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The value of travel time and reliability-evidence from a stated preference survey and actual usage

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ABSTRACT

This research examined travel behavior of Managed Lane (ML) users to better understand the value travelers place on travel time savings and travel time reliability. We also highlight the importance of survey design techniques. These objectives were accomplished through a stated preference survey of Houston's Katy Freeway travelers. Three stated choice experiment survey design techniques were tested in this study: Bayesian (D_b) efficient, random level attribute generation, and an adaptive random approach. Mixed logit models were developed from responses using each of those designs. The value of travel time savings (VTTSs) estimates do vary across the design strategies, with the VTTS estimates based on the D_b-efficient design being approximately half the estimates from the other two designs. However, among the three design strategies, the value of travel time reliability (VOR) was only significant in the D_b-efficient design.

The estimated VTTS from actual Katy Freeway usage (as measured using actual tolls paid and travel time saved on the managed lanes) is \$51/h. This likely also includes any value that travelers place on travel time reliability. In comparison, our combined estimate of VTTS and VOR based on the SP survey (D_b-efficient design) was \$50/h, which is remarkably close to the estimate from the actual usage data. Based on our dataset, the D_b-efficient design technique proved superior to the other two techniques. Finally, this research also supports the importance of including both travel time and travel time reliability parameters when estimating the willingness to pay for, and therefore benefits derived from, ML travel.

1. Introduction

In this study we use the popular stated choice experiment method (SCE) to analyze urban commuting decisions related to automobile traffic congestion and the use of managed lanes for travel. The SCE is a rigorous, accepted method among transportation modelers and economists (see Small et al., 2005). Traffic congestion is a major problem in many large cities, and the location where our study was conducted, Houston, Texas (USA), is certainly no exception. Congestion is associated with billions of dollars each year in lost hours of time for those stuck in traffic, in wasted fuel, and in polluting the environment (Schrank and Lomax, 2009). The concept of Managed Lanes (MLs) is an operational strategy to reduce this problem of congestion by intelligently allocating traffic capacity to different lanes. The Federal Highway Administration (FHWA) defines

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MLs as "a limited number of lanes set aside within an expressway cross section where multiple operational strategies are utilized, and actively adjusted as needed, for the purpose of achieving pre-defined performance objectives" (FHWA, 2004).

Managed lanes are becoming increasingly popular in the United States, partially due to the FHWA value pricing program efforts. Houston's Katy Freeway is one of these ML facilities and is the focus in this current study.

This paper focuses on estimating both the value of travel time savings (VTTSs, often referred as value of time [VOT]), and also the value of travel time reliability (VOR). The VTTS is the marginal rate of substitution between the travel time and cost in the choice models (Brownstone and Small, 2005; De Jong et al., 2007). Similarly, the VOR indicates the value travelers place on the reliability of estimated travel time and measures the willingness to pay to reduce the variability of travel time (Brownstone and Small, 2005). Though related, there is no reason to assume the two are equal, as individuals may have different preferences for time saved, and reliability gained. Empirical estimates of VOR have in fact varied considerably, ranging from as low as 0.55 times (Black and Towriss, 1993) to 3.22 times (Small et al., 1999) the VOT, on average. Brownstone and Small (2005), using the data from SR-91 and I-15 high occupancy toll (HOT) lanes, estimated the VOR to be 95–140% of the median travel time. Small et al. (2005) calculated the median VOR using revealed preference (RP) data of travelers in Los Angeles and estimated it be $19.56/h or 85% of the average wage rate. A recent study by Tilahun and Levinson (2010) found travelers' VOR to be quite close to their VTTS. Concas and Kolpakov (2009) reviewed the literature on VOT and VOR and recommended that the VOR could be estimated to be 80–100% of the VOT under ordinary travel circumstances, i.e., with no major travel constraints. However, under the constraint of non-flexible arrival/departure, they found that the VOR can be valued up to three times that of the VOT.

In this manuscript the VTTS and VOR values are estimated using data collected in a recent SP survey, which was given to travelers who used the Houston area's Katy Freeway. The SP estimates are compared with actual ML usage data.

The remainder of the paper is organized as follows. A brief description of the Katy Freeway MLs is presented in the next section. That is followed by a description of the SP survey and various survey designs used. Next, SP survey and actual usage data collection efforts are described and following that, the results of the analysis are presented. The final section contains some conclusions and suggestions for future research.

2. Katy Freeway

The Katy Freeway has (for most of its length) four general purpose lanes (GPLs) and three frontage road lanes in each direction. It extends over 23 miles connecting the nearby city of Katy to the city of Houston. In addition to these lanes, a portion (12 mile stretch) of the Katy Freeway near downtown was designed with two additional MLs in each direction (TxDOT, 2009). The construction of the Katy Freeway was completed in October 2008 and the MLs were initially opened as high occupancy vehicle (HOV) lanes 1 month later, in November. They opened for paid SOV use in April 2009.

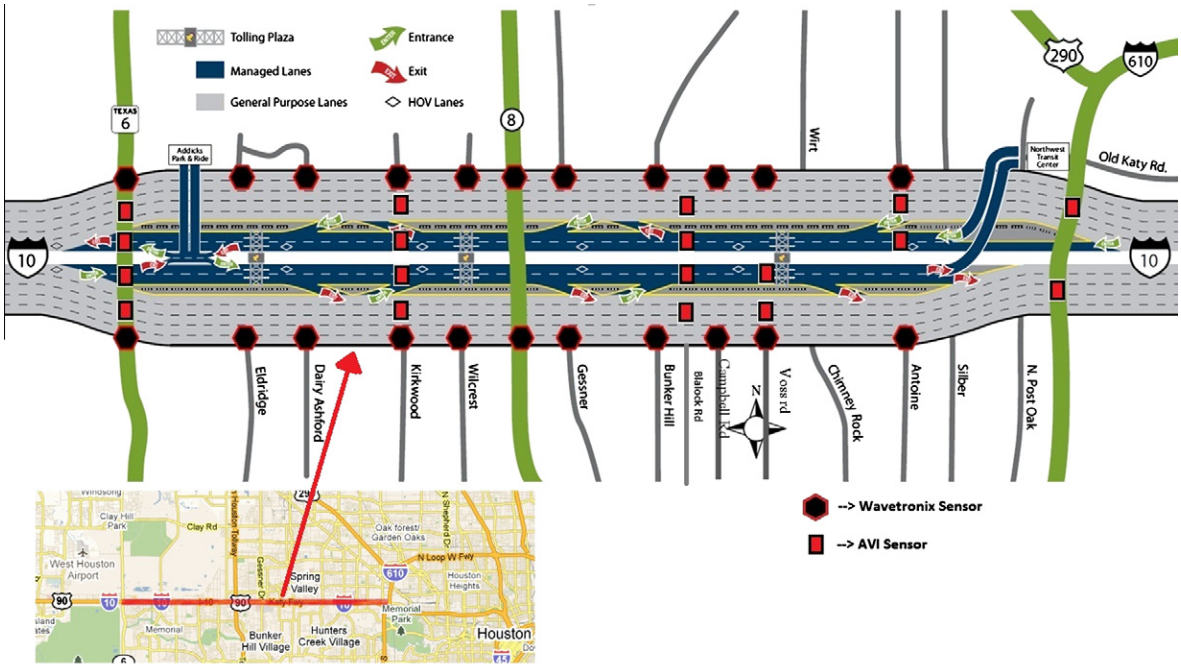

Fig. 1. Katy Freeway managed lanes and sensor location (TxDOT, 2009; Google Maps, 2011).