Accepted Manuscript

An extended macro traffic flow model accounting for the driver's bounded rationality and numerical tests

Tie-Qiao Tang, Hai-Jun Huang, Hua-Yan Shang

PII: S0378-4371(16)30796-8
DOI: http://dx.doi.org/10.1016/j.physa.2016.10.092
Reference: PHYSA 17650

To appear in: *Physica A*

Received date: 27 August 2016
Revised date: 3 October 2016

Please cite this article as: T.-Q. Tang, H.-J. Huang, H.-Y. Shang, An extended macro traffic flow model accounting for the driver's bounded rationality and numerical tests, *Physica A* (2016), http://dx.doi.org/10.1016/j.physa.2016.10.092

An extended macro traffic flow model accounting for the driver's bounded rationality and numerical tests

Tie-Qiao Tang[a*], Hai-Jun Huang[b], Hua-Yan Shang[c]

a) School of Transportation Science and Engineering, Beijing Key Laboratory for Cooperative Vehicle Infrastructure Systems and Safety Control, Beihang University, Beijing 100191, China

b) School of Economics and Management, Beihang University, Beijing 100191, China

c) Information College, Capital University of Economics and Business, Beijing 100070, China

Abstract: In this paper, we propose a macro traffic flow model to explore the effects of the driver's bounded rationality on the evolutions of traffic waves (which include shock and rarefaction waves) and small perturbation, and on the fuel consumption and emissions (that include CO, HC and NO_X) during the evolution process. The numerical results illustrate that considering the driver's bounded rationality can prominently smooth the wavefront of the traffic waves and improve the stability of traffic flow, which shows that the driver's bounded rationality has positive impacts on traffic flow; but considering the driver's bounded rationality reduces the fuel consumption and emissions only at the upstream of the rarefaction wave while enhances the fuel consumption and emissions under other situations, which shows that the driver's bounded rationality has positive impacts on the fuel consumption and emissions only at the upstream of the rarefaction wave, while negative effects on the fuel consumption and emissions under other situations. In addition, the numerical results show that the driver's bounded rationality has little prominent impact on the total fuel consumption, and emissions during the whole evolution of small perturbation.

Keyword: macro traffic flow model; the driver's bounded rationality; fuel consumption; emissions

1. Introduction

To date, various traffic problems (e.g., congestions, accidents, traffic energy consumption, traffic pollution, etc.) have become more and more serious and attracted researchers to develop many traffic flow model from different perspectives [1-4]. Generally speaking, the existing traffic flow

* Corresponding author. Email: tieqiaotang@buaa.edu.cn (Tie-Qiao Tang)