



Tomorrow's Transportation Market

Developing an Innovative, Seamless Transportation System

Exploratory Advanced Research . . . Next Generation Transportation Solutions

With the cost of congestion in the United States estimated to be in the order of \$121 billion,¹ transportation planners are under increasing pressure to improve conditions and meet projected demand increases. Harnessing emerging technologies to develop an entirely new type of decentralized transportation system to help meet this challenge is the goal of "Engineering Tomorrow's Transportation Market," a Federal Highway Administration (FHWA) Exploratory Advanced Research (EAR) Program study awarded to the University of Southern California.

Market Goals

The primary goals of the Transportation Market are to: (1) radically transform transportation systems by more efficiently utilizing available transportation resources; (2) reduce congestion and pollution by increasing the average number of passengers per vehicle; (3) make more transportation options available to consumers; (4) and increase the number of transportation providers by facilitating entrance into the market. To demonstrate how these goals might be reached, the project researchers are creating a real-time distributed system for negotiating routes and prices between consumers and transportation providers (companies or private citizens) who are willing to offer available capacity in the Transportation Market.

Emerging Technologies

The Transportation Market system will be based on single-item auction mechanisms and game theoretic models (used to study decisionmaking) that exploit the wealth of available traffic data and computational models. Consumers and providers will remotely access the Transportation Market and either request a specific trip or provide competing offers for a particular route, as shown in Figure 1. The system makes use of several emerging information technologies, particularly focusing on the rapidly growing information infrastructure and development of intelligent transportation systems. Real-time information will be utilized to dynamically price the transportation options that form the basis of the market. As transportation infrastructure and vehicles become equipped with more sensors, interconnected data systems, multiway communication devices, and on-board computers, a wealth of new real-time and dynamic data about traffic conditions will become available.

Making Use of Unused Capacity

Many significant advances have been made to provide real-time traffic information that can be used to effectively control transportation systems; however, this information has been applied with limited success to centralized transit system design and operation. As the workplace continues to move further away from core central business districts, the need to develop a decentralized system to supply transportation services becomes essential to meet the changing demands.

This project examines innovative technologies that can be used to develop such a decentralized transportation system, referred to here as the "Transportation Market." This integrated system would place a value on idle and unused transportation resources and offer real-time allocation of resources in response to shifting demand.

¹ "2012 Urban Mobility Report," Lomax, T., Schrank, D., Eisele, B., Texas A&M Transportation Institute, 2012 (<http://mobility.tamu.edu/ums/report/>).

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Market Complications

Several complex modeling, implementation, and computational issues must be resolved before the Transportation Market can be implemented successfully. Determining the appropriate fare for multiple passengers has led to extensive research into the following areas: market-based mechanisms, autonomous agents, and computational and planning tools. These different components must all interact properly and result in a platform for the Transportation Market that can deliver short and cheap travel, show a profit for vehicles in a system with a large number of riders and vehicles, and handle multiple modes of transportation and different types of trips.

Market Simulation

The project is developing a simulator with modules that replicate the Transportation Market and are able to model a future transportation system based on the market. The software will be open access so that other researchers and companies can use it as a basis for their own work and eventually for commercialization and market implementation. Over the duration of the project, this simulation framework will gradually be scaled up so that researchers will be better equipped to analyze an increasingly complex transportation market. Several outreach activities are planned, including conference participation and an invitational workshop with leaders in the field of dynamic ridesharing. These will help share the team's research findings and provide the team with the most current information about the state of practice in dynamic transportation markets.

In the short term, the Transportation Market could be used to supplement the current public transit system as a transportation alternative to increase mobility and ride sharing. In the long term the Transportation Market may be able to replace the current public transit system and reshape the transportation landscape. "A fully implemented Transportation Market could greatly increase the capacity and efficiency of our transportation system and substantially reduce urban congestion," said Jeremy Raw at FHWA. "In the near term, the lessons learned in this EAR Program project will contribute to the

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EXPLORATORY ADVANCED RESEARCH



What Is the Exploratory Advanced Research Program?

FHWA's Exploratory Advanced Research (EAR) Program focuses on long-term, high-risk research with a high payoff potential. The program addresses underlying gaps faced by applied highway research programs, anticipates emerging issues with national implications, and reflects broad transportation industry goals and objectives.

To learn more about the EAR Program, visit the Exploratory Advanced Research Web site at www.fhwa.dot.gov/advancedresearch. The site features information on research solicitations, updates on ongoing research, links to published materials, summaries of past EAR Program events, and details on upcoming events. For additional information, contact David Kuehn at FHWA, 202-493-3414 (email: david.kuehn@dot.gov), or Terry Halkyard at FHWA, 202-493-3467 (email: terry.halkyard@dot.gov).

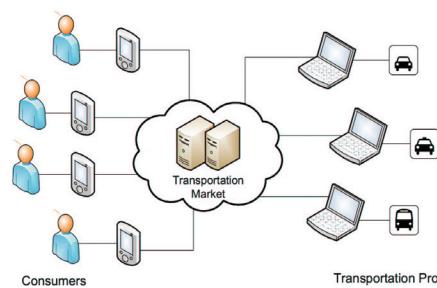


Figure 1. The Transportation Market structure.

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continuing emergence of innovative market-based options for urban mobility," he added.

Learn More

For more information on this EAR Program project, contact Jeremy Raw, FHWA Office of Planning, at 202-366-0986 (email: jeremy.raw@dot.gov).