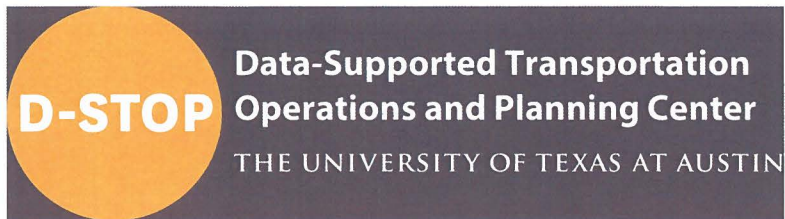


**Program Progress Performance Report**



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Project Title: Data-Supported Transportation Operations and Planning (D-STOP) Center

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Signature: 

## 1. ACCOMPLISHMENTS

### ***What are the major goals of the program?***

The Data-Supported Transportation Operations and Planning (D-STOP) Center's vision is to be a national and international multimodal and multidisciplinary center of excellence that promotes the integration of cutting-edge developments in wireless sensor networks and communications technology with transportation systems to improve the United States' economic competitiveness. This vision will be implemented through a research mission, an education and workforce development mission, and a technology transfer mission.

D-STOP's *research mission* is to develop fundamentally new methodologies to better harness traditional and recent data sources, and potentially develop new sources, in seeking to improve models for transportation planning and traffic operations. D-STOP research will occur in three areas: operations, planning, and technology, with significant priority placed on work that cuts across these areas.

The *education and workforce development (EWD) mission* is to build a transportation workforce that is able to use multi-disciplinary approaches to address multi-dimensional complex problems, through an emphasis on real-time data analysis and processing, the study of the dynamics underlying human activity-travel decision-making, and training on the effective use of information technology innovations.

D-STOP's *technology transfer (TT) mission* is to disseminate information on research activities and findings, and actively promote the utilization and implementation of research products/findings through demonstrations on small-scale networks (in collaboration with industry and public agency partners).

### ***What was accomplished under these goals?***

#### ***Research Program Accomplishments***

D-STOP's research activities will focus on harnessing innovative technologies and data sources to develop architectures and systems for data collection and analysis. The research will foster economic competitiveness through its focus on gathering and analyzing data to support effective and efficient decision-making. The major research accomplishment during the first six-month period was the development of the research agenda in coordination with the D-STOP faculty and researchers. So far, three projects have been identified, and work on these projects is in the beginning stages:

#### Transit demand and routing after autonomous vehicle availability (PI: Stephen Boyles)

Autonomous vehicles (AVs) create the potential for improvements in traffic operations as well as new behaviors for travelers such as car sharing among trips through driverless repositioning. Most studies on AVs have focused on technology or traffic operations, and the impact of AVs on planning is currently unknown. Development of a planning model integrating AV improvements to traffic operations and the impact of new traveler behavior options will soon be of practical interest as AVs are currently test-driven on public roads. The altered traveler preferences may affect mode choice, leading to changes in transit demand and transit provider cost. An analysis of the model on metropolitan planning data will provide predictions on the impact of general AV ownership on network conditions.

Objectives:

- Model the impact of autonomous vehicle availability on traveler behavior.
- Predict how increasing AV ownership will impact traffic.
- Provide guidance to school on how household AV ownership will affect bus service.

#### Cell Phone Data for Travel Forecasting (PI: Jennifer Duthie)

Little guidance exists on how to calibrate and validate planning models with anything except for very aggregate count data. With more data available than ever before, guidance is needed on how to calibrate and validate models that take advantage of this data. This project will focus on origin-destination trip

matrix data aggregated from cell-phone providers. The research team will acquire a dataset, evaluate its validity by comparing it to other data sources, and will report on the potential for the data to be used as input to a transportation planning model.

Objective:

- Evaluate the validity of cellular data-based travel demand matrices.
- Make recommendations for how cellular data can be incorporated into the planning process.

#### Semi-Autonomous Parking for Enhanced Safety and Efficiency (PI: Sriram Vishwanath)

This project focuses on the use of tools from a combination of computer vision and localization based navigation schemes to aid the process of efficient and safe parking of vehicles in high density parking spaces. The principles of collision avoidance, simultaneous localization and mapping together with vision based actuation in robotics will be used to enable this functionality.

Objectives:

- Establish a simulation plan for semi-autonomous parking management.
- Building a 4 robotic vehicle test bed to test algorithms in practice.
- Determine if there can be increased efficiency in the use of physical space towards parking.

DSTOP researchers have also partnered with the Dallas Police Department to study new technologies for monitoring parking space availability. The research team will evaluate alternative technologies, perform analysis of parking space data, and identify directions for improvement and best practices.

**Research Results Disseminated:** Nothing to report for this period.

**Plans for Next Reporting Period to Accomplish Research Goal:** Have all D-STOP research efforts identified, initiated, and underway. Identify and invite individuals from industry to be members of the Center's Business Advisory Council (BAC). Provide support, guidance, and assistance to project Principal Investigators so individual research project objectives can be achieved.

#### **Education and Workforce Development Accomplishments**

The research projects outlined above have three students working on them. MS transportation student, Michael Levin (supervised by Stephen Boyles), is involved in the autonomous vehicles project, undergrad civil engineering student, Ben Wallach, is involved in the cell phone data project, and graduate student Yan Gao is participating in the semi-autonomous parking project.

D-STOP is also currently working with KIPP-Austin, the 2nd largest charter school in the Austin-area to help optimize bus routes, and their transportation planning. At KIPP, 86% of students are low-income, and 90% are minorities. KIPP provides bus services for students located throughout Austin to their campuses, and currently, those bus schedules are created by hand. Dr. Stephen Boyles and his graduate student, Michael Levin, are working with KIPP to reduce bus costs while meeting constraints of capacity and maximum student travel time through vehicle routing problem methods. Using travel time data from dynamic traffic assignment models of Austin, they have implemented the Clarke-Wright heuristic, which merges stops into routes in order of greatest savings. Preliminary results indicate new routes that are guaranteed to satisfy the constraints (as some of the current KIPP bus routes do not) as well as modest reductions in the number of routes. These improvements are due to routes that use more of the bus capacity and have slightly higher average and maximum student travel time.

Preliminary discussions have also been held to organize an undergraduate interdisciplinary summer internship program.

#### **Education and Workforce Development Results Disseminated:**

Outreach Activity: Dr. Sanjay Shakkottai was a distinguished lecturer at the tenth annual Edison Lecture Series on February 5, 2014 (the event was to continue on Feb 6 and 7, but due to inclement weather the remaining two days of the series were postponed until May 2014). The Edison Lecture Series, a Science,

Technology, Engineering and Mathematics (STEM) Education Coalition program, invites middle and high school students and their teachers to a three-day workshop on the UT-Austin campus. The theme for 2014 is on mobile computing, and will be used as a platform to engage and excite youth from around central Texas about computing and engineering. During the past nine years, the series has reached nearly 26,000 students in the Austin area.

**Plans for Next Reporting Period to Accomplish Education and Workforce Development Goal:**

Involve more graduate and undergraduate students in the research being conducted by the Center. Complete the organization of an undergraduate interdisciplinary summer internship program.

**Technology Transfer Accomplishments**

Technology transfer activities will be pursued to deliver timely information on research activities and findings. These activities include: creating a D-STOP website, producing high quality peer-reviewed journal papers, and supporting researcher travel to participate in conferences that disseminate research results.

D-STOP website: The D-STOP website is under development and will provide information about the Center. It will include a listing of current research projects being conducted, as well as educational information, technology transfer, news and events, publications, and resources applicable to the overall D-STOP effort. The website address will be [dstop.utexas.edu](http://dstop.utexas.edu)

Publications: Two papers, whose research is partially supported by D-STOP, are being revised for possible publication in journals. The papers are:

"A New Estimation Approach to Integrate Latent Psychological Constructs in Choice Modeling," by Chandra Bhat and Subodh Dubey, under review, *Transportation Research Part B*.

"The Composite Marginal Likelihood (CML) Inference Approach with Applications to Discrete and Mixed Dependent Variable Models," by Chandra Bhat, under review, *Foundations and Trends in Econometrics*.

Presentations: Two D-STOP faculty researchers, Dr. Stephen Boyles and Dr. Todd Humphreys have been invited to give presentations at the upcoming Center for Transportation Research Annual Symposium on Wednesday, April 23, 2014. The theme of this year's symposium is "Celebrating 50 Years of Innovation."

**Plans for Next Reporting Period to Accomplish Technology Transfer Goal:** Complete D-STOP website design and launch the site. Continue to support researchers as they present their research results through peer-reviewed publications and professional presentations.

## 2. PRODUCTS

**Publications, conference papers, and presentations:**

Publication (under review): Bhat, C.R., "The Composite Marginal Likelihood (CML) Inference Approach with Applications to Discrete and Mixed Dependent Variable Models," *Foundations and Trends in Econometrics*, under review.

Publication (under review): Bhat, C.R., and S.K. Dubey, "A New Estimation Approach to Integrate Latent Psychological Constructs in Choice Modeling," *Transportation Research Part B*, under review.

**Websites:** <http://ctr.utexas.edu/>  
<http://wncg.org/>  
[http://www.cae.utexas.edu/prof/bhat/FULL\\_PAPERS.htm](http://www.cae.utexas.edu/prof/bhat/FULL_PAPERS.htm)

**Technologies or techniques:** Nothing to report for this period.

**Inventions, patent applications, and licenses:** Nothing to report for this period.

**Other products:** Nothing to report for this period.

### 3. PARTICIPANTS & COLLABORATING ORGANIZATIONS

**What organizations have been involved as partners?**

Dallas Police Department, Dallas, TX (in-kind support)

**Have other collaborators or contacts been involved?**

KIPP Austin Public Schools, Austin, TX

### 4. IMPACT

**Impact on the development of the principal disciplines of the program:** Nothing to report for this period.

**Impact on other disciplines:** Nothing to report for this period.

**Impact on the transportation workforce development:** Nothing to report for this period.

**Impact on physical, institutional, and information resources at the university or other partner institutions:** Nothing to report for this period.

**Impact on technology transfer:** Nothing to report for this period.

**Impact on society beyond science and technology:** Nothing to report for this period.

### 5. CHANGES/PROBLEMS

Nothing to report.