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MODELING COMMUTERS' DAY-TO-DAY ROUTE CHOICE DYNAMICS UNDER NETWORK UNCERTAINTY: A REFERENCE-DEPENDENT APPROACH

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Abstract. This paper presents a novel model for investigating commuters' day-to-day route adjustment behaviors under network uncertainty based on a reference-dependent approach. In the proposed model, the loss aversion effects, memory and learning processes of commuters and the impacts of network uncertainty are considered. A reference-dependent generalized travel cost function is introduced and defined as the sum of the gains and losses of commuters' perceived travel time and perceived cost of unreliability relative to reference points. It is assumed that commuters make their route choice decisions in a logit-based manner for every day. A day-to-day evolution model of route choice decision is presented, in which the equilibrium for every day's route choice is remained. The stability of the evolution model is analyzed and is solved by a heuristic solution algorithm that combines the method of successive averages with the logit assignment technique. A numerical example is used to illustrate the application of the proposed model and solution algorithm.

Keywords. Transportation network, route choice, day-to-day adjustment, reference-dependent, loss aversion, travel time uncertainty, stability.

AMS (MOS) subject classification: 90B06, 90B20.

1 Introduction

Traditional choice behavioral models often assume that individuals choose the alternatives with the minimum expected travel cost, independent of context and learning. This is also true for most of route choice models in transportation science. However, there is a wealth of literature in behavioral decision sciences and psychology, showing counter-evidence. Kahneman *et al* [8] and Tversky and Kahneman [20] argued that commuters' travel choice behavior is dependent on status quo or reference point(s) and empirically confirmed that the change of reference point might lead to preference reversal. Simonson and Tversky [18] also argued that context effects are both common and robust, representing the rule rather than the exception in choice behavior. Furthermore, experimental evidences [8,20] have indicated that individuals often evaluate the quality of a product or service relative to a certain *reference point* (e.g., expectation), and usually show stronger reaction to utility losses (i.e.,