

# **SOLUTIONS TO PUBLIC TRANSPORT CHALLENGES: EMERGENCE OF MOBILE INTERNET AND REVOLUTION OF URBAN PUBLIC TRANSPORT IN CHINA**

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## **ABSTRACT**

Since stepping into the mobile internet era, traditional challenges of public transport have been evolved and resurfaced with new types while the new challenges keep emerging ceaselessly. With the radical change of information dissemination and subsequently thriving mobile internet technologies, the rudimentary contradiction of public transport, the gap between the prosperous individual travel demand and comparative limited transportation infrastructure capacity, is promisingly to be mollified. This paper reviewed the traditional challenges of urban public transport as well as the evolved and emerged challenges in mobile internet era. By introducing four proven mobile internet techniques (or "ecology"), including the E-commerce, express logistic service, O2O commercial mode, sharing economy, and LBS service, the applications in Xi'an city were exemplified to illustrate that how their comprehensively effects can assuage the challenges.

**Key words:** Public transport; Mobile Internet; E-commerce; O2O; Sharing economy; LBS

## **1 INTRODUCTION**

### **1.1 Background**

In general, public transport can be defined as a set of all the modes available to the public, regardless of the ownership (White, 2016). From the perspective of European Commission, since late 1970s, the focus of public transport has been shifted from individual needs of low-incomer society to the satisfaction of collective wellbeing (Viegas, 1999). In China, with social development during the past decades, the list of prevalent and tricky challenges among public transport, such as traffic congestion, traffic safety, air pollution induced by automobile emission etc., has always been expanding without any indication to stop (Ma, 2003; Ceder, 2004).

Through the analysis based on general system theory, the challenges can be categorized back into two kinds of major relationship among the whole-parts (Bertalanffy, 1968). One is the rapid urbanization of the whole Chinese society and its profound impacts on

social-economy structure, the other is attributed to inevitable trend of individual motorization induced by prosperous travel demands (Ma, 2003; Pan, 2010).

Many approaches have been proposed to solve those challenges. Government-driven large-scale investment policy which endeavour to infrastructures construction did sharply ameliorate the traffic jam within short term (Pucher et al, 2007). However, as the Downs's Law revealed, the traffic increases accompanied with the roadway expansion would eventually made any congestion relief less effective from long-term perspective (Downs, 2005; Beaudoin, 2015). Besides, the urban planning such as transit-oriented design (TOD) is regarded as a valuable way to avoid those traffic challenges (Zou, 2014). While TOD strategy is more popular applied to the newly-development city in comparison of the rehabilitation of old city. Especially in China, it is the urban villages left behind rapid and rough urbanization that remain as the major obstacles to urban public transport (Zhang, 2008). In addition, public transport priority method has been well-developed and widely accepted. The practical priority method comprises of at least three aspects: policy, technology, and planning. Those effective measures such as PPP model, driving restriction, bus only lane, and multi-modal transport integration etc. did largely ease the transport challenges (Ma, 2003; Quan & Sun, 2007; Schade 2014). Nevertheless, the rudimentary contradictions between individual travel demand and comparative limited transportation infrastructure capacity were still not fully mollified. The effort to seek a creative solution to traditional challenges have never been stopped.

Since the 13th Five-year Plan for Economic and Social Development in China, the Internet Plus Initiative with the aims of innovation and coordinated development has been prevalent around the whole country. As the large-scale implementation of advanced mobile internet technologies, the revolution of productivity and relationship of production have been emerged from information technology area and swept across the other traditional industrials. Being inside the mobile internet wave, so it is necessary to review the traditional public transport challenges from a new perspective.

## **1.2 Scopes and objectives**

This paper sought to discuss the challenges of public transport under the circumstance of emerging mobile internet in China and attempt to analyse the advantages of mobile internet technologies for solving traditional and newly-generated challenges from the perspective of the revolutionary change of travel demand in the new era. The objectives included:

- Elaborate the challenges of mobile internet era;
- Introduce the advanced mobile internet technologies;
- Analyse revolution and solutions of public transport in mobile internet era

## **2 CHALLENGES IN MOBILE INTERNET ERA**

### **2.1 Revolution brought by mobile internet**

The huge progress in information and communication technologies (ICT) ignites the revolutionary change of mobile internet era (Guan, 2014; Wu, 2015). Take the high-speed and reliable communication infrastructure as guarantee, the combination effects of front-end application (smart phone, NFC, etc.) and back-end (Cloud computing, the Internet of Things, and mobile payment) have sharply changed the world, which irreversibly changed the way how the information flow in nature (Schade, 2014). The information flow in mobile internet era is decentralized, multi-source, concise, and rambunctious. That change is totally different and incompatible with the productivity and product relationships of Pre-Information Age, i.e. the age that information flow via paper, radio waves, and telephone wire. Therefore, any organized entities pertinent to the old time would experience stages of penetration, reformation, distinguish, and reconstruction to entrance the new age, so as the public transport.

## **2.2 Impacts of Mobile Internet on Public Transport**

The characteristics of mobile internet can be summarized as social, local, and mobile, which directly exert influence on the user and operator of the whole public transport system. The subversive effect can be demonstrated with an example. For individual user, the direct and instant interaction via mobile internet link all the users as the whole group, which is analogy to a complex system behaved uniformly. As if emergence condition occurred, the message from multi-resource would quickly traversed to all the individual users and trigger the group behaviour almost immediately, the process was uncontrolled and the behaviours were unpredictable. For operator of public transport system, the difficulty of remaining stability of the public transport system is disproportionately increased as the information flow more widely and quickly.

Apart from the example above, there were many positive or negative impacts. Various impacts keep getting concatenated until the formation of a new paradigm of the productivity and product relationship, which were called mobile internet ecology in China. The four practical impacts whose new ecologies formed were introduced in section 3.

## **3 MOBILE INTERNET TECHNOLOGIES FOR PUBLIC TRANSPORT CHALLENGES**

### **3.1 E-commerce and express logistic service**

The mobile internet stokes the e-commerce popularization as it is more convenient and easily-accessible for people of the old and lower-income society. Meanwhile, the advances of express logistic services, whose delivering time is usually within 24 hours or even 12 hours, broadened the boundary of e-commerce by introducing fresh food and major appliance as well as reshaped consumer's shopping tendency. The Chinese customers now are more intended to search via smartphone rather than go-to-street shopping.

The impact of e-commerce and express logistic service can be analysed from spatial and temporal perspectives. For spatial consideration, the demands of shopping are converted into online store, which eliminate considerable travel demands. As for logistic system, the hierarchical structure from main warehouse to subordinate station would takes up much more less roadway occupancy. For temporal consideration, the shopping time is extended to the whole 24 hours a day which avoiding the queuing. The mainly delivery (from warehouse to distribution station) is usually scheduled at midnight, which would transfer the considerable traffic volume from daytime to night. The deliveries in daytime are concentrated in the last kilometre, i.e. the short distance from delivery staff to the receiver which is usually accessed by small vehicles.

Therefore, both the travel demand and traffic volume during the consumption process can get greatly declined under the high-efficiency e-commerce and express logistic service.

### **3.2 Online to offline commercial mode**

The online to offline (O2O) commerce mode is substantial supplement to e-commerce (Tsai, 2015). The customers seek and order online and then consume in the brick-and-mortar stores, which seamless connect the online shop and offline store (Xiao, 2015). By this means, the actual shopping process would be straighter and the travel demand can be further decreased as the O2O commerce cover the most daily consumption such as dining, entertainment, or even government affairs etc. Once the trend get popularized in certain district, even the roadside business would have to embrace the mobile internet. It is what we called reformation and reconstruction.

Another advantage of O2O commercial mode is the breakthrough of the last kilometre, the delivery difficulty and benefit a cashless living atmosphere, which can be integrated with TOD urban planning.

### **3.3 Sharing economy**

There are now various sharing economy types such as bicycle-sharing, car-sharing, and ride-sharing. It can be regarded as the extension of “mobility as a service” concept in public transport priority method (Hamari, 2015). However, it is the mobile internet that make the sharing economy prevalent around the world. As the slogan “sharing not owning” indicated, sharing economy provided an attractive and sustainable alternative to solve travel demand, which can prominently control the car increase rate or even eliminate the car ownership percentage.

### **3.4 Location-based service**

Location-based service (LBS) provide a real-time navigation, route planning, and congest forecasting service for user, which would also be applied by public transport operator and regulation department. The LBS are developed to solve new challenges arisen in mobility internet era.

## **4 SOLUTIONS TO PUBLIC TRANSPORT CHALLENGES IN MOBILE INTERNET ERA**

As the advanced mobile internet technologies are applied in mix, the analysis of revolutionary change of public transport should take account of the comprehensive effects. Back to the rudimentary contradiction, the gap between the individual travel demand and comparative limited transportation infrastructure capacity, the comprehensive effects of mobile internet technologies were the very mollifying solutions.

On the one hand, the E-commerce, express logistic service, and O2O commercial mode weaken the original travel demand; on the other hand, it is the sharing economy that controlling and eradicating the private car ownership which is equivalent to emancipate the occupied transportation infrastructure capacity. Therefore, the rudimentary contradict of traditional challenges could be mollified by weakening the original travel demand and emancipate the occupied capacity. Besides, the emerged challenges that the less stable public transport system could be improved with LBS.

Take Xi'an city as example, the e-commerce giants such as JD.com, Amazon, and SUNING etc. all own local warehouses to provide express logistic service. The O2O commercial mode have been successfully applied on dining, entertainment, and utility bill payment by the pioneers such as Meituan, Eleme, and Maoyan, etc. The DiDi and Uber have managed to establish consuming habit of car-sharing and ride-sharing. Bicycle-sharing is now growing vigorously under the push of many start-ups such as OfO and Mobike. Baidu Maps and Amap provide reliable LBS service for users. As the basis of mobile internet, the mobile payment powered by Alipay and Wechat pay are popular and well-accepted. With the combination effects of mobility internet technologies, many travel demands can be accompanied within phone or dissipated from peak hours as well as the increasing trend of individual vehicle ownership would also be curbed to some extent.

The mobile internet is still developing and the new technologies and challenges emerged every day. So, it is too early to assert that technologies available now can provide all the solutions to the challenges of public transport. However, there is one thing could be averred as true now. As the means of information flowing updated by mobile internet, the public transport is experiencing the profound transformation. The solutions to challenges emerged in mobile internet era should be sought from the technologies also emerged in mobile internet era.

## **5 CONCLUSION AND PERSPECTIVES**

With the elaboration of the challenges in mobile internet era, introduction of the advanced mobile internet technologies, and analysis of the revolution of public transport in mobile internet era, it is found that the rudimentary contradiction summarized from the traditional challenges can be effectively mollified by series emerged advanced mobile internet technologies, including the E-commerce, express logistic service, O2O commercial mode, sharing economy, and LBS. Besides, the newly emerged challenges are supposed to be settled with correspondingly newly-emerged technologies through analogy.

What discussed in this paper were mainly focused on the urban public transport. However, revolution of mobile internet also influence the vast rural area and towns. Hence, the resident lived in town and rural area, the migrant workers, and other people who were not covered in this paper would all confront with the era of new challenges, which would also be expanded to larger region concluding the Intercity transport, train, highway, ferry, and air plane in the near future.

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