.

Assembling a Knowledge Base of case studies is an important first step in deciding how to accelerate the deployment of such applications. The structure and organization of the Knowledge Base evolves over time in coordination with the Telecommunications Cluster participants.

Categories of knowledge to be Assembled

Information in the Knowledge Base is arranged into ten categories. The categories established here fit into a generic process model of how Telecommunications applications evolve over time. That model is presented as a flow chart in **Exhibit 17.**

Exhibit 16:
The Telecommunications Cluster Adds a Second Loop to the Cycle of Value Creation

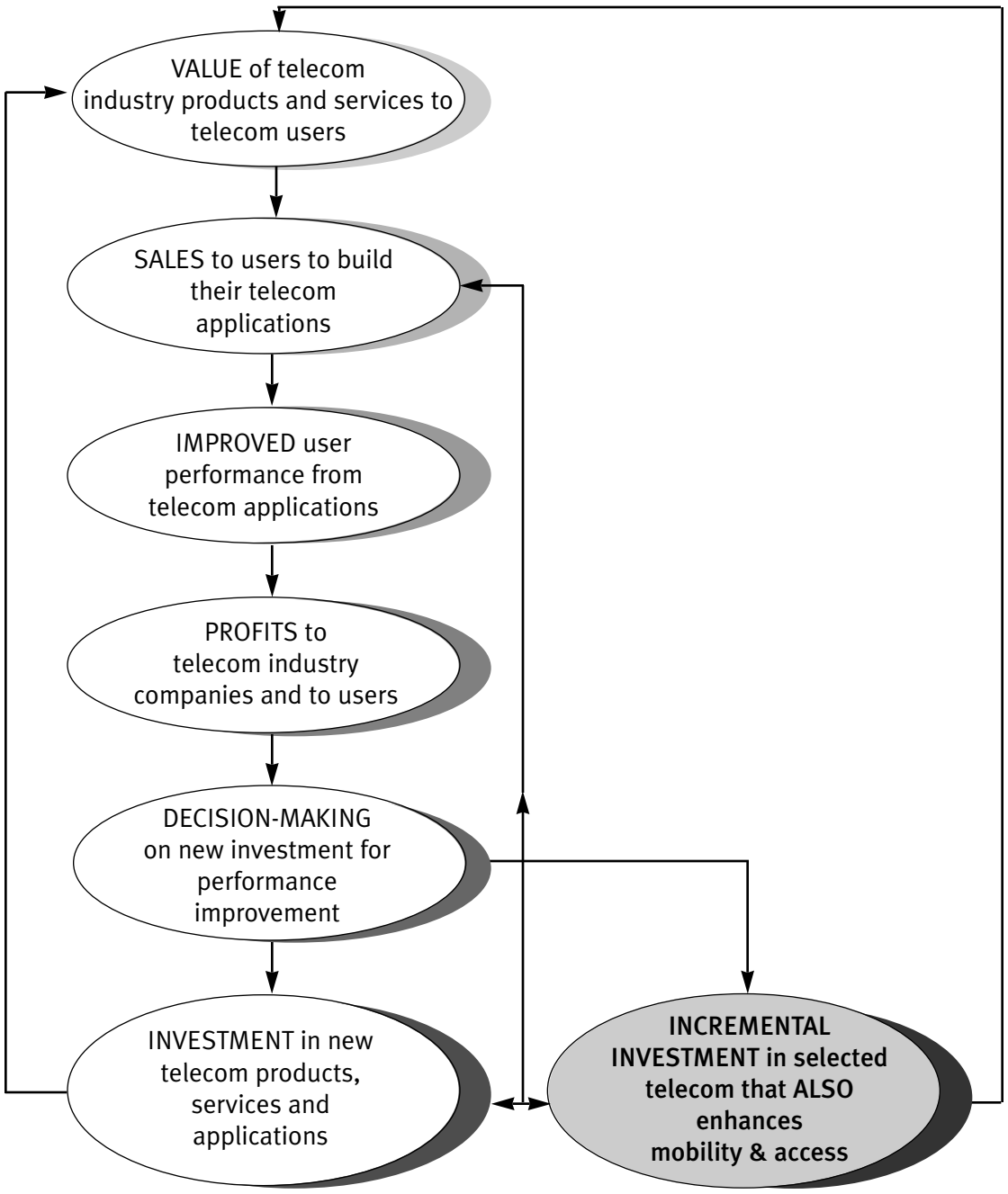
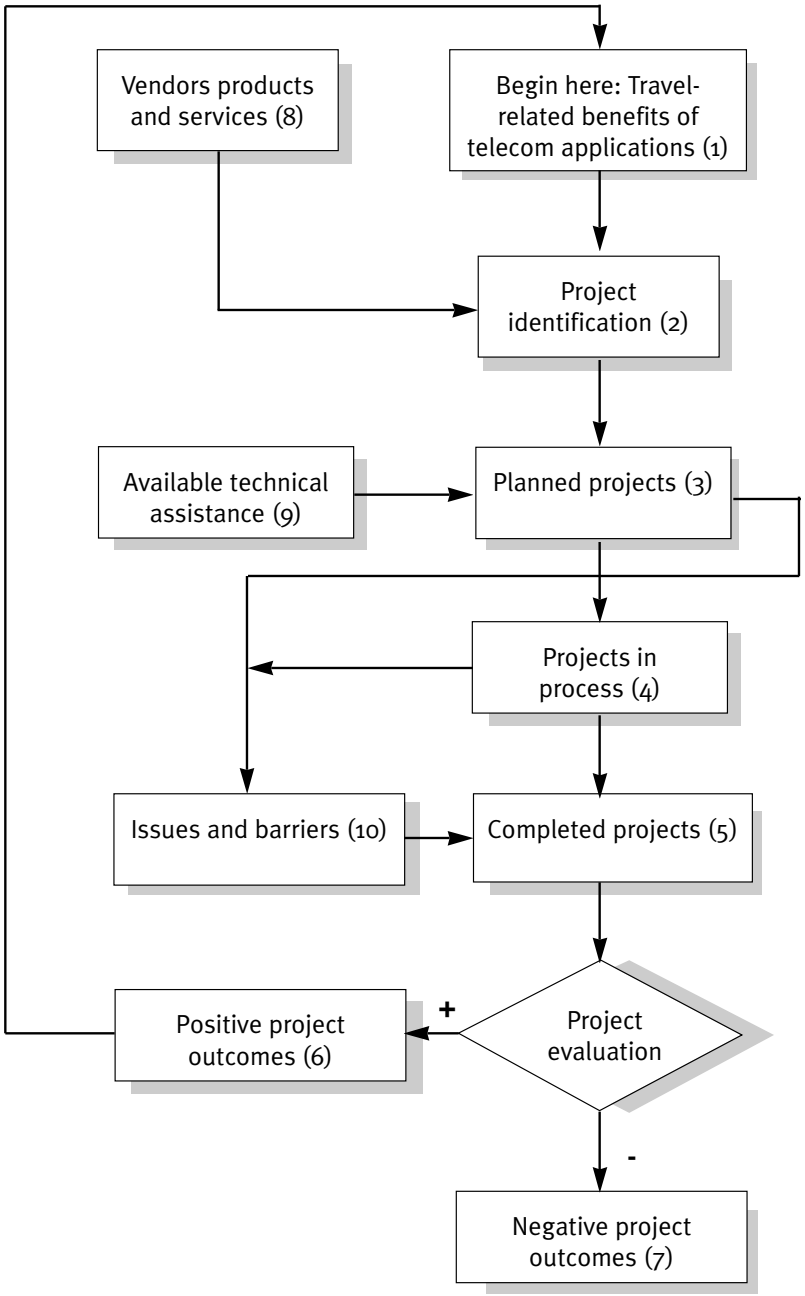


Exhibit 17:
Process Flow of Telecommunications Application Development and Deployment, and Knowledge Base Categories



Numbers in parentheses refer to the description in the accompanying text

Feedback loop: successssful examples motivate demands for extending applications to other organizations, in other locations and for other trip purposes.

1. Identified travel-related benefits of telecommunications applications, some of which could be met through new telecommunications applications development/deployment (TADD) projects.

A beginning list of examples of such demands are as follows:

- "Replace Boring, Routine Trips With Electronic Substitutes." Electronic delivery alternatives to routine, scheduled appointments of any type encountered in service delivery and information access that would otherwise require a vehicle trip to a physical office.
- "Meet Electronically (Not Physically!) With Colleagues and Customers You Already Know." Teleconferencing procedures to replace vehicle trips by workers to off-site business locations.
- "Step Out Electronically From Places Where You Already Go." Electronic access provided within shopping malls, libraries, and community centers to other Southern California services that would otherwise require a separate vehicle trip.
- "Know Before You Go." More easy ways to use the telephone or other communications services to evaluate the usefulness of physical travel to a service delivery or meeting destination before setting out.
- "I Can See Your Face From Where I Am, So Why Visit?" Instead of climbing in a car, use a widely available, inexpensive, standardized, full color, full motion, video phone that works over existing telephone lines or cable TV connections.
- "Why Get Hassled in Traffic Going to The Mall, When I Can Buy Products While Sitting at Home and Have my Purchase Delivered?" Electronic, on-line shopping as a replacement for going physically to a retail location.

We fully recognize that travel-related issues are rarely the main driver of TADD projects. Non-travel demands like the following are usually more important to organizations than travel saving:

- Cost saving: labor, materials, facility space, energy
- Improved customer service.
- More productivity: improved ratio of output to input
- Higher quality of service or product.
- Compliance with government regulations for information collection and record keeping, notification, timely performance
- Competitiveness: matching or exceeding a competitor

2. Potential telecommunications applications development/deployment projects that organizations have identified. Examples:

- Library identification of electronic access to its resource catalog from home and business locations.
- A bank that is contemplating establishing electronic home banking as a competitive response to other initiatives in the financial services industry.

3. Telecommunications applications development/deployment projects that organizations are planning now. Examples:

- A hospital that is writing the RFP for procurement of hardware and network services for the monitoring of patients who are recovering from surgery at home.
- A community college that is in the process of designing a distance learning program for middle managers that reaches corporation employees at their desks in local business offices.
- The Association of Governments Geographic Information System (GIS) Computer ACCESS Program that is planning to deploy computers in public locations to provide access to Association maintained information.

4. Telecommunications applications development/deployment projects that are in the process of implementation now. Examples:

- A local government agency that is in the process of linking some of its internal databases

to the computer of an Internet services provider in order to offer 24 hour per day access by the public to vital records.

- A small retail chain that is building an on-line shopping service on the Internet as a growth alternative to opening more branch locations around the Southern California region.

5. Recently completed projects, that can be evaluated as to their trip-related effects. Examples:

- A private building security company that has installed video monitoring in a dozen client locations under contract for 24 hour protection from intrusion, fire, and other threats.

- A business services sales organization that has shut down three floors of office space in a downtown office tower in order to put its computer and cellphone-equipped sales force closer to customers.

6. Completed projects that are successful according to the organization that executed them, and that in addition can be shown to reduce physical travel in the Southern California region. Examples:

- A county-wide criminal justice system that uses video arraignments to save thousands of police hours and several million vehicle miles per year.

- A utility agency that is actively marketing automatic monthly withdrawal of billed charges from customer checking accounts, simultaneously with shutting down its payment window locations where citizens could hand carry their payments.

7. Completed projects that may or may not be successful to the organization that implemented them, but that turn out to be disappointing in their travel saving results. Also, projects go here that save travel, but that are unsuccessful overall to the implementing organization because of other criteria. Examples:

- An unnamed telemarketing operation that is abandoning its attempt to operate a distributed call center operation where many workstations were located in employees' homes.

- An on-line shopping service that is withdrawn from the market because of a lack of consumer response.

8. Telecommunications-related hardware, software, and services that are offered by vendors as component inputs to TADD projects. This database amounts to an ongoing inventory of the particular technology components that the Strategic Plan is aimed at deploying. Examples:

- Network services offered by Pacific Bell, GTE California, Continental CableVision, Pacific Lightwave, Nextel Communications, and others.
- Internet services offered by Earthlink Network, Inc., Netcom, MCI, and others.
- Software offered by Performigence Corporation, Quarterdeck, Microsoft, and others.
- Video communications hardware offered by Alpha Systems Laboratory, Vivo, Intel, and others.

9. Consulting and other technical assistance (not tied to specific products) that is available to help organizations in planning and implementing TADD projects. Examples:

- Multimedia development services offered by Access Media and others.
- Telework Facilities Exchange development services offered by Siembab & Associates, and others.
- Training services in telecommuting offered by the Southern California Telecommuting Partnership, and others.

10. Issues (including barriers and unnecessary costs) relevant to the implementation of TADD projects that go beyond the influence of any one organization. Examples:

- Specific regulatory issues and barriers, such as the Brown Act in California.

- Technology gaps.

- Technical assistance gaps.

- Societal downsides, such as the reports that communicating mobile information technolo-

gies are causing longer working hours at the expense of time available for family and friends.[9]

The most prevalent record type will be the case study of a telecommunications application development/deployment (TADD) project. Each case study will follow a standardized format and be three to four pages in length, as shown in **Exhibit 18.**

Examples of case study entries for the Knowledge Base are provided in (Appendix B.)

Other standardized formats can be developed for listings of technology products and services that are component parts of applications, and of technical assistance offerings that are available to support the development of applications.

Other inventories can be conducted as needed in response to analysis of applications yielding barriers, opportunities, and issues worthy of Cluster attention. Examples of supplementary inventories that may eventually prove useful include infrastructure systems (telephone company facilities, cable TV facilities, wireless facilities); attached network terminals (kiosks, home computers, public internet access points, set-top boxes for televisions); content providers (local governments, regional retailers, health services, higher education systems); and market channels (consumer electronics retailers, value-added dealers in specific vertical markets, neighborhood training centers). Such inventories should not be conducted however unless they are part of addressing an issue that is identified as blocking the deployment of mobility-enhancing applications.

Criteria for choosing case studies for the Knowledge Base

A main criterion for putting a particular TADD project into the Knowledge Base is that the project operates in a way that is likely to have positive impact on accessibility by providing alternatives or improvements. Another way of saying this is that its operation carries with it the logic of mobility improvement.

Other criteria include availability of data, willingness of the project sponsor to provide data, and involvement of private sector vendors in publicizing the project. Vendors promote their own products and services by describing and disseminating case studies of successful applications development/deployment projects.

Organization and dissemination of knowledge in a World Wide Web Site

Building and using a successful telecommunications application (a World Wide Web site on the Internet) can be a primary information management and dissemination tool for the TDS.

The structure and format of the model flow chart and the underlying information in the ten categories provide content suitable for building a Web site. When arranged as a flow chart (see **Exhibit 17** earlier), the information categories describe the steps in a process model of how TADD projects can be emphasized by the Economic Partnership and carried out by individual organizations in the Region.

The World Wide Web site should be made available at public access sites (libraries, community centers, schools, lobbies of government buildings) throughout the six-county Region. The existing Association of Governments GIS Computer ACCESS Program is a potential vehicle for doing this, see (Appendix B.)

At the information layer just below the top-level flow chart, information should be presented in structured, categorized, indexed formats. Hot button linkages can be created to take users to other Web sites that are operated under the control of vendors and other parties.

The World Wide Web is a good tool for disseminating the TDS Knowledge Base because of its growing use in the economy generally. There is a growing private sector industry that builds understanding, acceptance, usage, and technical support of users of the Internet through private sector initiatives. The newspaper industry, the banking industry, the public library community, the public schools, the home computer industry, and the consumer on-line services industry are actively taking steps to build Web usage. For example, libraries and public schools are installing more

Web access with each passing month. As another example, home computer manufacturers are bundling modems and Web access software tools with every home computer sold. The recommended TDS Web Site rides on these existing efforts, and does not contemplate incorporating additional action to build Internet usage, except possibly for participation in the Association of Governments ACCESS program following necessary approvals.

The Web site for information dissemination has the secondary benefit of reaching population segments that are younger, well-educated, high income, and open to new ideas. These people are likely to be naturally high in vehicle trip generation, but also able to understand, buy, and use technological alternatives.

There could be two information input buffers in the Web site.

- An input buffer where any and all can offer commentary and additions. This input buffer will be evaluated and massaged by staff into additions to the above categories. The input buffer will be available for all to see.
- A private input buffer for Telecommunications Cluster Advisory Group and forthcoming Sub-Cluster Group members who are working in particular user industries. This input location would be similar to the public one, only not visible to the general public, again out of which information will be moved to one of the ten organized databases under the flow chart elements.

This Web site once implemented would provide the data structure and central information clearinghouse function for the execution of the Strategic Telecommunications Technology Deployment Plan.

The World Wide Web site would have the flow chart on or near the top level. Users would click on a box in the flow chart to see the particular database of information "underneath."

The proposed Knowledge Base Web site provides an additional forum for expanding relationships between telecommunications technology suppliers and users.

Steps in the Analysis & Planning Process of the Strategy

To create a continuing long-term learning and focusing process that will cause the right incremental telecommunications investments to be made by both the vendor industry and the users of telecommunications who build applications, the Telecommunications Deployment Strategy has an Analysis & Planning process that incorporates these steps:

1. Build a Knowledge Base: Identify naturally-arising, market-driven telecommunications applications in Southern California or elsewhere that influence mobility in the direction of trip reduction and alternative electronic accessibility. This compilation of applications is at the heart of the Analysis and Planning process, as shown in **Exhibit 19**.

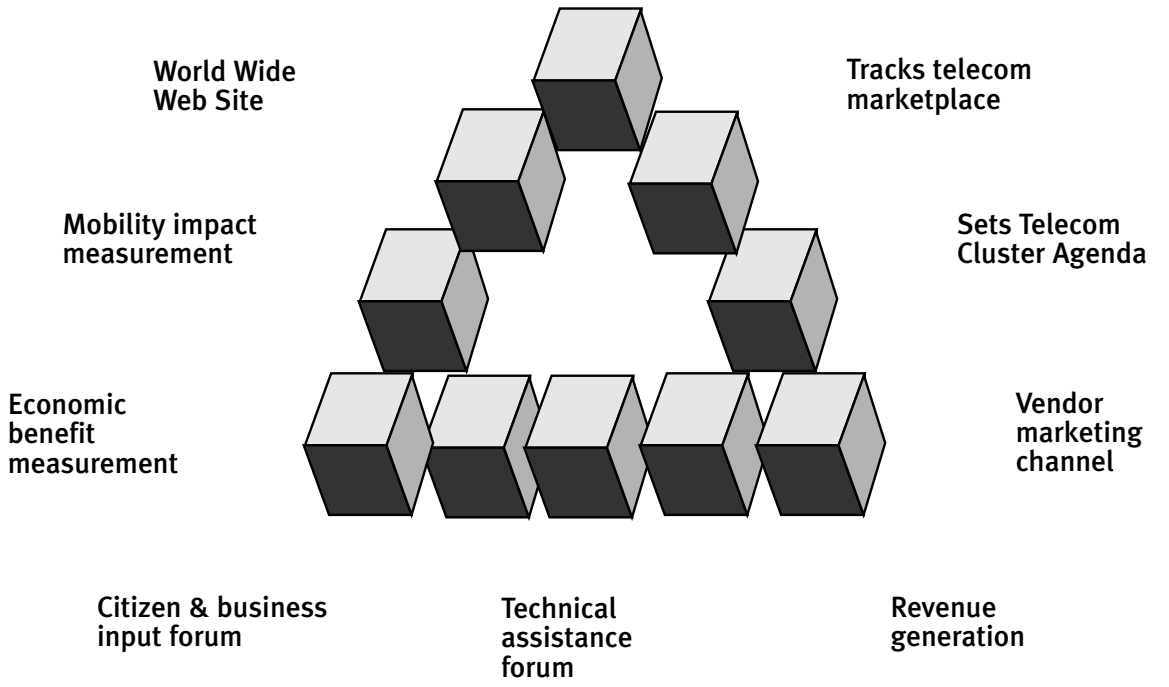
2. Analyze applications: Select and analyze the most promising of the specific projects identified in the previous step to quantify actual mobility impacts. An example of a specific project is Los Angeles County Superior Court contracting with the vendor Ameritech Corporation for the provision of interactive court services, enabling law firms to file and retrieve documents electronically, as well as search documents and civil indexes. In thinking through this specific application, a series of questions must be considered: How much trip saving will this particular application accomplish? How much trip making can be influenced by implementing interactive court services in all of the courts in Southern California? How does expanding this application compare in trip impacts with other applications?

One point of the analysis is to link dominant trip purposes to telecommunications applications. How this could be done is shown in the matrix illustrated in **Exhibit 20**.The focus of this matrix is on aggregation of common barriers and issues across multiple applications in order to determine the leverage points where the Telecommunications Cluster should push and take further action to accelerate telecommunications deployment. A key criteria for selecting applications for such further action is a judgment on the degree to which they do something posi-

Exhibit 18:
Format of telecommunications application case studies in the Telecommunications Cluster Knowledge Base

- Title of project
- Contact person, address, phone
  - Electronic addresses
  - electronic mail
  - hot link to further on-line documentation
  - hot link to the application itself, if available.
- Application type. Examples: telecommuting, teleshopping, public safety
- Implementing organization(s)
- Mission: Mission/business of the organizations involved
- Date when project became operational
- Purpose of the application
- Description of users (if workers: job titles, functions; if consumers: geographic location, demographics)
- Number of users
- Total potential universe of users in Southern California region
- Equity considerations: Describe how this application differs in its market acceptance across economically advantaged and economically disadvantaged people. Also, describe whether there is a public interest in promoting access and use of the application by economically disadvantaged people.
- Application accomplishments: Focusing on what the implementers are seeking, and spinoffs that may or may not have been anticipated.
- Description of the chain of events leading to mobility impacts
  - Example: customers receive what they need at home and don't have to come to the service center.
  - Example: couriers are no longer used to move the data files between offices
- Quantification of mobility impacts
- Technology overview
- Availability of the application to mitigate the effects of earthquakes and other transportation system disruptions.
- Technology vendors and technical assistance providers
- Facility location
- Facility location changes associated with this project (if any)
- Block diagram of the application, emphasizing geographic locations and information flows that replace physical travel
- Costs
- Sources of funds
- Economic indicators vis a vis technology users and technology suppliers
  - jobs
  - sales
  - profits
  - new companies formed
  - units sold
  - employment mix
- Market size: Estimated Southern California market size for this application, and present market penetration of implementations of this application, including this example and all other examples.
- Issues and barriers: Those overcome, those still hindering, and those anticipated

Exhibit 19:
Analysis and Planning Process of the Strategy (Knowledge Base) Has Many Facets



tive for reducing trips and improving mobility. The eventual effect of the various actions that the Telecommunications Cluster takes amounts to the delta in telecommunications deployment and resultant travel impacts that amounts to the difference between the baseline and the RTP "Plan."

Looking more closely at **Exhibit 21,** the matrix is an outline for the process of taking the next analytic steps after compiling case studies for the Knowledge Base of applications. Travel destinations, travel purposes, and telecommunications applications that serve those destinations and purposes are listed toward the left side of the matrix. The matrix is filled in illustratively across the row describing travel to government buildings. The squares of the matrix are analytic categories and steps, where more information may be developed than can fit into a small space.

Several telecommunications applications that could replace trips to government buildings are indicated in the column in the middle of the matrix titled "Example applications in the Knowledge Base." The applications, which are described in Appendix B, are the Davis Community Network and the Association of Governments ACCESS project. To the right of that entry are listed a number of characteristics and issues related to these two applications. Partially filled in for the example, these characteristics and issues include travel savings potential, economic impacts, social impacts, and a number of potential barriers -- specifically, human awareness and skill gaps, unknowns reducible through research, local government regulations, federal and state government barriers, infrastructure, service availability, and user equipment barriers.

Exhibit 20:
Draft Analysis Tool for Determining Best Opportunity Targets for Telecom Cluster Action

Travel Destination	Estimated Relative Share of Daily Trips for this Destination Type	Travel Purpose	Traveler Target	Code	Telecommunications Applications for Mobility and Access Enhancement (Taken from the Knowledge Base)	Example Applications in the Knowledge Base 2020	Technologies used and Regional/ National Market	Southern California Travel Saving Potential,	Positive and Negative Economic Impacts
Place of daily work	High	Reporting to Work	Commuters	1	Telecommuting from Home			6.3% of Commute Trips	
Place of	High daily work	Reporting to Work	Commuters	2	Telecommuting from an Alternative Office				
Shopping Malls	High	Going Shopping	Shoppers	3	Mall Shopper Information Network: check stock availability, parking, and crowds before you go.				
Shopping Malls	High	Going Shopping	Shoppers	4	Once there, use kiosks to reach other services and avoid other stops.				
Shopping Malls	High	Going Shopping	Shoppers	5	Remote electronic tele-shopping and home delivery				
Worksites, Restaurants other Business Meeting Venues	Medium	Face- to-face interaction during work day	Professional Workers	6	All modes of teleconferencing: audio, video, document, whiteboard				
College & University Campuses	Medium	Reaching a Learning Environment	Adult Students	7	Wider access to course offerings through Networked Classrooms				
College & University Campuses	Medium	Retrieving Learning Resources	Adult Students	8	Remote access to library, study groups, other resources				
College & University Campuses	Medium	Going to place of registration	Adult Students	9	Remote registration				
High Schools	medium	Reaching off-site resources	Adolescent students	10	Remote access to course offerings and resources				
Medical Offices	medium	Going to a health care facility	Patients	11	Reduce patient visits by remote consultation, monitoring treatment				
Medical Offices	medium	Going between medical facilities	Medical personnel	12	Transmission of medical diagnostic images; remote participation in procedures (tele-surgery, etc.)				
Libraries	low	Retrieval of documents	Customers	13	On-line catalogs and electronic document access				
Workplaces, Homes	low	Delivery of a physical document	Many worker types & couriers	14	Electronic transmission, verification, signatures				
Customers & Prospects in the Field (Industrial & Business Sales)	Low	Face-to-face sales calls	Outside sales professionals	15	Pre-visit remote monitoring and qualification. Electronic interaction for followup. Sales literature on line.				
Grocery Stores	Low	Buying groceries	Shoppers	16	Electronic ordering and home delivery				
Cinemas, Video Rentals, Arcades	Low	Entertainment & recreation	Consumers	17	Enticing, in-home telecom-based alternatives to going out				
Government Buildings	Low	Obtain forms, maps, other	Customers: business people and ordinary citizens	18	Remote government information retrieval from homes, business, and additional public places (CELLE TO THE RIGHT FILLED IN AS AN EXAMPLE TO SHOW HOW THE KNOWLEDGE BASE CAN BE ANALYZED)	**Davis Community Net; ACCESS Project**	**Fax on demand; e-mail; Internet Web; Community Networks**	**A KEY RESULT FROM CARRYING OUT THE PROCESS**	**Structural employment shifts; reduced governmental spending and workload burden**
Government Buildings	Low	Attend hearings and events	Customers:	19	Remote viewing and participation in hearings and other events				
Government Buildings	Low	Access service transactions	Customers:	20	Teleservice transactions from homes and public kiosks				
Banks, Financial Services	Low	Obtain cash & make deposits	Customers:	21	Teller machines everywhere. Credit and debit cards as cash substitutes. Direct electronic deposit.				
Banks, Financial Services	Low	Apply for loans , open accounts	Customers:	22	Remote applications by mail, telephone, fax, computer modem, kiosk				
Prospective Employers, Job-Hunt Stops	Low	Pick up applications, go to job interviews.	Job-seekers	23	Electronic access to position listings. Video screening interviews.				
Real estate for Sale or Rent with Listing Agents	Low	Visit and show listed properties	Prospects; real estate agents	24	On-line photos for screening before touring and showing.				

		Potential barriers that could be focus for Telecom Cluster Intervening Action														
Travel Destination	Societal impacts mobility, access, & economic	Awareness gaps	Unknowns reducible through research	Local government regulatory involvement	State & Federal government caused barriers	Telecommunications infrastructure barriers	Telecommunications service availability barriers	End user barriers	Human skill barriers	Other barriers	Grade the overall potential for improvement via Telecom Cluster Action	Other applications with similarities, synergies	Options for public sector action	Options for private sector action	Conclusion public sector action	Conclusion private sector action
Place of daily work																
Place of daily work																
Shopping Malls																
Shopping Malls																
Shopping Malls																
Worksites, Restaurants other Business Meeting Venues		**These cells would be filled in with information from the Knowledge Base**														
College & University Campuses																
College & University Campuses		**from professional staff research at The Association, and**														
College & University Campuses																
High Schools																
Medical Offices		**from Telecommunications Cluster Advisory Group deliberations**														
Medical Offices																
Libraries																
Workplaces, Homes																
Customers & Prospects in the Field (Industrial & Business Sales)																
Grocery Stores																
Cinemas, Video Rentals, Arcades																
Government **Buildings**	**Better service to citizens**	**Among government officials & consumers**	**Status of standards; state of the art**	**Obsolete statutory requirements for physical access**		**None**	**None**	**Home computers & fax machines efforts**	**Consumer formulation of information needs, design of presentation interfaces**	**Lack of government investment dollars**	**A KEY RESULT FROM CARRYING OUT THE PROCESS**	**Numbers 13, 14, 15, 20, 22, 23**	**Intergovern-mental development projects sharing of successful methods**	**Transfer of technology from leading business focus of mainstream marrketing**	**A KEY RESULT FROM CARRYING OUT THE PROCESS**	**A KEY RESULT FROM CARRYING OUT THE PROCESS**
Government Buildings																
Government Buildings																
Banks, Financial Services																
Banks, Financial Services																
Prospective Employers, Job-Hunt Stops																
Real estate for Sale or Rent with Listing Agents																

Columns further to the right indicate a place to grade the applications for the overall potential for expanded, accelerated improvement via the Strategy, and a place to make the linkage to other telecommunications applications with similar characteristics and barriers. This last column would be filled after a number of applications are analyzed. The bottom line on the whole process comes further over to the right with a column to list options for public sector action and options for private sector action. The final two columns on the right are the place where decisions to take action in the public or private sectors can be indicated.

3. Determine leverage points: From the analysis of specific projects, determine the characteristics of the telecommunications applications that produce trip reductions. These characteristics are potential leverage points for further action by the Telecommunications Cluster. For example, what technologies produce the greatest trip savings? What are the characteristics of trip types that are most amenable to substitution? Do organizational characteristics matter? Are there geographic factors?

These evaluated projects can yield the barriers and gaps that are the most worthwhile targets for attention and action by the Telecommunications Cluster. Addressing these barriers and gaps will expand the number and enhance the quality of such projects, and thus improve mobility.

For example, assume that interactive court services is found to produce significant trip savings: Are there other courts in the six-county region that have not yet implemented such services? A barrier may be simple lack of awareness of the technological potential on the part of other court administrators. Are there collective public interest policies and activities that can be initiated and facilitated by the Telecommunications Cluster or by the Association of Governments? For example, the professional societies of court administrators could be the subject of educational and marketing activity by the private sector suppliers of telecommunications technology.

Furthermore, groups of project types sharing common technological characteristics need to be assessed for leverage points of public interest action. For example, interactive court services may be very similar to interactive services around other government regulatory agencies and around private sector services like insurance, banking, and on-line shopping. When assessed, all of these applications may be found to be blocked by infrastructure gaps, organizational readiness and capacity gaps, or technology barriers such as lack of standards for electronic signatures that carry the legal weight of blue ink on paper.

Interactive court services and related applications are only an example. The strategy consists of an evolving, increasingly more powerful and regionally-inclusive work process of collecting many case studies of telecommunications applications in the Knowledge Base, and then assessing these cases for leverage points and action by the policy makers, and the stakeholders.

4. Design actions: Conceive, analyze, and choose those specific public policies and actions that would cause more and better projects of the identified type.

In the example of interactive court services, an education and marketing program could be designed by the Cluster in cooperation with technology vendors. Or, because the Southern California market is so large and significant, the Telecommunications Cluster might reasonably form a task force to accelerate the development and implementation of an industry standard for digital electronic document signatures (equivalent to signing with a pen on paper) that would support a number of mobility-enhancing telecommunications applications that are currently blocked. The Smart Valley effort in the San Jose area has worked on accelerating industry standards for electronic transactions between firms.

Other barriers that conceivably, but not necessarily, stand in the way of telecommunications applications development and deployment include inadequate residential and commercial telecommunications infrastructure, gaps in the provision of common carrier services over the infrastructure, inadequacies in information content provision, insufficiently cost-beneficial network attachments (personal computers, smart televisions, etc.) available for purchase by households and businesses, lack of attention to user friendliness on the part of applications developers, and insufficiencies in availability of private or public investment capital.

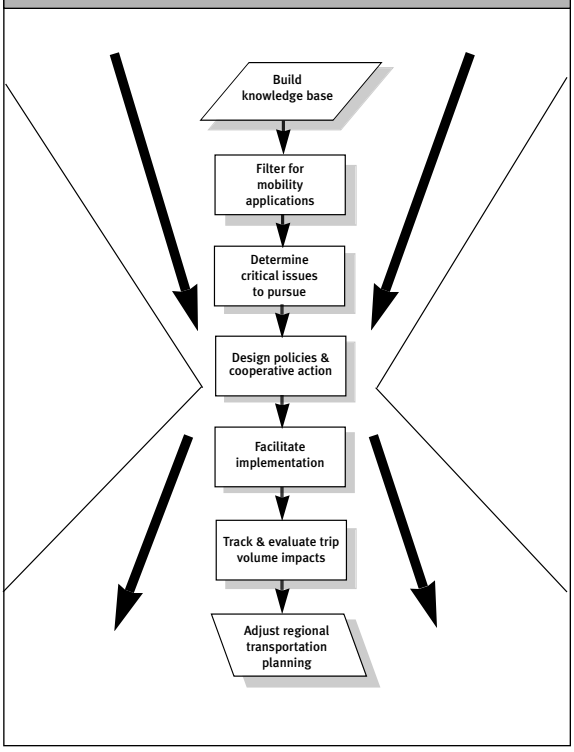
5. Facilitate implementation: Design and implement those actions and policies by assigning responsibilities and providing resources to carry them out. Depending on the scope and scale of the selected activity, this step could be formidable. The sum of all such activities across all targeted telecommunications applications would constitute a major share of the work program of the strategy.

6. Measure results: Track and evaluate actual mobility impacts that result. For example, if trip making in connection with courts is chosen as a target for public policy and programs that accelerate the deployment of new telecommunications applications, then the mobility effect of these applications as they are implemented across the courts in the six Southland counties should be tracked, measured, and assessed.

7. Input to planning: Findings from the steps described here would be continuously shared with the modeling staff at the Southern California Association of Governments. By focusing on an understanding of telecommunications applications' impacts on particular trip types, these professionals can develop a methodology to better estimate and forecast the overall trip generation consequences that result from telecommunications technology development and applications throughout the region. This methodology would be used in the development of future editions of the Regional Transportation Plan

These steps are shown in the **Exhibit 21** flow chart for the Telecommunications Deployment Strategy. The flow chart illustrates that the Strategy funnels a large mass of technology and application possibilities down to a specific set of high leverage initiatives in the marketplace. These initiatives attempt in turn to spur a wide array of private sector activity that yield a large impact on patterns of movement and remote electronic access that substitutes for movement.

Exhibit 21:
Telecommunications Deployment Strategy



8. 2020 Vision of tne Strategy in Operation

Here is the Telecommunications Deployment Strategy 2020 vision for making the Southern California region a leader in the use of telecommunications for mobility enhancement:

1. Mobility enhancement is widely perceived as an available additional benefit of telecommunications applications.

2. Users and vendors of telecommunications technology understand how to use telecommunications to enhance mobility, and consider this potential as they sell and build applications.

3. Established information dissemination mechanisms exist for easily finding the details of how organizations and people throughout Southern California are using telecommunications to save travel.

4. It is easy to find a wide array of professional technical assistance in designing, building, and operating telecommunications applications that enhance mobility.

5. The rate of growth of operational applications that are saving travel is greater in Southern California than anywhere else in the world.

6. The use of telecommunications by people and organizations for mobility enhancement has reached critical mass penetration.

7. Transportation and telecommunications on an equal footing in comprehensive planning at Association of Governments, with recognition that they are complementary ways of fulfilling transactions, interactions, relationships, and information exchanges.

8. The Association's social-economic-mobility-access real-time micro-simulation model of the Southern California Region fully encompasses telecommunications as well as transportation. The operation of the model is fully visible to anyone via the World Wide Web.

9. Public sector planning to influence telecommunications deployment has to be based upon deep insight and subtle indirect leverage. Operational data on telecommunications functioning is provided as a matter of law to the Association for its simulation model.

10. In the Southern California region an internationally prominent network-enabled think-tank has evolved, the Telecommunications Mobility Institute, with senior fellows based worldwide working on telecommunications-transportation relationships. The core staff and the knowledge server are based in Southern California.

A more focused vision for the Association is the following:

To achieve this vision, the Partnership's Telecommunications Cluster intends to become the most authoritative, widely-known broker of know-how, skills, information, and other resources for implementing mobility-enhancing telecommunications applications. This statement was developed by the Telecommunications Cluster Advisory members at a November 8, 1995 cluster meeting. The Cluster will continuously build linkages to private sector firms which are marketing products and services that implement these applications. Continuing liaison and cooperation with other mobility-focused developers of telecommunications applications, for example, the Southern California Telecommuting Partnership, the Playa Vista Development, and the San Diego Cities of the Future.

9. Benefits of the Strategy

1. Provides the focus of discussion and activity for the Telecommunications Cluster participants, including the Advisory Group, and any other groups that could emerge as needed; such as the Support Cluster Groups, working groups, and task teams.

2. Builds leadership understanding and consensus on how telecommunications deployment happens, what would be a better pattern (path and pace) of deployment, and what should be done to make that better pattern occur.

3. Establishes a foundation for analyzing and determining where and how a public-private partnership should intervene to accelerate ongoing processes (infrastructure deployment, equipment availability, applications development, or human capacity building) that would most efficiently accelerate ongoing telecommunications deployment.

4. Defines the specific telecommunications markets and product areas where the Telecommunications Cluster should focus for maximum impact.

5. Supports Association of Governments measurement and evaluation of telecommunications deployment impacts.

The TDS provides for the creation of a Knowledge Base of specific travel-saving projects that can be quantitatively evaluated for trip savings and then extrapolated to area wide travel savings as a part of monitoring the performance of the Regional Transportation Plan.

Focusing on quantifying the travel behavior impacts in a series of particular real world telecommunications applications would be helpful in learning how to quantify telecommunications impacts at a regional level. Judgments can now be made about the likely future impacts of telecommunications deployment on trip making generally, but experienced analysts may vary substantially in their prognoses, because of differing implicit assumptions about the impact of individual applications. The Strategy described here corrects this problem.

6. Provides an organized, research-based input to the process of forming new Telecommunications working groups.

7. Supports technical assistance to organizations in telecommunications application development.

8. Links to the revenue and profit interests of the private sector.

The Knowledge Base will be full of case studies of telecommunications application development/deployment projects that are motivated by business interests, including revenue and profit generation. The database also includes product and service offerings from the private sector. The database and its structuring provide a linkage between existing everyday business interests and the Association/Partnership public policy intent of modifying access and mobility habits. More directly, the proposed Internet Web dissemination of the database information amounts to the provision of a new marketing channel for the private sector suppliers to reach telecommunications applications developers. Vendors have their products and services listed in a neutral format, and then the Information Center Web site would provide for one-click hot links to vendors' own promotional, marketing, and ordering Web sites.

9. Support disaster preparation.

The Strategy recognizes that a focus on promoting telecommunications applications for mobility enhancement in normal times simultaneously offers a strategy for mitigating transportation disruptions in the abnormal times of earthquakes and other transportation and organizational facility disruptions. When the New York City World Trade Center was hit by a terrorist bombing several years ago, the affected firms which coped best when their offices were closed were the ones that were already practicing telecommuting.

10. Work Plan for Strategy Implementation

This is the recommended work plan to follow in implementing the Telecommunications Deployment Strategy described here.

Work Plan steps

Southern California Economic Partnership: Continue periodic meetings of the Telecommunications Advisory Group.

The charter members of the Advisory Group are listed in **Exhibit 4** earlier. The private sector members were selected from telecommunications service firms serving a variety of telecommunications applications, or otherwise having a broad view of applications. The Group also included public sector officials and managers. The membership can be augmented at any time to bring in members with more specialized perspectives that become important as particular groups of applications are chosen for attention.

The main continuing focus for the Advisory Group should be to provide advice and counsel to The Partnership staff and board on how to influence the dynamic telecommunications market toward a greater emphasis on mobility improvement.

Through an on going review process of applications to determine groups of them that should and could be accelerated by removing barriers (such as infrastructure gaps), by providing technical assistance, or by organizing additional marketing activity.

Candidate applications should be brought before the Advisory Group in a uniform format by a professional staff that documents applications in a consistent fashion highlighting issues that impede deployment. The Advisory Group members themselves can provide input to the professional staff on applications they know about stemming from the work of their organizations.

Partnership: Applies the same market development strategic planning to each of the five technologies it has been given the mission to accelerate. The approach is multi-disciplinary, totally integrated, constantly evolving, and consists of:

Association : Establish a telecommunications applications Planning & Analysis function.

This function at the Association, would provide the professional resources needed to document applications that collectively form a Knowledge Base that guides Telecommunications Cluster activity. The contents of this Knowledge Base becomes part of the substantive content of the Web site.

Two full-time equivalent analysts, one junior and one senior, are an appropriate starting level of effort for this function.

Association: Continue collecting information on existing telecommunications applications.

The Telecommunications Cluster needs to base its work on an understanding of telecommunications applications. This understanding requires a steady flow of data on existing applications.

A program of media and literature scanning could be one source of leads. The National Information Infrastructure Awards program has already offered to provide leads to applications that claim travel savings as an effect.

Also, a brochure could be created and distributed that explains the kind of applications that the Cluster is seeking, and the benefits in promotion and technical assistance that the Cluster offers in return to applications developers who provide information.

Association: Document case studies of telecommunications applications according to the format described earlier.

Documenting case studies means filling in the standard template that organizes each Knowledge Base entry with data from real world applications.

Association staff screen candidates for preliminary prima facie indications of mobility enhancement effects. Staff further analyzes those that appear to have mobility enhancement impacts in order to verify and quantify these impacts.

Association: Analyze case studies of telecommunications to find leverage points for collective action by the Telecommunications Cluster.

Staff collects and analyzes case studies with the goal of finding common barriers that cut across several cases.

Association: Feed analysis results into the agenda of the Telecommunications Advisory Group meetings for discussion and action.

Results of the analysis that come out of the preceding step should be in the form of identification of barriers and opportunities for technical assistance or marketing action that are common across a group of telecommunications applications. Options for action should be well reviewed and discussed at Advisory Group meetings.

Partnership: Establish working groups and task teams to take barrier removal, cooperative marketing, and technical assistance steps that emerge from the analysis of applications and deliberations of the Advisory Group.

These teams would be made up of stakeholders in firms and government agencies that are involved in telecommunications deployment.

The teams could work on projects large and small, depending on what the analysis and the Advisory Group deliberations determined were good intervention steps to take. A small project might be aimed at correcting a technical problem in pending legislation in Sacramento or a city council. A large project would be to create a partnership between content providers, service providers, communities, and customers to build a new travel-saving information service on a community network service such as Valley-Net or the Los Angeles FreeNet.

Another possible large project for a working group of the Telecommunications Cluster would be facilitation of an infrastructure upgrade in a particular geographic area. For example, a working group could provide assistance in negotiations between a municipality and telecommunications providers to leverage the procurement of new wiring for government facilities into the construction of a citywide high capacity network supporting interactive media transmission for all business and some residential locations. End user equipment vendors might provide discounts to users to provide incentives for use of the upgrade cap[abilities. This upgrade could be coordinated with an accompanying research effort to measure travel impacts upon users of new services and applications that are made possible by the upgrade.

Another kind of project would be experiments that take an action that encompasses some logic of mobility improvement, but also some uncertainty as to the size of the impact. For example, suppose a special marketing effort for a telecommunications service like ISDN were made in a limited geographic area. The response of consumers to the offer could be measured, and then some survey work could be done among both takers and a control group of non-takers to discern what changes result in travel patterns.

Partnership: Create a Telecommunications Model City Starter Kit

In line with an educational thrust developed in other Clusters of the Southern California Economic Partnership, the early findings from the analysis of telecommunications applications and follow-on deliberations of the Advisory Group could be turned into a "Telecommunications Model City Starter Kit" for municipal government officials. The kit would be a booklet that would be designed to assist Southern California cities to decide upon and carry out a series of action steps that advance the deployment of telecommunications applications by local businesses and other organizations, and by local government agencies themselves.

Following the emerging example of the Electric Vehicle Model City Starter Kit, a working outline for the Telecommunications Model City Starter Kit would look like this:

- Why Become a Telecommunications Model City
- The Acts and Regulations Supporting Telecommunications Deployment
- The Key Players Supporting Your Participation
- The Key Programs Supporting Your Participation
- Telecommunications Technology Update
- Support from Local Telecommunications Service Providers
- Telecommunications Case Studies
- How to Become a Telecommunications Model City

- Funding Support Opportunities and Tax Incentives
- Telecommunications Model City Recognition

The subject of general telecommunications policy for municipalities has been previously addressed by the California League of Cities in its Model Telecommunications Policy. The topics covered in the League's Model Policy are universal access, role of the city in regulatory structure, compensation for use of public rights-of-way and negative impact on local infrastructure, cities as users/providers of telecommunications services, adequate spectrum capacity for public safety and other public uses, FCC certification of local franchising authority, and privacy.[10] From the point of view of this Plan, these are all general telecommunications policy issues that need to be verified as important barriers to the deployment of trip-saving telecommunications applications. Not all of these issues will pass this test.

Following the thrust of the Partnership's Telecommunications Deployment Strategy generally, the Partnership's starter kit should address aspects of telecommunications that bear on enhancing physical movement and electronic access, as opposed to the whole field of telecommunications generally, which the League Policy attempts to address.

Partnership: Manage activities of the working groups and task teams.

Products of these activities could include working with one or more local municipalities to assist them in carrying out the steps that are outlined in the Model City Starter Kit just described. Whether or not in the context of a model city, working groups could take steps to help cities promote mobility-enhancing telecommunications, such as the use of the Internet to disseminate government information for which citizens would otherwise have to visit city hall, or residential housing and zoning codes that encourage telecommuting.

Association: Initiate special research projects as needed.

Examples of such project include surveys of users to validate findings from analysis of telecommunications applications and special studies to incorporate the effect of telecommunications application deployment into transportation models, such as the effects of the cashless society coming from growing use of debit and credit cards.

1. Deployment education and guidance in the form of Model City Starter Kits that contain information and implementation worksheets, and training and safety requirements and curriculum.
2. Workshops and outreach to generate addi tional interest and understanding of technol ogy deployment.
3. Technology/industry identity creation and awareness generation (logos and slogans) to help give a singular identity, purpose and synergy to deployment activities.
4. Information distribution and networking support creating a breakthrough, advertising-supported consumer friendly Web Site, to encourage feedback from stakeholders and as a clearing house of information.
5. Partnerships creation/brokering; and
6. Legislative initiative and actions to provide testimony on issues, and share potential direction with stakeholders to assist with action strategies.

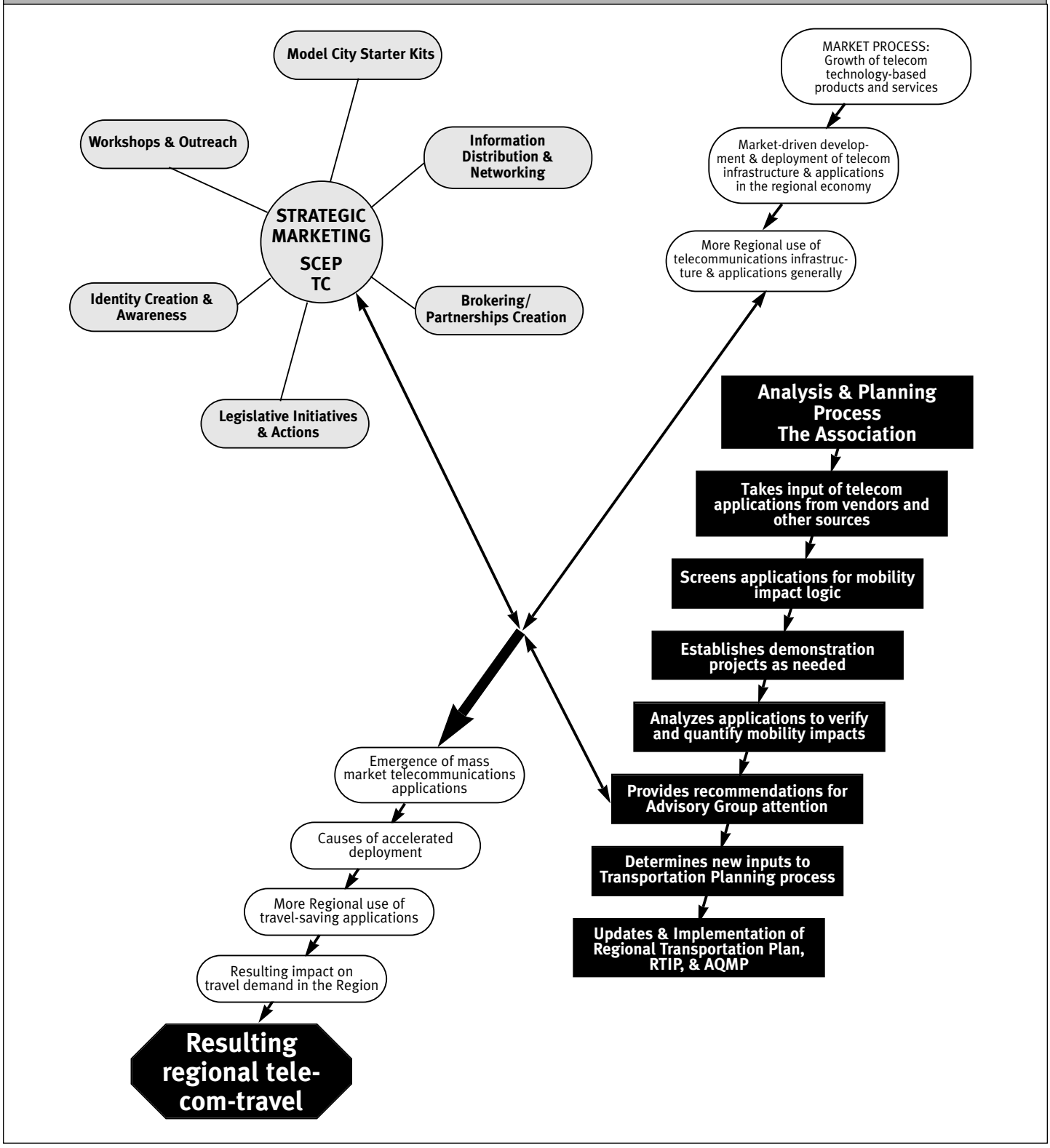
Association: Revise the regional transportation model to reflect the effects of telecommunications

This topic is covered in a subsequent section of this report.

Association: Assess results of the Cluster, and revise the work plan accordingly.

An overview of the Strategy in operation is shown in **Exhibit 22**, Public-Private Process to Accelerate Telecommunications Deployment. An Analysis and Planning Process supports the agenda setting for the Advisory Group meetings within the Economic Partnership Process, which carries out actions that feed into the Market Process.

Exhibit 22:
Public-Private Process to Accelerate Telecommunications Deployment



11. Financial Plan: Cost Elements

Flexibility is built into the design of this strategy, allowing either growth or shrinkage in the level of professional staffing and activity over time. The depth of implementation is a choice, now and continuing, based on priorities and budget available. The major cost elements of this work plan are as follows:

- Meetings of the Advisory Group.
- Management of the Telecommunications Cluster activity of the Partnership.
- Operation of the Association's telecommunications analysis function.
- Operation of the Web site.
- Intervention activities carried out by work groups and task teams.
- Special research projects.
- Outreach program of the Cluster.
- Outside Evaluative assessment three years period).

The fact that this Strategy is designed to work over a period of many years does not mean that shorter term results are unfeasible [11]. Any insights into barriers that are blocking the expansion of applications should be acted upon immediately. For example, suppose an analysis of the routine transmission of medical images between hospitals and clinics in Southern California turns out to be a significant travel saver. Suppose that a lack of a particular infrastructure or service offering is the clear blockage to expansion of this application. Then it would make sense for a working group to take steps to alleviate this problem.

12. Modeling telecommunications effects on transportation

Southern California Association of Governments, Southern California Economic Partnership, and California Department of Transportation seek to analyze telecommunications as a mode of transportation. This paradigm implies that the transactions, interactions, relationships, and information exchanges that are the purposes and result of physical movement in vehicles can sometimes be fulfilled through the use of telephoning, teleconferencing, computer network access, or other telecommunications.

To consider telecommunications as a mode of transportation, one must be able to map telecommunications events onto comparable transportation trips. Examples include:

- Instead of driving to work, a worker stays home and telecommutes.
- Instead of driving around to a variety of stores looking for a particular item to purchase, a shopper phones to a number of stores until the item is located, and then drives to one store directly.
- Instead of registering for university classes on the campus, a student registers over the telephone.
- Instead of going to church on Sunday, a family stays home and watches a popular minister on a televised religious service.
- Instead of driving to a video arcade at the mall, a teenager stays home and participates in an interactive game tournament that connects players nationwide over the Internet.
- Instead of a soft drink delivery truck driving to a heavily used Coke machine once every two days to fill it up (whether needed or not), wireless radio status reporting on the contents of the machine allow the bottler to visit as needed, which results in visits that calculate out to one visit every 3.3 days. (Actual application, numbers are hypothetical.)

One step in analyzing telecommunications as a mode of transportation is to list out the transaction, interactions, relationships, and information exchanges that can be fulfilled through either telecommunications or transportation. This means classifying by trip purpose those telecommunications applications with an impact on physical movement.

Another step in the analysis is to consider the degree to which the effect of telecommunications on physical movement is already built into the existing "four step" transportation models. Given that such models are calibrated to today's trip volumes, and given that the first incarnations of telecommunications (namely the telephone and TV broadcasting) have been acting on transportation in a serious manner for several decades (at least), a reasonable assumption is that telecommunications effects are implicitly built into transportation models, in that same sense that economic growth and land use patterns are built in. These effects would be measured through the periodic monitoring of travel characteristics in the region.

For example, consider the use of telecommunications as a substitute for meetings. One might assume that society is in the middle of a gradual evolution in the use of telecommunications as a way of meeting, an evolution that began with the growing use of telephones in the 1920s. Electronic mail came along later, and video-conferencing more recently. These technologies can perhaps be considered to be reaching use gradually enough to be fully encompassed in travel trend data that is used to create and calibrate present trip-generation models.

But gradual changes can work both ways. The overall conclusion of earlier research by Global Telematics is that there is a probability that there is no overall metro area trip reduction effect that telecommunications yields, in a natural, baseline sense, all forces considered. The list of ways in which telecommunications increases trip-making is just as long as the list of ways in which it decreases trip-making. *See Beyond Telecommuting*, [5] . Even for commuting trips, because of the prospect of other telecommunications applications besides telecommuting changing economic structure, business processes, and land use in the direction of more temporary employment, just-in-time behavior, and geographic dispersion, more SOV use is stimulated at the expense of ridesharing and transit.

The Association's present methodology of taking telecommuting and work at home as separate, outside, across-the-board overrides on the baseline trip generation stage of the model should be reconsidered in light this analysis. Given that the Association's traffic model is aimed at summariz-

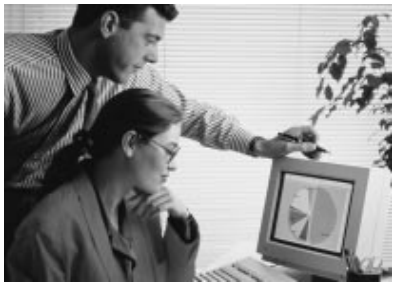
ing all forces that bear on trip making, simply isolating the trip reduction side of telecommunications and applying it as a secondary override on the trip generation baseline is not valid. If the Association's baseline trip generation estimations are functions of volume drivers such as numbers of people, households, workers, and vehicles per household, then telecommunications usage that either increases trips or decreases trips is reflected in changing coefficients in the equations that would show up over time as the equations are calibrated to the real world.

Modeling the future effects of the Plan

While the overall effects of telecommunications deployment show up in the baseline model through the overall trip generation equations, we would propose a different focus for modeling the incremental, policy-driven telecommunications effects that result from this Plan. A main thrust of this Strategy is that for the region to achieve trip reduction from telecommunications the implementation process must identify those particular types of applications out of which reduction actually happens, understand these applications, and then take targeted policy and marketing action to accelerate their deployment. Promoting telecommuting is one example of a targeted action that would likely reduce trips through the use of telecommunications.

The Telecommunications Model City Starter Kit, telecommuting marketing newsletters from Metro, promoting particular applications through the Partnership Web site, and other extraordinary, intentionally-designed programs of action produce an incremental effect on telecommunications applications development and deployment. The expected incremental effects on telecommunications deployment and trip-making behavior from these initiatives would be the "delta" from the baseline. These efforts if successful must ultimately come down to incremental growth in the use of particular telecommunications applications that change trip making. This chain of logic then leads to the proposition that the effects of particular telecommunications applications on particular transportation trip types is at the heart of measuring how telecommunications and transportation are jointly modeled.

Indeed, measurement of the trip generation/conservation effects of the telecommuting application (home based work trip replacement) over the past decade provides an example of this approach. Telecommuting was carefully analyzed for trip effects for the first time in the California and Washington State Telecommuting Demonstration Projects. These efforts involved a defined set of telecommuters keeping travel diaries to measure both commuting behavior and other trip making. Control groups from the same employer organizations as the telecommuters also kept travel diaries. These results have been published, and are very optimistic for travel savings in the short run in that telecommuters do not generate commute trips on telecommuting days. Also, telecommuters and their families do not engage in other trip making that rolls back the savings. The only concerns that have arisen in the telecommuting studies relate to long-run land use patterns (telecommuters show a tendency to live in more dispersed locations) and in the manifestation of latent demand [12] as other drivers fill in for those commuters who stay home. These are not of concern in the trip generation stage of the four stage model.



Trip making for the purpose of shopping is probably the next most productive target for analysis of trip making, since shopping is the next biggest trip type after commuting. Mail order catalog shopping (which is really telephone shopping) is a reasonable initial surrogate for full electronic shopping. The travel behavior of a sample of heavy catalog shoppers should be compared to the trip making of a demographically matched sample of "mall crawlers." The trip substitution data generated in such a study could be generalized by mapping it onto projections of the expansion of electronic shopping.

This process of analyzing telecommunications impacts can be repeated for each trip purpose, for example, school trips, college trips, home-based other, and non-home based other. Actual trip purposes with a telecommunications equiva-

lent needs to be extracted from the last two. Every trip purpose and corresponding telecommunications application is somewhat different, although it is possible that applications and trip purposes can be grouped to simplify analysis. A general pattern would be to assemble a group of people who make some trips of a particular type, and/or who use a telecommunications application for the same trip purpose. Travel behavior would be differentiated by telecommunications usage. Examples of potentially useful analytical results include:

- Household that use on-line electronic grocery ordering make only r trips per week to grocery stores, compared to non users who make s trips per week. However, the delivery of groceries by trucks from the warehouse generates a trip equivalence of t trips per week that offsets the gain.
- Since University Alpha has begun offering classes via the Internet, the weekday daily level of campus parking lot entries per student has fallen from y to z, compared to University Beta where the similar figure has remained stable at n.
- Households owning a personal computer and using the Internet generate on average only xx% of the daily weekday trips that households not owning a personal computer do.

Analyzing the Knowledge Base

The Knowledge Base that is part of the Telecommunications Deployment Strategy described in this report is a starting point for analyzing travel effects of telecommunications. Measuring what telecommunications applications do to change travel behavior begins with determining the travel effect of particular case studies in the Knowledge Base through travel diaries or estimation. Then, the total travel effect of one sample application working across all six counties would be a matter of scaling up the effect of one case study across a proportion of the universe of possible application implementations that is reasonable.

For example, suppose a telephonic registration system has been implemented at the UCLA main campus. Suppose that somehow, through travel diaries or through analytical estimation, a certain number of average trips per day are saved by this application, perhaps calculated by normalizing the effects of reduced quarterly registration home to campus trips across all days of the year. UCLA has, say, 30,000 students. The effect of this application being spread 100 percent across all campuses of all colleges and universities in the area is based on scaling up from 30,000 students on one campus to 120,000 students on 20 campuses. The mathematics is linear.

Suppose, for example, that the Telecommunications Cluster Advisory group with analytical help determines that this application is going to diffuse through market forces alone to only 60,000 students on 10 campuses. This becomes the baseline case for this application. The "Plan" case for this application is what would happen with a special incentive program from the Telecommunications Cluster. That would perhaps yield the 100 percent effect, with related travel benefits.

Measurement of the travel effects of telecommunications applications is thus an application-by-application effort that will take several years to complete. Eventually, with experience, economies in the process may appear in the form of generalizations about applications.

To summarize, the effect of applications is central to understanding how accelerated telecommunications deployment can effect trip-making. Even the long-run interest of Partnership and Association leadership in tracing the effect of telecommunications infrastructure deployment depends ultimately on understanding the trip-making impact of applications and working backwards into infrastructure.

13. Telecommunications and the Economy

Seeking positive impacts on the Southern California regional economy is a secondary mission of the Partnership. This is a secondary mission because it requires less targeting and focus than the primary mission of achieving travel impacts. Any effort to accelerate telecommunications deployment will have positive economic effects, so the primary particular focus on enhanced mobility and access of this Plan will certainly achieve such general effects. This section explains the range of mechanisms by which telecommunications affects any advanced economy.

Relationships between telecommunications and the economy

There are at least four relationships between telecommunications and the economy. Each of the relationships suggests a related economic development strategy for the region. Each potential economic development strategy can be folded into the Telecommunications Deployment Strategy.

First, telecommunications is provided by an important group of companies in the regional, national, and world economies. The industry of telecommunications service and equipment suppliers and related information technology companies is growing rapidly. These companies provide relatively high salaries and wages, but are not necessarily stable employers because of the turbulence in the industry common to high technology generally.

A regional economic development strategy that exploits this first relationship would be to foster attraction, retention, and growth in the region of telecommunications industry firms that have many employees.

To apply this economic development strategy within the strategy of telecommunications deployment for mobility and access enhancement, an emphasis would need to be placed on telecommunications deployment activity that favored the products and services of firms with relatively higher levels of local employment (actual or potential).

Second, the indirect but pervasive impact of application(s) and the use of telecommunications products improves the productivity, market reach, and other performance characteristics of all firms, including manufacturing, entertainment, wholesale, retail, financial, transportation, health care, education, and government. Information is an increasingly important input for the production of goods and services, and telecommunications provides the intra- and inter-regional highways for information flows. Telecommunications highways link all of the locations of enterprises, public services, and customers in the economy, and the performance of those highways --and how firms use these highways -- is critical to economic performance. Econometric analysis by Parker Telecommunications and DRI/McGraw Hill has shown that telecommunications investment in recent decades has caused economic growth[22] and productivity improvement[23] at the U.S. national level. Over the period 1963-91, the portion of total U.S. economy-wide productivity gains attributable to advances in telecommunications was 25 percent.

Providing incentives for the smart use of telecommunications by regional businesses and other organizations for the purposes of improving their efficiency, sales, productivity, export marketing, research capabilities or other aspects of performance is an economic development strategy. In response to Southern California's location in a zone of seismic activity, telecommunications also provides a means for economic functioning when the transportation system suddenly loses functionality as in the case of the 1994 Northridge earthquake.

To apply this strategy within the telecommunications deployment strategy, emphasis would need to be placed on particular applications projects that have a performance-enhancing effect on the organization involved, in addition to improving mobility. In fact, most organizations are interested only in mobility enhancements from telecommunications to the degree that the application also enhances organizational performance. In other words, this economic development strategy comes along for "free" with the rest of the telecommunications deployment strategy.

Third, new telecommunications applications cause qualitative and quantitative structural

changes in the economy that go beyond organizational impacts. Industry structure, types and numbers of jobs, entrepreneurial activity, and geographic activity location are all affected. The restructuring of the selling and distribution of goods through the growth of electronic commerce is one example.[24] The revolution that is occurring in adult training and education is another example.[25] More generally, the changing mixture of transportation and telecommunications in information exchange, transactions, relationships, and interactions is an example of structural change.

A related regional economic development strategy would be the promotion of telecommunications-enabled restructuring of the local economy, such as telecommuting, electronic commerce, and electronic service delivery. Such restructuring does not necessarily enhance mobility. A virtual office strategy with procedures that caused a mobile sales force to be driving during peak morning traffic is an example of reducing regional mobility even though the workers can stay personally productive using their cellular telephones.

To include a wider restructuring approach to economic development along with mobility enhancement would require choosing improvement activities that encompass wider restructuring effects. This would typically be the case in the widespread application of more daring and innovative approaches to mobility enhancement, such as restructuring consumer interaction with grocery stores into electronic ordering and home delivery. Another example would be an effort to restructure higher education around a much higher fraction of learning activity taking place at home or within walking distance of the workplace, so that fewer students drove to a traditional campus for their classes.

Finally, the purchase of telecommunications services and equipment by consumers is an important component of consumption. This consumption includes usage of telephones and computer modems, interactive services like Compuserve and America Online, and broadcast radio and television.

Promoting the consumption of telecommunications products and services by businesses and households when the purpose of that consumption yields a clear public benefit is a potential regional economic development strategy. Beneficial uses of telecommunications include those that yield educational, business development, productivity improvement, and trip reduction purposes. Choice of promotional focus is necessary. Promoting telecommunications usage generally, which includes children playing interactive games instead of doing their homework, and adults engaged in telecommunications-enabled interactive wagering, is not clearly in the public interest.

The economic development strategy of promoting telecommunications consumption comes along automatically with almost any approach to mobility enhancement through telecommunications deployment. By definition, telecommunications deployment means increasing societal usage of voice, data, and video telecommunications.

Demand-side emphasis works best

While employment gains in the Southern California telecommunications industry (supply side) have been emphasized in strategic planning for the Telecommunications Cluster, it is certainly true that greater economic benefits to the region would come from the employment and income gains generated by the effective application and usage of telecommunications by organizations of all types and by individuals, not just from the production of telecommunications goods and services by the firms in one industry. For example in the 1994 Regional Transportation Plan, the forecast of 65,000 jobs to be created in telecommunications supply by the year 2010 from the activities of the Telecommunications Cluster is a trivial one half of one percent of the 12 million total jobs forecast to be located in the Southern California region during that same year. Furthermore, 65,000 telecommunications supply jobs is only two percent of the 3.1 million jobs to be added to the regional economy in the period 1990-2010. A plan that seeks to increase the mobility and telecommunications usage of the entire 2010 economy of 12 million jobs is more meaningful than adding 65,000 new jobs. This reasoning suggests that the demand-side effects of telecommunications on the economy — the second, third and fourth effects given above — should be emphasized in strategic activity over the supply-side effect described first.

Another reason for emphasizing demand-side effects rather than supply-side effects is the prospect that the restructuring of the telecommunications industry coming as a result of technological change and the Federal Telecommunications Act of 1996 will lead to massive layoffs in the traditional telecommunications industry. On January 2, 1996 for example, AT&T announced the coming elimination of 40,000 jobs, 13% of its workforce, over the next three years. An analyst quoted in Business Week[26] estimates an additional 60,000 traditional telecommunications jobs will be cut in the next five years, on top of the 250,000 cut since the Bell system breakup in 1984. These layoffs are a manifestation of "creative destruction"[27] that frees up resources for the founding and growth of new enterprises.

Job creation or job destruction

The AT&T layoff mentioned earlier raises the persistent question, do telecommunications and other information technologies destroy jobs faster than they are created? Or does information technology create more jobs than the supply of skilled people to fill them?

Two articulate policy analysts provide contrasting points of view:

Jeremy Rifkin, author of the book *The End of Work: The Decline of the Global Labor Force and the Dawn of the Post-Market Era*, has attracted national attention with a pessimistic view of the impact of technology deployment on job creation: "The global economy is in the midst of a transformation as significant as the Industrial Revolution. We are in the early stages of a shift from 'mass labor' to highly skilled 'elite labor,' accompanied by increasing automation in the production of goods and the delivery of services. Sophisticated computers, robots, telecommunications, and other Information Age technologies are replacing human beings in nearly every sector. Factory workers, secretaries, receptionists, clerical workers, sales clerks, bank tellers, telephone operators, librarians, wholesalers, and middle managers are just a few of the many occupations destined for virtual extinction. In the United States alone, as many as 90 million jobs in a labor force of 124 million are potentially vulnerable to displacement by automation." Rifkin compares the past and the present like this: "In the past, when new technology increased productivity — such as in the 1920s when oil and electricity replaced coal- and steam-powered plants — American workers organized collectively to demand a shorter workweek and better pay and benefits. Today, employers are shortening not the workweek, but the workforce — effectively preventing millions of American workers from enjoying the benefits of the technology revolution."

Michael Rothschild, author of the book *Bionomics: Economy as Ecosystem* provides us with a contrary, more optimistic view: "You might ask whether anyone predicted the millions of new jobs that have been created worldwide by the personal computer industry over the last decade. The short answer is no. The explosion of growth caught economic forecasters by complete surprise....Imagining the future structure of an economy undergoing radical change is all but impossible. When George Washington took office, 97 percent of Americans were farmers. Today, fewer than 3 percent work the land. If an 18th century Jeremy Rifkin had asked President Washington to describe in detail the jobs that would absorb the talents of Americans about to be pushed off the land, could he have listed tractor mechanics, air traffic controllers and telephone installers?" Rothschild worries about an inadequate supply of skilled labor in the United States. He states, "We do not produce enough skilled young people to fill all the potential jobs technology creates. Were it not for a steady influx of technically trained immigrants, America's high-tech boom would be choked off. By their ability to create products and services that were previously impossible, technically skilled workers create jobs for others with lower skill levels. There is no inherent limit to job growth. If job opportunities expand too slowly, it will be because America has too few high skill workers spawning jobs for others."

Both Jeremy Rifkin and Michael Rothschild urge that the challenges of the Information Age become the subject of a critical national debate.

Based on evidence such as the two studies cited above from Cronin, et al, the consultant authors of this report are firmly on the side of the understanding that information technology — consider-

ing the demand side effects across all industries -- offers net job creation for the Southern California region.

With the job creation question settled, there is no need for the Partnership to choose which of three demand-side mechanisms noted above should be emphasized to bring economic benefits from telecommunications deployment to the Southern California region. It is certain that all three of the mechanisms -- organizational restructuring, industry restructuring, and consumer consumption will be working to create new jobs.

Distribution of Economic Benefits

Another issue about which the Partnership and the Association have been made keenly aware in Advisory Group discussion is the distribution of telecommunications benefits among people of different economic standing. It is increasingly common to hear leaders with a conscience worrying about the "haves" and "have nots" in the use of telecommunications and information services. Considerations of supply and demand then arise around this telecommunications issue as well. Equally important as the concept of "have/have not" (referring typically to availability and affordability of services to the economically disadvantaged) are the concepts of "can/cannot" which refers to knowledge and skill levels, and of "want/want not" which refers to interest and motivation. These latter two concepts are drivers of demand.

Any effective program of distributional equity in the development and deployment of telecommunications applications requires attention to these concepts as well as availability and affordability. That said, it is incumbent upon a public-private cooperative partnership like the Southern California Economic Partnership to address distributional equity in its efforts to accelerate telecommunications deployment. In the format of the Knowledge Base, there is a data field for describing how the application differs in its market acceptance across economically advantaged and economically disadvantaged people, and whether there is a public interest in promoting access and use of the application by economically disadvantaged people.

Indicators

The economic impacts of implementing the Telecommunications Deployment Strategy should be assessed through multiple measurements that capture direct specific effects as well as broad general effects.

Specific telecommunications indicators capture direct effects of strategic intervention that attempt to change patterns of telecommunications production or usage.

- telecommunications service and equipment purchase and usage trends in the region and in the various subregions
- telecommunications consumption per capita in the region and in the various subregions
- telecommunications cost relative to other regions
- representation of Southern California firms on independently-generated lists of firms rated for best telecommunications usage
- size and strength of the regional telecommunications industry sector, including number of new jobs created.

General economic indicators capture broad effects that lie downstream from changed patterns of telecommunications usage. However, the broad effects described here are the result of multiple factors, not just telecommunications.

- regional economic output
- regional productivity
- per capita personal income in the region
- distribution of personal income in the region
- regional employment levels
- export performance of the region
- travel consumption per capita in the region

Conclusion

The Telecommunications Deployment Strategy provides a new, additional focus and motivation for the private and public efforts that are already deploying telecommunications in Southern California. The focus described here is justified because of the extraordinary magnitude of the mobility and air quality problems in the region.

At the same time, the telecommunications infrastructure, services, and applications that are deploying in the six counties of the region are nested within a National Information Infrastructure and a Global Information Infrastructure that along with transportation is a key mechanism for letting California perform competitively and successfully as part of the global economy.

The Association and the Partnership are convinced that the specific mobility enhancement focus of this plan indirectly yields the additional economic benefits of job creation, organizational productivity, and enhanced competitive performance by regional firms in addition to the travel-saving benefits that are sought directly.

The Telecommunications Deployment Strategy, if executed flexibly in response to changing environmental conditions, will establish Southern California's worldwide leadership in the application of telecommunications for mobility and access enhancement, while at the same time contributing to economic competitiveness, increasing service delivery efficiency, and improving quality of life.

References and Notes

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2. In Volume 2, Appendix G of the Regional Mobility Element cited in note 1, telecommunications is defined as "the conveyance of information by electronic means. Examples include the telephone, interactive cable facilities, computer networks and video conference centers." (page G-10) We have enhanced this definition by recognizing interactive (real-time, two-way) communications, by noting the optical part of the electromagnetic spectrum, and by stressing communications beyond easy consumer walking distance where vehicle travel begins to be the leading alternative to telecommunications.

3. This model benefits from consideration of the Integrative Technology Model, prepared by the Vicki Suter at the Davis Community Network. See the DCN/Smart Communities Project Description, provided in Appendix C.

4. Reports examined include California Public Utility Commission, Enhancing California's Competitive Strength: A Strategy for Telecommunications Infrastructure, November 1993; California Council on Science and Technology, Project California: A Blueprint for Energizing California's Economic Recovery, October 1993; The Governor's Council on Information Technology, Getting Results, March 1995; City of Los Angeles Special Advisory Committee on Technology Implementation, Final Report, January 1995; Joint Venture: Silicon Valley Network, The Joint Venture Way: Lessons for Regional Rejuvenation, 1995; Institute for Local Self Government (Sacramento), A Telecommunications Framework, November 1991; The National Information Infrastructure Advisory Council, Common Ground: Fundamental Principles for the National Information Infrastructure, March 1995; United States Department of Transportation, Transportation Implications of Telecommuting, April 1993; and United States Department of Energy, Energy, Emissions, and Social Consequences of Telecommuting, June 1994.

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26. "The Bloodletting at AT&T is Just the Beginning," Business Week, January 15, 1996, page 30.

27. This phrase was popularized by economist Joseph Schumpeter in reference to the continuing dynamic of old business organizations dying under the pressure of competition from newly created firms.

Glossary

Travel: The physical movement of people or material from one location to another using transportation.

Transportation: The means of physical movement of people and material, for example, the system of public roads and private and public vehicles.

Mode of transportation: The type of medium used to travel (example: vehicles).

Mobility: The ability to move people or material from one location to another. Transportation provides mobility.

Telecommunications: Interactive communications and other conveyance of information over a distance by electronic and optical means

Access: The ability of people to communicate with or travel to a distant location. Transportation and telecommunications both provide access.

Physical Accessibility: The ability or ease of all people to travel among various origins and destinations.

Electronic Accessibility: The ability or ease of all people to use telecommunications to connect with various distant locations.

Telecommunications Infrastructure: Cables, antennas, switches and other physical facilities that permit telecommunications.

Telecommunications Application: The deployment and use by one or more organizations of networks, hardware, software, and telecommunications services to carry out an organizational purpose such as service delivery to customers, or support of employees in dispersed locations. Examples of telecommunications applications are telecommuting, telemarketing, community networking.

Telecommunications Deployment: The increasing societal usage of telecommunications.

Telework: Any use of telecommunications that changes the location of workers or facilitates their mobility.

Telecommuting: Using the telephone, computer networks, and other telecommunications to work at home or at telework centers, instead of commuting. Telecommuting is a particular type of telework.

Teleservice: Any use of telecommunications to make service available to customers in a non-traditional location through electronic access.

Telelogistics: Any use of telecommunications that modifies the transportation of freight and other material.

Appendices

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