Transit Network Design for Green Vehicles Routing

Victor Zakharov and Alexander Krylatov

Saint-Petersburg State University, Universitetskaya Nab. 7-9, 199034
Saint-Petersburg, Russia

Abstract. Transport of modern worldwide cities generates harmful emissions that accounts for nearly half of the total pollution in urban areas. Therefore local governments are forced to stimulate appearance of new fuels and technological innovations in urban mobility. Nevertheless there is a lack of methodological tools for supporting decision makers in spheres of motivation for using green vehicles by drivers and allocation available green capacity. This paper is devoted to the problem of green and non-green traffic flow assignment on the network consisting of green and non-green routes. The approach of defining green routes (green subnetwork) which are fully loaded and provide less travel time for green vehicles are developed. Conditions of well-balanced green subnetwork are obtained explicitly for the network of parallel routes.

Keywords: routing, Wardrop equilibrium, green routes allocation, transit network design.

1 Introduction

Transportation sectors of modern worldwide cities consume a large portion of fossil fuel and significantly contribute to greenhouse gas (GHG) emissions. According to Federal State Statistics Service of Russian Federation since 2000 in this country emission of road transportation were 41,9% of all greenhouse gas [1]. In particular, the use of passenger cars contributes to 15% of the overall carbon dioxide emissions. In Europe passenger cars emitted 12% of air contaminants and there exist increasing dynamic of this indicator [2]. In 2011, 27% of total GHG emissions in the U.S. comes from transportation end-user sector and passenger vehicles are responsible for 43% of this total share [3]. Developing countries of South America demonstrate the same state. While industrial sector of Brazil emitted in 2010 29% of air pollution, road transport contributed 43% [4]. Certainly, such situation influence on quality of life directly and authorities are interested in decisions that could change situation in the direction of pollution decreasing.

Emissions from on-road vehicles depend on several attributes that include: fleet composition, age distribution of the vehicles, fuel type, atmospheric attributes, operational characteristics, congestion, and travel choices made by the road users. Simultaneously, without a doubt, green vehicles cause the least harm