Exploring the Future of Integrated Transportation Systems in the U.S. from 2030 to 2050: Application of A Scenario Planning Tool

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Presentation Overview

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• Delphi Approach
• Focal Question

• Scenario Worlds and Signposts
• Scenario Workshop Results
• IATS Driving Forces: Barriers and Opportunities
• Response to Driving Forces
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Introduction

• In October 2010, FHWA launched a project with the Transportation Sustainability Research Center (TSRC) and Cogenia Partners to explore how the nation’s transportation system will evolve during the 21st century.

• The project was motivated by a need to advance understanding on what types of strategies and transportation investments are most practical under a range of plausible future scenarios.
Project Objectives

I. Explore feasibility of an Integrated Active Transportation System (IATS), where all vehicles in all modes of transport are seamlessly interrelated, sharing information, and actively adapting to current local situations and the larger system state.

II. Identify viable approaches to integration and assess possible technical implementation.

III. Develop deployment strategy that addresses barriers and exploits opportunities.

IV. Develop a research framework to facilitate realization of the IATS concept.

V. Create strategic roadmap for IATS realization, 20 and 40 years into future.
Defining IATS

• An exploration into 21st century transportation

• A more effective and robust transportation system
  – Multidisciplinary approach
  – Integrating existing ITS and new energy technologies

• A means of adapting infrastructure for natural disasters and climate change

• An optimization of transportation systems with an emphasis on safety and mobility
Scenario Planning Methodology

• Strategic planning tool supported by FHWA as enhancement to traditional planning process

• Envision plausible and provocative descriptions of how critical forces may interact and unfold in future

• Prepare, plan, and develop alternatives for range of outcomes

• Examine social and economic variables that may affect transportation system

• Monitoring key indicators enables organizations to recognize shifts leading to realization of one future in contrast to another

• Adaptive decisionmaking that optimizes outcomes
Delphi Approach

A structured survey method based on the assumption that collective judgments are more reliable than individual ones

• Requires consultation of experts through multiple phases
  – Results from one stage are provided to and elaborated on by the next round’s experts

• Delphi approach was applied to the formation of a focal question and scenario quadrants in four workshops

• Individuals provided a variety of expertise
  – Social
  – Political
  – Legal
  – Economic
  – Environmental
  – Energy
  – Technology
Delphi Approach to Scenario Planning

Three-stage scenario planning process

1) Initial steering committee discussion
   – PURPOSE: Identify driving forces and initial focal question for each scenario world

2) Scenario planning workshops
   – Experts represented the following disciplines
     – Transportation
     – Technology
     – Sociology
     – Economics
     – Energy
     – Policy
     – Planning
     – Freight
     – Futuristics
   – PURPOSE: Identify potential disruptive scenarios and leading indicators

3) Final steering committee session
   – PURPOSE: Recommend an additional stakeholder survey at the national, state, and regional levels
The Scenario Development Process

1. Define Focal Issue, Question, or Decision, and a Relevant Timeframe
2. Review Past Events & Discuss Alternative Interpretations

- Identify Driving Forces
- Identify Critical Uncertainties
- Develop Plausible Scenarios
- Discuss Implications & Paths

Workshop 1

Workshop 2
IATS Focal Question

“What is the most effective strategy for evolving a convenient, safe (i.e., system security and human safety), robust (i.e., survivable, adaptable, and resilient), and efficient transportation system in 2030 and 2050?”
2030 & 2050 Scenario Worlds

2030 Scenario Worlds:
I. Natural Disaster World
II. Changing Economies World
III. Cyber-Terrorism World

2050 Scenario Worlds:
I. Climate Catastrophe World
II. Changing Production World
III. Resource Constrained World
## Key Signposts of Scenario Worlds

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<td>Meteorological conditions that result in many unpredictable disasters</td>
<td>Increased outsourcing of manufacturing to foreign countries</td>
<td>Degradation of environment as a result of carbon and other GHG emissions</td>
<td>Breakthroughs and investments in alternative energy sources</td>
<td>Product prices increasing due to rising input costs</td>
<td>Fully autonomous technologies realized</td>
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<td>Technology-based prediction systems</td>
<td>Increased unemployment (lack of jobs and skilled labor force)</td>
<td>Increased regularity of severe weather events</td>
<td>Use of clean energy</td>
<td>International food shortages</td>
<td>Multiple failback systems in effect</td>
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<td>Increasing import/export ratio</td>
<td>Changes in animal migration patterns and extinction of certain species</td>
<td>Creation of more efficient energy products</td>
<td>Increase in international competition for resources</td>
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<td>Economic slowdown</td>
<td>Adoption of green lifestyle choices</td>
<td>Reduced dependency on petroleum</td>
<td>Collapse of resource-poor nations</td>
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<td>Increase in the number of green businesses</td>
<td>Decline in imports</td>
<td>More cold wars</td>
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Scenario Workshop Results

- Participants identified most significant non-technical driving forces likely to affect transportation:
  - Increased population
  - Increased urbanization
  - Constrained petroleum resources
  - High energy costs

- Importance of foresight and adaptation to:
  - Changing economies
  - Changing political sentiment
  - Changing social acceptance
  - Climate change/severe weather
Political and Economic: Driving Forces

BARRIERS:

• Updating infrastructure requires large initial investment

• Technology funding perceived as regressive tax on lower-income bracket

OPPORTUNITIES:

• Public-private partnerships

• International collaboration

• New funding schemes
  – Local-level distributed funds vs. state and federal funding
  – New/revised taxes
Social: Driving Forces

**BARRIERS:**

- Loss of autonomy
- Privacy concerns
- Distrust of failback system
- Cyber-terrorism

**OPPORTUNITIES:**

- Changes in social norms
  - Willingness of younger population to share personal information
  - Potential for increased living density due to lack of available land and fuel
Environmental: Driving Forces

**BARRIERS:**

- Climate change
- Natural disasters
- Inadequate transportation infrastructure

**OPPORTUNITIES:**

- Using post-natural disaster construction to upgrade infrastructure
- Employing ITS in construction of infrastructure to withstand climate change
Response to Driving Forces

- When energy resources are abundant
  - Introduce truck-only lanes to expedite freight movement
  - Create an electricity metering system to collect taxes on electric vehicles to pay for transportation infrastructure growth and maintenance

- When resources are constrained
  - Shift the focus of ITS toward the streamlining of the nation’s freight system (e.g., electrically-powered rail)
  - Improve the efficiency of mass transportation systems

- When government is fiscally challenged
  - Discover unconventional funding sources to continue the development and deployment of ITS technologies
  - ITS concepts and benefits must be marketed to the public
  - Make road sensor data more readily available to third parties to create new industries focused on optimized routing and mode choice information (increase sensors)

- When climate change occurs and natural disasters are common
  - ITS technologies adapt to provide more efficient evacuation and rescue operations
Future Testing Grounds

- Public transit systems
  - Improve safety
  - Reduce congestion
  - Reduce energy use
  - Reduce emissions

- Carsharing (shared-use vehicle systems)
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