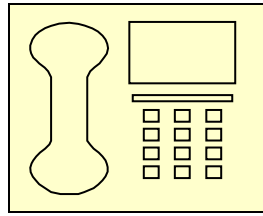


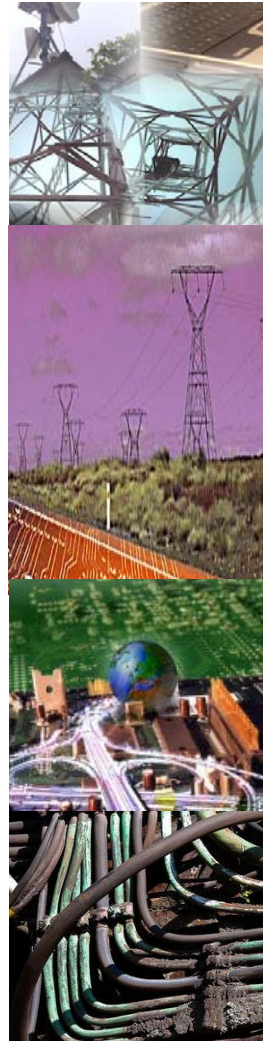
Implications of Telecommunications Technology Investment

Overview

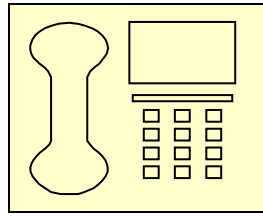


2

- Introduction to the Information Economy
- Brief History of Telecommunications Technology
- Locational Considerations and System Efficiency
- Relationship with Transportation
 - ▣ Teleworking and Social Connectivity
 - ▣ Intelligent Transportation Systems
- Summary



The Information Economy



3

- Telecommunications has been seen as the foundation for “post-industrial” economies.
 - Shift from manufacturing to service focus
 - Shift from financial to knowledge capital as fundamental resource

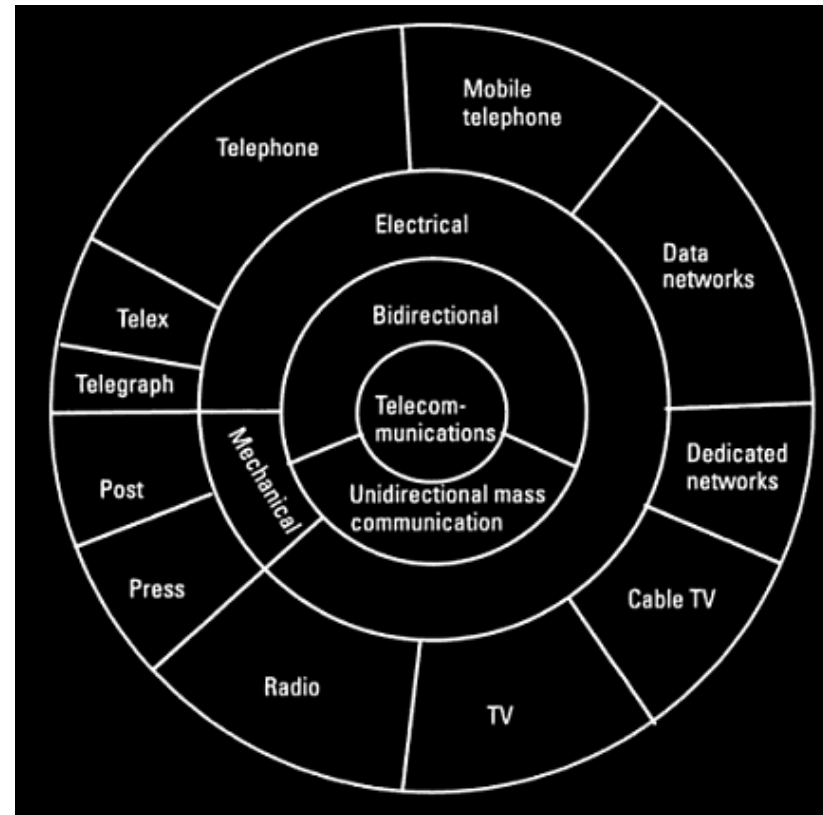
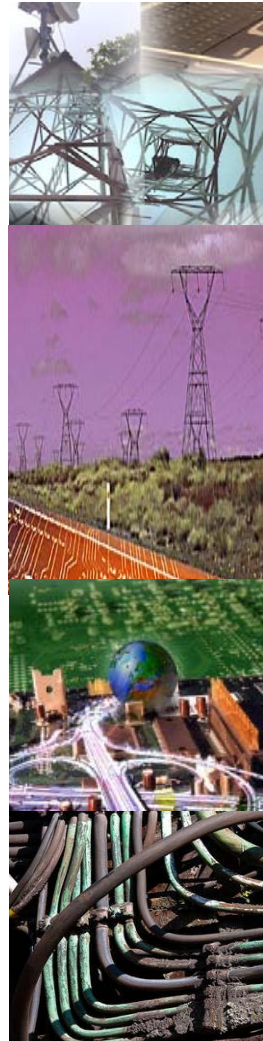


Figure 1: The Telecommunications Industry (From Anttalainen, 2003)

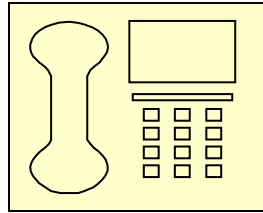
SOURCES:

Goddard, J., and Gillespie, A. (1986) “Advanced Telecommunications and Regional Economic Development” *The Geographical Journal.*, 152(3)

Anttalainen, T. (2003) *Introduction to telecommunications network engineering: 2nd Edition.*



Telecom Technology Timeline



4

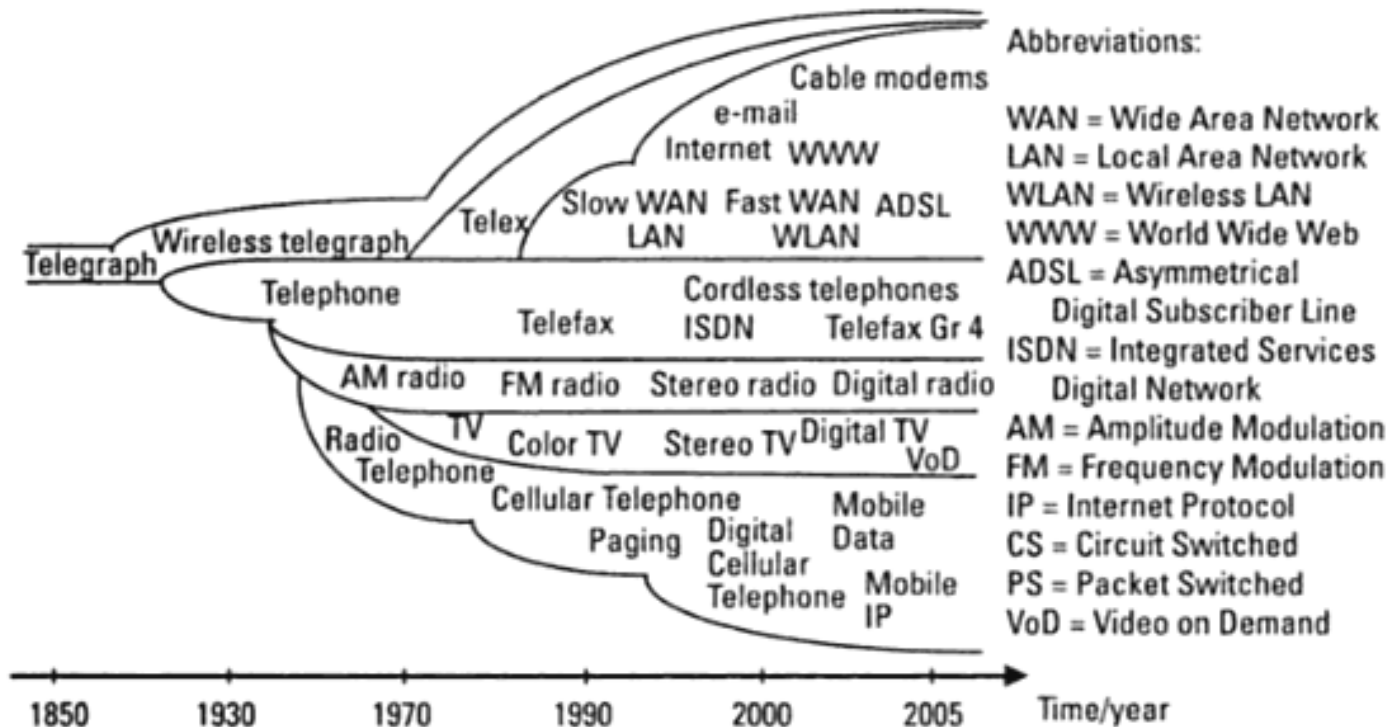
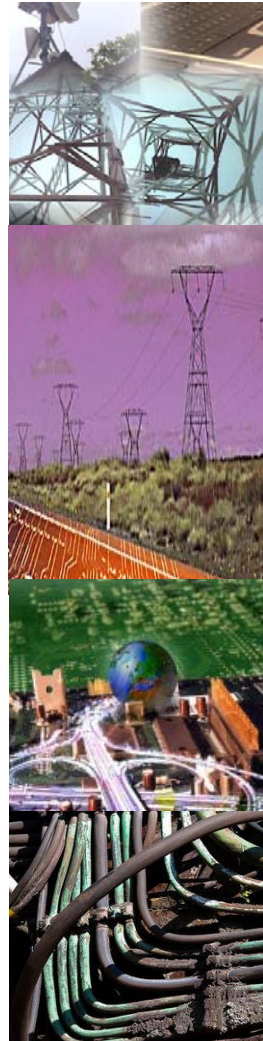
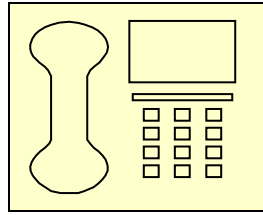


Figure 2: Development of Telecommunications Systems and Services (From Anttalainen, 2003)

SOURCE: Anttalainen, T. (2003) *Introduction to telecommunications network engineering: 2nd Edition.*

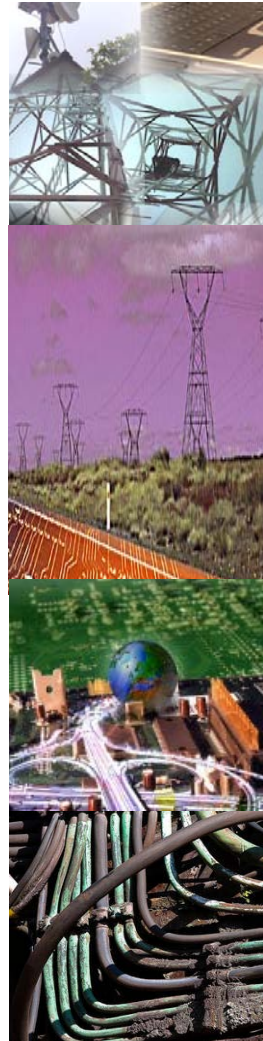


Technical Efficiency

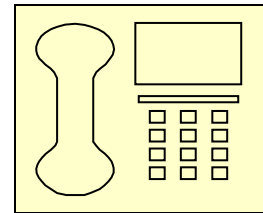


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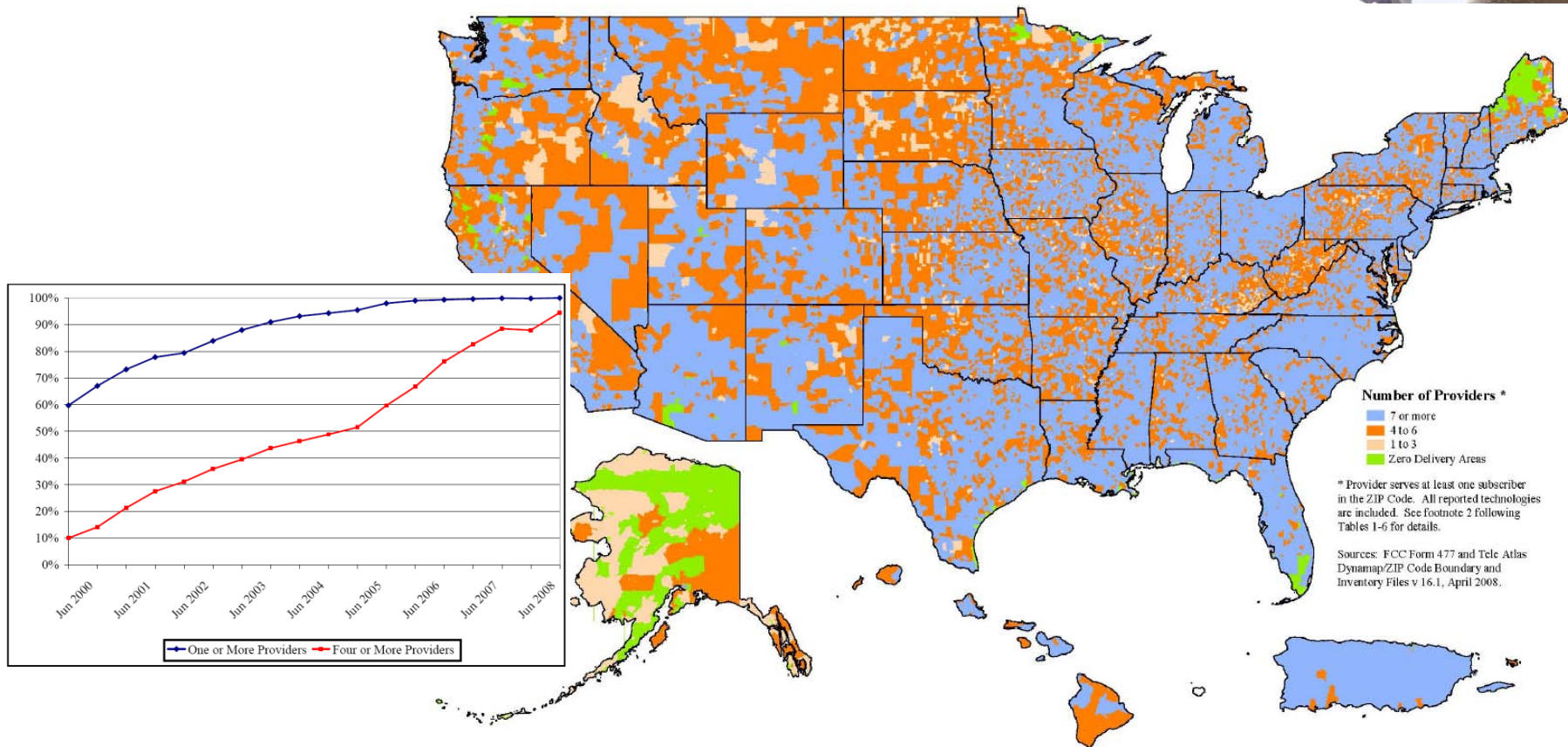
- **Basic telecom services:** “plain old telephone service” (POTS)
- **Advanced services:** broadband services such as digital subscriber line (DSL), cable modem, fiber, wireless, satellite, and broadband over powerline (BPL).
- **Infrastructure Types:**
 - ▣ **Wireline System:** Transmission through copper wire or fiber optic cable. Consists of customer services equipment, transmission facilities, and switches.
 - ▣ **Land-based Wireless:** Transmits voice and data using radio waves, to mobile or stationary receivers. Consists of transmitters, receivers, repeaters, plus switches and points of interconnection to the wireline network.
 - ▣ **Satellite:** Communications satellites can be used to provide different types of services such as radio, telephone, data, television, and imaging. Capable of providing services over wide geographic areas, and often used in underserved or remote areas.
 - ▣ **Cable:** Distributes signals, via coaxial or fiber optic cable, or satellite. Cable operators may use poles, a microwave link, or underground cable.



System Efficiency (1)

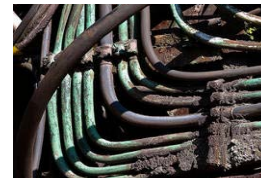


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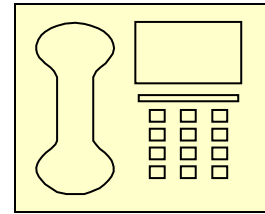


Figures 3 & 4: Zip codes with high-speed internet providers as of June 30, 2008 (From FCC 2009)

SOURCE: FCC (2009) *High-Speed Services for Internet Access: Status as of June 30, 2008*. Industry Analysis and Technology Division, Wireline Competition Bureau.



System Efficiency (2)



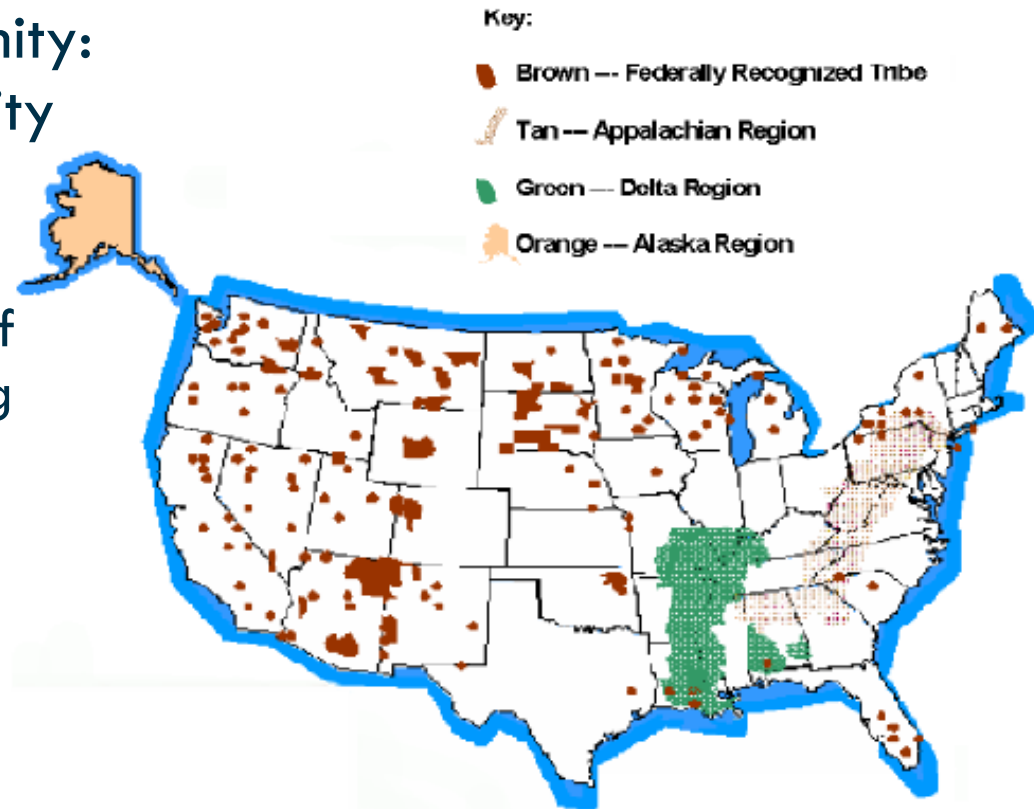
7

□ FCC “Lands of Opportunity: Building Rural Connectivity Outreach Program”

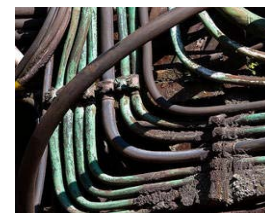
■ To enable the social and economic development of rural regions by fostering

- Distance learning,
- E-commerce
- E-government
- Telemedicine

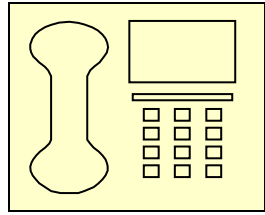
Through broadband telecommunications services



Figures 5: Target areas for the FCC “Lands of Opportunity” Program

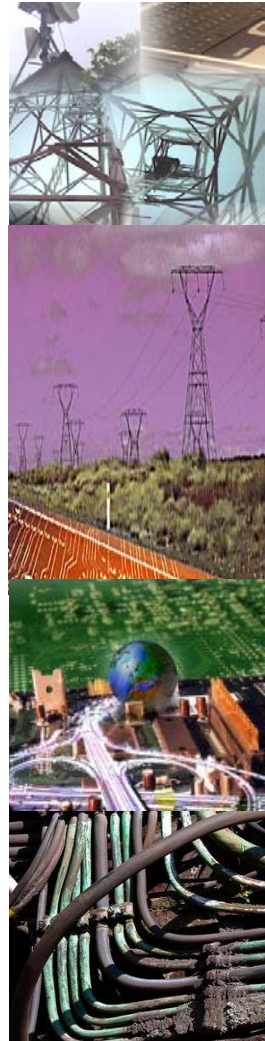


Integration with other Sectors

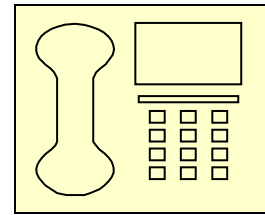


8

- Transportation
 - ▣ Teleworking
 - ▣ Social networking, online commerce, etc.
 - ▣ Intelligent Transportation Systems (ITS)

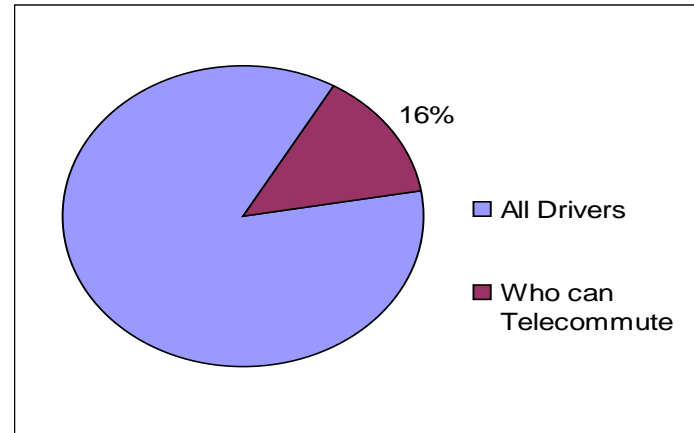
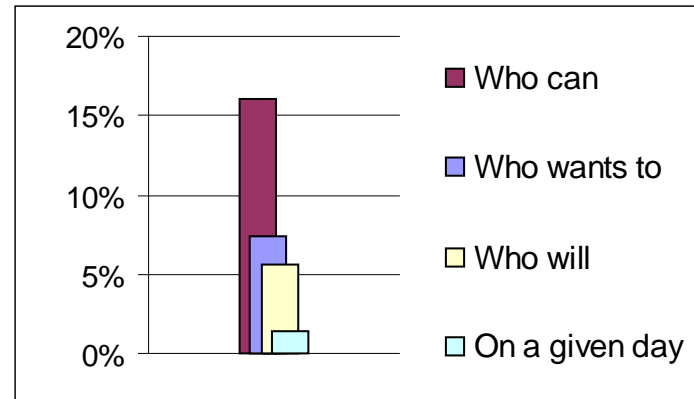


Teleworking (1)

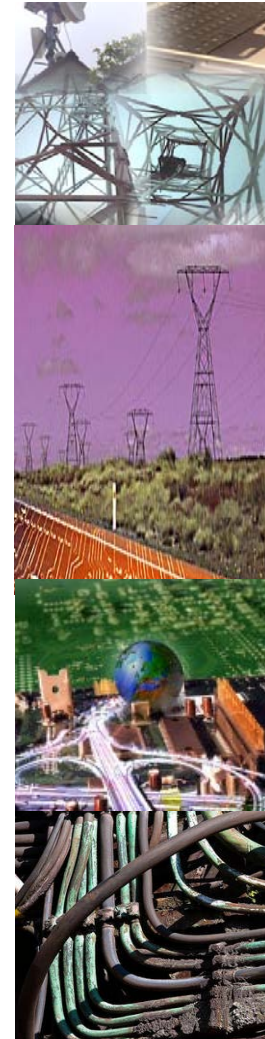


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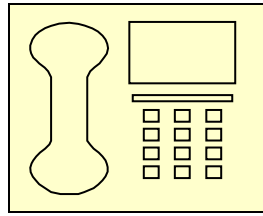
- ▣ Five motivations to telework:
 - Work
 - Family
 - Leisure/ independence
 - Commuting
 - Ideology (pro-environment)



Figures 5 & 6: Percentages of drivers who can telecommute (From Mokhtarian 1998)

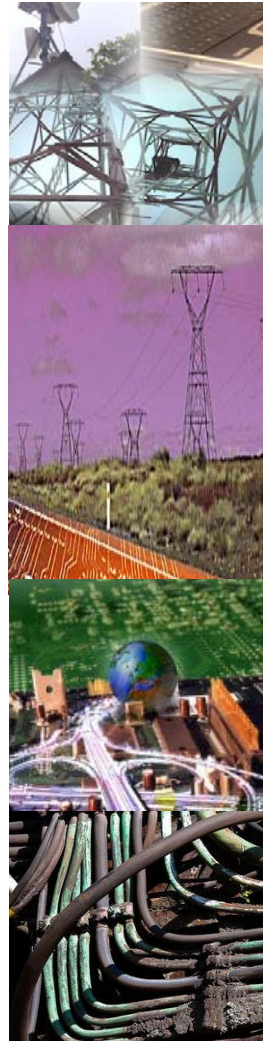


Teleworking (2)



10

- 0.5 - 1% net reduction in VMT due to telecommuting.
- Workplace Effects
 - ▣ Increased productivity of teleworkers (+)
 - ▣ Decreased absenteeism of teleworkers (+)
 - ▣ Decreased productivity of non-teleworkers (-)

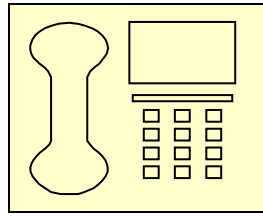


SOURCES:

Butler, S., Aasheim, C. and Williams, S. (2007) "Does Telecommuting Improve Productivity?: Seeking Solid evidence of demonstrable productivity gains." *Communications of the ACM*, 50(4)

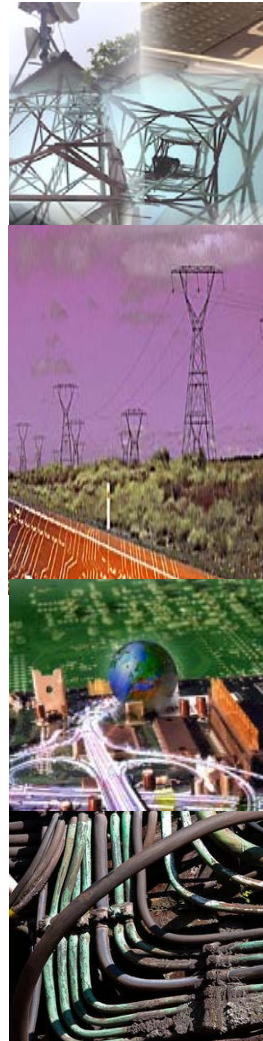
Mokhtarian, P. (1998) "A Synthetic Approach to Estimating the Impacts of Telecommuting on Travel" *Urban Studies*, 35(2)

Other Human-element Transportation Impacts



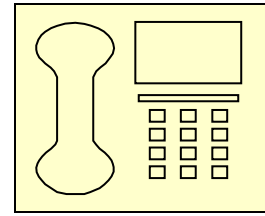
11

- Telecommunications infrastructure can induce travel demand through:
 - Social Networking
 - Increased awareness of activities of interest
 - Expanding network of personal and business relationships
 - Stimulation of economic growth, which stimulates travel
 - Reduced disutility of travel by making travel time more productive



SOURCE: Mokhtarian, P. (1998) "A Synthetic Approach to Estimating the Impacts of Telecommuting on Travel" *Urban Studies*, 35(2)

Intelligent Transportation Systems (1)



12

□ Traditional ITS

Technologies:

- ▣ Ramp Metering
- ▣ Transit Information
- ▣ Electronic Payment and Credentialing
- ▣ Transportation Management Centers

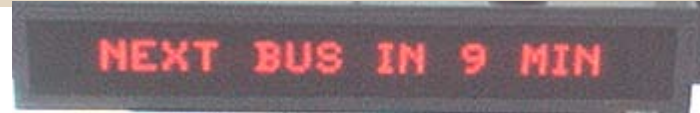
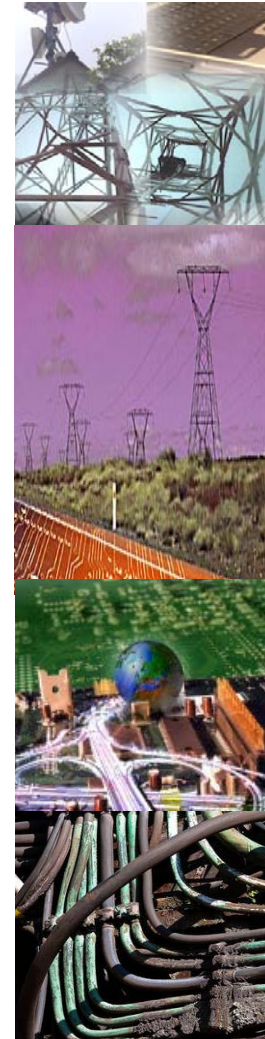


Figure 7: Los Angeles Metro Rapid Real-Time Arrival Sign (From USDOT)

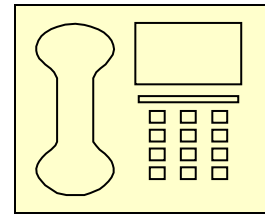


Figure 8: Ramp metering diagram (From New Zealand Transit Agency)



SOURCE: Row, S. (2009) "Future of the ITS Program" Presentation to the ITS America 2009 Annual Meeting, Plenary Session: "A New Era in Transportation – A Federal Perspective." Research and Innovative Technology Administration, USDOT. Tuesday June 2, 2009.

Intelligent Transportation Systems (2)



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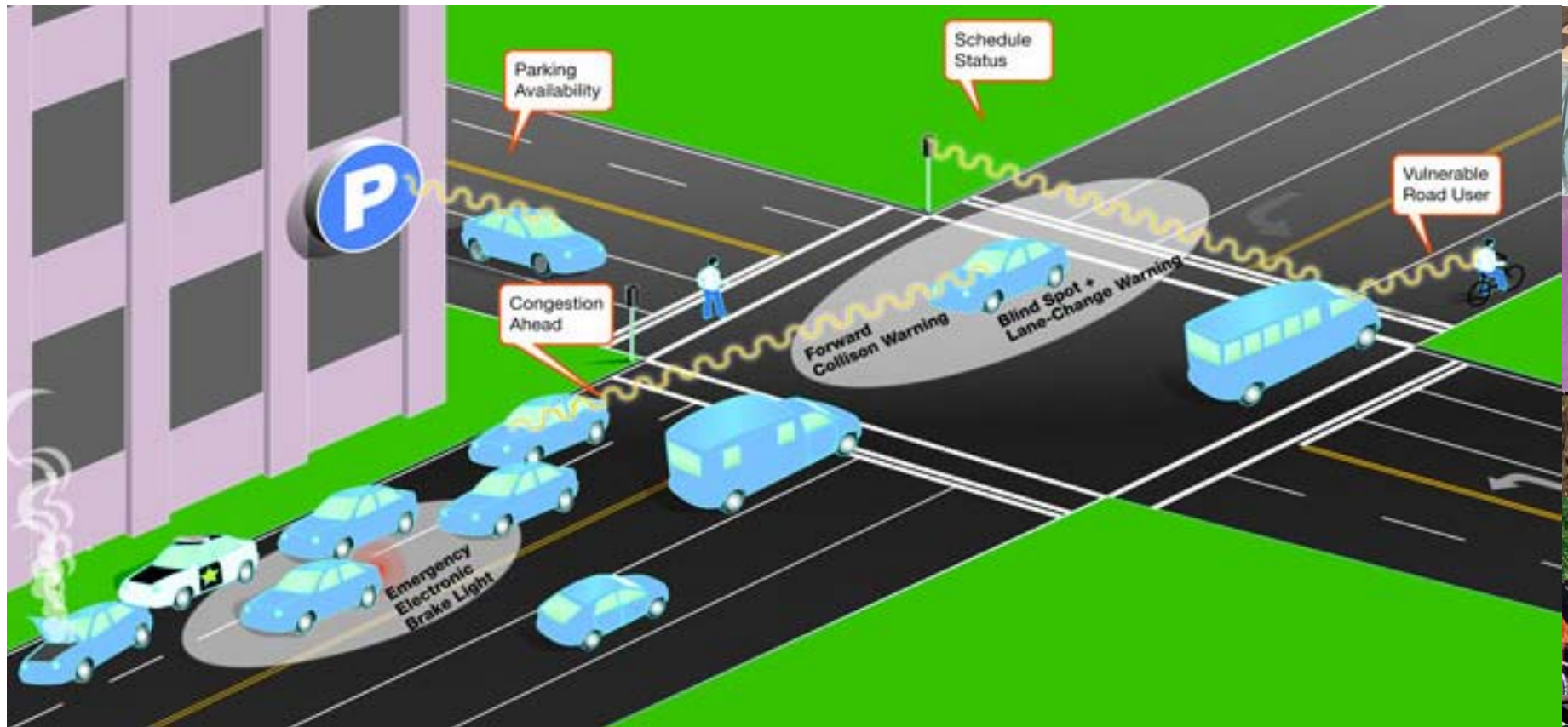
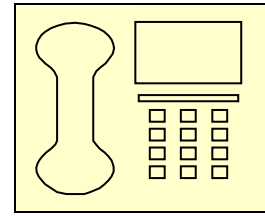


Figure 9: Intellidrive systems (formerly “Vehicle Infrastructure Integration” (VII)) consist of Vehicle to Vehicle (V2V), Vehicle to Infrastructure (V2I), and Vehicle to Device (V2D) Wireless communications.

SOURCE: http://www.its.dot.gov/intellidrive/intellidrive_overview.htm



Intelligent Transportation Systems (3)



14

□ Vision for 2009 ITS Strategic Plan

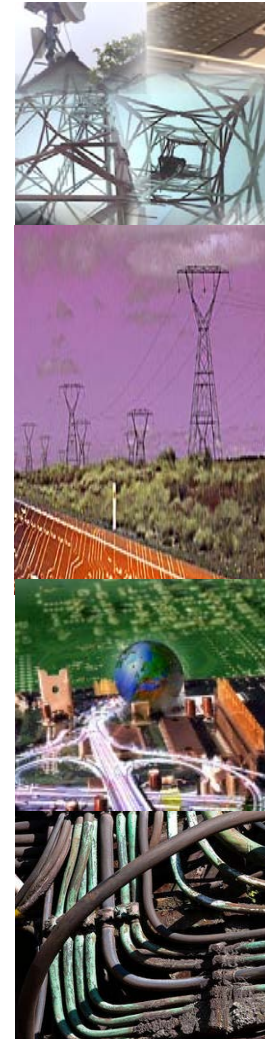
- A national, multimodal surface transportation system that features a connected transportation environment among vehicles, the infrastructure, and portable devices to serve the public good by leveraging technology to maximize safety, mobility, and environmental performance.

STRATEGIC INITIATIVES

SAFETY

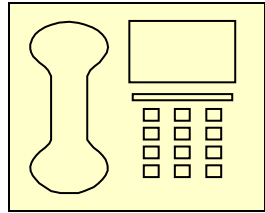
MOBILITY

ENVIRONMENT



SOURCE: Row, S. (2009) "Future of the ITS Program" Presentation to the ITS America 2009 Annual Meeting, Plenary Session: "A New Era in Transportation – A Federal Perspective." Research and Innovative Technology Administration, USDOT. Tuesday June 2, 2009.

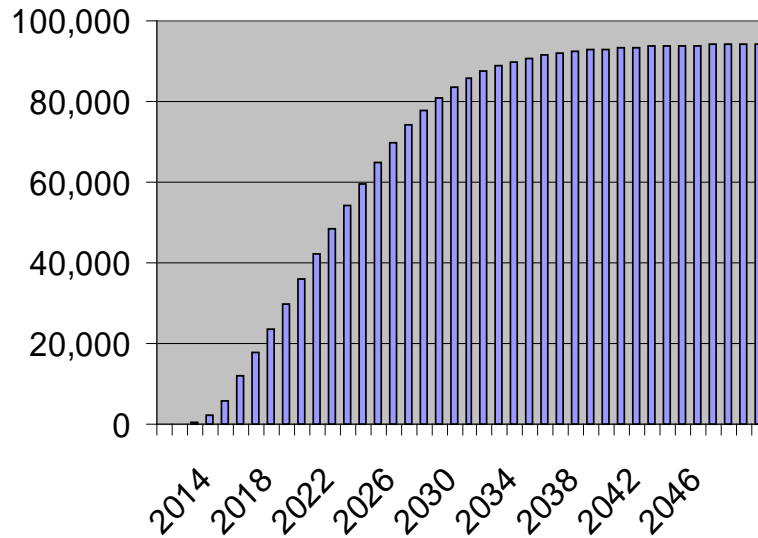
ITS STRATEGIC INITIATIVES (1)



SAFETY

Outcome: Significant reduction in crashes, injuries, fatalities and associated economic costs

Goal: Transformative safety through vehicle and infrastructure connectivity



Estimated Number of Vehicle Crashes PREVENTED by VII

The safety benefits of a project are expressed in terms of expected reductions in injuries and fatalities on the transportation network resulting from the project in question. These reductions are converted into monetary terms using standardized values.

Estimated 1.9% reduction in total annual vehicle crashes by 2050.

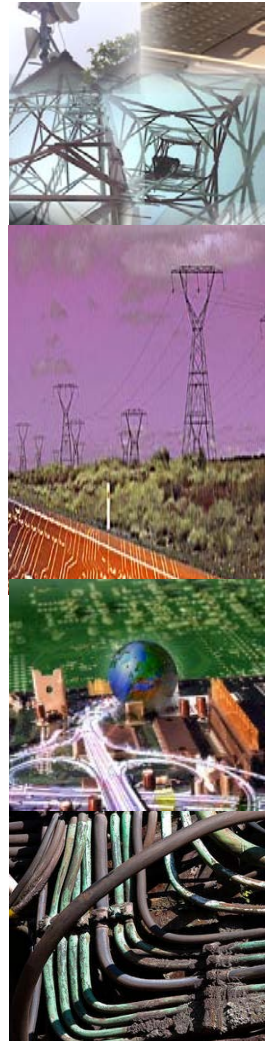
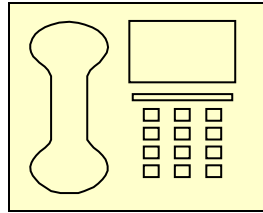


Figure 10: Prevented crashes as ITS is deployed

ITS STRATEGIC INITIATIVES (2)



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MOBILITY

Outcome: Significant improvements in mobility that result in more sustainable and livable communities

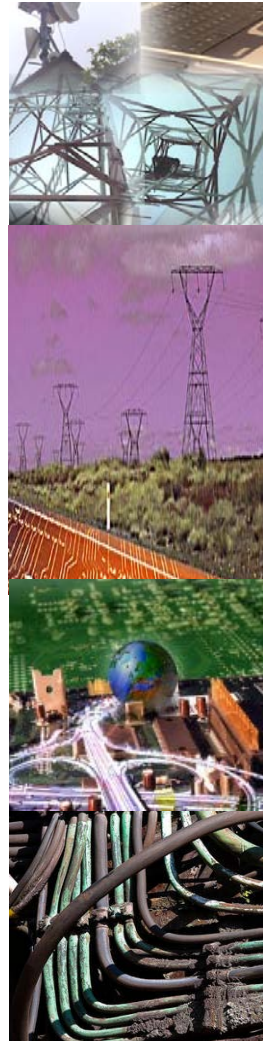
Goal (1): Capture complete, real-time information on all roads and all modes to support transformational system performance.

Goal (2): Achieve transformational transportation management and system performance through vehicle and infrastructure connectivity.

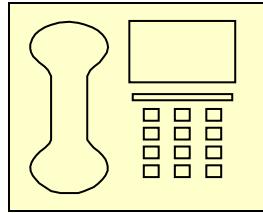
Goal (3): Realize “next generation” electronic payment systems that support transformational system performance

Mobility benefits refer to the improved ability of travelers to reach destinations and to reduce the required amount of travel time, for example by reducing congestion delays. Time savings and delay reductions, measured in hours, are converted to dollar terms using standardized values. These values are typically pegged to average wage levels, since wages represent the marketplace trade-off between time and money.

Estimated 1.7 million hours of delay reduction per year due to signal timing.



ITS STRATEGIC INITIATIVES (3)



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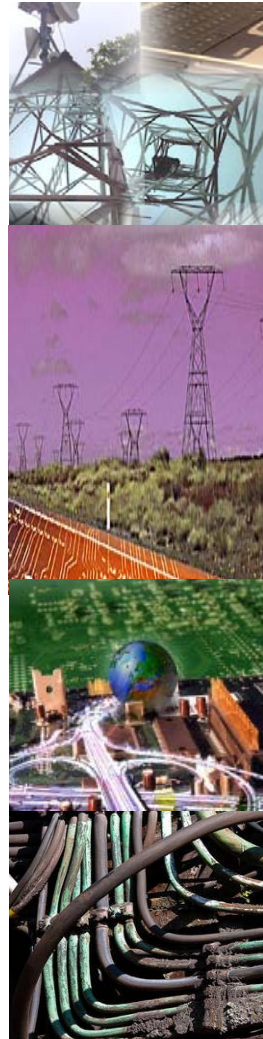
ENVIRONMENT

Outcome: Reduced transportation impact on the environment and improved livability

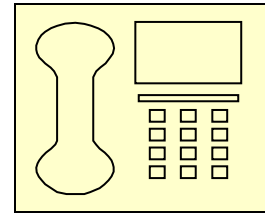
Goal: Enable environmental management through vehicle and infrastructure connectivity

Environmental benefits stem from reduced vehicle emissions and other pollutants, for example from reductions in vehicle idling time. Again, changes in quantities (e.g. tons of carbon monoxide) are converted into monetary terms using standardized values.

Estimated 1.1 million gallons of gasoline saved, and 9,600 tons of CO₂ emissions avoided per year due to signal timing.



ITS BCA (1) COST Summary



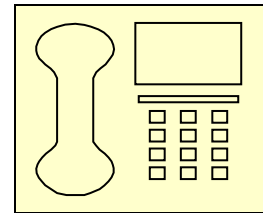
18

- Initial infrastructure installation is estimated to cost \$5 Billion, spent over a 5 year period.
- Installation of VII equipment and systems on all sold vehicles will cost over \$1 Billion per year at full deployment.
- Total present value of all implementation costs estimated at \$27.3 Billion, including
 - ▣ Initial infrastructure installment
 - ▣ On-board vehicle equipment
 - ▣ Operations and maintenance costs



SOURCE: DOT/RITA (2008) "Vehicle-Infrastructure Integration (VII) Initiative Benefit-Cost Analysis: Version 2.3 (Draft)"

ITS BCA (2) Benefit Summary



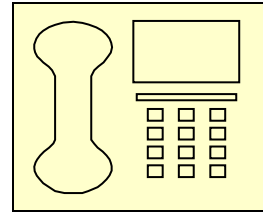
19

- Present value sum of benefits from eight of the applications of VII estimated at \$44.2 Billion. Benefits from other applications cannot yet be calculated and are presently excluded.
- About 95% of benefits result from reduced crashes, with other 5% from improved mobility and other “positive private and societal impacts.”
- Net Benefits: \$16.9B
- Benefit Cost Ratio: 1.6 to 1



SOURCE: DOT/RITA (2008) “Vehicle-Infrastructure Integration (VII) Initiative Benefit-Cost Analysis: Version 2.3 (Draft)”

ITS Deployment Timelines (1)



VII Light Vehicle Fleet Penetration

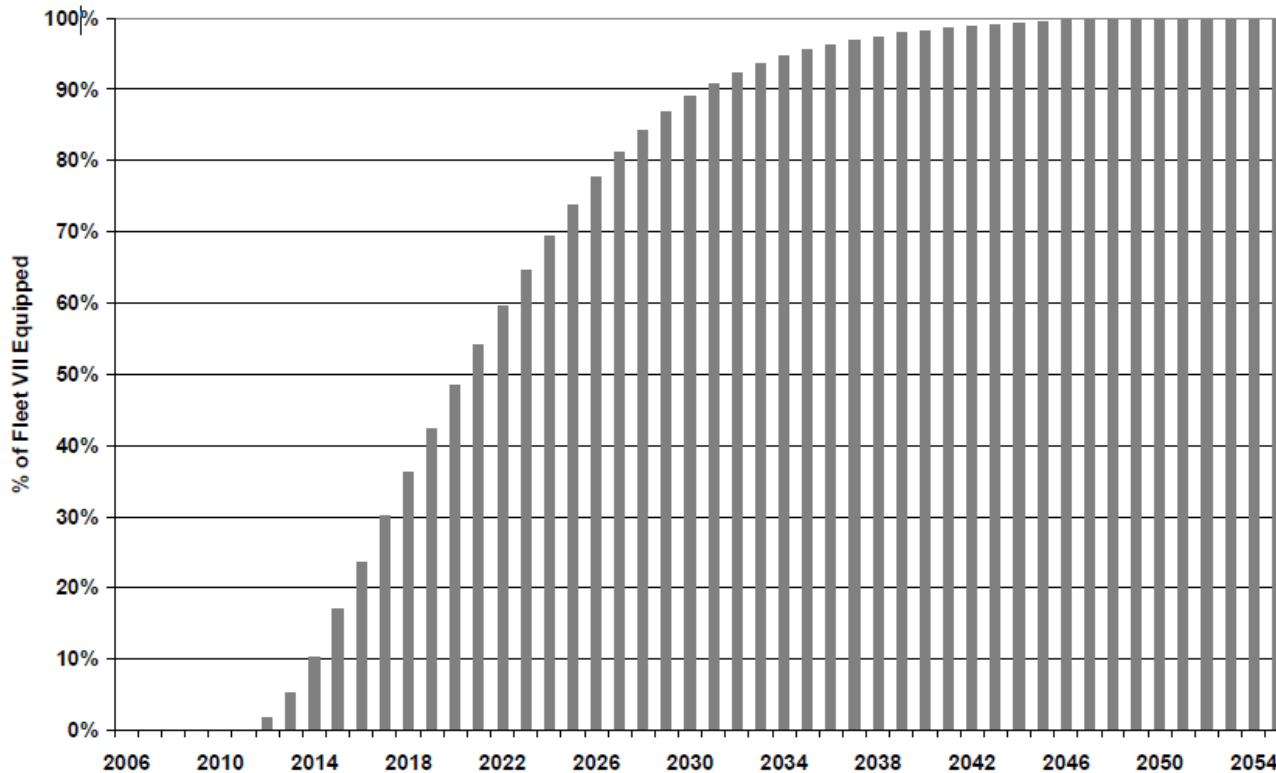
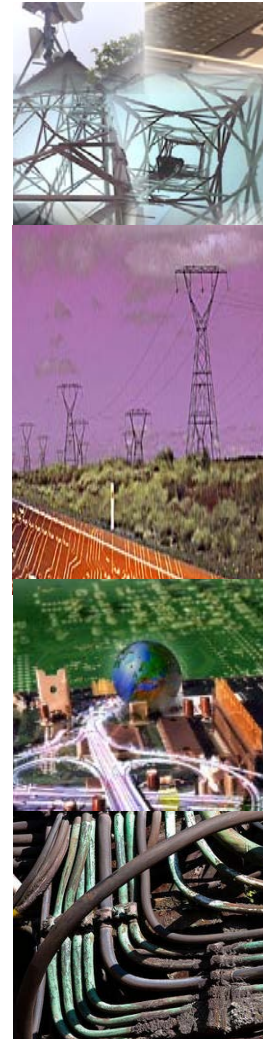
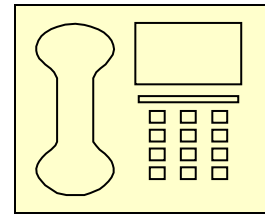


Figure 11: Trajectory of VII equipped light vehicle fleet over time

SOURCE: DOT/RITA (2008) "Vehicle-Infrastructure Integration (VII) Initiative Benefit-Cost Analysis: Version 2.3 (Draft)"



Public-Private Partnership (1)



- Infrastructure development is primarily managed by the public sector, but vehicle stock is manufactured in the private sector.
- Public-private partnership is required to accommodate timely, national deployment, and it has the potential to maximize both public and private benefits.

Table 1: Major stakeholders in ITS deployment

Public	Private
Public agency infrastructure owners and operators	Motor vehicle manufactures
Federal government as policy maker and provider of funds	Equipment and systems providers
Users of the system	Communications systems providers



Public Private Partnership (2)

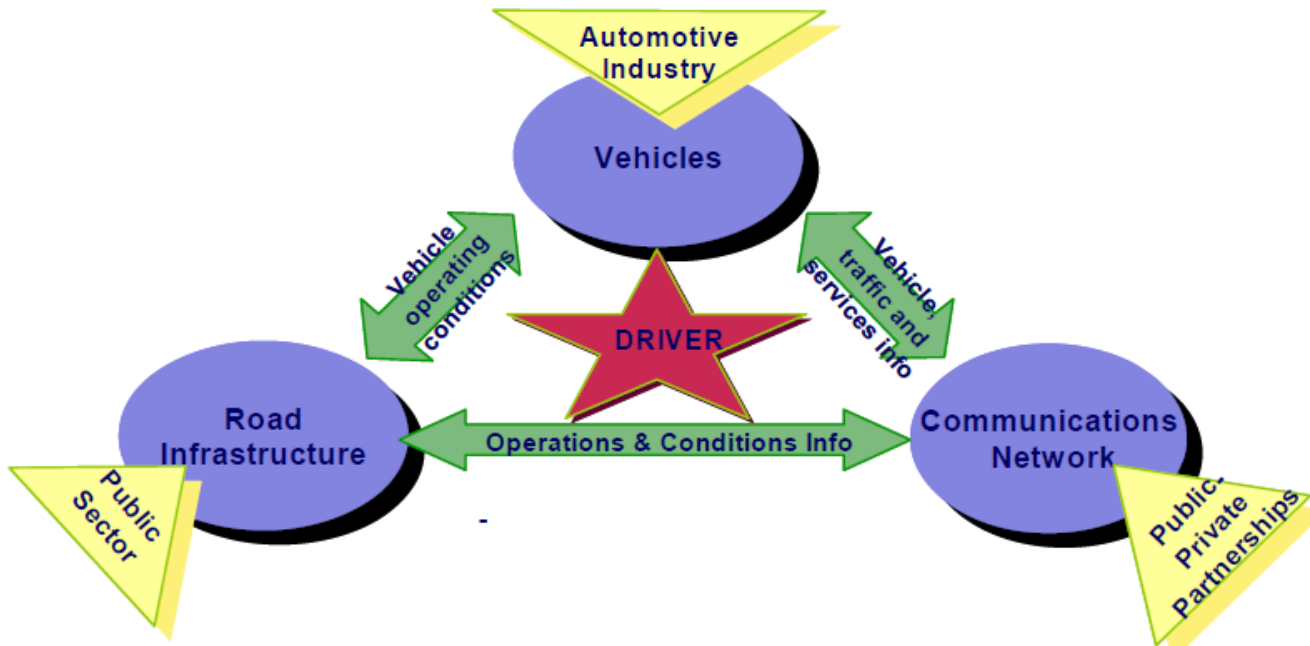
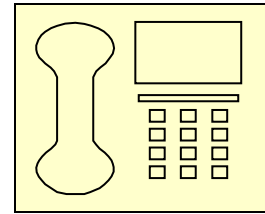
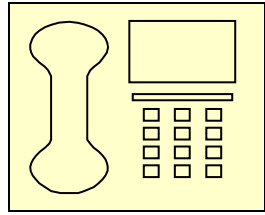


Figure 12: New service relationships required by VII implementation



Questions?



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