

# TECHNICAL SUMMARY

U.S. Department  
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## Federal Highway Administration

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## TravTek Operational Test Evaluation Final Reports

Safety

This technical summary announces the availability of a series of eight final reports that provide detailed results for nine studies performed as part of the TravTek operational test of an advanced traveler information system (ATIS) and advanced traffic management system (ATMS). Consistent with the goals of the Intelligent Transportation Systems (ITS) program, the TravTek test addressed the following eight basic questions:

1. Did the TravTek system work?
2. Did drivers save time and avoid congestion?
3. Will drivers use the system?
4. How effective were the visual turn-by-turn and moving map displays?
5. How effective was voice guidance?
6. Was TravTek safe?
7. Could TravTek benefit travelers who do not have the TravTek System?
8. Will people be willing to pay for TravTek features?

### Introduction

TravTek, short for "Travel Technology," was an ITS operational field test. The purpose of TravTek was to perform research, development, test, and evaluation of ATIS and ATMS concepts. TravTek was performed under a joint public and private partnership.

The TravTek system consisted of three major components: 100 TravTek vehicles, the Orlando Traffic Management Center (TMC), and the TravTek Information and Services Center (TISC).

The TravTek vehicles were equipped with route planning and route guidance software and hard-

ware and a directory of local services and attractions. To support the conduct of research studies, vehicles were configured with different levels of ATIS capabilities. Vehicle configurations were defined on the basis of the capabilities provided to the drivers:

- Services (S). This configuration provided access to a local services and attractions data base, local assistance and emergency services, and a complete tutorial on the TravTek in-vehicle system.
- Navigation (N). This configuration included the Services functions and also included navigation, route planning, and route guidance functions.
- Navigation Plus (N+). This configuration presented the capabilities of the Navigation configuration with the addition of up-to-date data communicated by the TMC. The up-to-date data included link travel times and incident information. These data were used by the route planning function to calculate best travel time routes.

Of the 100 vehicles, 75 were rented to Orlando visitors as part of a year long Rental User Study. Most of the remaining vehicles were used in other evaluation studies.

The Orlando TMC, operated by the city of Orlando, collected travel time and incident information from a variety of sources and broadcast travel and congestion information to the TravTek vehicles. The TravTek vehicles served as one source of travel time information as each vehicle broadcast its travel times across network links once each minute.

The TISC provided help desk services to TravTek users and maintained navigational and local information data bases. The TISC and TMC operated around the clock during the 1-year test.



## The TravTek Studies

The TravTek evaluation was composed of nine individual, yet integrated studies. Figure 1 presents an overview of the relationships among the studies. The Field Studies and Field Experiments provided the significant bulk of the empirical results for the operational test. These studies provided input to major analytical efforts including the Safety, Modeling, and Architecture Evaluation Studies. The following presents brief discussions for each of the TravTek studies.

**Rental User Study.** The Rental User Study provided TravTek vehicles to 4,354 drivers, primarily Orlando visitors. Rental users provided questionnaire and debriefing assessments of TravTek, and their use of the vehicles was recorded in electronic data logs in the vehicle, at the TMC, and at the TISC.

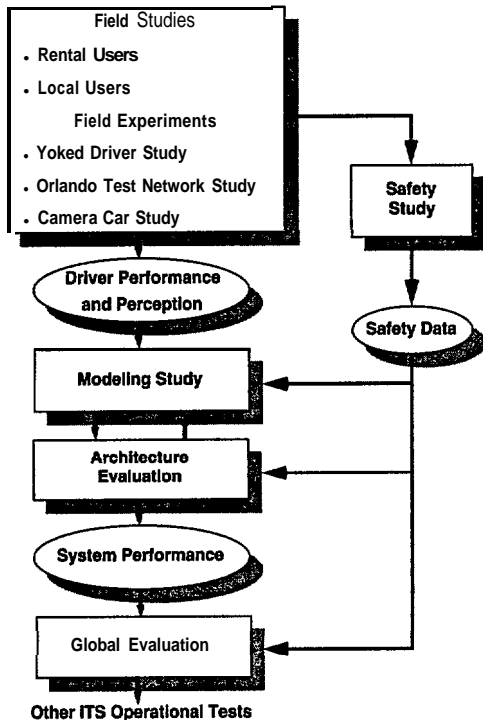


Figure 1. Overview of TravTek Evaluation

**Local User Study.** In the Local User Study, 53 Orlando residents each drove a TravTek vehicle for 6 to 8 weeks. In addition to examining how local users would use the system, this study examined how use changed over time. Due to similarities in methods and results, the Rental and Local User Studies are reported in a single final report.

**Orlando Test Network Study.** The Orlando Test Network Study was a controlled field experiment to

examine driving and navigation performance as a function of the display alternatives offered by the TravTek system. Two visual route guidance displays were evaluated: a Turn-by-Turn display that minimized the information content presented, and a moving map display that showed planned routes superimposed over an electronic version of a traditional map. A supplemental synthesized speech system was evaluated both by itself and in combination with the two visual displays. The study examined performance both in day and night driving environments.

**Yoked Driver Study.** The Yoked Driver Study focused on the benefits of real-time information. In this study, sets of three vehicles left the same origin for the same destination at the same time. One vehicle in each set was configured to each of the three vehicle configurations, only one of which used real-time information. Trips in this study were made during the evening-peak travel period.

**Camera Car Study.** The Camera Car Study focused on safety issues related to the use of ATIS displays. What made the Camera Car Study unique was the additional data collection instrumentation added to the test vehicle. Four video cameras were installed. One camera was focused on the driver's eyes and enabled detail examination of glance patterns. Other cameras recorded the roadway environment, lane tracking, and driver hand and foot movements. Additional sensors in the camera car recorded lateral and longitudinal acceleration, steering wheel position, and vehicle speed. In addition, the Camera Car Study provided the ability to test the performance of younger drivers, and measure the effects of different levels of experience with TravTek on driving performance and use of the system.

**Modeling Study.** The objectives of the Modeling Study were to extrapolate benefits from the data obtained in the field studies and experiments. These projected benefits were assessed for varying levels of market penetration and congestion. Benefits were projected for TravTek system users as well as for drivers of non-TravTek equipped vehicles. A traffic simulation model was used to extrapolate effects. The simulation model produces measures of effectiveness for travel time, travel distance, fuel consumption, vehicle emissions, and safety.

**Safety Study.** The Safety Study examined the accident experience of TravTek vehicles, evaluated the safety impact of various in-vehicle display alternatives, and projected the safety impact of a fully deployed TravTek system to both system users and to other drivers. One component of the Safety Study was the integration of safety related results across all

TravTek empirical and analytical studies. Derived empirical relationships were used in the Modeling Study to project safety benefits as a function of level of market penetration.

**Architecture Study.** The Architecture Evaluation Study analyzed TravTek’s hardware, software, and data base triad as a system, verified system accuracy, established system reliability, assessed system design alternatives, and examined system staffing and operation requirements.

**Global Study.** The Global Study integrated and summarized **the findings** of the other **evaluation** studies, and provided observations and recommendations regarding the partnership process under which the operational test was conducted.

## Results

Figure 2 presents an overview of the results derived from the operational test. These results are from the TravTek Modeling and Safety Studies. The TravTek operational test resulted in measurable benefits in terms of travel time, travel distance, number of wrong turns, number of vehicle stops, and safety. In addition, modeling studies projected fuel consumption and emissions benefits for a fully deployed system. The following presents selected results determined from each of the separate studies.

The TravTek Architecture study showed that the system worked well. The TravTek system showed

high levels of reliability during the 1-year test period. The Orlando Test Network Study demonstrated that, for trips to unfamiliar destinations, TravTek users saved considerable trip planning time and travel time. The Yoked Driver Study reported that TravTek vehicles using real-time **information** avoided congestion without incurring a travel time penalty. Based on results of the Yoked Driver Study, the Modeling Study projected that real-time information would yield a net benefit to both TravTek users and drivers of non-equipped vehicles at most of the market penetration levels that were examined. The Camera Car Study and the Safety Study concluded that the introduction of the TravTek device in vehicles does not pose a safety risk. These studies also concluded that most TravTek display configurations are likely to yield a safety benefit.

The Local and Rental User studies demonstrated that both visitors and drivers familiar with the local area frequently used TravTek for trip planning and route guidance. These studies also reported that the median price users said they were willing to pay for a TravTek-like system was about \$1000.

The Global Study served to present the results of all TravTek studies in an integrated manner. Also presented are the lessons learned from the conduct of the test and evaluation. The TravTek operational test demonstrated the safe and effective use of ITS under real-world conditions by potential users of deployable systems. As a research project, the operational

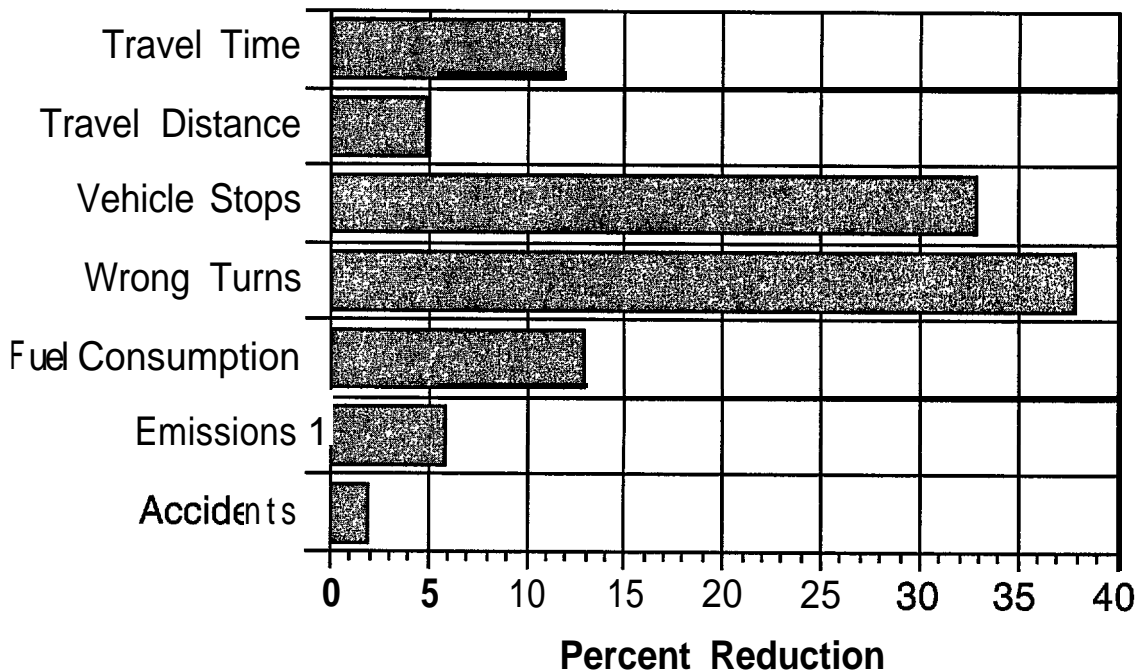


Figure 2. Summary of results (from TravTek Modeling and Safety Studies).

test provided a wealth of data that allowed the testing of a wide range of hypotheses of interest and critical importance to the transportation community. For additional information on TravTek, consult the TravTek series of final reports:

TravTek Evaluation Rental and Local User Study  
publication no. FHWA-RD-96-028

TravTek Evaluation Task C<sub>3</sub> Camera Car Study  
publication no. FHWA-RD-94-076

TravTek Evaluation Orlando Test Network Study  
publication no. FHWA-RD-95-162

TravTek Evaluation Yoked Driver Study  
publication no. FHWA-RD-94-139

TravTek Evaluation Safety Study  
publication no. FHWA-RD-95-188

TravTek Evaluation Modeling Study  
publication no. FHWA-RD-95-090

TravTek System Architecture Evaluation  
publication no. FHWA-RD-94-141

TravTek Global Evaluation  
and Executive Summary  
publication no. FHWA-RD-96-031

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Distribution-This technical summary is being distributed according to a standard distribution. Direct distribution is being made to the Regions and Divisions.

Availability-Copies of TravTek Evaluation Task C<sub>3</sub> Camera Car Study, publication no. FHWA-RD-94076; TravTek Evaluation Yoked Driver Study, publication no. FHWA-RD-94-139; and TravTek System Architecture Evaluation, publication no. FHWA-RD-94-141 are now available. Copies of TravTek Evaluation Safety Study, publication no. FHWA-RD-95-188; TravTek Evaluation Rental and Local User Study, publication no. FHWA-RD-96-028; TravTek Evaluation Orlando Test Network Study, publication no. FHWA-RD-95-162; TravTek Evaluation Modeling Study, publication no. FHWA-RD-95-090; TravTek Global Evaluation and Executive Summary, publication no. FHWA-RD-96-031 will be available early in 1996. The publications may be ordered from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161. A limited number of copies will be available from the R&T Report Center, HNR-11, Turner-Fairbank Highway Research Center, 6300 Georgetown Pike, McLean, Virginia 22101-2296, phone no. 703-285-2144.

Key Words--TravTek, ATIS, ATMS, M-IS, ITS, Evaluation.

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