GPS-Assisted Data Collection to Support Transportation Planning

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At one time, all a transportation planner needed to know was the number of vehicles which could be expected to use a given facility. With the availability of computers and the design needs of the Interstate Highway System, travel demand models were developed in the 1960s to generate, distribute, and assign auto trips based on the projected locations of population and employment. The primary data sources upon which these models were built were home travel surveys, roadside interview surveys, and traffic counts. Supply was the road system, and demand was the choices of destinations and routes.

"During the late 1960s and the 1970s there occurred in transportation systems analysis a shift from unimodal analysis of large capital decisions toward multimodal systems and considerations of pricing, operational policies, and the construction of new facilities." (Discrete Choice Analysis by Ben-Akiva and Lerman: MIT Press, 1985. Page 1)

To get observations of people's travel behavior, the Puget Sound Regional Council (PSRC) has conducted several rounds of travel surveys, including the ten waves of its panel survey from 1989 to 2002. In 1999 the PSRC conducted a household activity survey which included a two-day travel diary for each trip maker. These diaries were used to record locations and activities throughout the day, as well as mode of travel, arrival and departure times, and family members traveling together. Departure times, routes, and stops were recorded by the survey participants.

People's travel decisions are influenced by their knowledge of and perception of the transportation "environment" – the travel times, reliability, costs, characteristics, comfort, and safety of the various modes. The more we know about the environment in which people make their travel decisions, the better we can understand and model their decisions. In 2000 the PSRC used GPS equipped cars to travel the region's roads and record data points from which travel speeds could be calculated. Interns in the cars also noted posted speed limits, numbers of lanes, etc.

At the same time that technology can collect and process greater quantities of data, people have become more reluctant to share personal data and/or be inconvenienced. A GPS device can be used to record passively the location by time of a person or a vehicle. The data can identify trips which were omitted from a diary, and the recorded trip ends may enable a researcher to infer the purpose of a trip. Some day the units also may be used to implement a road pricing scheme in which rates vary by facility.

With funding from the Federal Highway Administration, the PSRC currently is conducting a "traffic choices" demonstration project to gather data about people's responses to paying for access to faster roads. For eleven months 260 households will have 420 GPS units permanently installed in their vehicles. During the first two months and the last six weeks, the units will simply record the movements of the vehicles, to

establish the baselines. During the middle 7 ½ months the drivers will "pay" between $0.10 and $0.50 per mile to use freeways (depending on the time of day), and half that amount to use major arterials. The project is using real money. Each household has an endowment account which will be spent down according to their choices. At the end of the project, each household gets to keep the money remaining in the account.

So for 11 months there will be 420 vehicles with GPS units traveling the streets of the region, recording their locations every 250 meters - sufficient accuracy to determine which facility they are on, and when. More than 300,000 vehicle trips will be made under conditions simulating tolling, and another 150,000 in "normal" conditions. Since many trips during those months will be repeat trips, the resulting database will be able to be analyzed to show variations in departure time and route choice relative to changes in congestion and – the primary subject of this project) – the imposition of pricing. In this project no effort will be made to identify the purpose of each trip or the number of people in the car.

The PSRC has made extensive use of both the panel survey and the 1999 household activity survey in recent updates to its travel demand model. The next major modeling initiative is anticipated to be the development of an activity-based model to simulate the day-to-day decisions of the households synthesized and located within the UrbanSim land-use model which is currently being implemented. A new large household survey being planned for some time in 2006 is an ideal opportunity for PSRC to acquire data using a combination of traditional and GPS recording methods.