

Guideline for Incorporating Gender into ITS Planning, Design and Operation

2016

Preface

During the past two decades, the Intelligent Transport System (ITS) has been applied rapidly in Chinese cities. It has been upgraded gradually from a single-function application to a top-level designed resource-sharing platform, designed to improve public sector efficiency in the area of satisfying people's travel needs. The provision and quality of an urban transport service influence all residents. However, due to social differences in gender, age and race, the seemingly equally provided social product may have different impacts on various social groups. Therefore, government sectors should become more sensitive to potential social inequality in the areas of gender, age and race during the process of the planning, design and construction of urban transportation and ITS.

It is recognized that male and female have different travel behavior and transport needs. Both the public and private sector can take advantage of ITS's technology and resource-sharing platform to make urban transport infrastructure and services more gender friendly, thus mitigating social inequalities. This can eventually not only maximize the efficiency of the transport infrastructure, but also provide a people-oriented transport service to make trips more comfortable and convenient for the masses.

Under the funding support from the Umbrella Facility for Gender Equality (UFGE) in East Asia Pacific (EAP), the World Bank commissioned Prof. Tong Xin, a Professor from the Department of Sociology of Peking University, as a chief expert, together with other researchers from Peking University, Wuhan University, Xinjiang University, and China Women's University as a research team. In 2015, the project team used Wuhan and Urumqi as two case studies to evaluate the gender impacts of urban transport ITS and prepared an *Assessment Report of Gender Impacts of ITS*. Based on the findings and recommendations, the project team developed this technical guideline for government authorities and ITS practitioners to better incorporate gender considerations in ITS planning, design and operation. The guideline focused on the commonly applied ITS in Chinese cities, which mainly includes ITS for traffic management and enforcement and ITS for public transport operations, management and passenger services.

The guideline features the following four chapters:

- Chapter One: Gender-Sensitive ITS Planning
- Chapter Two: Gender-Sensitive ITS Design
- Chapter Three: Gender-Sensitive ITS Operation
- Chapter Four: Gender-Sensitive ITS Monitoring and Feedback

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1 ITS Planning

1.1 Balancing Efficiency and Equality

Urban transportation development aims to improve transport efficiency for both people and goods. With the fast pace of urbanization and limited transport resources in China, the transport sector therefore has spent a great deal of time focusing on improving the efficiency of urban transport, and satisfying most people’s general travel needs. However, they have paid less attention to the travel needs and preferences of the minority and vulnerable groups, somehow ignoring equality in urban transportation resource allocation.

An imbalance between efficiency and equality in gender manifests itself as a lack of attention to the travel traits of different genders as well as a lack of humanized travel services designed to better satisfy gender-specific needs—for example, a safer and more comfortable travel environment for females or more efficient travel services for males.

The development of the ITS provides good opportunities for balancing urban transportation efficiency and equality. **The government and decision-makers could clearly define the principle of balancing efficiency and equality in the ITS planning process.** Transport infrastructure efficiency should be gradually improved, and the potential of intelligent transport services should be further discovered. At the same time, more attention should be paid to the different travel needs of different groups, especially those of China’s minority and vulnerable groups. The ITS is supposed to be more accessible and practical for such groups as females, the elderly, and children (Table 1-1).

Table 1-1: Balancing Efficiency and Equality in Urban Transportation

Urban Transportation Infrastructure Development		Intelligent Transport System (ITS) Development	
Efficiency	Equality	Efficiency	Equality
<ul style="list-style-type: none"> To meet preferences of mainstream groups (young adults/office workers) To maximize using efficiency of transport infrastructure and resources 	<ul style="list-style-type: none"> To pay attention to travel needs of vulnerable groups (the elderly/children/females/rural migrant workers) To meet travel preferences and needs of males and females To use transport infrastructure and resources equally 	<ul style="list-style-type: none"> To improve efficiency of intelligent transport facilities To meet preferences of mainstream groups (young adults/office workers) To provide standardized and advanced intelligent transport services 	<ul style="list-style-type: none"> To populate intelligent transport facilities among non-mainstream groups To pay attention to using preferences of vulnerable groups (the elderly/children/females/rural migrant workers) To provide humanized intelligent transport services that can meet

			different preferences of males and females
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1.2 Recognizing Gender Traits and Needs

Women and men have different traits and preference, which leads to various transport needs and travel behaviors, such as trip purpose, travel mode, frequency, and trip distance. However, these differences usually tend to be ignored in traditional urban transport planning. Therefore, gender mainstreaming should be advocated in transport planning and development. It is a strategy for making men's and women's concerns and experiences an integral dimension of ITS planning, design, construction, and operation in the context of politics, economics and society to make sure that women and men benefit equally. Gender inequality may slow down the economic development and poverty-reduction advances of developing countries. A gender-sensitive and successful intelligent transport system must eliminate mechanical and physical obstacles, thus enhancing the incentive mechanism. Moreover, it should adapt to local feature and improve level of accessibility, especially for women.

Therefore, **ITS practitioners should be nurtured according to the following characteristics of gender-consciousness in ITS planning phase:**

- Recognizing the rights that men and women share with regard to the use of transport services and the ITS;
- Recognizing the balance between ITS efficiency and equality to benefit men and women equally;
- Being aware of men's and women's different needs and ITS services; and keen to investigating the differences;
- Being aware of the potential difference of females in the aspects of the economy, physiology and freedom of speech, compared to males; paying attention to women's difficulties and challenges in using the ITS; helping women to use ITS equally, efficiently, and safely through reasonable ITS design and operation.

1.3 Gender Analysis

Residents' travel demand remain the basis of urban transportation planning. Similarly, urban ITS planning should also take into consideration travel demand as well as the need of ITS usage. To get a full understanding of gender differences and traits in their trips and in ITS application, **gender analysis should be conducted during the stage of ITS planning.**

Gender analysis is a powerful tool for gender mainstreaming. It is used to evaluate and understand the differences in men's and women's lives, including those lead to social and economic inequity, and to provide an informed understanding of the potential different impacts of proposed policies, projects, and services on men and women. Gender analysis aims to eliminate these inequalities and to achieve positive change for women. A number of different

gender analysis frameworks and approaches have been widely applied in many fields – for example, the Harvard Framework, the Gender Analysis Matrix and Moser’s Framework. Each framework was designed in a different way in terms of research method, scope, data collection and results presentation, and is suited to a particular context. In terms of transport projects, this study suggests choosing a proper gender analysis framework according to the features and locations of transport projects, as well as to the executive scopes of policy (city or region). However, no matter which framework is adopted, gender analysis in transport project planning should consider the following three points:

- Problems identification
- Investigation and data collection
- Result prediction and assessment of transport project planning after taking gender into consideration

For gender-sensitive ITS planning, the first step is to identify gender-specific travel needs and behaviors. ITS provides service for people. It is therefore crucial to understand their travel needs and travel behaviors, which is also the foundation of ITS planning. Household travel survey and public transport user satisfaction, etc., could be utilized to understand travel differences by gender. The following aspect should be referred to in gender analysis according to the local context:

- Trip purpose

Studies have shown that men and women have different travel purposes. Generally, men tend to make work trips during the morning and evening peak hours. Meanwhile, women tend to make more trips associated with their reproductive work for their households at more varied times. Moreover, women are more likely to take more frequent and shorter, multiple-purpose trips within one trip, called chained trips. For example, they might be going to work/home, but on the way, they might drop off their kids at school, or stop at a grocery store.

- Trip mode

In terms of trip mode, women tend to choose walking and public transport. The majority of men usually have access to private motorized forms of transport, such as private cars, or take taxis.

- Travel cost

With multi-purposes and multi-destinations in travel, women require low cost to meet their needs. Generally, women tend to spend less money than men do for daily commute, no matter which transport mode they choose – private car or public transport. However, when compared to their incomes, women proportionally spend more than men do on transport on average¹. With regard to choosing travel mode, females are more price-sensitive than males are.

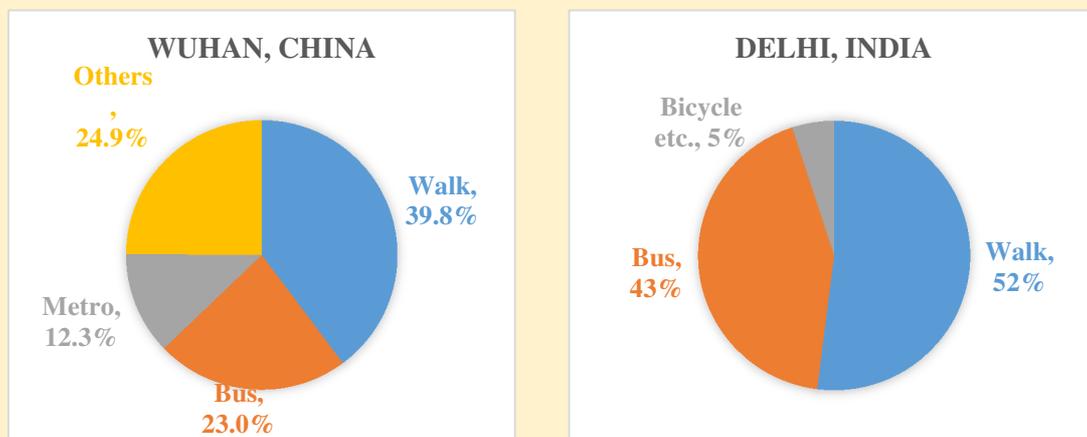
¹ Babinard, Julie and Kinnon Scott. (2009). *What Can Existing Surveys Tell Us about Gender and Transportation in Developing Countries?* Proceedings of the Transport Research Board (TRB) 4th International Conference on Women's Issues in Transportation. October 27-30, 2009. Irvine, California. Forthcoming.

- Travel time and time consumption

Generally speaking, men tend to have much more linear origins/destinations centered on work during the morning and evening peak hours. Women tend to take more frequent and shorter trips at more varied times of the day. Moreover, because of their unique trip modes and social roles, females consume less time than males do on a single trip on average.

Box 1: Travel behaviors of women in developing countries, using Wuhan, China and Delhi, India as examples

Studies have shown that males and females have different travel needs and face various restraints. The fact that women's travel purposes tend to involve going to multi-destinations causes women to have fewer travel options than men do in most current urban transport system designs. Women particularly have less access to cars (Anand & Tiwari, 2006). As shown in the following figures, in both Delhi and Wuhan, women tend to be highly dependent on either walking (Wuhan: 39.8%; Delhi:52%) or public transport (Wuhan:35%; Delhi:43%). Other transport modes are not available to women because they are either too expensive or inconvenient.



Source: India case from Anand and Tiwari (2006), Wuhan case from our Gender Impact of ITS study report.

- Factors of concern in travel

Males and females have different priorities in the evaluation of transport attributes. Overall, both of them list road safety as a significantly important factor (see Box 2). Women's concerns about safety are greater than men's are, while men value efficiency more. However, when "efficiency" and "safety" conflict, men tend to value speed, sometimes at the expense of safety. The factors summarized in Box 2 indicate that males are concerned more with speed, traffic safety, travel choices, etc., while females' worries are more on personal security, traffic safety, and ticket prices, etc.

The second step is to identify the needs to use ITS by gender. In the process of overall ITS planning and each sub-system planning, a gender analysis can be conducted from administrators' and users' perspectives to understand their different needs regarding intelligent transport facilities and applications. Typically, these differences will be reflected in the

different usage of hardware, the various needs and preferences for either the software itself or the information content, and concerns about personal security and privacy.

Box 2: Factors of concern in travel

Female		Male
(+)		(+)
-Importance (high)	Order	- Importance (high)
Personal security (theft, harassment)	1	Speed (get to destination fast)
Road safety (accident)	2	Road safety (accident)
Ticket price	3	Travel choices (shuttle bus, routes and stops)
Comfort	4	Ticket price
Courteous treatment	5	Personal security (theft)
Hygiene	6	Courteous treatment
Travel Choices (Shuttle bus, route and pit stop)	7	Hygiene
-Importance (low)		- Importance (low)
(-)		(-)

Source: Gómez (2000)

In sum, ITS planning and design need to develop a systematic, scientific and reasonable gender-analysis framework. The first step is to collect data on users to understand what they prefer and what they need (see Table 1-2). This study suggests including four major parts of gender analysis: understanding gender traits in travel behaviors, understanding gender needs in travel, understanding gender traits in the ITS, and understanding gender needs in the ITS.

Table 1-2: Gender Analysis Framework for ITS

I. Understanding Gender Traits in Travel Behaviors	II. Understanding Gender Needs in Travel	III. Understanding Gender Traits in ITS	IV. Understanding Gender Needs in ITS
Travel Preferences Survey <ul style="list-style-type: none"> • Infrastructure Satisfaction • Public transport satisfaction • Travel environment comfort • Travel environment safety • Travel environment convenience 	Travel Survey <ul style="list-style-type: none"> • Travel purpose • Travel distance • Travel time • Travel frequency • Trip mode • Travel time • Time distribution • Travel space distribution • ... 	ITS Usage Survey <ul style="list-style-type: none"> • How to get intelligent transport information • How to use intelligent transport information in travel • Public transit card recharging method 	ITS Demand Survey <ul style="list-style-type: none"> • Needs and preferences for intelligent transport information and its publish methods • Needs and preferences for function, form, swiping and recharging method of public transit card

<ul style="list-style-type: none"> • Travel information promptness • Travel information accuracy • Travel Information Richness • ... 		<ul style="list-style-type: none"> • Public transit card swiping method • Usage frequency and preferences of all kinds of intelligent transport facilities • ... 	<ul style="list-style-type: none"> • Using need of all kinds of intelligent transport facilities and willingness to pay • ...
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1.4 Data Collection

Given different cultural, social and economic backgrounds and specific geographic conditions, travel preferences and ITS needs vary between men and women. Although it is possible to find similarities in these preferences and needs across cities, the characteristics and differences of people's travel behaviors and ITS demands can be more specific and accurate only when taking local features into consideration. Therefore, **ITS planners should use local residents as an investigated sample to obtain accurate data and information for gender analysis.** Moreover, ITS planning, design and operation depend largely on the support of the government, transport administrations, operators and communities. Therefore, **ITS planners should widely consult the views and suggestions from these stakeholders.**

A variety of ways of collecting such data exist and include, but are not limited to the ones listed as follows.

■ Questionnaire

Questionnaires can be distributed to people at bus stations and at commercial and community centers as well as to residents of each community door to door in the investigated areas. Questionnaire collection needs to ensure that the proportion of males and females is balanced and that the sample covers all ages, major residential areas, major travel destinations and transport



Figure 1: Information collection by questionnaire

hubs, it must also ensure that the collected information is accurate and reliable. In Chinese cities, this type of questionnaire collection can be combined with a household travel survey as well as a public transport passenger satisfaction survey. In the questionnaire design, besides residents' basic information (such as age, education background, work experience, and income, etc.), it

should include people's travel needs and travel choices by gender (such as daily travel patterns, travel purposes, travel modes travel costs, and so on).

- Semi-structured interview

Semi-structured interview can be used not only to explore various travel behaviors that are difficult to quantify or notice, but also to understand existing travel options, the services available to users, travel frequency and the costs and preferences of travel choices. Additionally, it can be used to find out the social, economic and psychological reasons behind these travel behaviors, including why females feel unsafe and uncomfortable in travel, how the division of household labor affects travel, which details in ITS services affect females' feelings and so on. An interview questionnaire has specific targeted interviewees in the transport-users group, such as pregnant women, homemakers, office women, and low-income workers, etc. More importantly, this questionnaire assesses bottlenecks in using existing travel options, and seeks to understand the travel needs of beneficiaries and other special user groups.

- Big-data analysis

Big data built on various sets of data sources—including information from public transit cards, ETC, vehicle Global Positioning System (GPS) tracking system, and camera and cell phone positioning tracking system—can be used to obtain the time-space information related to the travel and trip chain that could further analyze residents' travel patterns and travel needs. What needs to be noted is that big data is featured with high facticity, accuracy and reliability, but many times lacking demographic and economic attribute information, such as gender and age attributes. Therefore, this study suggests creating a real-name or semi-real-name record system (gender, age and other user social information) in public transport ITS (public transit card, ETC, and so on) so that these valuable information can be obtained for decision-making.

- Focus group discussions

Focus group discussions are held with two major groups of stakeholders. One is a group of government representatives, decision-makers and ITS operators; the other is a group of community and resident representatives, etc. The discussions focus on efficiency and equality in the use of the ITS, understanding the point of view and perspectives of each stakeholder, exploring gender differences and issues in ITS service, and proposing a plan for facilitating the shared benefits of both genders from ITS development. Discussion also focus on the issues of ITS gender development that is involved in projection planning, construction, management, operation, and implementation, as well as on defining the feasibility of the proposed plan. When selecting community and resident representatives, they can be grouped separately by their social backgrounds (gender, income, age, and job) to ensure a full understanding of various needs of each ITS user group. Additionally, the proposals of a gender-sensitive ITS program involve with different stakeholders. Focus group discussions provide a platform for exchanging ideas, as well as negotiating and collaborating among ITS beneficiaries so that a consensus is reached and a cooperation frame is ultimately established.

2 ITS Design

2.1 Intelligent Transport Information System

Complex traffic situations, together with ever expanding public transport services in major Chinese cities, are major challenges for the management of the transport department and the public users' daily travel. The collection and usage of relevant traffic information from all kinds of intelligent transport information systems could be a solution. It can not only provide advanced managerial methods and support for transport sectors, but also provide real-time traffic information for all transport users, such as pedestrians, public transport users and drivers, to choose travel modes and plan travel routes ahead. **Accurate and real-time traffic information especially help women to efficiently make trips and mitigate time poverty**, considering the variety of reproductive work for which they are responsible in maintaining a household.

2.1.1 Bus positioning, dispatching and information service system

Bus positioning and other supportive technologies provide real-time operating conditions of buses for bus dispatchers and passengers to improve the quality and convenience of bus services. Since men and women have various expectations of and depend on the public transport service, the design of a bus positioning, dispatching, and information service system should consider the following aspects:

The bus positioning system can be applied to regulate driver's behaviors and increase the reliability and safety of bus operation. The bus positioning system can track the locations and routes of buses and monitor road conditions so that the reliability of travel for passengers can be ensured. In addition, bus driver can be monitored by the on-board unit, which regulates driver's driving behavior such as speeding or sudden breaks and thus significantly results in the decrease of accidents. The elderly, women and children are usually the vulnerable group in accidents caused by speeding or sudden breaks.

Bus station electronic boards should provide information about more oncoming buses. Most bus station electronic boards display the predicted arrival time of only the next coming bus (or the number of stops remaining before the bus's arrival), shown in Figure 2. Providing such bus location information can help relieve passengers' impatience while waiting. If the predicted waiting time is too long, most males will choose other means of transportation such as taking a taxi, while more females tend to continue waiting. Providing the estimated arrival times or distances of buses, therefore, is helpful for satisfying men's needs for efficient

travel and for assisting them in choosing other means of transport flexibly. On the other hand, female passengers like to have information on the estimated arrival time of the second oncoming bus as well, so that when the first oncoming bus is crowded they can decide whether to wait for the next bus or choose the current crowded one.

Bus station electronic boards could provide bus crowdedness information. Passengers, especially female passengers, want to acquire bus crowdedness information. Technologies such as infrared sensor technology and smart card counting are now capable of providing such information. Moreover,



Figure 2: Electronic board at bus station

drivers can manually provide information on real-time crowdedness conditions (crowded, normal or less crowded) to the bus monitoring center to be displayed on electronic boards.

The service coverage of the bus information system should be expanded. Besides electronic boards at bus stops, traffic information displays can be set up in community business service centers, supermarkets and shopping malls, and elementary/middle schools where women are more likely to visit. This information could help women plan their route.

2.1.2 Variable message signs

Variable message signs are placed on a city's main roads and provide traffic information for a variety of situations, including weather condition, traffic restriction rules, emergencies, road congestion and closures and so on. It not only increases the efficiency of travel for men, but also improves confidence and secure feelings for women. To better satisfy the different travel needs of men and women, the following aspects should be considered in the process of designing variable message signs:

The accuracy of real-time traffic condition information should be improved through data sharing and data fusion. Both male and female drivers pay high attention to real-time road information. However, they are concerned about the accuracy of traffic congestion shown on electronic boards. Traditional road information comes from an embedded loop vehicle detector, infrared sensor and video image processor on major roads. In recent years, GPS-based probe vehicles have increased the coverage of traffic information. All kinds of this information belong to different departments. Therefore, data sharing through data fusion and processing can significantly increase the accuracy of real-time traffic information (road accidents, congestion and maintenance). This supplemental information allows drivers to decide if a need exists to change routes.

Variable message signs should display readable content and reduce the frequency of updating information. Some drivers, especially female drivers, face difficulties in capturing

pictures and text information in a short time while driving. Therefore, if the board displays large size text, this limits the amount of content that can be shown at once and reduces the frequency of updating information.

2.1.3 Parking guidance information system

Parking guidance information system can deliver parking information to the public in a timely manner, help drivers to save a lot of energy when looking for parking lots, and further mitigate traffic congestion. It improves the utilization of parking facilities and reduces parking violations. The system also provides a better way of managing available parking lots, lowering operating costs and further promoting social and economic development.

The coverage of parking information should be expanded. When parking lots are full, people generally drive around to look for another one nearby. In addition, men tend to park illegally via temporary occupation of road side, while women tend to wait until a space becomes available. Therefore, the expanded coverage of parking information can provide more options for males so that parking violations can be reduced.

The distribution channels of parking information should be diversified. When males know that their destinations have busy parking lots before they travel there, most still choose to drive there and look for spaces, while females typically choose other means of transport or simply cancel their travel plans. Currently, most parking information is only shown on LED screens located near the parking lots. The provision of parking information before trip making through the internet or smart phones could help people make more reasonable trip mode choice.

Box 3: Case study: Parking guidance information system in Ningbo

The Ningbo parking guidance information system is one of the functions in an intelligent transport app, called “Ningbo Expert”. Parking information is displayed spatially by color: red, blue and yellow. Blue indicates that enough parking lots are available; red means all lots are full. Yellow represents the fact that lots are busy (the number of available parking lots is shown when one clicks for details). In addition, local residents in Ningbo have multiple way of acquiring parking information, such as traffic-induced screens and a parking guidance website. It is more efficient for drivers, especially female drivers to make parking choices in advance.

Source: <http://www.feiaock.com/news/639.html>

Parking information should be enriched. The results of a survey reveal that females are more concerned about parking information than males are. In addition to the availability of parking lots, they are eager to know the parking fees at their destinations. Parking fee information can be published in advance through the channels mentioned above, and it can also be used to adjust travel needs dynamically.

2.1.4 Personal service information and applications

Besides the intelligent transport information system that the government provides, all kinds of mobile data terminals such as GPS, mobile phone apps and the internet are actively being developed in the private sector to provide travel information to the public. The

participation of the private sector can improve the quality of service and further favor all kinds of users.

The government and private sectors should take advantages of the internet for publishing information. Internet and smartphone service have been common in China. Compared to government-invested intelligent transport infrastructure facilities, such as bus station electronic board and variable message signs, mobile data terminals have the advantages of lower prices and a wider coverage. However, bus service information in China is still limited, mainly because the government owns real-time traffic information, and private sectors face difficulties with acquiring such data for developing personal information services. Therefore, **transport departments should adopt open data policies** so that the private sector can be involved into data service, and provide more diversified information services for both men and

Box 4: Open data and contest of apps

In 2015, “Shanghai Open Data Apps” was successfully held with more than 1,000 GB of big transport data being opened to developers around the world. More than 100 well-designed transport applications and solutions were received from all over the world. In the same year, the city of Weihai (a city in Shandong province) also held “Internet and Open Data Innovation,” collecting all sorts of innovative projects that are beneficial to the public.

Local government and urban transport departments hold such contests for creative open-data apps. The public sector opens a series of urban traffic data to the developers, and request for specific solutions for improving urban transport service and the convenience of travel.

- 1) Open traffic data include, but are not limited to following: real-time metro schedule, real-time bus information, taxi information, smart cards data, real-time traffic data, air quality, weather conditions, accidents and annual the household travel survey.
- 2) “Gender-equality in travel” element can be one them for the contest. The contest can call for innovative apps that can improve gender equality and create a safe and convenient travel environment for females. A combination of open data, data analysis, and a proposed project serves to promote the efficient implementation of better travel programs.

women through market competition.

The following is an example of intelligent transport apps (shown in Figure 3) in China: in 2013, the city of Ningbo promoted an ITS app, called “Ningbo Expert”, which provides 18 various services including “real-time bus information, the best taxi pick/drop site , public bicycle, parking guidance system, long haul buses, road condition report, and car-moving assistance.” Moreover, it combines the information of traffic policies, weather, and others from multiple department sectors. Together with traffic information, including the transport infrastructure, the means of transportation and traffic events, this app provides comprehensive, real-time traffic information to travelers². Up to June of 2014, “Ningbo Expert” gained 400,000 users.

² Source: http://www.zj.xinhuanet.com/dfnews/2013-09/09/c_117285954.htm



Figure 3: Ningbo Expert app

Traffic information should be easy to use. With the development of informatization and technology, vulnerable groups in society may further be marginalized and be unable to equally enjoy the benefits of intelligent transport information and services. The major users of these transport information apps are adolescents and adult men. The usage of these apps by the elderly and by women is relatively lower. Therefore, traffic services should be designed practically and be easy to use by the general public. Moreover, trainings should be provided to elderly and female users particularly when conducting market promotions.

2.1.5 User-friendly methods

At present, it is still not very easy for all people to access, understand and operates various intelligent transport information systems in China. Especially for groups such as homemakers and the elderly who still are unfamiliar with internet, electronic device or its complicated system, it is a big challenge. Therefore, it is important to build a user-friendly, down-to-earth and easy-to-read system for the promotion of the ITS.

- **Inquiry steps should be simplified, avoiding complicated and long operating processes.** All kinds of inquiry functions and information should be clearly classified.
- **The interface should be easy to read and down to earth.** For example, “where to go,” “where to depart” and “how to get there” can be used instead of complicated technical terms such as “destination,” “place of departure,” “means of transportation,” and so on.
- **A user-friendly operating method should be utilized.** Convenient and efficient inquiry methods should be promoted, such as a touch screen and voice answering system.

2.2 Smart Cards

Smart cards, such as the public transit IC card, have been widely used in China to replace cash transaction and have benefited many citizens. Many cities have begun to promote multi-function cards, which are used not only for transport service, but also for many other daily consumptions, such as paying a taxi, shopping in a supermarket, and paying a parking fee, to further promote the urban transport service. Compared to men, women rely more on public

means of transportation and tend to have more transfers within a single travel experience. Hence, generally, more women than men own smart cards.

2.2.1 Public transit card swipe option

Females usually carry hand bags or other items on their daily travel, while men do not. Therefore, the improvement of the design and swipe option of the public transit card can benefit females significantly.

IC card readers could be more sensitive and allow users to pay fares without taking their card out, considering the inconvenience of making a payment when a woman is carrying bags and other belongings. This improvement will not only increase the convenience of taking public transit for women, but also reduce the potential risk of theft – surveys show that women are likely to expose their personal belongings when reaching for the IC card in the bag. A card will be charged only once during a single trip to avoid an accidental swipe caused by high sensitivity.

Various forms of public transit cards can be provided. It is not easy to keep a single traditional public transit card. A new generation of smart cards in small, portable forms, such as key chains, bracelets, phone chains and bag accessories, thus should be introduced for the convenience of commuters who use them every day. In China, Guangzhou and Shenzhen have launched and made this a successful practice into the urban transit system. Moreover, some mobile payment services, such as NFC and Apple Pay, can be used as well. In this way, there will be no need for passengers to take many small items on their travels.

2.2.2 Flexible ticket pricing system

Compared with traditional fare-collection approaches, including ticket counters and coin-operated machines, public-transit smart cards enable urban public transport systems to implement fare-price flexibility, which better meets the travel needs of riders of both genders.

Peak versus non-peak pricing. Generally speaking, men tend to take much more linear trips from origin to destination, accounted for by their daily work commutes during the morning and evening peak hours. Women tend to take more, shorter trips at more varied times during the day, accounted for by their meeting household needs. A system of peak vs. non-peak pricing could mitigate congestion during peak hours, while costing women who travel for household works during off-peak hours less.

Time-based fare. Women make more and shorter trips that may consist of multiple stops. For instance, on the way to work, they may need to stop by daycare or school. Within that trip chain, travel distance is similar to the distance to work, but women need to pay more because of the transfers involved. From a fairness of view, if people has a transfer within a certain period of time (e.g. 20 minutes), he/she should pay the same amount as a direct trip. Intelligent public transit cards can be programmed to allow riders to leave the transit service for a short period, and re-enter to continue the trip without paying more. In addition, it can also provide discounts

for transfers between various public transport routes. This benefits women significantly a lot on their chain trips.

In addition to traditional flat fares, peak pricing and time-based fares, a mix of the fare structures is possible. Although such a mix would increase the technology requirements to collect fares, it would not only increase profits of transit operator, but also satisfy the travel needs of passengers and improve their willingness to pay. For example, in Brazil, the city of St. Paul adopted a multi-fare structure for its bus service. It charged a flat fare in the central city, but reverted to a distance-based fare structure for riders going to satellite destinations.

2.2.3 Real-name information system

Compared with males, females have higher rates of public transit card ownership, since they rely more on public transportation and are more concerned about travel costs. The loss of their public transit card causes problems and inconvenience. Hence, in the absence of a real-name system, females may frequently recharge their transit cards with small amounts of money to avoid potential financial losses if their cards are lost. This frequent recharging is inconvenient. Therefore, **the introduction of a real-name information system and a system to report loss and replace cards can better ensure card security and can increase the efficiency of card use.** In particular, the development of a “multi-function card system” would enable public transit cards to be widely used to pay in supermarket, pay utility bills and make other daily purchases, thereby, finally making it feasible to recharge cards with larger amounts. Furthermore, a real-name information system for public transit cards would become a key aspect in furthering the development of smart cities.

Finally, **a real-name information system can associate transit payments with personal social information, including gender and age**, so that travel behavior analysis that includes those demographic statistics can be conducted using the data from public transit card.

2.2.4 Convenient public transit card recharge

Currently, recharging at station vending machines, on the internet, and through mobile apps recharge has not yet been widely adopted. Most passengers still use ticket counters and other traditional means of recharging.

Intelligent recharge should be promoted. Currently, the percentage of stations in Chinese cities with ticket vending machines and ticket counters is still low. As a result, recharging is quite inconvenient, disproportionately affecting women because they rely more on public transport. To address this issue, more auto-refill machines with easy, concise interfaces and understandable introductions should be added to city bus stations, and in business centers that have high passenger volumes. In addition, to improve the efficiency of auto-refill process, internet and mobile phone apps should be combined to develop online recharging platforms, including auto-refill phone apps, Alipay, and WeChat.

Ticket counters should be optimized and improved. Specific groups, such as women and the elderly, always face difficulty in using intelligent auto-refill services. More sites are

needed that provide manual refill services, especially at locations that women and the elderly visit frequently such as supermarket, community service centers and convenience stores. In addition, the payment options at ticket counters should be convenient and diverse. Some intelligent payment options, including Alipay, and WeChat, should be adopted soon.

2.3 Intelligent Monitoring Facilities

2.3.1 Comprehensive monitoring services

Safety and security during travel is everyone's top priority, but especially women's. Personal security includes security from physical assault, and verbal harassment, robbery, theft, and so on. In public spaces and on public transit, harassment is a serious issue that influences women's travel behaviors and patterns. To further increase people's personal security during their daily travels, many Chinese cities have implemented comprehensive monitoring systems, including municipal, transit and bus monitors.

Coverage of monitoring facilities should be expanded. Crimes like harassment and theft usually take place on buses and metros. Monitoring in these places must be reinforced, and camera locations should be optimized to cover all directions. Underground walkways, metro and bus stations, and deserted streets have the highest potential crime risks for women. Therefore, it is necessary to enhance monitoring and regularly check camera functionality. In addition, good lighting is important to reduce the opportunities for crime, and to ensure that cameras can capture bright images. If government funding is limited, capital from the private

Box 4: Case studies — Johannesburg and Nairobi's strategies to improve travel safety.

In the CBD of Johannesburg, South Africa, the basic social services provided by the government and augmented by private partners in the CBD, who have installed monitoring facilities and hired private guards to create a safer and more attractive business district. This strategy not only improves customers' travel security, but it also attracts a significant number of investments.

"Adopt a Light limited" is a lighting and advertising company in Nairobi, Kenya, that aims to achieve safer cities by installing adequate street lighting and reinvesting its revenues from advertising in community development. So far, the company has installed 185 streetlights with advertisements along all the major highways and in slums in Nairobi, resulting in a reduction in road crimes, including highway attacks, rapes, and muggings among both drivers and pedestrians.



Figure 4: Adopt a light project (source: <http://www.adopt-a-light.com/>)

sector can contribute to creating safe travel environments. Examples of this include “Adopt a Light”, a lighting and advertising company in Nairobi, Kenya, and a monitoring system in Johannesburg, South Africa (see Box 4).

High-risk places and time should be recognized. Through regular crime investigation and analysis, high-risk places and time must be recognized so their monitoring can thus be increased. Then, staff must be allocated at the monitoring center to monitor these high-crime areas during the night. If necessary, patrols should also be dispatched.

2.3.2 Timely, efficient incident management

Monitoring systems not only help administrators see real-time images of public places, but the videotapes are also invaluable as evidence in criminal and traffic-related cases.

Monitoring data should be saved properly. The length of time for which monitoring videos are saved should be maximized according to relevant regulations and real needs. In addition, monitoring facilities should be inspected regularly; and outdated or broken cameras fixed or replaced timely so that high-quality videotapes can be produced.

Incident handling should be further improved. Intelligent monitoring system are meant to serve people. To provide better service, the process for responding to incidents and providing video evidence for people who need it should be refined. Moreover, routing summary and reporting results of incidents will make intelligent monitoring system more of a deterrent.

Security precaution should be established. The Public Security Department, the Transport Department and the Bus Monitoring Center should implement a process for publicizing security risks and potential dangers detected by monitoring systems. For instance, electronic message signs at bus stations or on buses could warn to passengers about potential safety risks.

2.3.3 Special attention to women’s safety

Compared with men, women are more likely to be targeted by crimes, including harassment and theft. Therefore, an intelligent monitoring system should be designed particularly to address women’s travel safety and personal security.

A special security-alarming system could be implemented. To ensure security in secluded places on campus, some colleges and universities in China have installed security alarms that have alarm buttons, recording devices, lighting, and warning lights. Similarly, in secluded or dangerous places, urban management departments can install security alarms in pillars or kiosks that are equipped with flashing warning lights, lighting, cameras, alarm buttons, intercom telephones, and recording devices. The locations could also include first-aid kits and self-defense tools.

Women-only carriages could be introduced. Survey results indicate that some women call for women-only carriages on metros during peak hours. In addition, crowded bus line could either introduce female-only buses or designate special areas inside buses, at least during summer. Nevertheless, it might be difficult to implement women-only buses. Since women may

be inappropriately touched by men especially in crowded buses, increasing the frequency of bus service may to some extent obviate the need for female-only buses.

Help and warning buttons could be installed on buses. According to real needs, help buttons on buses or metros enable women to seek assistance from drivers and control centers. In addition, warning buttons can alert other passengers to pay special attention to their belongings through buzz or message signs on bus.

2.4 Traffic Signal Control System

Technology has enabled many advanced functions in signal-control system, including adaptive signals, green wave signals, area traffic control and bus priority. However, to improve access for special groups, basic signal timing need to be improved.

2.4.1 Intersection layouts and signal-system design

The signal-timing plan for intersections is always constrained by the size, form and channelization of each intersection. Therefore, to balance pedestrian safety and traffic flow, the traffic signal system and timing plan should be addressed when the street intersection is designed.

Signal-timing plan should be validated when designing the intersection layout. The signal-timing plan (including the bus priority scheme) should be developed based on the physical layout of the intersections, including their size, form and channelization, according to estimated traffic flow. If the plan does not work, the layout of the intersections should be redesigned, including the crossing distance, lane arrangement and intersection channelization.

Reasonable channelization should be realized through triangle islands or refuge islands. Since wide intersections take more time to cross, the pedestrians face more danger. To reduce crossing distance, triangle islands or refuge islands with enough space to accommodate significant numbers of pedestrians should be designed and provided.

Signal control system should be inspected regularly. The operation of intersection signals should be monitored closely. Regular inspections of intersection design and signal timing performance are necessary, so signal timing can be optimized, damaged signals repaired timely and signal controls added at un-signalized intersections where traffic flow is high.

2.4.2 Reasonable traffic timings and high priority for pedestrians

Signal control systems are responsible for distributing right-of-way on urban roads. When timing the signals, transport administrators in China tend to prioritize motor vehicles, facilitating traffic flow at the expense of pedestrians and causing many potential dangers and discomforts to non-motorized travelers (especially women and the elderly) crossing the street. **Modern signal timing design should be pedestrian-oriented**, with special attention to the needs of special groups, including the elderly, women and children. The signal control system should have reasonable signal times to create a safe, comfortable, convenient travel environment for all pedestrians.

Scientific, reasonable signal times should be designed. Signal times are calculated according to the physical characteristics of the intersection and the traffic volume. Minimum green times should ensure that all pedestrians have enough time to across the intersection, with special consideration for pregnant women, children and the elderly who walk slower than male adults.

Pedestrians should be given sufficient, reasonable right-of-way. At certain intersections or locations (for instance, in front of elementary and secondary schools or hospitals), pedestrian crossing buttons should be provided. Pressing the “WALK” button should trigger the green signal for pedestrians.

Conflicts between pedestrians and right-turning vehicles should be addressed. If possible, right-turn-only lanes should be designed at intersections, so that right-turning vehicles and pedestrians can be controlled in separate phases. More importantly, traffic legislation and its enforcement mechanism shall be established to further guarantee pedestrians’ right-of-way and travel security.

2.4.3 All-red signals

All-red signals would show a red signal for vehicle traffic in all directions at one point during the cycle at times of heavy traffic, and at intersections with long crossing distances. When all signals are red, all vehicles stop, enabling pedestrians to cross straight or diagonally. This mechanism not only ensures pedestrians’ safety, but also increases efficiency at intersections by reducing congestion caused by accidents and conflicts. All-red signals have been successfully implemented successfully at intersections in Tokyo and Hong Kong with high pedestrian volumes.

All-red signals are appropriate in the following situations:

- At intersections with long crossing distances and high pedestrian volume, including commercial pedestrian streets, near kindergarten, elementary schools, secondary schools and supermarkets.
- At peak hours, after which they can revert to normal signals. For example, all- red signals can be implemented at intersections near preschools, elementary schools, and secondary schools during the morning drop-off and afternoon pick-up times.
- All-red signals should be tested due, because situations can be complicated and vary among cities. This system should be further promoted only if it works well.

2.5 Electronic Police System

“Electronic police” is a camera system street intersections that automatically detects traffic violations and takes candid photos. In many cities in China, electronic police systems play an increasingly important role in detecting traffic violation, including running red lights, speeding and driving on irregular carriageway. Enforcement cameras now deal with more violations than

policeman do on site. To make the electronic police system more efficient and more of a deterrent, its design should integrate the travel behaviors and habits of both men and women.

HD cameras could be used to acquire drivers' pictures and identities. Our survey results showed that males more often violated traffic regulations than females, but they were less likely to receive penalties from enforcement cameras. Further research found that male drivers may memorize the specific locations enforcement cameras and avoid them. In addition, women drivers in the same household accepted the traffic tickets issued to men in the household, which circumvented justice in traffic-law enforcement. HD traffic cameras could be introduced to take clear pictures of drivers from the front that can identify gender, thus avoiding deception and enabling a justice result.

Law enforcement and safe-driving education should be combined. Rather than issuing penalties, the purpose of the electronic police system is to make the streets safer by regulating driving behaviors. Therefore, traffic administrators should implement a more equal and transparent law enforcement system. For example, the locations of electronic police cameras can be publicized regularly, and distinctive signs should identify areas where speed is measured. In addition, to raise citizens' awareness of safe driving, the factors underlying these actions, along with the traffic laws, should be publicized.

3 ITS Operation

3.1 Government Initiatives

International community-development experiences tell us that the more effort local governments make, the more successful gender mainstreaming will be. Only when the decision-makers in charge of allocating public resources recognize the existence of gender inequality and the importance of gender equality, can they create impartial, effective policies to improve urban environments for both men and women. Therefore, the government should take greater responsibility for promoting gender equality in ITS.

- ITS gender-equality policy goal

Focusing on the social benefits brought about by ITS, **the government should make “considering the interests of both genders equally and meeting the needs of both genders equally” a policy goal** by way of a gender action plan and a gender equality assessment of ITS operation. Currently, gender policy is relatively independent of transport development policy in China mainly because transport is driven by the economy and technology instead of by social issues. Unlike other national policies, gender policy is executed solely by the Women’s Federation and other women-centered organizations. Therefore, gender-equality policy should be included in the national transport development framework at all levels of government. Through unified planning, clarified operations guidance and gender management programs, gender-equality policy can be better realized, assessed and monitored.

- Gender equality in allocating institutional personnel

The government should maintain gender balance among top leaders in the transport department to prevent transport planning and design from being male dominated. By implementing nomination of exemplary employee and similar practices, the government can commend female leaders and employees in ITS planning, design, and operation encouraging females to apply their traits and skills in the field of intelligent transport.

- Gender equality in ITS vocational-skills training

Implementing ITS practices, including IC cards and intelligent dispatch systems is likely to replace traditional, manual operation positions, including bus conductor and dispatchers, jobs mainly held by females. Rather than laying off these employees, **the government and private enterprises should offer related vocational-skills training to help these female workers and other workers gain knowledge needed for new jobs**. With skills in using operating software and systems, workers can be more adaptive and qualified for new positions.

- Gender awareness in government personnel

Leaders and members of intelligent transport departments should be trained to be more gender-conscious.

3.2 Stakeholders in Developing ITS

Stakeholders in developing ITS consist of four major groups, shown as follows.

Table 3-1 Stakeholder framework in developing ITS

I. Government	II. Department in Charge	III. Operator	IV. Residents
<ul style="list-style-type: none"> • Emphasizing social equality in transport development planning • Providing sufficient financial support for ITS gender equality development • Making laws and regulations to protect special groups and setting relevant technological indexes 	<ul style="list-style-type: none"> • Doing surveys on residents' travel traits and needs • Studying and analyzing ITS gender needs • Establishing a diversified, human-based and equal ITS platform for suggestion collection • Striking a balance between efficiency and equality in ITS planning and design • Establishing monitoring and feedback mechanism in ITS operation and using • Assessing gender equality in ITS using 	<ul style="list-style-type: none"> • Sticking strictly to the principle of equality and providing diversified and differentiate travel services that can meet the needs of both gender. • Providing special travel services for special groups including pregnant women, the elderly and children • Focusing on the individual needs for travel services and providing human-based travel services • Collecting information and data on residents' travel behaviors and ITS using behaviors which are marked with corresponding demographic information including gender, age etc. 	<ul style="list-style-type: none"> • Being cooperative in resident travel needs surveys; focusing on own needs for ITS services, use preferences and giving voice to it • Involving eagerly in suggestion collection on ITS development • Actively providing feedbacks on the uses of ITS • Offering help all one can to special groups in daily travel

3.3 Media Publicity and Public Participation

Introducing ITSs and providing operating guidance for its use in the mass media could be key to realizing policy transparency, gender equality, and service efficiency. However, ITS, integrated with modern transport information science and technology, still is not widely accessible to all people because of differences in incomes, educational levels, genders and ages. Females, especially homemakers, along with children, the elderly, and the low-income are disadvantaged in adopting new technology and pay less attention to it, thereby, ITS operators and managers need to take various measures to bring these groups the same convenience by explaining them what ITS is and how to use it. Mass media provides a good avenue to for doing this.

- Publicizing ITS at the community level

Regular activities introducing and promoting ITS should be held in various city communities and should emphasize teaching homemakers and the elderly how to use various urban intelligent transport services, including public transport information apps.

- Publicizing ITS in the mass media

Various channels, including bus station boards, publicity boards, billboards and TV advertising should be used to briefly introduce, explain the advantages of, and provide instructions on the use of various ITSs.

- Social groups participation

During the planning, design, operation and monitoring stages of ITS, female-rights related organizations such as women's federation and NGOs should take an active role as the facilitators and catalysts. Their involvement ranges from providing the government with information about gender-specific requirement in travel, suggestions for planning and design, and feedback on the operation and usage of ITS applications, as well as comprehensive social/gender data for transport.

- Involvement of social organizations

During ITS planning, design, operation and M&E, women's federations, NGOs and other social organizations should play the role as drivers, supervisor and catalyst. They could work with the decision-maker in identifying the gender needs in transport and propose gender-

Box 5: Case Study – Improving urban transportation services through public participation

The Liaoning urban transportation project in China adopted participatory methods during the following three key phases of the project cycle:

- At the project design and feasibility stage, public participation was used to identify the public's major travel concerns;
- At the project-appraisal stage, public participation provided reaction to the way the public's concerns had been addressed in the project design.
- At the project implementation stage, public involvement in project monitoring and evaluation was encouraged.

The recruited participants can be classified into walkers, bus users and bus drivers, and so on, according to trip mode. Vulnerability-driven groups of transport users like the poor disabled, migrants and the elderly should be considered. More importantly, men and women should be separately interviewed so that women will feel engaged. Their travel needs and preferences can also be known through focus group discussions and in-depth interviews. For example, the interviews indicate that most people who usually travel on foot, by bike or public transit do not own a car. The interviews also show that travels are mainly for daily commuting, schools and hospitals, instead of leisure activities. Besides, key transport issues for local people are damaged pavement of secondary roads, undesirable drainage system, sidewalks and road equipment, mixed road rights of motor vehicle and non-motor vehicle, and lack of street lighting and signals.

The interviews also indicate that women are less satisfied with transport system, especially in terms of safety – poor lighting, long waits for bus and lack of sidewalks and intersections. With residents' engagement, especially the voices of women, the initial project design towards to improve the conditions of secondary roads, traffic management, sidewalks, public transport service and street lights.

specific recommendations. In addition, they could monitor and evaluate the issues and impacts of ITS projects and provide technical support to system development.

- Public participation

Before establishing new, large-scale ITS projects, operators and managers should hold public hearings to gather suggestions and concerns. Likewise, ITSs already in operation should provide hotlines or email addresses to gather feedbacks or suggestions and complaints from various group of users about their problems or inconvenience in using the ITS.

3.4 Personal Privacy

ITS functions by analyzing and making use of the personal information and video data it collects. For example, the electronic police system identifies information about related vehicles and drivers; intelligent monitoring systems collect videos in public places; a significant number of intelligent transport information services are based on information about personal location. However, as more and more information is gathered, users begin to feel uneasy about their personal privacy and cautious about using ITSs.

A survey showed that some mobile phone users, mostly females, refused to use GPS or other relevant positioning software because they were afraid their location information might be disclosed. However, safety counts more than privacy for females. Even though real-time monitoring cameras installed on streets, at stations or on buses might compromise personal privacy, a majority of females still stand by ITS.

- Monitoring personal privacy

To guarantee the public's privacy and safety, relevant departments should create laws and regulations regarding the use of personal information in the context of transport data.

- Protecting Data security

ITS departments, including those in the government and private sectors should take strict protective actions to avoid the disclosure of user information caused by attacks on data storage servers. If necessary, third party can be commissioned to store data. In addition, data masking, a technology that transforms sensitive, private information according to certain rules, should be applied to data collection and processing to better protect sensitive, private intelligent transport data.

- Scientific and wide publication

In areas covered by intelligent monitoring devices or electronic police systems, signs should announce the use of such systems to the public. In addition, the permission of users should be obtained before personal position information is collected through mobile phones and GPSs. Furthermore, relevant government or enterprises should reveal to the public how they collect, process and use data. Knowing how information is collected and for what purposes may help alleviate public concerns and misunderstandings.

4 ITS Monitoring and Feedback

Transport departments should implement efficient ITS monitoring and feedback mechanisms based on various social attributes, including gender and age. During monitoring, participatory methods can be used to allow all project members and transport users to express their voices, and participate in the process of establishing and operating ITSs . In addition, feedback channels should be established so that errors can be reported, problems addressed and the performance and timeliness of the ITS improved.

4.1 Monitoring and Assessment Methods

Transport departments should objectively and scientifically monitor and assess various effects of ITS on all users. The focus should include suitability and feasibility for vulnerable groups, including females, and the elderly, travel benefits to males and females, respectively, costs paid by males and females when using ITS; and so on. Firstly, a monitoring and assessment index of ITS gender effects should be implemented to assess the results and effects of ITS in terms of gender equality. Secondly, surveys, targeted interviews, and big data where applicable shall be conducted periodically to measure the impact of ITS redesign and interventions on gender and benchmark against the baseline data. Thirdly, social and gender experts should be invited to monitor and assess all planned and operational ITS project. Finally, feedback channels, including e-mail addresses and hotlines, should be provided.

Based on the local situation, the government can also adopt a gender audit checklist to monitor the implementation of a gender-sensitive transport system. This checklist would include the following:

- Assessment of how well local transport operators or authorities satisfy females' travel needs.
- Priorities that were determined by negotiations.
- Assessment of the progress made by transport operators and authorities on gender-oriented project development.

4.2 Assessment Indices

In the process of assessing gender equality in urban transportation services, there are two suggestions: 1) people can be grouped by age and income to investigate the differences between low-income men and women's travel behaviors and the elderly men and women' travel behaviors; 2) people can be grouped by type of urban community they reside in to investigate their travel traits, transport service quality, and the proportion of male residents and female residents in low-income communities, affordable housing communities, and aged communities.

The following indices can be used to assess gender equality in ITS use:

- Popularity by gender

This can be assessed by comparing the respective proportion of male and female ITS users to the population of males and females. To some degree, this also reflects the level of service's quality regarding accessibility and suitability of ITS services.

- Gender proportion of users

Ratio of male users to female users in a certain ITS service can be used to reflect to some degree gender equality level in suitability and practicality of ITS services.

- Use frequency /sufficiency

The average number of times both males and females use of a certain ITS service during a unit period can be used to reflect its level of gender equality level.

- Affordability

Affordability can be calculated from the average amounts spent by male and female ITS users in a unit period. In addition, this can also partly reflect whether the fare structure of ITS service is reasonable for females, who are generally less wealthy than males, and whether the fare structure could prohibit ITS use by females.

- Satisfaction

Ratings and grading can assess male and female ITS users' satisfaction with convenience, comfort, and cost. These rating and grading can efficiently and directly reflect the ITS service's level of gender equality.

- Safety/security

The perceived and real threat to safety and security of male and female users could be collected through surveys to verify the effectiveness of safety-related ITS and reflect the level of gender equality.

- Accident frequency

The proportion of males to females involved in accidents recorded either by ITS or in complaints can directly reflect the level of gender equality in the suitability and safety of the ITS service.

Annex A: General Steps for Incorporating Gender into ITS

Existing ITS application	Newly planned ITS application
✓ Data Collection <ul style="list-style-type: none"> - Questionnaire - Semi-structured interview - Focus group discussions - Big-data analysis 	✓ Data Collection <ul style="list-style-type: none"> - Questionnaire - Semi-structured interview - Focus group discussions
✓ Gender analysis to detect any gender imbalances and gender specific needs	✓ Gender analysis to identify gender specific needs for ITS
✓ Redesigning ITS application ✓ (or) Reconfiguring ITS application	✓ Designing and developing the ITS application
✓ Monitoring and evaluation	✓ Designing monitoring and evaluation framework

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