Spatial Distribution Characteristics and Influencing Factors of Urban Residents’ Travel Carbon Emissions in Guangzhou

Jianfeng Lu, Southwest Jiaotong University, Chengdu, China
Jiahong Zhao, College of Civil and Traffic Engineering, Guangdong University of Technology, Guangzhou, China
Haiyan Jiang, College of Architecture and Urban Planning, Guangdong University of Technology, Guangzhou, China

ABSTRACT

Transportation is an important source of carbon emissions. Since the level of urban traffic motorization enhanced quickly, the problem of carbon emissions derived from transportation has become a significant concern in recent years. It has become a key issue to study how to effectively reduce the carbon emissions of urban residents and to develop low-carbon urban traffic. The authors study 33 communities in Guangzhou city and analyze the characteristics of carbon emissions in each community, where the influence factors of carbon emissions are analyzed by establishing a multiple regression model. Finally, some policy suggestions are accordingly proposed to reduce the carbon emissions of residents.

KEYWORDS
Community, Gini Coefficient, Multiple Regression Model, Travel Carbon Emissions

1. INTRODUCTION

Transportation is an important source of carbon emissions. Since the level of urban traffic motorization enhanced quickly, the problem of carbon emissions derived from transportation has become a significant concern in recent years. Residents’ travel behavior usually plays a key role in the urban transportation. For the development of the urban low carbon transport, there is a need to effectively control the carbon emission produced by residents. Accordingly, it has become a key issue to study how to effectively reduce the carbon emissions of urban residents and develop low-carbon urban traffic.

There has been much research on the characteristics and influencing factors of traffic carbon emissions. The residents’ travel carbon emissions are in accordance with the “60/20 rule”, that is, 20% of people contribute 60% of the total carbon emissions (Brand & Preston, 2010; Ko, Park, Lim, & Hwang, 2011). The studies on the factors of transportation emissions paid more attention to the social and economic attributes and travel preferences of families and individuals. Also, it was found that residents’ carbon emissions are affected by residents’ family characteristics, such as the rate of motor vehicle ownership and utilization, income condition, population size and composition, age structure, education background and occupational differences. Owned car group is not the car population produce more travel times and longer travel distance. Moreover, the relationship between

DOI: 10.4018/IJAL.2017070103

Copyright © 2017, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.
family income and household travel way is different, the British 1 / 5 high-income families compared
to 1 / 5 of low-income families have 1.3 times and 3 times the number of travel distance (Department
for Transport, 2006). The impact of gender on household travel carbon emissions was second only
to the level of the household economy (Barla, Miranda-Moreno, & Lee-Gosselin, 2011).

Household car ownership rate has the greatest impact on the residents’ trip carbon emissions
(Aamaas, Borken-Kleefeld, & Peters, 2013). The travel distance and the probability of motorized
car travel have a significant positive effect on the traffic carbon emissions, while the impact of travel
frequency is not significant. Meanwhile, the impact of travel structure is much greater than the total
amount of travel (Ma et al., 2011). The investigation and research on the Nanjing city as a typical
city in China, Ningbo and Changzhou, showed the main effect of the city residents’ daily commuter
traffic carbon emission factor for the mode of transportation, travel distance, family income, age,
and gender (Xu et al., 2014). Compared with the individual social and economic attributes and the
residents’ attitude preferences, the residential space environment variables had more significant
impact on the residents’ commuting carbon emissions (Huang et al., 2014).

Some researchers revealed the mechanism of individual trips and their carbon emissions through
the study of the relationship between land use and traffic trips, and found the policy options and
technological paths of low carbon regulation. Based on the study on the effects of urban space and urban
resident travel carbon emissions, it was confirmed that the characteristics of urban space environment
such as the use of land, transportation planning and urban form decide the spatial distribution of people
living and employment, which affected the residents travel mode, travel direction, travel distance and
the changes in travel carbon emissions. The degree of land mixing, the number and concentration of
jobs, and the limited expansion of urban boundaries have a great impact on the transportation carbon
emissions (Kenworthy, 2003). Multi-center urban morphology is likely to arise or deepen separation
of occupation and residence, resulting in an increase in family travel distance and an increase in travel
carbon emissions (Buliung & Kanaroglou, 2006). Tight urban development helps reduce traffic carbon
emissions (Ewing & Rong, 2008). By calculating the relationship between the 66 cities with the urban
population and energy consumption, expand the city that the growth of population, the city limits
will lead to higher levels of carbon emissions, carbon emissions of most of the city center area was
significantly lower than that in the outskirts of the city suburbs (Kahn, 2009; Glaeser & Kahn, 2010).
When the distance from CBD is fixed, the influence of land use and traffic supply on traffic carbon
emission is weak (Barla et al., 2011). Based on the research of residents’ travel behavior, many works
show that the choice of residents travel, accessibility of communities and home position are related
to Carbon emissions. Improving the accessibility of community transportation can reduce the carbon
emissions of residents (Zahabi, Miranda-Moreno, Patterson, Barla, & Harding, 2012). High density,
land use, and high accessibility communities do not automatically reduce household vehicle distance
(Brand, Goodman, Rutter, Song, & Ogilvie, 2013). The spatial structure of surrounding communities
can lead to differences in carbon emissions among residents (Chai, Xiao, & Liu, 2012).

As a big city with a developed coastal economy, Guangzhou has a serious traffic environment
problem, which is broadly representative of urban traffic problems in China. The study used different
locations consisting of of several communities in Guangzhou as the research object, looking for the
travel distribution characteristics of carbon emissions and studying the main influencing factors can
provide policy advice or theory for low carbon transport and low-carbon urban construction. It helps
to guide the residents to choose low-carbon travel mode from urban construction and transportation
policies, which can reduce the urban traffic carbon emissions. The related results of this study can
be used as a reference for other cities and urban planners.

The remainder of this paper is organized as follows. Section 2 provides the data sources and
related methods to study the carbon emission derived from the real-life problem in Guangzhou.
Section 3 analyzes the distribution characteristics of travel carbon emissions in this case study. The
influence factors of carbon emission of community residents are also presented in Section 4. Finally,
the conclusion, suggestion on current policy, and future research directions are presented in Section 5.
Delivery Reliability in Machinery and Equipment Industry: A European Study
[www.igi-global.com/article/delivery-reliability-machinery-equipment-industry/62262?camid=4v1a](www.igi-global.com/article/delivery-reliability-machinery-equipment-industry/62262?camid=4v1a)

Spatial Distribution Characteristics and Influencing Factors of Urban Residents’ Travel Carbon Emissions in Guangzhou