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Public Transport Policy Measures to Improve the Mobility of the Elderly in Hong Kong
為提升老人於香港社區流動性的公共交通政策措施研究

Final Report
(December 2016)

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Abstract

Transport is a basic human need, enabling people of all ages to maintain their independence, autonomy, and quality of life. However, the elderly have limited transport choices in Hong Kong, which has reduced their mobility. Moreover, the rapid growth of the region’s elderly population will lead to more serious mobility problems in the future. Therefore, maintaining the quality of elderly people’s daily lives by improving their mobility should be a top priority for transport policy makers in Hong Kong.

Historically, the creation of a transport system accessible to all has been emphasised in Hong Kong’s transport policies, planning, and regulations. Particular attention has been paid to the needs of the disabled, whose mobility is usually treated as identical to the mobility of the elderly. However, the elderly and the disabled have different travel needs. The existing public transport policy measures also fail to accommodate the important effects on elderly mobility of the accessibility of the transport system. Nearly 90% of Hong Kong’s daily commuters rely on public transport; the cost of taxis prevents their widespread use by the elderly. It is therefore necessary to review Hong Kong’s existing public transport policy measures and recommend possible measures to improve the mobility of its elderly population.

The ultimate objective of this Study is to recommend feasible public transport policy measures to improve the mobility of Hong Kong’s elderly residents. In particular, the advantages and disadvantages of an existing travel fare concession scheme for the elderly were reviewed and the possibility of extending this scheme to all public transport modes was explored. The Study also investigated the feasibility of a taxi fare subsidy scheme and the reservation of a minimum number of priority seats for the elderly on each public transport mode. To provide suitable recommendations, appropriate models were developed to identify factors that influence elderly people’s journey-making decisions and their satisfaction with Hong Kong public transport services. The Study provided policy makers with important practical recommendations for ensuring that public transport services meet the needs of Hong Kong’s ageing population, as well as offering interesting theoretical insights into the travel behavior of the elderly in a high-density and transit-oriented city.
摘要

交通運輸服務乃所有人的基本需要，它沒有年齡的規限，讓人保持自己的獨立性，自主性和生活質量。然而老人的交通模式選擇往往不足，限制了他們於社區的流動性及生活質量。這問題將因人口老化的加劇而變得更嚴重。因此這應是香港未來運輸政策的研究重點。

現時，香港運輸政策強調提供一個方便所有人使用的運輸系統。提供無障礙的運輸系統是一個關鍵因素以提升他們的流動性，但目前的公共交通的政策措施沒有充分考慮並有必要檢討。

該研究將檢討票價優惠計劃對老人流動性的利弊，並探討將其擴展致所有運輸模式。該研究還將討論公共交通工具上最低的優先座位數目及的士車費補貼計劃的可行性。此前，必須先了解他們出行的行為和偏好。該研究將根據調查數據尋找可影響公共交通服務滿意度的關鍵因素及研究這些因素如何影響老人的出行決定，並將建立數據模型作出分析。該研究最後將提出及建議切實可行的公共交通政策措施，以提升老人於香港社區的流動性。
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1. INTRODUCTION

1.1. Background of this Study

Predominantly due to sustained low fertility and mortality rates, the population in Hong Kong is ageing at an unprecedented and considerable rate. According to figures provided by the Census and Statistics Department, the proportion of the population aged below 15 dropped significantly between 2003 and 2013, while the elderly population increased. The shrinking base and widening tip of the population pyramids shown in Figure 1.1 indicates that Hong Kong has a significantly ageing population. According to population projection data for 2012-2041, the proportion of elderly people aged 60 or above, is expected to reach 36.4% in 2041 (Census and Statistics Department, 2012), as illustrated in Figure 1.2. Demographic data also revealed that the proportion of elderly people in Hong Kong’s population is the second highest in Asia (United Nation, 2015), exceeded only by that in Japan. Indeed, Bryskine (2011) had claimed that ‘Hong Kong's population is fast becoming the most rapidly ageing in Asia’.

Figure 1.1 Population pyramids at the end of 2003 and 2013

Hong Kong’s ageing population had already created numerous social and economic challenges to the society such as health care, old age allowance, and senior residence provision (Financial Services and the Treasury Bureau, 2013). The accessibility and the level of service of public transport systems are of particular concern, because transport is a basic human need that helps to maintain the
independence, autonomy, and quality of life of people of all ages (Carp, 1988; Dickerson et al., 2007). Moreover, public transport is the major mode of transport in Hong Kong with 90% of people using it daily.

Figure 1.2 Growth of elderly population in Hong Kong

1.2. Transport policy measures for the elderly in Hong Kong

Frankly, the impact of ageing population on the transport system had been ignored by government officials and policy makers over the decades. It is expected that the existing transport system is inadequate to support such a striking increase in elderly population in the near future. No doubt the improvement of elderly mobility is a ways and means of promoting overall societal development, especially in the transport sector (Olawole and Aloba, 2014), and hence it should be a top priority for transport policy makers.

The Hong Kong government had made an effort to improve the mobility of the residents in the last few decades. In the 1995 White Paper on Rehabilitation, the Hong Kong government set out two key policy objectives: (1) to provide a barrier-free physical environment enabling region-wide access to transport services; and (2) to provide a transport system capable of meeting the needs of all people in the community (Lee and Su, 2010; Transport Department, 2010). In 1997, public transport operators implemented facilities to improve the accessibility of Hong Kong’s public transport system. By 2002, a new vision for policy – ‘Transport for All’ – had been formulated to guide stakeholders in planning and designing public transport services. The new policy vision was ultimately intended to make Hong Kong’s transport system more accessible to all by ensuring the on-going provision of barrier-free access facilities (Labour and Welfare Bureau, 2007; Mok et al., 2010), for example fixed ramps, lower floors, and wheelchair aids. In addition to this, the Hong Kong government had established
regulations for all Hong Kong citizens to ensure that an accessible transport system is provided.

The abovementioned ‘Transport for All’ policy is designed to deliver a barrier-free transport system accessible to people in Hong Kong, including the disabled, the elderly and those with special needs. Particular attention is paid to the needs of people with disabilities. Unfortunately, as the transport needs of elderly and disabled people are different, the implemented measures may not be sufficient to guarantee the mobility of the elderly. Certainly, the provision of an accessible transport system had increased the use of public transport among elderly people. Because many old people are in good physical health and remain socially engaged in the community, they are more likely to benefit from other supportive measures, such as priority seats in vehicles, stations, and even at bus stops. Furthermore, the provision of point-to-point transport services and the introduction of fare reduction schemes should also be considered instead. Nonetheless, few of these measures had been incorporated into transport policy plans in Hong Kong (Chow, 1999). In all conscience, the needs of the elderly are not adequately considered in the planning, design, and implementation of transport policies in Hong Kong.

Due to the differences outlined above between the needs of the elderly and those of the disabled, as well as the impact of the accessibility of a transport system on the mobility of the elderly, it is vital to review Hong Kong’s existing public transport policy measures and establish new measures designed specifically to meet the needs of the elderly. To establish effective and appropriate public transport policy measures for the ageing society of Hong Kong, it is essential to understand and capture the travel behavior and preferences of the elderly.

1.3. Project aim and objectives

The ultimate purpose of this Study is to recommend public transport policy measures to improve the mobility of Hong Kong’s elderly population. It is first necessary to understand the travel behaviour, preferences, and needs of the elderly, and to identify areas in which Hong Kong’s existing public transport services can be improved to meet the needs of the elderly. Therefore, the specific objectives of the project are as follows.

i) Identify the factors that may influence elderly residents' perceived service satisfaction with Hong Kong’s public transport and the factors that influence their journey-making decisions;

ii) Develop models to analyse the travel behaviour and preferences of elderly people in Hong Kong; and

iii) Evaluate the effectiveness of current public transport policy measures for the elderly and recommend possible new measures to improve the mobility of old people in Hong Kong.

All these objectives were achieved completely in this Study.
1.4. Outline of research methodology

The proposed Study was conducted in three phases: (1) data collection and analysis, (2) model development and analysis, and (3) the establishment and analysis of new public transport policy measures. The details of each phase are described below.

1.4.1. Data collection and analysis (Phase I)

*Travel pattern and behavior of the elderly*

To gain a basic understanding of the travel characteristics of the elderly in Hong Kong, the most recent Travel Characteristics Survey 2011 (TCS2011) conducted by the Transport Department of the Hong Kong government was examined. The TCS2011 data were obtained from a random sample of more than 35,000 households, which provided a comprehensive database on the journey-making characteristics of people in Hong Kong.

Information on journeys made by elderly people in Hong Kong, such as daily travel frequency, origin and destination, purpose, choice of transport mode, and journey time, were extracted from the TCS2011 database. A series of in-depth comparisons of the travel patterns of different categories of elderly people (distinguished by age, gender, employment status, etc.) was carried out, with particular reference to the frequency of journeys made per day, the purpose of travel, choice of mode, and average journey times.

*Elderly’s perceptions on Hong Kong’s public transport system*

Information on the trip-making decisions of the elderly and on the use of public transport was collected using interview surveys and stated preference (SP) surveys. The surveys were conducted at district elderly community centres, social centres, and non-subsidized service centres for the elderly. In individual face-to-face interviews, the respondents were asked to identify the modes of public transport they use most frequently, and to indicate their perceptions on the use of a given public transport mode under a different set of conditions with a range of decision factors, for example walking distance, travel time, service reliability, seat availability, level of comfort, safety, and cost.

1.4.2. Model development and analysis (Phase II)

Based on the data obtained from Phase I, a series of analysis were carried out. First, a spatial-temporal analysis was used to evaluate the travel characteristics of the elderly using the TCS2011 information. After that, data collected for the surveys were then adopted to establish two types of regression models: (1) an ordered probit model for each mode of public transport designed to identify and analyse the factors that
significantly influence elderly people’s perceived service satisfaction with the mode used; and (2) a binary logistic regression model for each mode of public transport designed to investigate the key determinants of the elderly’s journey-making decisions.

1.4.3. Establishment and analysis of public transport policy measures (Phase III)

In this phase, discussions on the factors that influence elderly residents’ perceived satisfaction with Hong Kong’s public transport services, as well as their journey-making decisions were provided. Effective public transport policy measures were recommended based on the results of the models developed in Phase II. Issues overlooked by the existing policy measures were identified, and feasible new public transport policy measures to improve the mobility of Hong Kong’s elderly population were proposed. It is anticipated that the recommendations could strengthen public transport planning in Hong Kong, as well as helping policy makers to establish new policies or policy measures to further improve elderly mobility.

The Study will provide policy makers with important practical recommendations for public transport measures that meet the needs of Hong Kong’s ageing population, as well as offering theoretical insights into the travel behavior of the elderly in a high-density and transit-oriented city.

1.5. Structure of this report

Chapter 1 introduces the research background, aim and objectives. It also outlines the research methodology, and the structure of this report.

Chapter 2 presents a thorough and critical account of the relevant literature.

Chapter 3 investigates the travel characteristics of the elderly in Hong Kong using the household interview survey data.

Chapter 4 discusses the findings on the elderly users’ perceptions on the level of satisfaction of the existing public transport system.

Chapter 5 identifies the significant influencing factors on the elderly in making travel decisions, and hence to provide some insights of public transport policy measures for the policy makers.

Chapter 6 provides the main conclusions of the study and recommendations for the way forward in relation to future research, practice, and policy-making.
2. LITERATURE REVIEW

2.1. Elderly mobility

Mobility refers to a person’s ability to move from one place to another in an independent and safe way, and it declines gradually as people age (Rantakokko et al., 2013). For the elderly, mobility is not only a crucial element of overall life satisfaction, but also a prerequisite for active ageing. It is essential for independence and ensuring good health and quality of life (Tacken, 1998; Metz, 2000; Banister and Bowling, 2004; Whelan et al., 2006; Spinney et al., 2009). A lack of mobility can deter the elderly from participating in social activities, resulting in low morale, depression, and loneliness (Atkins, 2001). With the deficits in their sensory function and musculoskeletal strength, the elderly are a disadvantaged group that requires special attention (Ipingbemi, 2010). Therefore, it is vital to maintain the mobility of elderly people to ensure that they can continue to engage in civic and social life, take part in community activities, and pursue human interactions that enrich their health, well-being, and quality of life from a social integration perspective (Dickerson et al., 2007).

The mobility of the elderly is often reduced by the inability to access certain forms of public transport. Meyer (2008) pointed out that transport choices for the elderly are limited. Likewise, the elderly in Hong Kong face similar difficulties. Chow (1999) expressed the concern of the elderly in Hong Kong that they prefer to rely on tram services rather than buses because of the high degree of crowding in most of the time. Although his observation was made more than a decade ago, Hong Kong’s transport system has changed little since; the forms of public transport available to the elderly are still limited. For example, inadequate pedestrian crossing facilities to access public transport stations, a lack of assistance in boarding/alighting from public transport vehicles, and stations that are only accessible by stairs make it inconvenience for the elderly to use, and hence reducing their mobility. Studies have also shown that the accessibility of a transport system significantly affects the mobility of the elderly. For instance, long walking distances and poor walking conditions on routes to and from transport facilities hinder the mobility of the elderly (Loo and Lam, 2012; Somenahalli and Shipton, 2013). However, this important factor seems to have been ignored in Hong Kong’s existing transport policies and related measures.

Hong Kong is a high-density, transit-oriented city with extremely high public transport use. The elderly are regarded as a less privileged population segments with limited transport choices, and their mobility is very dependent on public transport. In light of this, the Hong Kong government’s transport policies, planning, and regulations have emphasized creating systems that are accessible to the elderly. For example, public transport concession fare schemes have been implemented in four designated public transport modes (railways, buses, ferries, and public light buses) to subsidize the elderly
by traveling any time for a concession fare of HKD 2 per trip. The provision of priority railway and bus seats also encourages the elderly to travel and participate in social activities. However, those in need have relayed that the provision of priority seats is inadequate (Department of Applied Social Sciences, 2015), adversely affecting their willingness to travel. Moreover, policy makers mainly focus on travel fares and seat availability to encourage the elderly to travel. Other influencing factors that significantly affect the mobility of the elderly, such as walking distances to and from stops and stations and wait times, are neglected. Hence, a comprehensive study is needed to help policy makers establish new measures to improve elderly mobility in Hong Kong.

2.2. Use of transportation modes

The elderly are regarded as transit captives due to their reliance on public transportation in transit-oriented cities like Hong Kong, yet their mobility is often compromised by their inability to access such transport. In western countries, driving is the primary means of transport with a very low patronage of public transport. Considerable researches with differing degrees of depth and sophistication have focused on the travel patterns of the elderly in an effort to improve their mobility. Nonetheless, local studies on uncovering the travel patterns of the elderly in Hong Kong, which is a high-density and transit-oriented city, were not found to the best of our knowledge. In most of the countries concerned, driving is the primary means of transport, and only a small proportion of elderly people use public transport services. For example, approximately 80% of people in North American countries use private vehicles as their major mode of transport (Bureau of Transportation Statistics, 2005; Transport Canada, 2012) and the transit share in the United States is only 1.9% (Department of Transportation, 2011). Likewise, in most of the European countries, such as the United Kingdom, Germany, France, Sweden, Finland, Portugal, Switzerland, Italy, Spain, and Denmark, the transit shares are less than 20% (European Environment Agency, 2009). Obviously, driving is the most common mode of transport among the elderly in western countries. Public transport is used for less than 2% of the daily city journeys made by older adults (Burkhardt et al., 2002; Ritter et al., 2002). In contrast, Hong Kong is a unique city, where nearly 90% of the Hong Kong population use public transport and only few residents use private vehicles.

The Hong Kong government initially tried to improve people’s mobility by increasing public transport share. However, as the needs and preferences of the elderly are often neglected by transport authorities and policy-makers, the existing public transport policy measures of Hong Kong primarily fail to provide elderly friendly transport facilities such as the provision of priority seats on public transport, more seats at bus stops and train stations, and steady vehicle speeds. Other transport services, such as ride-sharing and taxis, is not ideal for the elderly due to difficulties such as finding a driver willing to share a car and high travel costs. As such, it is vital that the aspects of
2.3. Travel characteristics of the elderly

Improving elderly mobility should be regarded as an important part of promoting overall societal development, especially in the transport sector (Olawole and Aloba, 2014). Therefore, maintaining the quality of elderly people’s daily lives by improving their mobility should be a top priority for transport policymakers. In Western countries, particularly in the United States and Europe, driving is the primary means of transport and only a small portion of elderly people use public transport. Accordingly, numerous studies have been conducted on the driving behavior and safety of elderly drivers (Stamatiadis et al., 1991; Robertson and Aultman-Hall, 2001; Yannis et al., 2010; Gelau et al., 2011; Nakagawa et al., 2013; Broberg and Willstrand, 2014). Some other studies have also been conducted on the travel patterns of the elderly (Carp, 1988; Hildebrand, 2003; Newbold et al., 2005; Schmöcker et al., 2008; Buehler and Nobis, 2010; Currie and Delbosc, 2010; Ipingbemi, 2010; Broome et al., 2012; Siren and Haustein, 2013; Rahman et al., 2016) in an effort to improve their mobility.

Traditional travel demand modeling generally assumes travel activities are age-related (Figueroa et al., 2014). As age increases, the willingness and ability to drive decrease, and a reduction of travel activity, journey time, and driving distance as a result. Research by Johansson-Stenman (2002) had found the travel distance would reach its peak at about the age of 50. In addition, the observable trend becomes significant once they reach their retirement age (Collia et al. 2003; Somenahalli and Shipton, 2013). Despite this, the elderly of today seem to be as mobile as their younger counterparts with respect to the number of trips. As a matter of fact, the elderly were more likely to have driving licenses, to take more trips, and to drive more than older adults a decade ago. The elderly were more mobile than ever before, and the trends towards increased trip rates and distances could be witnessed. The recent study by van den Berg et al. (2011) had reviewed that there is no significant age effects on the travel distance and time among the young adults and the elderly in the Netherlands.

Cars (for drivers and passengers alike) are the most important travel mode for the elderly in Western countries. In Canada, car drivers and car passengers were the two dominant transport modes for the elderly, with public transport (train and bus) ranked the most unpopular mode (Newbold et al., 2005). Similarly, Rosenbloom (2004) reported that in the United States, older adults made most of their trips by car, with only around 6% walking and 2% using public transit. The situation is similar in Australia, with the shares of automobiles and public transport being 83% and 7%, respectively (Truong and Somenahalli, 2015). Numerous studies have revealed that the shares of cars and taxis are much higher than those of buses, coaches, and rail in European countries. For example, In the United Kingdom, older adults (70 and above) make about 50% of their trips by private car (includes driving and car-sharing) and only 12% by bus
(Department of Environment, Transport, and Regions, 2000). In the Netherlands, nearly 50% of the elderly aged 65 or above make their trips by car, with less than 10% made by public transport (Tacken, 1998). In contrast, in a few developing countries such as China, characterized by lower car and driving license ownership rates, the elderly travel mostly on foot (49%), followed by public transport (43%), bicycle (4%), and car (less than 1%) (Hu et al., 2013).

For most of the elderly, work is no longer part of their activities. Hence, the changes generated by retirement can affect their trip-making behavior (van den Berg et al., 2011). Beyond staying at home, the activities of the elderly include visiting, shopping, and recreational activities. For example, Newbold et al. (2005) stated that traveling for goods and services ranked first among all outdoor activities for the elderly in Canada. However, travelling to religious places constituted the highest proportion of total trips generated by the elderly in Nigeria (Olawole and Aloba, 2014). In Asian countries such as China, the two major trip purposes for the elderly were shopping (21%) and leisure (11%) (Hu et al., 2013). Understandably, the travel patterns of the elderly are substantially different in differing settings. Considerable research has been conducted on the travel patterns of the elderly, but most have been focused on countries where driving is the primary means of mobility, with a very low patronage of public transport. To the best of our knowledge, there are no local studies revealing the travel patterns of the elderly in Hong Kong—a high-density, transit-oriented city.

Meanwhile, a rapid growth in elderly population in the future years poses a great challenge for transport operators and urban planners tasked with offering travel options that consider the unique and complex travel patterns of the elderly (Alsnih and Hensher, 2003; Hess, 2009). Thus, it is generally believed that ageing’s effect on transport systems should receive more attention, compared with the other challenges that ageing poses for the economy and for health care and retirement systems (Buehler and Nobis, 2010). There should be no exception on the Hong Kong transport system. The travel characteristics of the elderly should be taken into account when improving the Hong Kong transport system.

2.4. Perceptions of public transport

Substantial research has been conducted over the years to determine the key factors influencing users’ perceptions of public transport, with the goal of establishing new transport policies and identifying the areas that need improvement and image-lifting, based on the levels of importance and satisfaction (Foote and Stuart, 1998; Hensher and Prioni, 2002; Tyrinopoulos and Antoniou, 2008; dell’Olio et al., 2010; Broome et al., 2013; del Castillo and Benitez, 2013; Rojo et al., 2013; Hensher, 2014; Shiau and Huang, 2014; Das and Pandit, 2015; Laverty and Millett, 2015; Mouwen, 2015). According to the results of the Understanding Senior Transportation Survey (Ritter et al., 2002), driving is the most common mode of transport among older Americans. The elderly have a perception that public transport is unreliable and inaccessible.
Furthermore, the concern on safety and security is a reason of not using public transport services.

Among all public transport modes, taxis may be the most desirable public transport mode for the elderly, as they offer convenient and personalised point-to-point transport services round the clock. Some taxis are custom-made to provide high-quality transport services for the elderly and disabled people, for example the provision of larger seating areas. However, the results of the Understanding Senior Transportation Survey indicate that taxis are too expensive to be used widely by elderly people, despite their high accessibility and provision of point-to-point services. Therefore, taxis were regarded as a luxury rather than a feasible means of daily transport. Consequently, most of the older American respondents intended to continue using private vehicles for daily travel, due to a greater sense of independence and the ability to travel anywhere and at any time. Alternatively, ride-sharing is identified as the most common mode of transport for the elderly with physical conditions that prevented them from driving; however, this transport mode made them feel dependent and anxious about imposing on others.

In contrast, travel behavior is significantly different in Hong Kong. Driving in Hong Kong is very costly, particularly due to the high price of parking. Very few apartments in Hong Kong offer car parking spaces and this limited supply further increases parking costs. As noted by Inocencio (2012), Hong Kong is the third most expensive place to park in the world. Due to these costs, few people in Hong Kong use private transport. Meanwhile, ride-sharing is rare because it is difficult to find a driver willing to share his or her car on a daily basis.

In fact, limited transport research has been conducted focusing on the elderly in Hong Kong or other metropolitan cities that provide similar public transport services. The provision of an age-attuned transport system, which accommodates the elderly’s mobility needs, is both urgent and necessary (O’Neill, 2016). Although some local studies of elderly mobility have been conducted (Stephen et al., 2005; Mok et al., 2010; Yoshiyuki et al., 2010), the transport needs of the elderly have rarely been fully captured, as most researchers place disabled and elderly people in the same category and emphasise the travel needs of the disabled. In many local studies, the travel characteristics of elderly people have been qualitatively assessed, based on the results of interviews; very few researchers have used modelling methodologies to analyse the travel behavior and preferences of the elderly.

In 2011, the Hong Kong government’s Transport Department conducted an attitudinal survey named the Travel Characteristics Survey (TCS2011) to obtain elderly people’s views of the experience of travelling on public transport (Transport Department, 2014). However, the survey covered only three types of public transport, rail, standard buses, and public light buses. As other modes of transport, such as taxis, non-franchised buses, ferries, and trams, were not addressed in the survey, the data do not provide a comprehensive view of the use of each transport mode by Hong Kong’s
elderly residents. In addition, the respondents were not asked to rate their satisfaction with various public transport services. Therefore, the data cannot be used to identify aspects of these services that require improvement. Although information was collected on the respondents’ views of Hong Kong’s fare concession scheme, the special concessionary fares were limited to the Mass Transit Railway (MTR) and only offered on Wednesdays at the time of the survey, whereas the offer now covers the MTR, buses, and ferries, and its use has been extended to any day of this week. To the best of our knowledge, the views of the elderly on this extension to the concession scheme have not been gathered. To gain in-depth insights into the travel preferences and behavior of Hong Kong’s elderly population and identify areas for improvement in the region’s public transport system, it is necessary to carry out a more comprehensive interview survey in Hong Kong.
3. TRAVEL CHARACTERISTICS OF THE ELDERLY IN HONG KONG

This chapter presents the household interview survey data extracted from Travel Characteristics Survey 2011 (TCS2011) for the travel patterns of the elderly, makes comparisons with other age cohorts and among subgroups of the elderly population. It helps visualize and uncover spatial-temporal travel characteristics of the elderly. In light of these findings, suggestions are introduced to improve the public transport services to the elderly in Hong Kong.

3.1. Household interview survey data

Household interview surveys have been widely used to study the travel patterns and behavior of the elderly in previous studies (e.g., Collia et al., 2003; Choi et al., 2014; Figueroa et al., 2014). However, as mentioned, there is scant literature on the travel behavior of older populations in high-density, transit-oriented cities such as Hong Kong. The travel characteristics of the elderly can be determined by taking advantage of the TCS2011 data (Transport Department, 2014). The TCS2011 was a self-reported attitudinal survey conducted by the Transport Department of Hong Kong SAR between September 2011 and March 2012. The data were obtained from a random sample of 101,385 local respondents in 35,401 households, with approximately a 1.5% sampling rate (the total number of households and the population count were 2,363,300 and 6,881,900, respectively). Quality control measures were strictly applied in the fieldwork periods to ensure high-quality data.

The household interview survey consists of three levels: 1) household data (including number of household members, housing type, private vehicle availability, etc.); 2) household members’ personal particulars (including gender, age, occupation status, driver’s license ownership, financial status, etc.); and 3) a complete record of every trip involving mechanized transport (including departure and arrival time, origin and destination, transport mode used, trip purpose, interchange location, etc.) made within the past 24 hours (on a normal weekday) for every household member. Walking trips with the same start and end point that did not involve a mechanized transport mode were neglected. The collected survey data were processed and adjusted by the household expansion factor based on independent control data, such as population distribution in Hong Kong territory, to expand the household-related data (35,401 households) to be representative of the territory-wide total (2,363,300 households).
As presented in Figure 3.1, Hong Kong territory was divided into 26 zones (broad districts) for transport planning and modeling analysis. Each zone had a certain degree of homogeneity in land use. Four zones were in Hong Kong Island (shown in red), six zones were in Kowloon (shown in yellow), twelve zones were in the New Territories non-rural area (shown in blue), and the remaining four zones were in the New Territories rural area (shown in grey). It is worth mentioning that the rural areas were much less populated than their urban counterparts.

### 3.2. Trip patterns and behavior

#### 3.2.1. Trip rate: How many trips did the elderly travel by mechanized transport modes?

To present the travel characteristics of the elderly and allow for comparisons with those of young adults, this study used the household interview survey data from Hong Kong respondents aged 18 or above. Data on children and teenagers were ignored because their travel patterns were considerably different, which could potentially confound the underlying contribution factors in the observed patterns among the young adults (Collia et al., 2003; Figueroa et al., 2014).

According to the TCS2011 data, the household interview survey covered 65,758 young adults (aged 18-59) and 20,062 elderly respondents (aged 60 or above). A total of 91,242 trips were taken by young people aged 18-59 and 14,211 were taken by the elderly aged 60 or above. The elderly are not a homogenous group, as mobility characteristics and travel patterns might vary among subgroups (Alsnih and Hensher,
Therefore, to gain a deeper understanding of travel behavior of the elderly and examine how such behavior differed across age cohorts, this study followed similar studies (Alsnih and Hensher, 2003; Newbold et al., 2005; Horner et al., 2015) and categorized them into three finer cohorts: aged 60-69, 70-79, and 80 or above.

### Table 3.1 Mechanized trip rate of people in different age cohorts

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Age Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18-59</td>
</tr>
<tr>
<td>Expanded number of respondents</td>
<td>4,493,381</td>
</tr>
<tr>
<td>Expanded number of trips</td>
<td>6,664,561</td>
</tr>
<tr>
<td>Mechanized trip rate</td>
<td>1.48</td>
</tr>
</tbody>
</table>

After applying the expansion factors to the collected data for a better representation of the population’s travel patterns, about 5.8 million more respondents with over 7.6 million expanded mechanized trips in a day were obtained for further statistical analysis. **Table 3.1** reports the mechanized trip rates on a typical weekday for young adults and the elderly. The trip rates varied considerably across different age groups, gradually declining from 1.48 to 0.29 trips (a decrease of up to 80%) as people aged. The results indicated that older adults tended to be less mobile than their younger counterparts, and the former generated significantly fewer mechanized trips per day in comparison. This phenomenon could be due to the financial status and physical conditions of the elderly. The majority of the elderly population is retired, and thus they do not have the incentive or income to support unnecessary travel. Furthermore, due to deficits in sensory function and musculoskeletal strength, the elderly are more sensitive to rough and uncomfortable rides and become tired more easily on long journeys, especially when travelling without a seat.

### 3.2.2. Journey time: How long/far did the elderly go?

**Figure 3.2** illustrates the proportion of trips by journey time for the respondents in the different age cohorts. Note that the proportions for all of the age cohorts reached their peaks in the journey time group at between 21 and 30 minutes, and less than 5% of the trips lasted more than an hour. The majority of the mechanized trips were completed within 30 minutes for the elderly. In particular, those aged 80 or above dominated the journey time group of less than 10 minutes. The proportion of the elderly’s trips rapidly dropped from around 35% to 10% when the journey time exceeded 30 minutes. The decreasing trend was less obvious for young adults’ trips, where still more than 20% were completed in 51-60 minutes. The findings revealed that most of the elderly traveled for a short trip for less than 30 minutes journey time, while the young respondents made more long trips than their senior counterparts. It is worth mentioning that the length of journey time was not entirely equivalent to the actual travel distance, which depended on the transport modes used and their corresponding average traveling...
speed. Considering that more elderly individuals preferred slower transport modes for their cheaper travel fares and more stable rides, the actual travel distance was anticipated to be more divergent between young adults and the elderly.

Figure 3.2 Trip distribution by journey time for people in different age cohorts.

3.2.3. Mode Choice: How did the elderly travel?

The following mechanized transport modes were categorized in this study: 1) Mass Transit Railway (MTR), 2) Light Rail Transit (LRT), 3) tram, 4) ferry, 5) public light bus, 6) franchised bus, 7) private vehicle, 8) taxi, 9) special purpose bus (local shuttle bus, respondent’s service, direct cross-boundary coach, cross-boundary shuttle bus, company coach, school bus, and tourist coach), and 10) others (golf cart and ambulance vehicle). Figure 3.3 presents the public transport mode choices of the different age cohorts. Unlike many Western nations in which cars are the dominant travel mode and adequate alternatives are extremely unpopular, public transport is by far the most frequently used mode by all age cohorts in Hong Kong, representing over 92% of the total ridership. MTR, franchised bus, and public light bus were the three most popular transport modes out of all of the segments. MTR was the most favorable mode for young adults, comprising about 35% of their daily trips, whereas franchised bus constituted the highest percentage of daily travel for old adults (37%, 46%, and 43% for the elderly in the 60-69, 70-79, and 80 or above age groups, respectively). The findings revealed that the elderly preferred using franchised bus services for the following reasons: cumbersome MTR interchange experiences (they are required to walk a long way to the next platform inside train stations to transfer); shorter walking distance for franchised bus services (franchised buses offered point-to-point direct services with less interchanges and more frequent stops on streets, and they did not have to walk downstairs to underground MTR stations); and seat availability (MTR was always crowded, with limited provision of seats, such that the elderly had a higher chance of finding a seat on a bus). In addition, the elderly enjoyed traveling more by tram due to
cheaper travel fares, and by taxi due to higher accessibility. In contrast, the usage of private vehicles decreased with age, perhaps due to the additional car licensing restrictions for those aged 70 or above.

Figure 3.3 Trip distribution by mechanized transport modes for people in different age cohorts

3.2.4. Trip purpose: What did the elderly do?

Trips were categorized by purpose: work, school, market (shopping), food premise (eating in a restaurant), exercise, medical care, culture, elderly homes, visiting friends, and other (some low-frequency trips, e.g., entertainment, religion, financial affairs, going to mainland China, escorting schoolchildren to and from school, etc.). As illustrated in Figure 3.4, the trip purposes of the young and older adults varied significantly. The most striking difference was that the proportions of the elderly’s work and school trips were greatly lower than those of young adults. Work trips accounted for the greatest share (67%) for the younger group, and it gradually decreased to less than 3% for the respondents aged 80 or above. For the elderly aged 60-69, work was still the dominant trip purpose. The retirement age in Hong Kong is typically 60-69, but a proportion of people in this age group still had full- or part-time jobs. School trips constituted over 5% of the daily trips of young adults, but almost none for the elderly cohorts. In contrast, market (shopping) trips constituted a large share of those made by the three elderly subgroups (27%, 36%, and 34% for those in the 60-69, 70-79, and 80 or above age groups, respectively). This was the dominant trip purpose for those aged 70-79 and 80 or above, but it only accounted for less than 10% of young adults’ trips. Similar patterns could be observed for other trip purposes, such as for food (eating in a restaurant) and visiting friends. Furthermore, the elderly travelled more frequently to hospitals, medical centers, and clinics for medical care and to the park, playground, sports grounds, and gym centers for exercise than their younger counterparts.
The above details indicate that people move from attending school, to joining the labor force, to retirement in a step-by-step manner as they age. The frequent trip purposes changed from mandatory trips (work and school) to optional trips (household-sustaining and leisure).

![Figure 3.4 Trip distribution by purposes for people in different age cohorts](image)

**Figure 3.4** Trip distribution by purposes for people in different age cohorts

3.2.5. Trip starting time: When did they go?

**Figure 3.5** shows the start times of the respondents’ trips over different hourly periods in a day. Two obvious peaks were identified between 7 am and 10 am in the morning (defined as morning peak hours, and highlighted in red), and between 5 and 8 pm in the evening (defined as evening peak hours, and highlighted in blue). These periods aligned with typical office hours, which accounted for 62% of the young adults’ trips. During these two peak commuting periods, the elderly travelled much less, which demonstrates that they tended to avoid travelling with their younger counterparts, probably because they preferred staying away from crowds. Because they were retired, the elderly travelers could alter their trip start times for a more comfortable travel environment. In contrast, the elderly respondents travelled more frequently during the noon off-peak hours from 10 am to 5 pm. Their probability of making a trip after 8 pm was usually lower than that of the younger group (less than 5% of total trips in a day for each sub-group in the elderly population). This indicates that the majority of elderly adults preferred not to travel at night. The finding was consistent with that of Alsnih and Hensher (2013), who indicated that older adults were more active outside the home during daylight hours than after dark.

The trip-making patterns of the elderly aged 60-69 was similar to that of the young respondents when compared with those of the elderly aged 70-79 and 80 or above. It is interesting to note that the travel patterns gradually transformed as people aged. Some of the older adults aged 60-69 had full- or part-time jobs and made compulsory trips
during peak commuting hours. Hence, more trips started during rush hours, but the
distribution was more even than that of the young adults’ trips. For the elderly aged 70-
79, the trip start times shifted to noon off-peak hours, and only one peak could be
identified. Once the respondents had reached age 80 or above, they had a higher
tendency to start their trips during the 10 am to 11 am period to avoid traveling with
crowds.

Figure 3.5  All day profile of trip starting time for people in different age
cohorts

3.3. Spatio-temporal travel characteristics

We also conducted a spatio-temporal analysis to investigate how the respondents’
travel behavior related to space and time. According to the discussion in the previous
section, four study periods (morning peak, noon off-peak, evening peak, and midnight
off-peak) were identified. Figure 3.6 provides a visualized demonstration of the
popularity of 26 destinations during these periods among young adults and the elderly.
The darkness of a zone represents its level of popularity or attractiveness (calculated as
the proportion of trips to a specific zone during a specific period over the total number
of trips in a day for each age cohort). There are noticeable differences between two
groups in terms of their spatio-temporal distributions. The young adults concentrated
their travel during the two peak commuting hours, whereas the elderly preferred
travelling during the noon off-peak period.
Figure 3.6  Proportion of trips attracted during the four study periods
During the two peak periods, the young adults took a higher percentage of trips (33% and 29% in the morning and evening peak hours daily, respectively), with the majority being compulsory (work and school) trips. During the morning peak, the most popular zones were commercial districts, including Central and Western (3.8%), Kwun Tong (2.8%), and Wan Chai (2.6%). The most popular zones during the evening peak were residential districts, including Kwun Tong (2.5%), Eastern (2.4%), and Tuen Mun (2.1%). Interestingly, Kwun Tong exhibited a better jobs–housing balance, and its town planning setting decreased the number of vehicle trips and long-distance commuting demands in addition to relieving traffic congestion (Cervero, 1989, 1991; Giuliano, 1991; Loo and Chow, 2011).

The majority of the elderly respondents’ daily trips (57%) were generated between 10 am and 5 pm; specifically, 22%, 18%, and 12% of the trips were taken in the morning peak, evening peak, and midnight off-peak hours, respectively. This indicates that the older adults preferred to avoid traveling during the peak commuting hours and at night. Seven of the zones (Kwun Tong, Eastern, Wan Chai, Sha Tin, Sham Shui Po, Tuen Mun, and Central and Western) were the most popular among the elderly during the noon off-peak hours, with each zone attracting over 3% of daily trips.

Some zones were more attractive to young adults or to the elderly, overall. In terms of the most divergent destination for both groups, Central and Western attracted 7.6% of the young adults’ trips and only 5.4% of those made by the elderly. In contrast, Eastern attracted 9.4% of the trips made by the elderly, and only 7.5% of the young adults’ trips. These travel patterns could be explained by trip purpose (as mentioned above) and population distribution. Figure 3.7 demonstrates the population distribution of young adults and the elderly. The darker zones represent greater population. Note that the population distributions of these two groups were somewhat similar. The majority of the Hong Kong respondents lived in urban areas, particularly concentrated in the Kwun Tong and Eastern zones. A deeper analysis of Figures 3.6 and 3.7 reveals that the young adults’ trip destinations were more dispersed due to the obvious differences
between the population distribution and trip destination distribution for this group. Among the elderly, the population distribution was similar to that of the trip destinations, indicating that the zones more frequently visited by the elderly had higher elderly populations. A possible explanation is that the elderly made more short (intra-zonal) trips, in line with our previous observations regarding shorter journey times for trips taken by the elderly.

3.4. Identified issues related to elderly mobility

The public transport services’ ability to address the needs of their elderly passengers is of particular concern. The elderly are transit captives who rely heavily on public transport in Hong Kong. Understanding the unique travel behavior of older adults provides the basis for policy instruments. It is the first step for city governments to take in establishing effective and appropriate public transport policy measures for the elderly. Based on the aforementioned travel patterns and characteristics of the elderly, we summarize the following four observations that provide policy insights into improving public transport services for the elderly.

i) The mechanized trip rate declined significantly (dropped up to 80%) as people aged, due to gradual changes in their financial status and physical condition;

ii) The elderly respondents aged 80 or older usually made short trips (less than 10 minutes journey time), travelling less by MTR and franchised bus and more by taxi and other modes (e.g., ambulance);

iii) The elderly respondents preferred public transport modes with fewer interchanges and shorter walking distances, and they preferred traveling during the noon off-peak hours between 10am to 5pm to avoid crowds; and

iv) Most of the elderly respondents lived in particular zones (Kwun Tong and Eastern) and frequently made intra-zonal trips near their living places.

3.5. Concluding remarks

This chapter presented the household interview survey data extracted from TCS2011. It described the travel patterns of the elderly, and made comparisons with those of people in other age cohorts and among subgroups of the elderly population. It then visualized and uncovered the spatio-temporal travel characteristics of the elderly, and discussed some policy insights for improving public transport services to the elderly. The results can be served as a valuable reference to the city government on formulating effective and appropriate public transport policy measures to improve elderly mobility.
4. ELDERLY USERS’ LEVEL OF SATISFACTION WITH PUBLIC TRANSPORT SERVICES

To address the preceding issues, face-to-face interviews were used to collect the elderly users’ perceptions on the service quality of public transport modes. An ordered probit model was developed to determine the importance of the concerned service aspects to the overall service performance. An importance-satisfaction analysis was also conducted to visualize how best to prioritize actions for improving each of the nine service aspects.

4.1. Face-to-face interviews

The elderly users’ perceptions of public transportation service quality, based on their latest travel experiences, were collected during face-to-face interviews. The face-to-face interviews were conducted at numerous selected district elderly community centres, clinical centres, public housing estates, parks, and public transport stations throughout Hong Kong in March 2015 during days and nights. It is noteworthy that no special events or incidents occurred during our interview period. In this study, 613 elderly residents aged 60 and above were successfully interviewed from over 3,000 attempts. The response rate was about 16%. Based on the pragmatic decision that the estimation sample should not be less than 500 individuals for an ordered probit model, hence 113 observations were randomly selected from the samples for validation at a later stage.

The questionnaire used in the interviews comprised three parts: (1) collection of the respondents’ socio-demographic characteristics; (2) identification of the most frequently used public transport mode, including railways, buses, public light buses or taxis; and (3) discovery of the respondents’ satisfaction levels regarding specific service aspects and overall performance, based on their latest public transport experiences.

4.1.1. Respondents’ socio-demographic characteristics

Table 4.1 shows the respondents’ socio-demographic characteristics. The sample covered a broad spectrum of public transport users, and the profile of the estimation sample was generally similar to that of the validation subsample. Adults aged 80 and above were the most numerous, constituting about 29% of the total. Gender distribution was quite even, with slightly more than half the respondents being male. Regarding the education level, the largest group was formed of users at the primary level, representing at least 61.8% of the total, and only 7.6% of them were educated up to the tertiary level. Around 80% of the respondents were retired, with only a small proportion engaging in full- or part-time work. Over 90% of the respondents’ households did not own any private cars. About 70% of the respondents spent around HKD 1,001 to 5,000 per person each month.
Table 4.1  Respondents’ socio-demographic profiles

<table>
<thead>
<tr>
<th>Personal Particulars</th>
<th>Frequency (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall [Sample Size = 613]</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>60-64 years</td>
<td>75 (12.2%)</td>
</tr>
<tr>
<td>65-69 years</td>
<td>122 (19.9%)</td>
</tr>
<tr>
<td>70-74 years</td>
<td>117 (19.1%)</td>
</tr>
<tr>
<td>75-79 years</td>
<td>121 (19.7%)</td>
</tr>
<tr>
<td>80 years or above</td>
<td>178 (29.1%)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>317 (51.7%)</td>
</tr>
<tr>
<td>Female</td>
<td>296 (48.3%)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>390 (63.6%)</td>
</tr>
<tr>
<td>Secondary</td>
<td>177 (28.9%)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>46 (7.5%)</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>524 (85.5%)</td>
</tr>
<tr>
<td>Housewife</td>
<td>43 (7.0%)</td>
</tr>
<tr>
<td>Full-time job</td>
<td>27 (4.4%)</td>
</tr>
<tr>
<td>Part-time job</td>
<td>19 (3.1%)</td>
</tr>
<tr>
<td><strong>Private car available for household use</strong></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>580 (94.6%)</td>
</tr>
<tr>
<td>Yes</td>
<td>33 (5.4%)</td>
</tr>
<tr>
<td><strong>Monthly expenses (HKD) per person</strong></td>
<td></td>
</tr>
<tr>
<td>$1,000 or below</td>
<td>42 (7.0%)</td>
</tr>
<tr>
<td>$1,001-$5,000</td>
<td>422 (68.8%)</td>
</tr>
<tr>
<td>$5,001-$10,000</td>
<td>124 (20.2%)</td>
</tr>
<tr>
<td>$10,001-$15,000</td>
<td>19 (3.1%)</td>
</tr>
<tr>
<td>$15,001 or above</td>
<td>5 (0.8%)</td>
</tr>
<tr>
<td><strong>Household (Respondents could provide multiple answers)</strong></td>
<td></td>
</tr>
<tr>
<td>Living alone</td>
<td>110 (17.9%)</td>
</tr>
<tr>
<td>Living with spouse</td>
<td>335 (54.7%)</td>
</tr>
<tr>
<td>Living with parents</td>
<td>5 (0.8%)</td>
</tr>
<tr>
<td>Living with children</td>
<td>327 (53.3%)</td>
</tr>
<tr>
<td>Living with grandchildren</td>
<td>55 (9.0%)</td>
</tr>
<tr>
<td>Living with other relatives</td>
<td>5 (0.8%)</td>
</tr>
<tr>
<td>Living with friends</td>
<td>7 (1.1%)</td>
</tr>
<tr>
<td>Others (e.g., elderly home)</td>
<td>19 (3.1%)</td>
</tr>
</tbody>
</table>

Note: The values in brackets represent the percentage of respondents.
4.1.2. Travel patterns

Table 4.2 presents the elderly respondents’ travel patterns. It can be seen that about 22% of them traveled by public transport less than one day a week, whereas 24.8% went out every day. The dominant trip purposes were visiting friends and relatives and participating in leisure activities, both over 33% of the samples. Table 4.2 also shows their overall level of satisfaction with public transport services and the effects that the fare concession scheme and provision of priority seats had on their travel.

Table 4.2   Travel patterns and feedback on public transport policy measures

<table>
<thead>
<tr>
<th>Travel Patterns/ Comments</th>
<th>Frequency (Percentage) [Sample Size = 613]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (number of days) of using public transport service in a week</td>
<td></td>
</tr>
<tr>
<td>Less than 1</td>
<td>135 (22.0%)</td>
</tr>
<tr>
<td>1-2</td>
<td>182 (29.7%)</td>
</tr>
<tr>
<td>3-4</td>
<td>115 (18.8%)</td>
</tr>
<tr>
<td>5-6</td>
<td>29 (4.7%)</td>
</tr>
<tr>
<td>Every day</td>
<td>152 (24.8%)</td>
</tr>
<tr>
<td>Trip purpose (Respondents could provide multiple answers)</td>
<td></td>
</tr>
<tr>
<td>Medical appointment</td>
<td>99 (16.2%)</td>
</tr>
<tr>
<td>Visit friends and relatives</td>
<td>205 (33.4%)</td>
</tr>
<tr>
<td>Shopping</td>
<td>171 (27.9%)</td>
</tr>
<tr>
<td>Social activities</td>
<td>27 (4.4%)</td>
</tr>
<tr>
<td>Go for a walk</td>
<td>176 (28.7%)</td>
</tr>
<tr>
<td>Leisure activities</td>
<td>205 (33.4%)</td>
</tr>
<tr>
<td>Others</td>
<td>114 (18.6%)</td>
</tr>
<tr>
<td>Overall satisfaction with public transport services</td>
<td></td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>33 (5.4%)</td>
</tr>
<tr>
<td>Neutral</td>
<td>151 (24.6%)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>429 (70.0%)</td>
</tr>
<tr>
<td>Deliberate travel using discounted public transport modes</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>192 (31.3%)</td>
</tr>
<tr>
<td>No</td>
<td>353 (57.6%)</td>
</tr>
<tr>
<td>Depends</td>
<td>68 (11.1%)</td>
</tr>
<tr>
<td>More willing to travel after implementation of concession fare scheme</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>438 (71.5%)</td>
</tr>
<tr>
<td>Yes, a little more</td>
<td>108 (17.6%)</td>
</tr>
<tr>
<td>Yes, a lot more</td>
<td>67 (10.9%)</td>
</tr>
<tr>
<td>More willing to travel after provision of priority seats</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>528 (86.1%)</td>
</tr>
<tr>
<td>Yes, a little more</td>
<td>79 (12.9%)</td>
</tr>
<tr>
<td>Yes, a lot more</td>
<td>6 (1.0%)</td>
</tr>
</tbody>
</table>

Note: The values in brackets represent the percentage of respondents.
decisions. Up to 70% of the respondents were satisfied with the public transport. More than half reported that they did not travel by discounted modes of public transport deliberately because of the lower travel fare. Large percentages of the respondents (71.5% and 86.1%) did not increase their intention to travel after the implementation of public transport fare concession scheme and provision of priority seats, respectively. This implies that the current public transport policy measures do not effectively improve elderly mobility.

During the interviews, most of the respondents expressed concerns about the provision of priority seats. They recommended increasing the number of priority seats and boosting awareness of the importance of offering priority seats to people in need among regular passengers. They also requested a more frequent service to shorten wait times, and better waiting areas at railway stations and bus/public light bus stops. Some of the respondents requested that the government extend the coverage to include public transport fare concession schemes for people aged 60-64 (some bus service providers were providing discounts to their passengers in this age group).

4.1.3. Service aspects contributing to overall service performance

The respondents were invited to report their level of satisfaction with individual service aspects based on their latest public transport experiences. To address the characteristics and circumstances of travel in Hong Kong, the selected service aspects reflected the Transport Characteristics Study (Transport Department, 2014). Minor adjustments were made based on two pilot surveys conducted in December 2014 and January 2015. Nine service aspects were thus considered:

i) Seat availability (Sufficient priority seats? Not applicable for public light buses and taxis, where seats are guaranteed);
ii) Travel stability (Rough and uncomfortable ride, or traveling too fast?);
iii) Wait time for service (Tardy services or long wait times?);
iv) Driver’s attitude (Vehicle starting to move before passengers are seated? Not applicable for railways, where there is no direct interaction with the operators);
v) Ease of boarding and alighting (High floor platform?);
vii) Internal temperature (Erratic air-conditioning?);
viii) Walking distance to stations or stops (Stations or stops are too far apart?);
ix) Condition of stations or stops (Provision of seats and shelter at stations or stops?).

Satisfaction levels were measured on a 5-point Likert scale ranging from 1 (very dissatisfied) to 5 (very satisfied) for all of the individual service aspects. At the end, the respondents were also invited to provide scores for the overall service performance, which was expected to be based on the respondents’ satisfaction with the individual service aspects (Olawole and Aloba, 2014). In non-applicable situations (e.g., asking about seat availability among respondents who traveled by public light buses, where
seats are guaranteed), the respondents’ views on the associated service aspects were not considered.

4.2. Ordered probit model

The respondents’ overall satisfaction levels with public transport services were presented using an ordinal scale. Ordinal scales have a few distinctive features: clearly ordered levels, unknown and unobservable absolute distances between levels, and the potential for unequal distances between adjacent ratings (e.g., the distance between ratings 2 and 1 may not be the same as that between ratings 3 and 2 or 5 and 4). It was considered inappropriate to use the ordinary least squares regression model, which would produce biased results (Hensher, 1990; dell’Olio et al., 2010; Iseki and Taylor, 2010; Zheng et al., 2014).

In this Study, an ordered probit model was proposed to relate the overall satisfaction level to the performance of individual service aspects. This model has been widely used to fit the data structure of an ordinal response (Redmond and Mokhtarian, 2001; Pai and Saleh, 2007; Su and Bell, 2009, 2012; Hasegawa, 2010). Assuming that $y_i$ represents the reported overall satisfaction level of respondent $i$, then a latent (unobserved) variable $y_i^*$ is introduced as

$$y_i^* = \sum_k \beta^k X_i^k,$$  (4.1)

where $k$ is the index of the individual service aspect, $X_i^k$ is the score of the service aspect $k$ as reported by respondent $i$ and $\beta^k$ is the corresponding coefficient. $y_i$ is equal to $j = 1, ..., J$ under the following conditions:

$$y_i = \begin{cases} 
1, & \text{if } y_i^* \leq \mu_1; \\
 j, & \text{if } \mu_{j-1} < y_i^* \leq \mu_j; \\
 J, & \text{if } y_i^* > \mu_{J-1},
\end{cases}$$  (4.2)

where $J$ is the number of satisfaction levels (in this case, $J = 5$) and $\mu_j$ is the threshold value (cut-off point) to be estimated for each pair of adjacent levels, where $\mu_1 < ... < \mu_{J-1}$. From Equation (4.2), the probabilities of $y_i$ taking on each of the values of $j = 1, ..., J$ are determined as
\[ P(y_i = 1) = \Phi(\mu_i - y_i^*); \]
\[ P(y_i = j) = \Phi(\mu_j - y_i^*) - \Phi(\mu_{j-1} - y_i^*); \quad \text{(4.3)} \]
\[ P(y_i = J) = 1 - \Phi(\mu_{J-1} - y_i^*), \]

where \( P(y_i = j) \) is the probability that response variable \( y_i \) of individual \( i \) will take a specific level \( j \). \( \Phi(\mu_i - y_i^*) \) is the cumulative standard normal distribution function of \( \mu_i - y_i^* \). Both \( \beta^i \) and \( \mu_j \) are unknown parameters to be calibrated jointly based on the maximum likelihood estimation method.

4.3. First preference recovery analysis

To gain confidence in the model’s performance and ensure the accuracy of the evaluated attributes’ relative importance, 113 observations from the collected samples were used to validate the developed model. The model validation was based on the concept of first preference recovery (FPR) (de Dios Ortuzar and Willumsen, 2011) — a measure that presents the proportion of respondents who effectively select the option with the greatest modeled probability. It is equivalent to the percentage of choices correctly predicted according to the maximum utility classification. FPR has been used in a number of studies for model validation (Gunn and Bates, 1982; Wong et al., 2014) to compare the values of chance recovery (CR) and expected recovery (ER) and confirm that the model is both informative and reasonable.

CR is the proportion of the first preference choice given by the equally likely model. The CR value and its standard error can be calculated as

\[ \text{CR} = \frac{1}{N} \sum_i \frac{1}{M_i}, \quad \text{and} \]
\[ \text{SE(CR)} = \frac{1}{N} \sqrt{\sum_i \frac{1}{M_i} \left(1 - \frac{1}{M_i}\right)}, \quad \text{(4.5)} \]

where \( N \) is the size of the validation subsample (in this case, \( N = 113 \)) and \( M_i \) is the number of choices for the satisfaction level regarding the public transport services experienced by respondent \( i \) (in this case, \( M_i = 5 \)). Because FPR is an independent binomial random event for the elderly respondent \( i \), the standard error of CR is given by Equation (4.5).

ER is the expected proportion of FPR estimated from the ordered probit model over the validation subsample \( N \). The ER value and its standard error can be calculated as
\[ \text{ER} = \frac{1}{N} \sum_{i} P_i^{\text{max}}, \quad \text{and} \]
\[ \text{SE(ER)} = \frac{1}{N} \sqrt{\sum_{i} P_i^{\text{max}} (1 - P_i^{\text{max}})}, \]

where \( P_i^{\text{max}} \) is the maximum predicted probability associated with respondent \( i \)'s best option, which is the estimated probability assigned to the first preference option. Similar to Equation (4.5) for the standard error of CR, the standard error of ER can be calculated by Equation (4.7).

Model validation involves the following two null hypotheses: 1) there is no difference between the values of FPR and CR. We reject the hypothesis that the value of FPR is equal to that of CR, if the test statistic exceeds the threshold value; and 2) there is no difference between the values of FPR and ER. We do not reject the hypothesis that the value of FPR is equal to that of ER, if the test statistic does not exceed the threshold value. The threshold value is specified for the normal distribution at the chosen level of significance. If the first hypothesis is rejected and the latter one is not rejected, we can conclude that the model is both informative and reasonable (Wong et al., 2014).

4.4. Model results

4.4.1. Usage of public transport modes and perceived scores for each service aspect

Table 4.3 presents the frequency and percentage of respondents who traveled by four popular public transport modes. When asked which mode they used most frequently, up to 90% of the respondents replied either railways (45.0%) or buses (50.4%), with only a limited proportion using public light buses (2.2%) or taxis (2.4%). The findings are consistent with Chapter 3 that railways and buses are the most popular public transport modes for the elderly residents in Hong Kong. Given that the mass transit system in Hong Kong provides elderly users with reliable, convenient, and cheap services (supported by the public transport HKD 2 fare concession scheme), the elderly have become more willing to travel by railway and bus. Moreover, the respondents noted that the rough, uncomfortable rides provided by public light buses, and the high travel cost of using taxis were their reasons for not using these modes, even though seats are guaranteed and walking distances are usually shorter.

The frequencies and percentages of the public transport modes used in the respondents’ latest travel experiences are shown in Table 4.3. The numbers of each transport mode are close to those of the most frequently used, as discussed above.
Table 4.3  Frequencies and percentages of respondents’ travel experiences by each public transport mode

<table>
<thead>
<tr>
<th>Public Transport Modes</th>
<th>Frequency (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimation Subsample</td>
</tr>
<tr>
<td></td>
<td>Validation Subsample</td>
</tr>
<tr>
<td></td>
<td>[Sample Size = 500]</td>
</tr>
<tr>
<td></td>
<td>[Sample Size = 113]</td>
</tr>
<tr>
<td>Most Frequently Used</td>
<td></td>
</tr>
<tr>
<td>Railways</td>
<td>225 (45.0%)</td>
</tr>
<tr>
<td></td>
<td>26 (23.0%)</td>
</tr>
<tr>
<td>Buses</td>
<td>252 (50.4%)</td>
</tr>
<tr>
<td></td>
<td>74 (65.5%)</td>
</tr>
<tr>
<td>Public Light Buses</td>
<td>11 (2.2%)</td>
</tr>
<tr>
<td></td>
<td>10 (8.8%)</td>
</tr>
<tr>
<td>Taxis</td>
<td>12 (2.4%)</td>
</tr>
<tr>
<td></td>
<td>3 (2.7%)</td>
</tr>
<tr>
<td>Used in the Latest Travel Experience</td>
<td></td>
</tr>
<tr>
<td>Railways</td>
<td>243 (48.6%)</td>
</tr>
<tr>
<td></td>
<td>27 (23.9%)</td>
</tr>
<tr>
<td>Buses</td>
<td>232 (46.4%)</td>
</tr>
<tr>
<td></td>
<td>67 (59.3%)</td>
</tr>
<tr>
<td>Public Light Buses</td>
<td>16 (3.2%)</td>
</tr>
<tr>
<td></td>
<td>17 (15.0%)</td>
</tr>
<tr>
<td>Taxis</td>
<td>9 (1.8%)</td>
</tr>
<tr>
<td></td>
<td>2 (1.8%)</td>
</tr>
</tbody>
</table>

Note: The values in brackets represent the percentage of the respondents.

Table 4.4  Weighted averages and standard deviations of service aspect scores

<table>
<thead>
<tr>
<th>Service Aspects</th>
<th>Weighted Average (Standard Deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimation Subsample</td>
</tr>
<tr>
<td></td>
<td>Validation Subsample</td>
</tr>
<tr>
<td></td>
<td>[Sample Size = 500]</td>
</tr>
<tr>
<td></td>
<td>[Sample Size = 113]</td>
</tr>
<tr>
<td>Seat availability</td>
<td>3.30 (0.95)</td>
</tr>
<tr>
<td>Travel stability</td>
<td>3.59 (0.77)</td>
</tr>
<tr>
<td>Wait time for service</td>
<td>3.52 (0.93)</td>
</tr>
<tr>
<td>Driver’s attitude</td>
<td>3.36 (0.63)</td>
</tr>
<tr>
<td>Ease in boarding and alighting</td>
<td>3.64 (0.87)</td>
</tr>
<tr>
<td>Internal temperature</td>
<td>3.49 (0.83)</td>
</tr>
<tr>
<td>Walking distance to stations or stops</td>
<td>3.66 (0.90)</td>
</tr>
<tr>
<td>Travel time and reliability</td>
<td>3.71 (0.76)</td>
</tr>
<tr>
<td>Condition of stations or stops</td>
<td>3.49 (0.88)</td>
</tr>
<tr>
<td>Overall performance</td>
<td>3.78 (0.72)</td>
</tr>
</tbody>
</table>

Note: The values in brackets represent the standard deviation of the score.

Table 4.4 tabulates the weighted averages and standard deviations of individual aspect scores and the overall service performance of each transport mode used by the respondents in their latest travel experiences. The average scores for overall service performance for the two subsamples were similar, about 3.8, indicating that the respondents were generally satisfied with the current public transport service quality (higher than the passing score of 3). The mean scores of all of the individual service aspects were also higher than 3. In particular, travel time and reliability received the highest satisfaction score of around 3.7 while seat availability scored the lowest.
4.4.2. Results of model calibration and validation

The data analysis and statistical software Statistical Package for the Social Sciences (STATA) was adopted, using the maximum likelihood estimation method to calculate the coefficient associated with each service aspect, along with the threshold values (cut-off points) between each pair of adjacent levels. As the rating scale representing the degree of satisfaction has five levels, there are four threshold values separating the choices. The estimated coefficient associated with each aspect should be non-negative in theory, because individual service quality should have positive or no repercussions on the overall service performance. Furthermore, because each of the variables has the same potential range (i.e., from 1 [very dissatisfied] to 5 [very satisfied]), all of the coefficients are unit-less and can be directly compared.

Table 4.5 Coefficients and their t-statistics for the ordered probit model

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficients</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seat availability</td>
<td>0.16&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.75</td>
</tr>
<tr>
<td>Travel stability</td>
<td>0.27&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.40</td>
</tr>
<tr>
<td>Wait time for service</td>
<td>0.19&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.86</td>
</tr>
<tr>
<td>Driver’s attitude</td>
<td>0.37&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.29</td>
</tr>
<tr>
<td>Ease in boarding and alighting</td>
<td>0.16&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.37</td>
</tr>
<tr>
<td>Travel time and reliability</td>
<td>0.21&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.70</td>
</tr>
<tr>
<td>Condition of stations or stops</td>
<td>0.44&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.38</td>
</tr>
<tr>
<td>$\mu_1$ (cut-off point of levels 1 and 2)</td>
<td>3.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.57</td>
</tr>
<tr>
<td>$\mu_2$ (cut-off point of levels 2 and 3)</td>
<td>3.84&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.17</td>
</tr>
<tr>
<td>$\mu_3$ (cut-off point of levels 3 and 4)</td>
<td>5.65&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11.43</td>
</tr>
<tr>
<td>$\mu_4$ (cut-off point of levels 4 and 5)</td>
<td>7.83&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.48</td>
</tr>
</tbody>
</table>

Note: <sup>a</sup> Parameters are significant at the 1% level.  
<sup>b</sup> Parameters are significant at the 5% level.

Table 4.5 summarizes the results of the ordered probit model. Seven out of nine of the service aspects considered are significant at the 5% level, with the exceptions of walking distance to stations or stops and internal temperature. All four threshold values are significant at the 1% level, and all of the estimated coefficients are positive. The condition of stations or stops poses the largest coefficient (0.44), followed by those associated with driver’s attitude (0.37) and travel stability (0.27). Regarding the threshold values, the difference between the threshold values $\mu_1$ and $\mu_2$ (0.67) is obviously smaller than those between $\mu_2$ and $\mu_3$ (1.81), and $\mu_3$ and $\mu_4$ (2.18). The magnitudes of the range are consistent with the observed frequencies of selecting satisfaction levels, where 10 respondents selected 2 (dissatisfied)—much fewer than the 135 respondents who selected 3 (average) and the 290 who selected 4 (satisfied) in the calibration subsample.
Table 4.6 presents the model validation results. The FPR value is 71.68%, indicating that 81 out of 113 respondents from the validation subsample selected the satisfaction level to which the calibrated model assigns the greatest probability. The FPR value also lies more than 3 standard errors from the corresponding mean CR. Hence, the first null hypothesis is rejected, confirming that our model is informative. Moreover, the FPR value lies within 2 standard errors from the mean ER calculated from the developed choice model. Therefore, we do not reject the second null hypothesis that there is no difference between FPR and ER, which indicates that the developed model is reasonable and confirms that the validation subsamples are consistent with the model. We can thus conclude that the developed model is both informative and reasonable, and has the capability to explain the data variation well.

Table 4.6  Results for first preference recovery analysis

<table>
<thead>
<tr>
<th>Measures</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validation sample size</td>
<td>113</td>
</tr>
<tr>
<td>FPR(^a) (%)</td>
<td>71.68</td>
</tr>
<tr>
<td>CR(^a) (%)</td>
<td>20</td>
</tr>
<tr>
<td>3 standard errors (%)</td>
<td>11.29</td>
</tr>
<tr>
<td>Conclusion of CR hypothesis test (^b)</td>
<td>Reject</td>
</tr>
<tr>
<td>ER(^a) (%)</td>
<td>65.02</td>
</tr>
<tr>
<td>2 standard errors (%)</td>
<td>8.87</td>
</tr>
<tr>
<td>Conclusion of ER hypothesis test (^c)</td>
<td>Do not reject</td>
</tr>
</tbody>
</table>

Note: \(^a\) FPR, CR and ER denote first preference recovery, chance recovery and expected recovery, respectively.
\(^b\) Null hypothesis tests at the 99% confidence interval.
\(^c\) Null hypothesis tests at the 95% confidence interval.

4.4.3. Priorities for service quality improvement

Based on the model results stipulated above, an importance-satisfaction analysis was conducted to provide a quick visual representation of the service satisfaction scores (collected from the questionnaire survey, as shown in Table 4.4) and the importance scores (calibrated by the ordered probit model, as shown in Table 4.5) to identify the priorities for actions to improve the public transport service quality. Thus, public transport operators and policy makers can establish action plans that better address the target customers’ needs, and direct investments toward the most effective enhancements.

The concept of the performance evaluation matrix adopted in this study was first introduced by Lambert and Sharma (1990) and has been used extensively in other research on service quality evaluation (Hung et al., 2003; Chen et al., 2007). The performance evaluation matrix, as shown in Figure 4.1, consists of nine cells with each axis divided into three sections. The two vertical lines (3.37 and 3.66) are determined based on the mean value of the service performance rating of 3.52, plus or minus one
standard deviation of 0.15. Similarly, the two horizontal lines (0.15 and 0.37) are calculated by adding or subtracting one standard deviation of 0.11 from the average important rating of 0.26.

The service aspects in the three cells in the top-left corner (shown as purple cells in Figure 4.1) are those most in need of improvement according to the respondents, due to their relatively high importance combined with low satisfaction. These variables require immediate attention and hold the top priority for enhancement, include the driver’s attitude, the condition of stations and stops, and seat availability. In contrast, only travel time and reliability fall in the three cells at the bottom-right corner (shown as green cells in Figure 4.1), indicating their relatively low importance and high satisfaction. The subsequent recommendation is to keep monitoring the quality, and that no improvement is needed at this stage. The remaining three service aspects fall in the middle cells (shown as white cells in Figure 4.1), reflecting average scores on both satisfaction and importance. These service aspects should be maintained to prevent deterioration.

**Figure 4.1 Importance-satisfaction analysis and recommended priorities for service quality improvements**

### 4.5. Concluding Remarks

In this Study, 613 questionnaire surveys were conducted among elderly respondents aged 60 and above to evaluate their satisfaction level with the current public transport services in Hong Kong, a high-density and transit-oriented city. An ordered probit model was calibrated to evaluate the relative importance of the level of service in relation to nine identified aspects. The concept of first preference recovery was applied to validate this model, demonstrating that it was both informative and
reasonable. An importance-satisfaction analysis was used to visualize the priorities for action to improve service quality.

According to the results of the ordered probit model, seven service aspects were found to significantly influence the respondents’ perceived overall service performance. The FPR analysis validated our developed model, confirming that it was both informative and reasonable. According to the importance-satisfaction analysis, the service areas in the most urgent need of improvement include the driver’s attitude, seat availability, and the condition of stations or stops, based on their high importance ratings combined with low satisfaction scores. It is anticipated that the results will strengthen the capabilities of public transport planners in planning better transport systems and enhancing policy makers’ ability to establish new policies that further improve elderly mobility, in particular in transit-oriented cities.
5. PUBLIC TRANSPORT POLICY MEASURES FOR IMPROVING ELDERLY MOBILITY

In this chapter, based on the information collected from the face-to-face interviews in Chapter 4, a binary logistic regression model was established to determine which factors significantly influenced the elderly respondents’ travel decisions. To review the feasibility of a taxi fare subsidy scheme, a supplementary survey was conducted. Based on the model results of these surveys, policy measures are suggested to strengthen public transport planning in Hong Kong with the goal of improving elderly mobility.

5.1. Stated preference (SP) survey

As mentioned previously, we interviewed 613 elderly respondents about their travel decisions at numerous selected areas of Hong Kong. Each respondent was required to answer four hypothetical games, and hence a total of 2,452 observations were collected for model development.

5.1.1. Travel decisions

In this Study, the respondents’ travel decisions about using public transport services were found to be influenced by the following explanatory variables.

i) **Mode of public transport**: Different modes of public transport provide dissimilar travel experiences, which may affect the elderly’s willingness to travel. This variable described the respondents’ general perceptions of different transport modes in terms of reliability, travel stability, level of comfort, etc. Understanding which mode is more favourable to the elderly can make the establishment of policy measures more effective.

ii) **Travel fares**: It was found that most of the respondents were unemployed or retired with limited monthly expenditures. Expensive travel fares may be a financial burden for them, which would decrease their willingness to use particular transport modes.

iii) **Walking and wait times**: Most of the public transport modes (except taxis) offer stop-to-stop service. Walking and wait times for services can always be used to describe the difficulty in getting the elderly from their trip origins to transport hubs, such as railway stations and bus/public light bus stops. First, walking time is a key factor as the health conditions of the elderly are worse than those of people in other age groups. It is difficult for them to walk for long times or great distances. Second, the conditions of railway stations and bus/public light bus stops may not be satisfactory. People must often stand
while waiting for public transport services, mostly in outdoor areas. This can result in the elderly feeling very uncomfortable when waiting at stops or stations.

iv) **Seat availability:** Long-term standing while on board is also difficult for the elderly due to poor physical health. If the journey is rough and unstable, the elderly may fall or sustain an injury. Thus, providing dedicated seats inside the vehicles is extraordinarily important in improving elderly mobility.

Fractional factorial design was used in this study to reduce the sizes of experiments and make effective use of resources. We generated 36 combinations of hypothetical games involving four explanatory variables (i.e., mode of public transport, travel fare, walking and wait times, and seat availability). Both the travel fare and walking and wait times were 3-level factors for capturing nonlinear effects. For seat availability, because seats are guaranteed in public light buses and taxis, the possibility of having no seat was neglected. In the questionnaire survey, each respondent was asked for their travel decisions for four designated modes of public transport (i.e., railways, buses, public light buses, and taxis). Four independent cases were included in each set in the survey, and there were nine questionnaire sets in total. Table 5.1 shows the attributes and levels used in the SP survey.

### Table 5.1 Attributes and levels used in the stated preference survey for satisfaction with public transport services

<table>
<thead>
<tr>
<th>Games</th>
<th>Modes of Public Transport</th>
<th>Attributes and Levels</th>
<th>Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Railways</td>
<td>Travel Fare (HKD) 0, 2, 4, Walking and Wait Times (min) 5, 8, 11</td>
<td>1 (Yes), 0 (No)</td>
</tr>
<tr>
<td>2</td>
<td>Buses</td>
<td>Travel Fare (HKD) 0, 2, 4, Walking and Wait Times (min) 6, 10, 14</td>
<td>1 (Yes), 0 (No)</td>
</tr>
<tr>
<td>3</td>
<td>Public light buses</td>
<td>Travel Fare (HKD) 2, 4, 6, Walking and Wait Times (min) 6, 10, 14</td>
<td>1 (Seat guaranteed)</td>
</tr>
<tr>
<td>4</td>
<td>Taxis</td>
<td>Travel Fare (HKD) 15, 20, 25, Walking and Wait Times (min) 4, 7, 10</td>
<td>1 (Seat guaranteed)</td>
</tr>
</tbody>
</table>

The respondents were asked to decide between going out to attend a non-compulsory social activity by the given mode of public transport, or staying at home.

**Socio-demographic characteristics:** In addition to the abovementioned explanatory variables, it was found that respondents with different socio-demographic characteristics may make substantially different choices. To study the heterogeneity of
the travel decisions of respondents with different socio-demographical characteristics, these factors were included in the choice model for analysis.

5.2. Binary logistic regression model

A binary logistic regression model was used to determine the associations between the probability of making a trip and the aforementioned explanatory variables. The model takes the following form:

\[
P^m_q = \frac{1}{1 + \exp(-U^m_q)},
\]

where \( P^m_q \) is the probability that an elderly individual \( q \) will decide to use the given mode of public transport \( m \); and \( U^m_q \) is the deterministic utility, which captures the factors influencing the travel decisions of elderly individual \( q \)—mathematically expressed as

\[
U^m_q = \alpha^m + (\beta^F F + \beta^W W + \beta^A A) + \sum_i (\theta^i S^i) + C,
\]

where \( \alpha^m \) is a dependent coefficient associated with the mode of public transport \( m \), which equals zero for railways as model control. \( F, W, \) and \( A \) represent travel fare, walking and wait times, and seat availability, respectively, and \( \beta^F, \beta^W, \) and \( \beta^A \) are their corresponding model coefficients. \( \sum_i (\theta^i S^i) \) denotes the combined effect of all individual socio-demographic characteristics of the elderly individual’s travel decision. \( S^i \) is the dummy variable for socio-demographic characteristics aspect \( i \), and \( \theta^i \) is the corresponding model coefficient. \( C \) is the model constant. For simplicity, the subscript \( q \) is omitted in each attribute on the right side of Equation (5.2).

According to Equation (5.1), the higher utility implies a higher probability of the elderly selected traveling by the designated mode of public transport. If a variable associated coefficient is positive, it has a positive effect on the probability of making a trip. This probability increases with the value of this variable. Conversely, if a variable has a negative coefficient, it adversely influences the probability of making a trip.

5.3. Factors contributing to the journey-making decision

A data analysis and statistical software package STATA was used with the maximum likelihood estimation method to calculate the coefficient associated with each
variable, based on the 2,452 observations. Table 5.2 tabulates the model coefficients and their associated t-statistics.

Table 5.2  Coefficients and their t-statistics for the binary logistic regression model

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Group</th>
<th>Control</th>
<th>Coefficient (t-statistics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modes of public transport</td>
<td>Buses</td>
<td>Railways</td>
<td>-0.09 (-0.7)</td>
</tr>
<tr>
<td></td>
<td>Public light buses</td>
<td></td>
<td>-0.84(^a) (-5.6)</td>
</tr>
<tr>
<td></td>
<td>Taxis</td>
<td></td>
<td>-0.81(^b) (-2.1)</td>
</tr>
<tr>
<td>Travel aspects</td>
<td>Travel fare</td>
<td>--</td>
<td>-0.08(^a) (-4.2)</td>
</tr>
<tr>
<td></td>
<td>Walking and wait</td>
<td>--</td>
<td>-0.03(^c) (-1.9)</td>
</tr>
<tr>
<td></td>
<td>Seat availability</td>
<td></td>
<td>0.84(^a) (6.3)</td>
</tr>
<tr>
<td>Age</td>
<td>70-74 years</td>
<td>60-69 years</td>
<td>-0.32(^b) (-2.5)</td>
</tr>
<tr>
<td></td>
<td>75-79 years</td>
<td></td>
<td>-0.34(^a) (-2.5)</td>
</tr>
<tr>
<td></td>
<td>80 years or above</td>
<td></td>
<td>-0.42(^b) (-3.4)</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Male</td>
<td>-0.25(^a) (-2.8)</td>
</tr>
<tr>
<td>Personal monthly expenditure</td>
<td>More than HKD 5,000</td>
<td>HKD 5,000 or below</td>
<td>0.20(^c) (1.9)</td>
</tr>
<tr>
<td>Household structure</td>
<td>Living alone</td>
<td>Not living alone</td>
<td>0.21(^c) (1.8)</td>
</tr>
<tr>
<td>Frequency (number of days in a week) of taking public transport</td>
<td>Less than one day in a week</td>
<td>At least one day in a week</td>
<td>-0.75(^a) (-6.3)</td>
</tr>
<tr>
<td>Occupation status</td>
<td>With full-time/part-time job</td>
<td>Without job</td>
<td>0.08 (0.4)</td>
</tr>
<tr>
<td>Overall satisfaction with public transport services</td>
<td>Satisfied</td>
<td>Dissatisfied or neutral</td>
<td>0.13 (1.4)</td>
</tr>
<tr>
<td>Constant</td>
<td>--</td>
<td></td>
<td>0.53(^b) (2.3)</td>
</tr>
</tbody>
</table>

Note: \(^a\) Parameters are significant at the 1% level.
\(^b\) Parameters are significant at the 5% level.
\(^c\) Parameters are significant at the 10% level.

Regarding modes of public transport, the coefficients associated with public light buses and taxis are negative and significant at the 1 and 5% levels, respectively. This implies that the respondents were less likely to travel using public light buses and taxis than railways if other variables were the same, which is intuitive and representative of reality. By comparing the coefficients of the three modes, we can see that the attractiveness of public light buses is the lowest, probably due to the rough and uncomfortable rides. In contrast, the coefficient associated with buses is not significant. There is no sufficient evidence that the respondents significantly preferred buses over railways.
The coefficients associated with travel fare and walking and wait times are negative, implying that the respondents preferred to travel when a lower travel fare and a shorter time were offered. The value of walking and wait times was around HKD 0.4 per minute. In contrast, the coefficient associated with seat availability is positive, implying that the respondents preferred to travel using modes that guaranteed seat availability. The absolute value of its coefficient is much larger than the other two introduced above. Improving this aspect could more effectively improve elderly mobility. The value of seat availability is around HKD 10.5, which is mathematically equivalent to 28 minutes of waiting and walking.

Various socio-demographic characteristics were incorporated into the model for analysis. Regarding the different age groups, the coefficients of 70-74 years, 75-79 years, and 80 years or over are all significant at the 5% level, and their values decrease as the age increased. This shows that mobility declines gradually as people age. The female respondents travelled significantly less than their male counterparts, perhaps because women generally have more housework to do, and thus may prefer to stay home. This is largely consistent with other gender travel studies (Su and Bell, 2012). The respondents with higher personal monthly expenditures were more likely to go out than those with lower expenditures. They were more economically active, and thus could travel without any financial burden. The coefficient associated with the household variable is positive and significant at the 10% level, suggesting that the elderly who live with others have a higher tendency to stay home. Elderly individuals who live alone might feel lonely, but still must go out to shop and support their daily lives. However, in this study, we may have unconsciously excluded many elderly individuals who live alone and always stay home. Home-based interviews should be conducted in future studies to address the limitations of this study. Frequent public transport users were likely to travel more (1% significance). The variables for having a full-/part-time job and being generally satisfied with public transport services had a positive influence on willingness to travel, but neither was significant. They are too weak to determine travel decisions, which may be due to insufficient sample size. The constant term is modest at 0.53. This means that the proposed binary logistic regression can effectively model the travel behavior of the elderly.

5.4. Supplementary survey on the taxi fare subsidy scheme

5.4.1. Taxi services in Hong Kong

As a mode that is complementary to public transport, taxis are highly convenient in providing door-to-door services around the clock, especially to the physically challenged people for journeys where multiple interchanges are needed, at odd hours or when they are feeling unwell. Recently in Hong Kong, a fleet of accessible taxi vehicles equipped with a larger passenger compartment and a mechanical ramp for wheelchair users have been put into operation. A number of other ad-hoc accessible mobility services can also be found in Hong Kong. These include Rehabus service and Easy-
access Bus service in the public sector. Unfortunately, these two services provide only fixed-route and/or fixed-time services mainly for hospital visits with advanced booking required (Hong Kong Society of Rehabilitation, 2015). Therefore, special taxis have significant potentials in improving the level of comfort of travel for the elderly, hence increasing their willingness to move and expand the range of activities that are accessible to them. However, the limited supply and an even higher cost of special taxis have prevented a wider acceptance by the elderly. In a city that nearly 90% of the daily commute relies on public transport, it is necessary to review its policy measures and improve the policy setting to better accommodate the needs of the growing ageing population.

5.4.2. Experimental design

To review the feasibility of providing a taxi fare subsidy scheme for the elderly in Hong Kong, again, a SP survey was conducted in January and February, 2016. The taxi fare subsidy scheme questionnaire used in the survey was divided into four parts: (1) basic information of their mobility level and awareness of accessible taxi service; (2) daily trip making information, such as monthly number of trips, taxi travel frequency, travel purpose, and willingness of using accessible taxi services at reduced price; (3) stated preference part, with hypothetical situations consist of different scenarios of walking times, waiting times, and travel costs of using ordinary taxis and accessible taxis with subsidized fares; and (4) personal particulars.

In order to capture the sensitive variations in the difference of choice preferences, a total of 36 combinations of hypothetical games containing different values of walking time, waiting time, and travel fare were generated. Similarly, four independent cases were included in each set in the taxi questionnaire, and there were nine questionnaire sets in total. Table 5.3 presents the attributes and levels used in the SP survey.

<table>
<thead>
<tr>
<th>Taxi Type</th>
<th>Attributes and Levels</th>
<th>Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Situation</td>
<td>Walking Time (min)</td>
</tr>
<tr>
<td>Ordinary taxi</td>
<td>Non-urgent, Urgent</td>
<td>1, 3, 5</td>
</tr>
<tr>
<td>Accessible taxi</td>
<td>Non-urgent, Urgent</td>
<td>0</td>
</tr>
</tbody>
</table>

In this supplementary survey, a total of 521 respondents were interviewed in 13 districts of Hong Kong. Among these respondents, 32% are male and 68% are female, with an average age of 73. Most of the interviewed respondents, 91% of them are retirees, where 36% of them are living alone. It is also recorded that the propensity of
the elderly to use taxi is relatively low, where only 14% of the respondents made one or more taxi trips each month.

5.4.3. Feasibility of the taxi fare subsidy scheme

The feasibility study aims to understand the current mobility status of the elderly, their attitudes towards traveling by taxi and to determine an acceptable level of concessions to incentivize the use of special taxis, thereby contributing to the improvement of their mobility level and life quality. Likewise, a binary logistic regression model was developed to identify the contributory factors that the elderly are considered significant. It was generally found that the elderly respondents are most sensitive to travel fare, whereas walking time and waiting time are not considered as important factors for them to make their travel decisions. The survey also demonstrated that elderly passengers who are dependent on wheelchairs are much more likely to choose accessible taxis. Severely mobility impaired elderly passengers are in greater needs of accessible transport modes. The very high level of impact implies that their needs may not have been well catered, as the number of accessible taxis available is low and the travel cost is high. Furthermore, respondents who are living alone are also more likely to choose accessible taxis. This may be attributed to their lack of support and assistance in travel.

The existing HKD 2 concession fare scheme provides a good and comprehensive support to the mobility of elderly population in Hong Kong. This scheme is widely accepted among the elderly passengers. This survey also shows a satisfaction rate of nearly 50%. The taxi service inevitably cannot replace other public transport services. However, the taxi service is supplementary to the existing public transport services, contributes to a greater public transport network, and is especially useful for the elderly whose walking abilities are impaired. Accessible taxis with their special features should be better utilized to improve the mobility of a group of the elderly populations who are otherwise highly challenged in using ordinary public transport modes, for example, those who are dependent on wheelchairs. Given that the higher cost of using accessible taxis, the government is expected to step in and provide a subsidy in order to promote the use of accessible taxi by the elderly.

5.5. Concluding Remarks

In this Study, 2,452 observations were collected from 613 elderly residents about their travel decisions during face-to-face interviews. A binary logistic regression model was then calibrated for possible influencing factors. The developed model shows that mode of public transport, travel fare, walking and wait times, seat availability, and numerous socio-demographic characteristics are key factors that significantly influence travel decisions among the elderly. Railways and buses are more attractive modes of travel than public light buses, and rough and uncomfortable journeys are particularly
problematic for the elderly due to their poor physical condition. Seat availability poses the highest priority for improvement to improve elderly mobility.

Furthermore, a supplementary survey was conducted to evaluate the views of the elderly on the provision of a taxi fare subsidy scheme. The results of this survey demonstrated that the Hong Kong government is expected to step in and provide a subsidy in order to promote the use of accessible taxis by the elderly.
6. POLICY IMPLICATIONS AND RECOMMENDATIONS ON PUBLIC TRANSPORT POLICY MEASURES

Based on the results as presented in Chapters 3, 4, and 5, key areas of improvement for each public transport mode were identified. The list of required improvements could properly help both the government and transport providers to increase the accessibility and the level of service of Hong Kong’s public transport system, leading to a more elderly-friendly public transport system.

6.1. Review on existing public transport policy measures

The findings of the importance-satisfaction analysis supported that the driver’s attitude holds the top priority for improvement. This service aspect was not applicable for railways, with no direct interaction between passengers and operators. This study in particular indicates the poor services provided by buses, public light buses, and taxis. Some respondents complained that drivers were sometimes in haste, and did not pay special attention to the elderly passengers. One example is that vehicles started moving before they were seated. Another example is that door was closed quickly, leading to insufficient time for their boarding and alighting. The public transport operators should therefore provide appropriate training and guidance to their drivers in order to enhance their awareness on driving behavior and attitude, and timely evaluate the performance of the drivers.

Second, seat availability for the elderly passengers should also be improved. It is the service aspect that received the lowest service performance score. Improving on this aspect could enable the elderly to use transit in a comfortable and safe way greatly, and enhance elderly mobility effectively. Indeed, the provision of priority seats is one of the transport measures undertaken to improve seat availability for the elderly. In Hong Kong, priority seats for people with special needs were first introduced in 2009. Nonetheless, the elderly often have to stand because priority seats are occupied by other passengers. Many passengers have little awareness of offering seats to the elderly around them. A recent study revealed that using mobile phones or tablets is the main reason that passengers neglect to offer seats to the needy on public transport (Department of Applied Social Sciences, 2015). Thus, the concern about insufficient priority seats cannot simply be addressed by providing more priority seats. Making it mandatory for users to offer seats to their counterparts with special needs through legislation would be difficult and impractical. To improve the current situation with seat availability, promoting the culture of offering seats to the needy through education should be considered instead. For example, a priority seat campaign could be launched by the government or mass transit operators. Furthermore, the policy-makers may also consider the introduction of a Priority Seat card or badge, as has been a custom in
London since 2012, to provide a clear indicator that encourages other passengers to give up their priority seats for the needy.

The condition of stations or stops (provision of seats and shelter) is another service aspect that needs to improve, as it is the most important factor influencing overall service performance, as discussed in Chapter 4. Due to the limited road space in congested urban areas, such as narrow footways or inadequate headroom clearance, shelters and seats are not normally provided at franchised bus stops, public light bus stops, and taxi stands in Hong Kong. Elderly residents may have to wait for services under direct sunlight and rain. Although it may not be feasible to provide sufficient shelters and seats at all bus stops and public light bus stops, policy-makers may consider providing these facilities at locations typically frequented by the elderly, such as outside hospitals, district elderly community centres, social centres, and non-subverted service centres for the elderly. In addition, the real-time time-estimating system for the arrival of the next service could be extensively introduced at stations and stops to provide passengers with dynamic arrival information, allowing the elderly to alter their public transport mode choice to minimize the waiting time at stations.

6.2. Proposed transport policy measures

This study confirms that mode of public transport, three concerned travel aspects, and numerous socio-demographic characteristics influence the travel decisions of the elderly. The attractiveness of railways and buses was higher than that of public light buses. Rough and uncomfortable journeys are particularly unfavourable among the elderly due to their poor physical condition. In the new era of population ageing, travel stability should place a higher priority on improving public transport services. The following policy measures are recommended for the policy makers to considered:

6.2.1. Public transport concession fare scheme

To address the first problem of the lower mechanized trip rate among the elderly, the Hong Kong government recently implemented public transport concession fare schemes for four public transport modes (MTR, franchised buses, public light buses, and ferries) to subsidize the elderly aged 65 or above by allowing them to travel any time for a concession fare of HKD 2 per trip. However, given that the mechanized trip rate declines as people age, introducing stepwise subsidization to the elderly in different age cohorts could be more effective in encouraging them to travel and participate in social activities. It has been noted that more elderly individuals are retiring at the age of 60, but must still pay full-price for public transport until the age of 65. A scheme that subsidizes those aged 60-64 years with a discount (e.g., half-price) would improve their mobility. Such travel fare discounts would provide additional incentives for retired elderly individuals aged 60-64 to travel. In contrast, the trip rate of the elderly respondents aged 80 or above was the lowest. The public transport concession fare schemes may consider entirely waiving the travel costs of this group to encourage
mobility. This approach has proven effective in enhancing elderly mobility in Britain (Baker and White, 2010). Moreover, the schemes only cover four public transport modes. An extension to other modes is worth exploring.

6.2.2. Provision of priority seats

In Hong Kong, priority seats for people with special needs were first introduced in 2009 on MTR and franchised buses to encourage the elderly to travel by these public transport modes and participate more in social activities. Nonetheless, the elderly often have to stand because priority seats are occupied by other passengers. Many passengers have little awareness of offering seats to the elderly around them. A recent study revealed that mobile phone and tablet use is the main reason that passengers neglect to offer seats to the needy on public transport (Department of Applied Social Sciences, 2015). Thus, the concern about insufficient priority seats cannot simply be addressed by providing more of them. Making it mandatory for users to offer seats to their counterparts with special needs through legislation would be difficult and impractical. To improve the current situation with seat availability, promoting the culture of offering seats to the needy through education should be considered instead. The proportion of priority seats on each public transport mode should be increased to cater to the forthcoming ageing trend. Moreover, the culture and behavior of offering seats to the needy (the elderly, the disabled, pregnant women, and other people in need) should also be strongly promoted and encouraged.

6.2.3. Age-friendly public transport system and alternative transport options

MTR and franchised bus were found to be the most popular public transport modes for the elderly in Hong Kong. However, a decrease in patronage has been observed as people age and start to travel more by taxi and ambulance for their medical care trips. However, these modes are not financially sustainable and thus are inappropriate for frequent or daily use. To resolve this issue, the provision of an age-friendly public transport system is suggested. Refer to the suggestions provided by Shiau and Huang (2014) about the age-friendly improvement strategies for transit services in Taipei. Ease of boarding and alighting, conditions of stations and stops, and drivers’ attitudes can all be improved.

To improve the elderly’s accessibility to transit services, low platform buses and escalators connecting underground MTR stations and streets are suggested. Seats and shelters are also recommended for those waiting for service. Although it may not be feasible to provide sufficient shelters and seats at all bus stops and public light bus stops due to the limited road space in congested urban areas, caused by narrow footways or inadequate headroom clearance, these facilities could be strategically placed at locations typically frequented by the elderly, such as outside hospitals, district elderly community centers, social centers, and non-subverted service centers for the elderly. Public transport drivers should pay special attention to the elderly passengers on board. The
public transport operators should therefore provide appropriate training and guidance for their drivers to enhance their awareness about driving behavior and attitude, followed by the timely evaluation of drivers’ performances.

In addition to improving the traditional transit modes, Whelan et al. (2006) pointed out that the elderly may need new and different types of public transport options that are viable, affordable, accessible, safe, and coordinated. Rahman et al. (2016) suggested numerous transportation alternatives for the elderly, including volunteer drivers, senior-center-based shuttle buses, prepaid taxi services, and specially coordinated bus/rail service to distant medical centers. Improving alternative transport options for the elderly in the forthcoming years is considered to be both indispensable and urgent.

6.2.4. More frequent and direct public transport services during noon off-peak hours

The number of interchanges reflects a trip’s directness and convenience. The elderly are usually more interchange-averse due to their poor physical condition. To improve elderly mobility, the number of interchanges involved in public transport services should be minimized. However, to relieve traffic congestion caused by franchised buses, the Hong Kong government recently introduced bus–bus interchange schemes to promote interchanges at major bus stops, and cancelled many of the direct bus routes that overlapped. These schemes have had adverse effects on travel among the elderly by suppressing their willingness to participate in social activities. The government should achieve a better balance between the overall traffic conditions and the travel demands of the elderly when planning direct bus services.

In this study, the elderly individuals concentrated their travel during the noon off-peak hours from 10 am to 5 pm to avoid crowds. We suggest that the direct bus services only operate during this window between the popular origins and destinations of the elderly (e.g., elderly community centers, social centers, markets, and non-government-subsidized service centers for the elderly, etc.). This would not worsen the traffic conditions, and would ensure better public transport services for the elderly. In cases where interchanges are unavoidable, volunteers or staff members could be recruited at stations and stops to help the elderly carry luggage and find their way.

According to population projection data for 2012-2041, the proportion of elderly people aged 60 or above is expected to reach 36.4% in 2041 (Census and Statistics Department, 2012). Based on the travel patterns of the elderly, it is reasonable to anticipate that more respondents will travel during the noon-peak hours, alleviating the congestion level during the two commuting peak hours.
6.2.5. Provide facilities in districts with concentrated elderly populations and encourage cross-district travels

Most of the elderly’s trips were concentrated within specific board districts (Kwun Tong and Eastern). As the population distributions of the young and older adults were similar, it follows that population ageing will not significantly change how the elderly population is distributed. Hong Kong’s government should therefore consider providing more permanent elderly facilities in those concerned districts to provide an age-friendly living environment that enhances their willingness to take part in community activities.

We should also continue exploring potential ways to encourage the elderly to make more cross-zonal trips for leisure purposes. For example, elderly community centers may consider organizing frequent day-trips to sightseeing hotspots in rural areas of the New Territories (e.g., wetland parks, nature reserves, monasteries, Buddha statues, etc.) with the provision of direct shuttle bus services. This would effectively enrich the health, well-being, and quality of life of the elderly from a social integration perspective.

6.2.6. Taxi fare subsidy scheme

As a matter of fact that the current transport services and policies are insufficient for disabled and mobility impaired elderly persons. Meanwhile, taxis are highly convenient in providing door-to-door services around the clock, especially to the physically challenged people. Nevertheless, the utilization rate of taxi among the elderly is relatively low (less than 3% as shown in Table 4.3), because the elderly are unwilling to pay for the high travel fare. In view of this, the policy makers may consider the introduction of a taxi fare subsidy scheme as a measure to improve the mobility of the elderly. For example, the subsidized fare for an accessible taxi trip is equal to or slightly less than the fare for the corresponding ordinary taxi trip may be considered.

6.3. Concluding remarks

Hong Kong and other metropolitan cities are facing a serious ageing problem, with the population of elderly continuing to increase in the forthcoming years. Future transport policies should prioritize improving the mobility of elderly individuals, supporting their independence and thereby enhancing the quality of their lives. Public transport concession fare schemes have been implemented to encourage more elderly to use related transport services. However, the policies place too much emphasis on the role of money (i.e., travel fares) in determining willingness to travel; other factors, such as walking and wait times and seat availability, have been neglected by officials and policy makers.

The results of this study indicate that coverage of the target beneficiaries of public transport fare concession schemes should be extended to include those aged 60-64, providing full subsidization to the elderly aged 80 or above to encourage them to
participate in social activities. Ways to enhance the accessibility of stations and stops and increase service frequency should be investigated to attract more elderly to travel by public transport in the context of high-density and transit-oriented cities such as Hong Kong.
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Department of Transportation (2011) Summary of Travel Trends: 2009 National Household Travel Survey, United States.


Transport Department (2010) Speech by Commissioner for Transport at the 12th International Conference on Mobility and Transport for Elderly and Disabled


Appendix A
Questionnaire for satisfaction with public transport services and elderly mobility

香港大學
土木工程系

有關研究長者流動性以及對公共交通工具滿意度的問卷調查
香港大學土木工程系助理教授司徒惠源博士，現正進行一項關於長者流動性以及對公共交通工具滿意度的學術研究。此調查目的為了解長者對現時公共交通工具服務質素的評價以及影響他們選擇出行的因素，並檢視現時公共交通工具的不足及確定日後改善措施的方向。這個研究無任何已知的風險。完成此問卷只需時約五分鐘，是次研究並不會為閣下提供任何個人利益，所搜集的數據將對是次研究提供寶貴的資料。

本問卷採用不記名方式進行，收集到的資料只會作綜合分析用途，個人資料將絕對保密。是次參與純屬自願性質，閣下可隨時終止參與是項問卷調查，有關決定將不會引致任何不良後果。如閣下對是項研究有任何疑問，歡迎致電香港大學土木工程系黃博士查詢（電話：2859-2662）。如閣下想知道更多有關研究參與者的權益，請聯絡香港大學非臨床研究操守委員會（電話：2241-5267）。謝謝。

請問您年多幾多歲（請於適當的空格中填上√號）

□59歲或以下（謝謝您的寶貴時間和參與，問卷完結）
□60-64歲
□65-69歲
□70-74歲
□75-79歲
□80歲或以上

甲部 基本問題（請於適當的空格中填上√號）

甲一. 唔過去一個禮拜，您有幾多日搭過公共交通工具離開屋企外出呢

□有
□1-2日
□3-4日
□5-6日
□每日都有

甲二. 您通常搭公共交通工具出街做咩㗎（可以多選一個）

□覆診
□探親戚朋友
□買野
□參加社區活動（去社區中心，去太極班）
□散步
□其他消閒活動（飲茶，睇戲）
□其他（請註明：

甲三. 您覺得而家整體公共交通工具既服務質素好唔好呢

□好唔嫌
□唔係唔好
□一般
□唔錯
□非常好

甲四. 自從政府推出長者兩蚊搭車以來，有冇令你你搭多啲公共交通工具出街呢

□有
□有，多啲少啲
□有，多啲好多

甲五. 您有冇受登陸咗有減價優惠既公共交通工具啲呀（比如特登唔去搭小巴呢）

□會
□唔會
□睇情況

甲六. 而家公共交通工具有關愛座係長者，有冇令你搭多啲公共交通工具出街呢

□有
□有，多啲少啲
□有，多啲好多

甲七. 您認為而家公共交通工具應該點改善嚟照顧老人家既需要呢


乙部 對現時公共交通工具服務質素的評價（請於適當的空格中填上√號）

乙一. 您最經常搭以下幾種邊一種公共交通工具呢

□港鐵
□巴士
□小巴
□的士

乙二. 啥您最近一次係搭邊種公共交通工具呢

□港鐵
□巴士
□小巴
□的士
乙三. 就作您最近一次搭車經驗，您對以下幾點服務質素滿意評價呢

<table>
<thead>
<tr>
<th></th>
<th>好唔满意</th>
<th>唔條唔好</th>
<th>一般</th>
<th>唔錯</th>
<th>非常好</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) 有冇位坐（關愛座夠唔夠） [小巴及的士除外]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) 行車唔會太樓（chok）或嘅太快</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) 洗唔洗等好耐車</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) 司機服務態度好唔好 [港鐵除外]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) 咸唔容易上到車（本身太高，同月台距離太開）</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) 車裏面有冇太凍或者太熱</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7) 行去車站或者月台會唔會太遠（行長樓梯）</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(8) 行車時間會唔會太長，準唔準時到目的地</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9) 等車果陣會唔會好辛苦（有位坐，有瓦遮頭等車）</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

呢一次搭車經驗既整體滿意程度 

<table>
<thead>
<tr>
<th></th>
<th>好唔满意</th>
<th>唔條唔好</th>
<th>一般</th>
<th>唔錯</th>
<th>非常好</th>
</tr>
</thead>
</table>

丙部）外出的選擇[請於適當的空格中填上√號]
假如明天有工展會，花卉展，粵劇或者話劇表演等，日子活動俾長者免費入場，您有興趣但係去唔去都有咩所講既。而家只係得一種公共交通工具，可以去到，喺以下四種情況下，您會選擇去定留喺屋企呢

| 情況一 | 免費搭港鐵，行去車站同等車大約要 5 分鐘，應該有位坐 | 去 | 留喺屋企 |
| 情況二 | 免費搭巴士，行去車站同等車大約要 14 分鐘，應該無位坐 | 去 | 留喺屋企 |
| 情況三 | 用 2 蚊搭小巴，行去車站同等車大約要 6 分鐘，一定有位坐 | 去 | 留喺屋企 |
| 情況四 | 用 20 蚊搭的士，行去車站同等車大約要 4 分鐘，一定有位坐 | 去 | 留喺屋企 |

丁部）個人資料[請於適當的空格中填上√號]

| 丁一. 性別 |                      |
|           | □男                   |
|           | □女                   |

<table>
<thead>
<tr>
<th>丁二. 教育程度</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>□小學或以下</td>
</tr>
<tr>
<td></td>
<td>□中學</td>
</tr>
<tr>
<td></td>
<td>□專上學院或以上</td>
</tr>
</tbody>
</table>

| 丁三. 職業 |                      |
|           | □退休人士            |
|           | □家庭主婦            |
|           | □全職工作            |
|           | □兼職工作            |
|           | □遊客                 |

<table>
<thead>
<tr>
<th>丁四. 家庭狀況（可以多選）</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□獨居</td>
<td>□同配偶住</td>
</tr>
<tr>
<td>□同父母住</td>
<td>□同子女住</td>
</tr>
<tr>
<td>□同孫兒住</td>
<td>□同其他親戚住</td>
</tr>
<tr>
<td>□同朋友住</td>
<td>□其他（請註明：）</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>丁五. 您同住既家庭有幾多架私家車</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□1 架</td>
<td>□2 架或以上</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>丁六. 個人平均每月支出（港幣）（可以用家庭支出除以人數計算）</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□$1,000 或以下</td>
<td>□$1,001-$5,000</td>
</tr>
<tr>
<td>□$5,001-$10,000</td>
<td>□$10,001-$15,000</td>
</tr>
<tr>
<td>□$15,000 以上</td>
<td></td>
</tr>
</tbody>
</table>

問卷完。多謝！閣下撥冗回答。
Appendix B
Questionnaire for a taxi fare subsidy scheme

有關研究提供津貼予長者及合資格殘疾人士乘搭無障礙的士的問卷調查
香港大學土木工程系副教授司徒惠源博士，現正進行一項關於如何提升長者及合資格殘疾人士流動性的學術研究。此調查目的是了解日常乘車外出的交通選擇以及乘搭無障礙的士的意願，並制定合適的津貼額度予長者及合資格殘疾人士乘搭無障礙的士。是次研究無任何已知的風險，完成此問卷並不會為閣下提供任何個人利益，所搜集的數據將對是次研究提供寶貴的資料。完成此問卷只需時約十分鐘。

本問卷採用不記名方式進行，收集到的資料只會作綜合分析用途，個人資料將絕對保密。若您對是項研究有任何疑問，歡迎致電香港大學土木工程系楊先生查詢（電話：2859-2662）。若您想知道更多有關研究參與者的權益，請聯絡香港大學非臨床研究撫恤委員會（電話：2241-5267），謝謝。

甲部 基本問題【請於適當的空格中填上“✓”號】

甲一，您是否年滿65歲的長者或合資格殘疾人士？

□ 長者
□ 合資格殘疾人士
□ 兩者皆是
□ 不是（謝謝您的寶貴時間和參與，問卷完結）

甲二，您是否需要使用輪椅？

□ 有需要
□ 只需部份時間使用
□ 需長期使用

甲三，您認為政府對行動不便人士（包括長者及合資格殘疾人士）的交通政策支援足夠嗎？

□ 不足夠
□ 一般
□ 足夠

甲四，您是否清楚知道無障礙的士與普通的士的分別以及收費模式？

□ 知道
□ 不知道（請作詳細介紹）

乙部 日常乘車外出的情況【請於適當的空格中填上“✓”號】

乙一，您平均每月乘搭幾次車出街？（一來一回算兩次）

□ 從不
□ 少於一次
□ 1-9
□ 10-19
□ 20-29
□ 30次或以上

乙二，當中幾多次乘搭的士呢？（包括普通的士及無障礙的士，一來一回算兩次）

□ 從不（請跳至問題乙五）
□ 少於一次
□ 1-4
□ 5-9
□ 10次或以上

乙三，您一般搭的士去幹咩呀？（可以多過一個選擇）

□ 逛街買物
□ 醫診
□ 探親戚朋友
□ 參加社區活動（去社區中心、上太極班）
□ 喜歡吃飯
□ 其他消閒活動（睇大戲）
□ 其它（請註明）

乙四，您通常乘搭的士的原因係咩？（可以多過一個選擇）

□ 時間
□ 搭帶大型行李
□ 天氣因素
□ 唔熟路
□ 身體唔舒服
□ 其他公共交通工具唔適合
□ 其它（請註明）

乙五，無障礙的士有以下哪些條件會吸引到您呢？（可以多過一個選擇）

□ 方便輪椅上落
□ 司機服務態度較普通的士好
□ 有較舒適的座位
□ 車廂空間大
□ 可以八達通付款
□ 其它（請註明）
□ 沒有吸引力的地方

乙六，如果無障礙的士能提供折扣優惠（例如普通的士的五折，車費由11元起），您會著價考慮搭多啲嗎？

□ 會（請跳至內部問題）
□ 不會
□ 搭多少少
□ 未決定

乙七，您會唔會考慮坐無障礙的士去幹咩呀呀？（要同問題乙三的答案唔一樣，可以多過一個選擇）

□ 逛街買物
□ 喜歡吃飯
□ 探親戚朋友
□ 參加社區活動（去社區中心、上太極班）
□ 醫診
□ 其他消閒活動（睇大戲）
□ 其它（請註明）
內部）乘車外出的選擇（請於適當的空格中填上“√”號）

請您就以下兩個情況（情況一及情況二）分別回答(a)及(b)欄：

(a) 情況一（普通非緊急情況）：假設您而家駕駛車，約唔朋友去睇電影。在下列兩次獨立遊 戲中，您會分別選擇搭邊種的士作為您的首選：

<table>
<thead>
<tr>
<th>遊戲一</th>
<th>用22元搭普通士，步行到較方便的士的路口要3分鍾，等的士要4分鍾。</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>用28元搭無障礙的士，電召後乘車安25分鍾，落樓直接可以上車。</td>
<td>□</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>遊戲二</th>
<th>用30元搭普通士，步行到較方便的士的路口要3分鍾，等的士要6分鍾。</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>用11元搭無障礙的士，電召後乘車安15分鍾，落樓直接可以上車。</td>
<td>□</td>
</tr>
</tbody>
</table>

(b) 情況二（緊急情況）：假設您而家駕駛車，身體唔舒服，想立即翻屋企休息。在下列兩次獨立遊 戲中，您會分別選擇搭邊種的士作為您的首選：

<table>
<thead>
<tr>
<th>遊戲三</th>
<th>用22元搭普通士，步行到車場門口的士站要1分鍾，等的士要4分鍾。</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>用11元搭無障礙的士，電召後乘車安15分鍾，落樓直接可以上車。</td>
<td>□</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>遊戲四</th>
<th>用22元搭普通士，步行到車場門口的士站要5分鍾，等的士要8分鍾。</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>用28元搭無障礙的士，電召後乘車安20分鍾，落樓直接可以上車。</td>
<td>□</td>
</tr>
</tbody>
</table>

丁部）個人資料（請於適當的空格中填上“√”號）

丁一．性別：
□男 □女

丁二．年齡：
□25歲以下 □25-34 □35-44 □45-54 □55-64 □65-74 □75-84 □85歲以上

丁三．職業：
□全職 □兼職 □學生 □退休人士 □家庭主婦 □求職人士 □遊客

丁四．教育程度：
□小學或以下 □中學 □專上學歷或以上

丁五．家庭狀況：（可以多選一個選擇）
□獨居 □同配偶住 □同父母住 □同子女住 □同孫仔住 □同其他親戚住 □同朋友住 □其它（請注明__________）

丁六．您同住家有幾多架私家車：
□有 □0架 □1架 □2架或以上

丁七．個人平均每月支出（港幣）（可以用家庭支出除以人數計算）
□$1,000或以下 □$1,001-$2,000 □$2,001-$3,000 □$3,001-$4,000 □$4,001-$5,000 □$5,001-$10,000 □$10,001-$15,000 □$15,001或以上

問卷完，多謝閣下撥冗回答。 Set 1