Implications of Telecommunications Technology Investment
Overview

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

Technical Efficiency

- **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.

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

System Efficiency (2)

- 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

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

- 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:

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

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)

**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
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.

Goal: Transformative safety through vehicle and infrastructure connectivity

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
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.
ENVIRONMENT

Goal: Enable environmental management through vehicle and infrastructure connectivity

Outcome: Reduced transportation impact on the environment and improved livability

*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

- 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

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

ITS Deployment Timelines (1)

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

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

<table>
<thead>
<tr>
<th>Public</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public agency infrastructure owners and operators</td>
<td>Motor vehicle manufactures</td>
</tr>
<tr>
<td>Federal government as policy maker and provider of funds</td>
<td>Equipment and systems providers</td>
</tr>
<tr>
<td>Users of the system</td>
<td>Communications systems providers</td>
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SOURCE: FHWA (2005) Public-Private Agreements/Arrangements Associated with V2I Implementation
Public Private Partnership (2)

**Figure 12:** New service relationships required by VII implementation

Questions?