Behavior Insights for an Incentive-Based Active Demand Management Platform

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ABSTRACT

Most current Travel Demand Management (TDM) programs such as vanpooling, ridesharing, or transit focus on managing travel demand of specific groups of commuters but are limited in effectively managing demand for automobile drivers, who are unable or unwilling to participate in such programs.

This paper highlights results from a pilot field study conducted in a large west coast city experiencing major traffic congestion, and documents results of the use of an incentive-based active demand management (ADM) system focusing on automobile commuters. The system, called "Metropia," predicts future traffic conditions, applies a proprietary routing algorithm to find time-dependent shortest paths for different departure times, and, based on user request, provides automobile travelers with multiple departure times and route choices. Each of these travel choices are assigned points values, with higher points (and thus more valuable rewards) available for travelling during off-peak times and less congested routes, and lower points available for peak traffic travel times. The goal of this ADM system is to improve traffic flow and commuter travel times citywide, alleviating heavily congested areas without the use of new roadway construction by incentivizing travelers to change their travel behavior and avoid traffic congestion.

The level of rewards points available to users (commuters) by the system depends on the travelers' behavioral change degree and their contributions to traffic congestion alleviation. This system was implemented in Los Angeles, Calif., USA, as a small scale pilot field study carried out beginning April 2013 and lasting for 10 weeks. Results from this field study show the system is able to accurately predict travel time with Relative Mean Absolute Error (RMAE) as low as 15.20%. Significant travel behavior changes were observed which validate the concept of using

incentives to influence people's travel behavior. Furthermore, field study results show 20% travel time can be saved for people who changed their travel behavior.

Key words: Active Demand Management (ADM), Travel Demand Management (TDM), Incentive, Departure Time Choice, Route Choice, Travel Behavior, Travel Time Prediction, Travel Time Savings

1. INTRODUCTION

Traffic congestion imposes a tremendous burden on society as a whole. For decades, the most widely applied remedy has been building more roads to better accommodate traffic demand, which turns out to be of limited effect: infrastructure construction and maintenance are very costly, and as more demand is induced, that added demand quickly saturates the newly built highways. Travel Demand Management (TDM) is another approach that has been receiving continual attention from both academic research and real-world practice, aiming to effectively influence people's travel demand, provide more travel options, and reduce the need for travel. A variety of TDM programs have been applied in real world practice, such as flexible work hours, teleworking, vanpooling, ridesharing, transit, etc.

Another aspect of TDM worth noting are travel pricing strategies, such as congestion pricing, HOV to HOT conversion, and parking pricing, which aim to influence travelers' behavioral changes by imposing monetary penalties on commuters. Although some of these strategies have proven to be, to a certain extent, effective in changing travelers' behavior while increasing revenue generation, this "stick" approach remains controversial on issues like socio-economic equity and capacity utilization efficiency.

Active Traffic and Demand Management (ATDM) - an increasingly popular strategy aiming to dynamically adjust network demand and supply in real time in order to improve operational efficiency - is surfacing as an viable approach for congestion management. In the realm of Active Demand Management, an opportunity that has not been fully explored in literature is to dynamically incentivize those auto drivers to make smarter travel choices such as departing outside peak periods or taking less congested routes to avoid traffic congestion.

Incentives are well known in TDM literature as well as in various behavior economics studies; however, incentives have not been attempted in influencing driver departure and route choices. Some previous pilot study research and practice advocated travelers to "avoid rush hour" or "use a transit mode" using incentives, and the results show that incentives are promising in altering a certain group's behavior [1, 2]. However, these studies did not provide predicted travel time information for different future departure times or alternative route options, without which travelers had limited information to assist their decision making and had to reply on the past experience. Another remaining question is how to develop a financially sustainable incentive program so that the program could be a market-driven, financially sustainable economics process.