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An Analysis for Providing Transportation Facilities to the Disabled People in Dhaka

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A Thesis Submitted to the Academic Faculty in Partial Fulfillment of the Requirements for the Degree of

BACHELOR OF SCIENCE IN CIVL AND ENVIRONMENTAL ENGINEERING

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APPROVAL

This is to certify that the thesis submitted by Animik Rahman, Md. Asif Anjum, Syed Zian Ahmed and Ekramer Reza Efat entitled as "**An Analysis for Providing Transportation Facilities to the Disabled People in Dhaka**" has been approved fulfilling the requirements for the Bachelor of Science degree in Civil Engineering.

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DECLARATION

We declare that the undergraduate research work reported in this thesis has been performed by us under the supervision of Associate Professor Dr. Shakil Mohammad Rifaat. We have exercised reasonable care to ensure that the work is original and has not taken from the work of others.

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ABSTRACT

Disability will be experienced by most people at certain points of life, either in personal form or in forms of family or friends. Approximately 11.5 million (19% of the entire population) are currently disabled in the UK, Over one in five of those reporting a disability experience difficulties when using transport. This can lead to a massive impact on the individual, making it difficult or impossible in some cases to access jobs, voluntary work, go shopping, attend educational institutions, meet friends and take holidays. The number of disabled people is expected to increase over time, a trend largely driven by an increasing number of people over the state pension age.

In Bangladesh a range of 9-16% of people are inflicted with disabilities. These numbers come from three surveys that use up-to-date methods and have shown how they got their results. Transportation is a critical arrangement issue for those with incapacities. To resolve this problem, the existing condition and the perspective of the disabled people is a major component in mitigating the problem and facilitate the movement of these people. The objective to review the assisting facilities available for the disabled in the developed world and to develop models that will indicate whether a disabled person prefers policy implementation (Less expensive fare, Travel time reduction, Safety and comfort improvement, Stoppage points closer to destination) or infrastructure development (Dedicated seats, Para-transit, Improved sidewalks and street signs, Trained aiding staff) to solve transportation problems.

To establish the relationship between solution preference and socio-economic, disability background and travel pattern of the disabled people, logistic regression model was used. Comprehensive feedback was gathered from the disabled individuals regarding the characteristics mentioned above and analysis was performed for the measurement of significant factors that affect the solution preference.

The result of this study suggests that different socioeconomic, demographic, disability background properties and travel pattern factors play an important role in selecting different solution preference. For example, from our study, we have found that the younger people prefer Policy Implementation as an effective solution to increase ease of movement. The people who frequently travel by bus prefer policy implementation to a greater degree compared to the people who use other modes of transportation. With the increase in personal monthly income, there is a noticeable increase in preference towards Infrastructure Development. With the increase in average daily transportation cost, there is a similar noticeable increase in preference towards infrastructure development.

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List of Acronyms

ADA	Americans with Disabilities Act
ADAGA	Americans with Disabilities Act Accessibility Gudelines
BRT	Bus Rapid Transit
DWB	Disabled, Wheelchair and Blind
EU	European Union
GIS	Geographic Information system
KII	Key informant interview
LUPTAI	Land use and Public transport accessibility Index
MH	Mental Handicap
MI	Mental illness
PH	Physical Handicap
RFID	Radio frequency identification
SI	Speech Impairment
TFL	Transport for London
TISAT	Time based transit service area tool
TLOS	Travel level of System
UFAS	Uniform Federal Accessibility Guidelines
UIC	Union Internationale des Chemins de Fer
VI	Visual Impairment

CHAPTER 1
INTRODUCTION

1.1 Background

Disability will be experienced by most people at certain points of life, either in personal form or in forms of family or friends. Approximately 11.5 million (19% of the entire population) are currently disabled in the UK, as defined by the Equality Act 2010. (Transport for London, 2010) Over one in five of those reporting a disability experience difficulties when using transport. **(**Transport for London, 2010**)**This can lead to a massive impact on the individual, making it difficult or impossible in some cases to access jobs, voluntary work, go shopping, attend educational institutions, meet friends and take holidays. The number of disabled people is expected to increase over time, a trend largely driven by an increasing number of people over the state pension age. (Bezzina and Spiteri, 2005)

In Bangladesh a range of 9-16% of people are inflicted with disabilities. These numbers come from three surveys that use up-to-date methods and have shown how they got their results. Inability is hard to quantify, there is no standard definition. Distinctive outcomes might be found from various strategies for overviews. In the event that a study is directed inquiring as to whether anybody is "debilitated", an answer like 1.4% would be found as like the 2011 Census. This is because of the reluctance of the general population to call themselves or a relative "impaired" and on the grounds that the comprehend handicap to be constrained to just certain sorts of extreme conditions.

If there should be an occurrence of asking individuals questions in regards to the troubles they confront with everyday exercises, a fuller picture will be gotten. Inquiries on useful restrictions will permit appropriate reactions in view of the level of trouble. The reviews that were directed in light of such techniques for approach gave a greatly improved outcome. The family wage and consumption study of 2010 review and the World Health

Survey give 9.1% and 16.2% individually. Transportation is a critical arrangement issue for those with incapacities. Individuals with handicaps have reliably portrayed how transportation boundaries influence their lives in critical ways. In the course of the most recent two decades the National on Disability (NOD) has supported three progressive Harris surveys with individuals with incapacities, and respondents in each overview have announced that transportation issues are essential concern. In the last review, embraced in 2004, simply under 33% of those with incapacities detailed that insufficient transportation was an issue for them; of those people, over half said it was a noteworthy issue. The more extreme the inability of the respondent was, the more genuine were the revealed transportation issues (Harris Interactive, 2004) Empowering and urging simple access to transportation offices for the handicapped conveys broad advantages crosswise over Government, through augmenting business openings; through access to human services and training; and by empowering impaired individuals to take an interest more in the public arena.

1.2 Defining Impairment and Disability

The ADA defines disability as A physical or mental impairment that substantially limits one or more of the major life activities of such individual: A record of such an impairment; or being regarded as having such an impairment. Americans with Disabilities Act (July 1990).

Person with disability (PWD) – is a person with physical or mental condition that limits his or her movement, senses or activities. People living with disabilities could be classified into two broad categories.

- Mobility Impaired (PWD)

Mobility impaired is referred to a person who by reasons of physical deficiency of any of his/her limbs is limited or incapable of carrying out partial or physical activity.

1. Cripple on one leg or both.

2. Loss of one or both hands.

- Sensory Impaired (PWD)

Sensory impaired is referred to a person who by reason of physical deficiency of any of his/her sensory organ is limited or incapable of understanding and carrying out certain activities.

1. Autism
2. Epilepsy
3. Blind
4. Deaf/blind

Typical everyday exercises distinguished in the Government's 'Direction on matters to be considered in deciding inquiries identifying with the meaning of incapacity' are a muddle of physical, tactile and mental capacities and social exercises. For instance, in trying to characterize "versatility" the direction booklet expresses that record ought to be taken of the degree to which, in view of either a physical or mental conditions, a man is repressed.

- ✓ In getting around unaided
- ✓ Using normal means of transport
- ✓ In leaving home with or without assistance
- ✓ In walking a short distance
- ✓ Climbing stairs
- ✓ Traveling in a car or completing a journey on public transport
- ✓ Sitting, standing, bending or reaching
- ✓ Getting around in an unfamiliar place

Physical capacities, for example, sitting, standing or bowing or coming to might be restrained by debilitation. Yet, the failure to utilize open transport is not the aftereffect of a physical or a mental condition. It is all around archived that many handicapped individuals can't utilize open transport since it is not intended to address their issues either

physically or hierarchically.

For those blessed to live to a more seasoned age, 85 percent will have a changeless incapacity that confines the scope of portability. Inabilities are basic through all ages, and the forever debilitated constitute no less than 15 percent of our populace. Those with changeless physical and broken or sprained appendages that may confine their portability, the incapacitated gathering incorporates

- Those who are visually impaired, hearing impaired, mobility impaired, mentally/emotionally impaired or other.
- Many older adults who have reduced abilities

1.3 Disability in Bangladesh

Bangladesh is a creating nation situated in South Asia and is home to roughly 160 million individuals. A nation of broad destitution, insufficient wellbeing, training and government managed savings administrations. On top, Estimates demonstrate that 10% of the populace in 16 million individuals are living with some type of inability and these are a standout amongst the most helpless gatherings as they get next to zero help (Lacey, 2004). Government and other non-benefit associations convey improvement projects to address the circumstance in the nation yet at the same time just achieve a little extent of the populace. For a long time, people with incapacities were avoided from these administrations especially in provincial and remote regions. The incapacity issue was regularly not tended to inside the general improvement programs, to a great extent because of absence of information and comprehension of how to address their requirements inside advancement programs, the negative overall population impression of inability and unnerve assets.

No exhaustive observational review has been led at present to decide the frequency and predominance of inabilities in Bangladesh. The few reviews that have been led mirror an inability of therapeutic conditions as opposed to a social model of incapacity, and they are

likewise constrained in topographical scope. While no solid national information exist, recounted data and various small scale contemplates for the most part recommend a handicap pervasiveness rate between 5 to 12 percent. This is near the WHO appraise, which expresses that 10 percent of any given populace can be considered to have a few or other frame. Transportation decisions for the vast number of crippled individuals are still exceptionally restricted with regards to the nation. Access to both private and open transport is critical to the capacity of the general population with inabilities, and their family and professions, to partake completely in group life.

Transportation is a critical issue for those with disabilities. Facilitating simple access to transportation for the disabled will produce advantages by

- Creating business openings
- Access to human services and training
- Encouraging impaired individuals to take part in society more effectively.

There are currently no detailed study or survey on mode choice preference and transportation facilities for the disabled people in Bangladesh. To resolve this problem, the existing condition and the perspective of the disabled people is a major component in mitigating the problem and facilitate the movement of these people. Involving stakeholders' perspective into consideration is very vital prior to any policy implementation (less expensive fare, travel time reduction, safety and comfort improvement, stoppage points closer to destination) or infrastructure development (dedicated seats, para-transit, improved sidewalks and street signs, trained aiding staff) . This topic has been mostly overlooked and ignored.

1.4 Objective

The objective of the research is to develop models that will help us understand the factors contributing to the solution preference of the disabled people and analyze factors that will indicate whether a disabled individual will choose policy implementation or infrastructure

development as solution to facilitate his/her movement.

1.5 Overview of the research

This thesis will include two main studies. The first study will develop a logistic regression model to analyze the solution preference of the disabled people and the second study will include inspecting factors and conditions related to the improvement of accessibility and mobility of the transportation facilities to meet the need of the disabled.

1.6 Thesis Outline

The remainder of this thesis is organized in six chapters. In chapter 2, a literature review on research related to the factors and components that revolve around the mode choice of the disabled as transportation users are presented. Chapter 3 describes the methods that are used to address the objectives of this research. Chapter 4 provides conceptual framework for modeling, the statistical analysis and discussion of results. The implications of analytic results and policy implications are presented in chapter 5 together with direction for further research.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

An examination of which measures can make open transport more available for crippled individuals begins with a meaning of those requirements. These have been surveyed on the premise of research studies, great practice rules and correspondence with transport suppliers in the field. While it is recognized that it is hard to evaluate the genuine way of debilitated individuals' interest for more prominent portability, since they don't have consummate information of the offices and transport assets that would be accessible to them in a theoretical boundary free condition, various suitable transport measures in light of investigations of client needs is depicted beneath. The most vital focuses might be abridged as takes after:

2.1 Accessibility to Public Transport of Disabled People

2.1.1 Accessible Bus or Equivalent Service

Many individuals with incapacities routinely ride the travel framework effectively. The measure of trouble that they encounter relies on upon the nature and degree of the impedance, their circumstance, and the travel framework being utilized Changes in travel practices are likewise prescribed notwithstanding the utilization of innovation.

One practice is to give affectability and mindfulness preparing to travel faculty. Table 1 is a rundown of bearings for travel faculty when helping individuals with hearing impedances. This rundown is reproduced from Transfer, which is a manual for preparing

travel mentors (Calif, 1992)**.** Work force preparing ought to incorporate data about deafness and hearing weaknesses, the utilization of specialized gadgets, the essentials of speaking with hard of hearing and hearing weakened individuals, and a few essential gesture based communication direction (Fitzpatrick et al., 1989). Cards hinting at the essential the American Sign Language ought to be given to staff and found in spots where travel work force and the voyaging open connect. An exertion ought to likewise be made to utilize a man on staff who is familiar in communication via gestures. Paper and pencils to encourage correspondence ought to be situated on all transports and data counters and cautioning frameworks supplemented by unmistakable signs.

Table 2.1: Directions for Transit Personnel When Assisting Passengers Who Are Deaf or Hard of Hearing (Calif, 1992)

1. When communicating with deaf passengers that read lips:

- Look directly at them so that they can see your lips.
- Talk normally and don't exaggerate your speech or lip movement.
- Speak with moderate speed without rushing your words. Even expert lip readers will understand 75% of your words in the first time.

2. When communicating with passengers using hand signals and finger spelling:

- It takes practice to become skillful in hand signals and finger spelling.
- Use a pad and pencil when necessary.
- Keep your communication as clear and simple as possible.
- Remember that not all deaf people can speak well. If they have been deaf from birth, they will usually speak in a flat and nasal tone.

Table 2.2: Directions for Transit Personnel When Assisting Passengers Who Are Visually Impaired (Uslan et al., 1990)

- Tell direction or final destination of the bus before passenger boards.
- When directing a visually impaired person to a seat, the seat adjacent to the door is preferable to the one behind the driver.
- When handing a transfer to a visually impaired person, place it directly on his/her hand.
- Call out major cross streets so that the passenger can anticipate his/her stop.
- It is crucial to remember to call out requested stop.
- Let a visually impaired person exit the bus in a spot free of poles, newspaper stands etc. Otherwise let them know of the obstacle.
- Always let a visually impaired person off at the bus stop.
- When giving directions use specific commands such as “turn right” instead of “0ver there”.
- When a visually impaired person exit the bus, tell him/her what street the bus is traveling on
- And whether the bus stop is on the near or far side of the cross street.

From the above sources and discussions, conclusion can be drawn to the fact that specialized directions are essential for assisting in the movement and boarding of those with some form of disabilities.

2.1.2 Access to Public Transport Terminal

Availability is essential in day by day life particularly when managing outside and inner condition. Understanding that most open transport terminals still need regarding great outline and offices in this way a genuine worry for the matters is expected to guarantee the

advantageous for all. It has been broadly acknowledged that handicapped individuals, have less open doors what's more, lower personal satisfaction than non-handicapped. Included with poor openness, the handicapped individuals confront more difficulties what's more, challenges while voyaging and utilizing general society transport. Along these lines, it turns out to be progressively hard to disregard the debilitated issues while utilizing the offices of the general population transport.

Availability is progressively perceived as a key component of a high caliber, proficient and practical transport framework. To be sure every one of us as clients of the vehicle framework advantage from less demanding access to transports, cable cars, prepares, planes and ships (Cullen, 2006). Figure 1 beneath demonstrates the travel cycle standard for handicapped individuals. In view of the breakdown over, this review analyze the outer condition to and from the terminal, purchasing ticket(s), finding the right administration, holding up at the terminal, getting on and off from the vehicle mode and getting to the coveted goal.

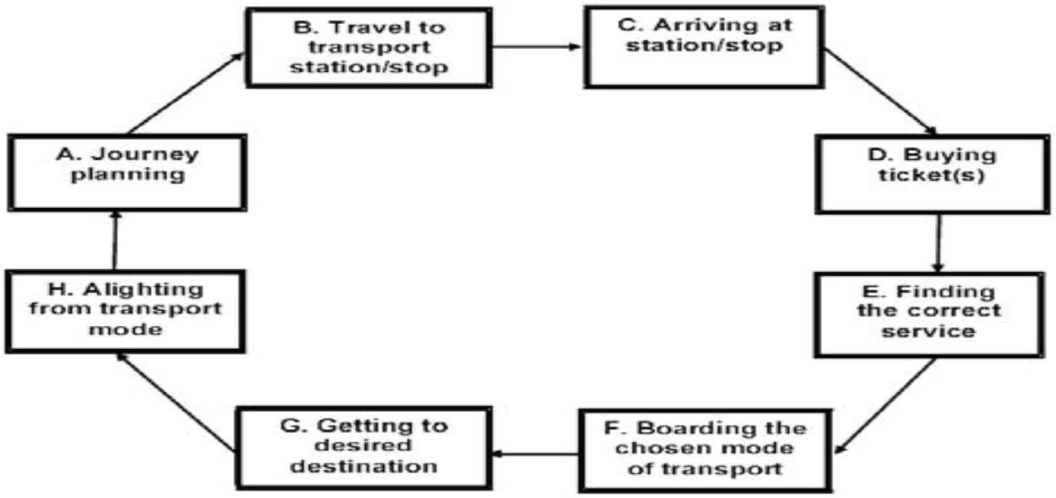

Fig. 2.1: The Journey Cycle. (Lafratta, 2008).

External Environment

In 2000, Cowan announced that very much composed open spaces are working parts of a system of person on foot courses, accommodating the requirements of all clients including impaired and elderly individuals. (Bezzina and Spiteri, 2005) portrayed that, in outlining structures it is critical that everyone incorporating people with an inability can get to and utilize the interior and outside offices related with the improvement building or offices. In 2006, Smith presume that, a great methods for get to would be a course that does not join obstructions and perils, and it is not hazardous to individuals, including the individuals who have disabled sights, hindered versatility utilize strolling helps or utilize wheelchair.

Lacey (2004) highlighted that autos are the main down to earth technique for transport for some impaired individuals, and available stopping is in this way, a vital thought. As being characterized by Bezzina and Spiteri (2005), auto stopping and setting down are imperative exercises toward the start or the finish of trips. Sawyer and Bright (2007), talked about that the arrangement of suitably outlined, developed and oversaw inclines is of significance to all clients, yet particularly those utilizing wheelchairs, pushing surreys o trolleys, and individuals utilizing strolling outlines. No less than one available course might be given inside the site from open parking spots and available traveler stacking zones; open roads and walkways; and open transportation stop to the open building or office entrance they serve, (ADA, 2004). Cullen (2006) pointed that, for individuals who are visually impaired or who have minimal leftover vision, material surfaces are fundamental for the protected advance through the road condition. Henry in (2009), noticed that by giving inclines, reasonable toilets and handrails its can accomplish openness to people with handicaps; Infrastructure for walkers needs to give courses that are immediate, ceaseless, sheltered, helpful and alluring. Ways and walkways ought to be exhaustive and accommodate the voyages that individuals need to make including courses through neighborhoods (Malhotra, 2010).

Internal Environment

Early review was finished by Griffin (2000), who directed a review on travel offices pointed that passages must be completely open and give advantageous access to travelers and fit suitably inside the encompassing urban setting and group. In 2004, Lacey concurred that another structures primary passageway (or doorways) ought to be open. Incapacitated and elderly locate that remaining for any time allotment awkward or even outlandish, so giving seating at suitable focuses all through the terminal is critical. It merits recollecting that a portion of the separations individuals need to consult inside a terminal are significant (Cullen, 2006). Sawyer and Bright (2007) focused on that the arrangement of available can offices in the building is imperative. No less than one latrine ought to be given at every area to the wheelchair client. It might decide if the building is genuinely available for a debilitated. In 2010, Malhotra who lead a practice in open transport highlighted that need seats for crippled in the vehicle ought to be near both the driver and to the passageway/exit, to straightforwardness correspondence with the driver and to limit the separation strolled into general society transport.

Finally it can be stated that accessibility is a key concern in every step of the journey cycle and both the internal and external structures and services that are included in the journey cycle should be user friendly for the disabled people.

2.1.3 Boarding Aid Devices

Encouraging access for rail go for incapacitated individuals is a problem that is begging to be addressed in Europe, where railroad transportation is far reaching. It is evaluated that by 2020 the quantity of crippled and elderly individuals will develop to around 31 percent of the European populace, or roughly 130 million individuals (McKee, 1998). While the Americans with Disabilities Act prompted controls for open railroad frameworks in the United States and the desire of expanded support (Simon, 1998).Sweden actualized directions for available railroad transportation in 1989 (Swedish Board of Transport, 1989) and Great Britain as of late achieved concurrence on the specialized details for trains under

the Disability Discrimination Act (Transport for People with Mobility Handicaps, 1992). In 1992 the European Conference of Ministers of Transport conceded to essential suggestions for enhancements to the railroad frameworks (Union Internationaledes Chemins de Fer (UIC), Paris, Jan. 1993).

In Europe just as of late have some new prepares been planned with low floors and level get to (i.e., the stage is at an indistinguishable level from the auto floor at the passage entryway). In many cases, as a result of the contrast amongst stage and auto floor statures, travelers need to make a couple strides when boarding and landing. These means are boundaries to individuals in wheelchairs and to individuals with strolling challenges. Boarding help gadgets (BADs) are important to connect the means or holes. The most well-known plans are a lift or a slope, which might be either portable or incorporated to be prepared. The review exhibited here was performed in conjunction with the European Cooperation in the Field of Scientific and Technical Research (COST) Action 335: Passengers' Accessibility to Heavy Rail Systems, to distinguish the pertinent variables for picking answers for making trains open to incapacitated individuals. The potential arrangements were assessed on the premise of a survey of the writing, examination of the current practices at European railroad systems required in the cost activity, and an examination of the French railroad's support of handicapped individuals. In most European railroad organizes there is an extensive contrast of stature between the stage and the auto floor. Incredible Britain is nearly the main nation that has kept its stages both high and inside a little tallness extend. In 1994 the International Union of Railway Operators [Union Internationale des Chemins de Fer (UIC)] suggested two stage statures: 55 cm and 76 cm (6). In any case, fitting stage statures all through Europe will be a long procedure. The greater part of administrators utilize stage lifts (manual or fueled) that are moved by maybe a couple representatives. The pattern is toward installed lifts, started by railroads in the Nordic nations, where frosty and cold climate is a worry. In a few nations the decision of installed gadgets is presently propelled by the diminishing accessibility of staff in railroad stations. The variety in cost for BADs of comparative sorts can be clarified by the level of robotization and the tallness traverse over which they are required to work. Get to slopes are more affordable arrangements yet just achievable if the tallness contrast is little (not

more than around 20 cm). Something else, the incline would be excessively steep, making it impossible to be overseen by a staff part. French railroad administrators noticed that staff might be obliged or may like to lift a wheelchair and its tenant physically. Undoubtedly the stage lift might be put away a long way from the point where the workers require it, or it might be gravely kept up. In addition, the lift is never utilized for a man with strolling troubles; a worker helps the traveler. Handicapped travelers purportedly don't whine much about administration that requires booking ahead of time. They esteem the chance to travel, even with troublesome get to. Be that as it may, they emphatically longing to act naturally adequate on account of their encounters with absence of staff accessibility and gear breakdowns.

A fact found from the above studies is that specialized boarding devices such as wheelchairs, lift or slope, gadgets and robots can improve the accessibility for the handicapped people.

2.1.4 Approaching Characteristics in Developing Countries

Open transport assumes a critical part in a city's economy and its social value. It is additionally instrumental in lessening car reliance and movement blockage. A few components must meet up to accomplish well-working open transport frameworks. One main consideration is the level of openness offered by general society transport framework.

Different orders characterize availability in various ways. One significance of openness is the simplicity by which physically-tested individuals can get to the different components of the fabricated condition (counting transport framework); this review is not worried with this sort of availability. The other definition originates from geology and transport disciplines. Geographers characterize availability as the relative simplicity of achieving a specific area or zone in the city. Hansen (1959) characterizes openness as the capability of chances for connection with accentuation on the power of the likelihood of communication as opposed to simply simplicity of cooperation (Hansen, 1959). Murray et al. 1998 recognize the expressions "get to" and "openness" and propose that "get to" is the open

door for utilize in view of vicinity to the administration and its cost, though "availability" is the reasonableness of the system to get people from their framework section indicate their framework leave area in a sensible measure of time (Murray et al., 1998).

This review concentrates on availability to open transport, which, thus, gives openness to different goals in the city. While considering definitions specific to open transport availability, the thought is underlined in Hillman and Pool (1997), as referred to in Joyce and Dunn (2010**),** who make a refinement amongst "neighborhood" and "system" open transport openness. Nearby openness is the availability of a specific area to an open transport framework; arrange openness is the availability of areas in a city by general society transport framework. General society transport openness levels (PTAL) idea basically addresses nearby availability, however in a roundabout way additionally consolidates arrange availability by utilizing course and recurrence information. A review by Litman (2008), as referred to in Joyce and Dunn (2010), endeavors to join both viewpoints by characterizing open transport accessibly as the quality and simplicity of travel administration at a specific area.

The key targets of this review were to gauge PTAL (barring paratransit modes), delineate, and start a talk of its significance in application to upgrading arranging rehearse. A few reviews have gained extensive ground on creating administration files to gauge travel availability. Diverse measures have been intended to reflect contrasting perspectives. A few measures of open transport availability concentrate on nearby openness and consider both spatial and transient scope. The Time-of-Day instrument created by Polzin et al. (2002), as referred to in Mamun and Lownes (2010**),** is a measure that considers both spatial and transient scope at trek closes. Notwithstanding the consideration of supply-side transient scope, this instrument clearly perceives and considers the request side of fleeting scope by joining the travel request time-of-day appropriation on an hourly premise. This combination makes the apparatus particular to open transport organizers. The Transit Capacity and Quality of Service Manual **(**TRB 2003), as referred to in Mamun and Lownes (2010), gives a methodical way to deal with surveying travel nature of administration from both the spatial and worldly measurements. The travel level-of-administration (TLOS)

pointer created by Ryus et al., (2000), as referred to in Mamun and Lownes (2010), gives an openness measure that extraordinarily considers the presence and prominence of person on foot courses associated with stops. It additionally joins populace and occupation thickness with various spatial and fleeting elements to gauge travel availability. This apparatus underscores different angles (strolling separation and access to stops, hold up time at stops, accessibility of administration at client's required time) in the thought of available open transport benefit by a man.

The Land Use and Public Transport Accessibility Index (LUPTAI) looks to quantify that it is so natural to get to basic goals (e.g., wellbeing, training, retail, saving money, work) by strolling as well as open transport. This is as opposed to the conventional technique for measuring openness by street remove and is the first of its kind to consider open transport as a methods for get to instead of an office to be gotten to (Pitot et al., 2005). Another travel time-based strategy to envision and break down travel benefit scope—a PC application called the Time-Based Transit Service Area Tool (TTSAT)— was produced as another way to deal with mapping travel availability by consolidating all out excursion travel time into the travel benefit region maps it creates. To make these travel-time gauges practical, TTSAT coordinates all sections of an entire, way to-entryway travel stumble into the outing time computations. TTSAT's mapping and investigation capacities offer various potential applications for organizers, designers, and individuals from general society attempting to make travel open groups. TTSAT clients can alter the time-based travel benefit zone (TTSA) maps they create by determining points of interest of travelers' normal travel conduct, for example, strolling speed or the greatest time they will spend going to and from open transport stops (Cheng and Agrawal, 2010).

This review utilizes the PTAL count technique created by the London Borough of Hammersmith and Fulham in 1992, which was later embraced by Transport for London (TFL), as the standard strategy for figuring of open transport openness in London (Transport for London, 2010). Notwithstanding the UK, open transport availability appraisals are utilized as a part of various nations, for example, the U.S., the Netherlands, Australia, and New Zealand (Joyce and Dunn, 2010). The philosophy in this paper was

fittingly adjusted from London (Transport for London, 2010) to fit Ahmedabad information.

Developing countries should focus on greater openness in the entire transportation framework which will assist in the movement of the disabled.

2.1.5 Bus Stop Selection for Improving Accessibility

Bus stops are enter connects in the trips of riders with incapacities. Blocked off transport stops keep individuals with physical inabilities from utilizing settled course transport administrations, hence constraining their versatility. Because of restricted spending plans, travel organizations must choose transport stops for which their upgrades, as a feature of the push to consent to the Americas with Disabilities Act (ADA), can augment the general advantages to riders with physical inabilities. As an application illustration, the enhancement model was connected to the 5,034 transport stops in Broward County, Florida. Contrasted with the standard methodologies, the streamlining model gives a more target stage on which to distinguish transport stops for ADA changes. Bus Stop Accessibility Standards

The ADA is the most imperative plan reference for travel stop inventories, as it blueprints the base prerequisites for transport stop availability by individuals with handicaps. Title II of the ADA covers walkway and road development and travel availability, referencing the ADA Accessibility Guidelines (ADAAG) or the Uniform Federal Accessibility Standards (UFAS) for new development and modifications attempted by or in the interest of a state or nearby government (Federal Transit Administration, 1992). Likewise, the Department of Justice (1994) Title II control particularly requires that check slopes are given when walkways or roads are recently developed or adjusted. Figure 1 shows the ADA least prerequisites for transport stop openness. In view of useful experience of travel organizations (Transit Cooperative Research Program, 1996**),** 5 ft. is the favored width for walkways for pleasing supporters with physical inabilities instead of the ordinarily utilized 3-ft clear section width. This is on account of 5 ft of walkway is the real development

width, and some worthy roadway offices, for example, utility shafts regularly possess the unmistakable width inside the walkway's region. As indicated by the base ADA necessities and the Design Handbook for Florida Bus Passenger Facilities (Florida Planning and Development Lab, 2004), 5-ft walkways (with a 3-ft clear open course), with existing check cuts and a 5×8 sq.ft. Stacking cushion are the benchmarks for all transport.

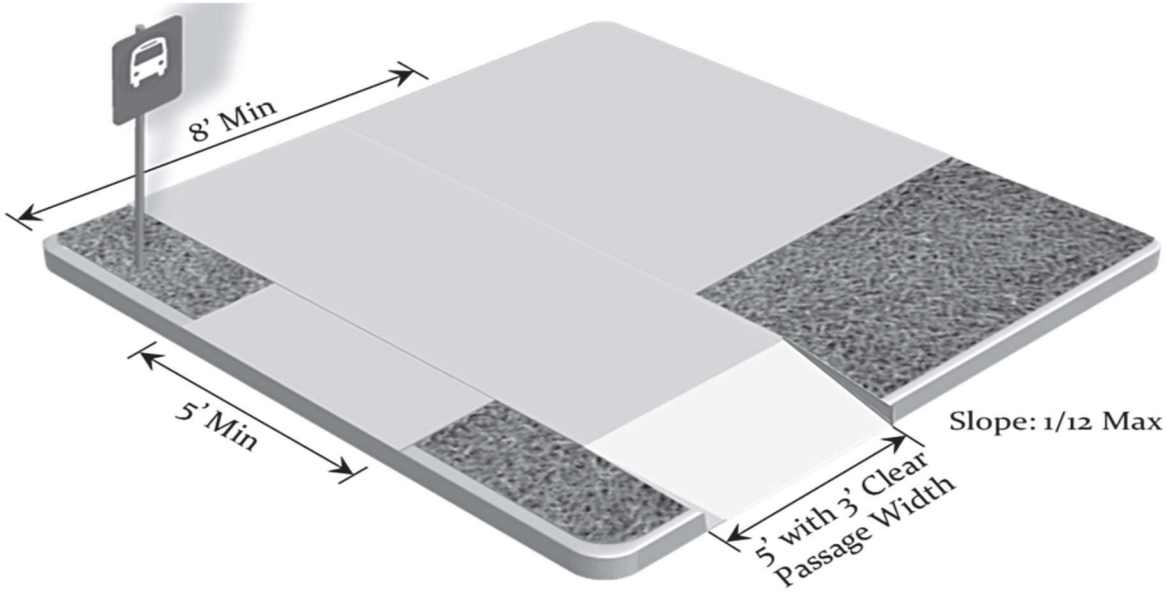

Figure 2.2: 5-ft walkways (with a 3-ft clear open course)

Source: Journal of Public Transportation, Vol. 14, No. 2, 2011

To conclude that we can say the ADA (Americans with Disabilities Act) provides the most basic prerequisites to enhance accessibility for people with physical disabilities. A width of 5 ft. in addition to existing check cuts & 5×8 sq.ft. is the benchmark for all transportation according to ADA.

2.1.6 Routing Problems

Among the various classifications of issues that have been examined in operations inquire about, vehicle directing issues (VRPs) likely constitute a standout amongst the most symbolic class. By and by, their motivation is by and large to propose advanced dispersion arranges while conveying merchandise to clients (e.g., be they people, firms, or retailers).

In the greater part of the many models created for the directing of vehicles, a solitary timeframe is considered (say, a day). This displaying, be that as it may, compares to two altogether different viable circumstances: either the courses are planned to be performed once and recomputed with new information the following day, or the courses are rehashed indistinguishably each and every day over quite a while skyline.

In any case, there is a moderate circumstance in which requests are practically indistinguishable from every day. Notwithstanding the typical cost minimization objective, another model may then bode well: restricting the changeability of the courses between the distinctive times of the time skyline. The issue then turns into a multiday VRP where courses are relied upon to demonstrate some normality from day to day. An imperative delineation of this issue was given by Groër et al., (2004). And concerns quick bundle conveyance (including huge organizations, for example, UPS). The capacity to guarantee steady timetables and to restrain the quantity of drivers that a client needs to manage can fundamentally enhance the fulfillment of these clients: encouraging receipt operations, enhancing trust between the conveyance organizations and their clients, et cetera. A noteworthy preferred standpoint can in this way be given in examination contending organizations. Another intriguing case, which inspired this article, concerns the transportation of individuals with mental incapacities from and to day mind focuses **(**Bloch and Hoyt, 2001). In view of their absence of self-sufficiency, the vast majority of the people concerned have no vehicle and are not equipped for going by open transport. Thus, medico social focuses for the most part turn to specific transportation organizations to sort out and play out the day by day trips.

Summarizing the above context we can say that clients should be transported routinely however now and then with some little varieties amid the week. For instance, a man may not request transportation or might not have a similar address each day. Moreover, these clients are especially delicate to changes. The issue of keeping reliable time timetables is thusly central.

2.1.7 Intelligent Transport System Concepts

The conventional urban open transport framework by and large can't give a successful get to administration to individuals with inabilities, particularly for incapacitated, wheelchair and visually impaired (DWB) travelers.

In this paper (Intelligent Urban Public Transportation for Accessibility Dedicated to People with Disabilities, 2012), in view of cutting edge data and correspondence innovations (ICT) and green advances (GT) ideas, a committed open urban transportation benefit get to framework named Mobi+ has been presented, which encourages the versatility of DWB travelers. The Mobi+ extend comprises of three subsystems: a remote correspondence subsystem, which gives the information trade and system association benefits amongst transports and stations in the complex urban conditions; the transport subsystem, which gives the DWB class discovery and transport landing warning administrations; and the station subsystem, which executes the urban ecological observation and transport helper get to Administrations. The Mobi+ card that backings multi-microcontroller multi-handset receives the blame tolerant segment based equipment engineering, in which the committed implanted framework programming, i.e., working framework smaller scale bit and remote convention, has been coordinated. The devoted Mobi+ installed framework gives the blame tolerant asset mindfulness correspondence and booking component to guarantee the unwavering quality in information trade and administration arrangement.

At present, the Mobi+ framework has been executed on the transports and stations of line "2" in the city of Clermont-Ferrand (France). The experiential outcomes demonstrate that, on one hand the Mobi+ model framework achieves the outline desires and gives a powerful

urban transport get to benefit for individuals with handicaps; At present, notwithstanding the essential advances in transportation frameworks in created nations (e.g., European Union) the openness to the urban open transportation framework still does not meet the prerequisites of individuals with handicaps. To confront the expanding quantities of individuals with handicaps in the following decade, the Syndicat Mixte de Transport en Commun de l'agglomération clermontoise (SMTC) transportation union of Clermont-Ferrand (France) propelled the Mobi+ extend (http://www.sillages.eu/nos-services/mobi-plus/index.htm), which means to enhance the availability (administrations) to urban open transportation to meet the necessities of Disabled, Wheelchair and Blind (DWB) individuals by embracing propelled data and correspondence advancements (ICT) and green innovations (GT) ideas. Keeping in mind the end goal to encourage the availability to urban open transportation for individuals with handicaps diverse changes must be done together to vehicles (transports, tramways, trains, metros, and so on.), framework and data. One of the issues to encourage transport access for individuals with inabilities is that the transport floor must be level with the asphalt and the separation between the asphalt and the transport floor must be less than 5 cm (the EU standard). On the off chance that these conditions are accomplished, people with incapacities can get in/out the transport self-sufficiently. On the off chance that the tallness of the asphalt is not the same as the transport floor one, three arrangements might be received:

- Rebuild the pavement (economically unacceptable in old cities).
- Dynamically adapt bus floors to the height of the pavement.
- Deploy pallets.

The last two arrangements require additional time. In the Mobi+ extend, the third arrangement is embraced to limit the cost by utilizing the current accessible transports and holding the old asphalt. Truth be told, to encourage transport access for DWB travelers, the transport driver needs to painstakingly stop the transport near the asphalt (<5 cm) and to send the bed at each transport station. This takes three minutes more than expected transport stopping for solid travelers however when all is said in done at the transport station the DWB travelers are absent. In this way for a transport line having 30 transport

stops, 90 more min are required if the transport driver needs to stop deliberately and send the bed for DWB travelers at each transport stop. Therefore for a similar transport line to give a similar administration (e.g., a similar transport recurrence), the quantity of transports must be expanded essentially. Keeping in mind the end goal to enhance the openness to the urban open transportation framework for individuals with inabilities, it is critical to motion to the transport driver the nearness of the handicapped individuals before the following transport stop. Thus an urban open transportation assistant get to framework committed to individuals with inabilities was actualized. In this framework, the handicapped individuals, incorporating the travelers with infant carriages will take a particular ticket (RFID tag) to show the sort of their impairment (e.g., wheelchair client). With the RFID tag, when the label clients arrive and hold up at the transport station, their nearness will be naturally identified and the transport driver will be along these lines educated, so that the driver will play out the transport stopping painstakingly to accurately convey the pallet. Moreover, right now the air contamination in huge urban communities achieves a basic limit for delicate travelers that is the reason it is vital to evaluate continuously the air nature of the city by inserting CO and NO gas sensors in the transport. So by consolidating the continuous gas sensors information of the transports with the settled air contamination location station ones, the nature of city air contamination might be measured all the more absolutely over the entire city. Our work is to execute a urban open transportation benefit get to and urban condition checking framework committed to individuals with handicaps with the components of power, minimal effort, little shape element and simple to send adequately, which is named Mobi+. In this paper we will concentrate on the examination and usage of Mobi+ framework engineering. The framework underpins a dependable transport station communication in the complex urban conditions and gives the accompanying administrations: DWB class recognition/caution notice benefits in the station peer and natural observation/transport stopping and get to administrations in the transport peer. Figure 1 demonstrates the practical coalition graph of the Mobi+ framework.

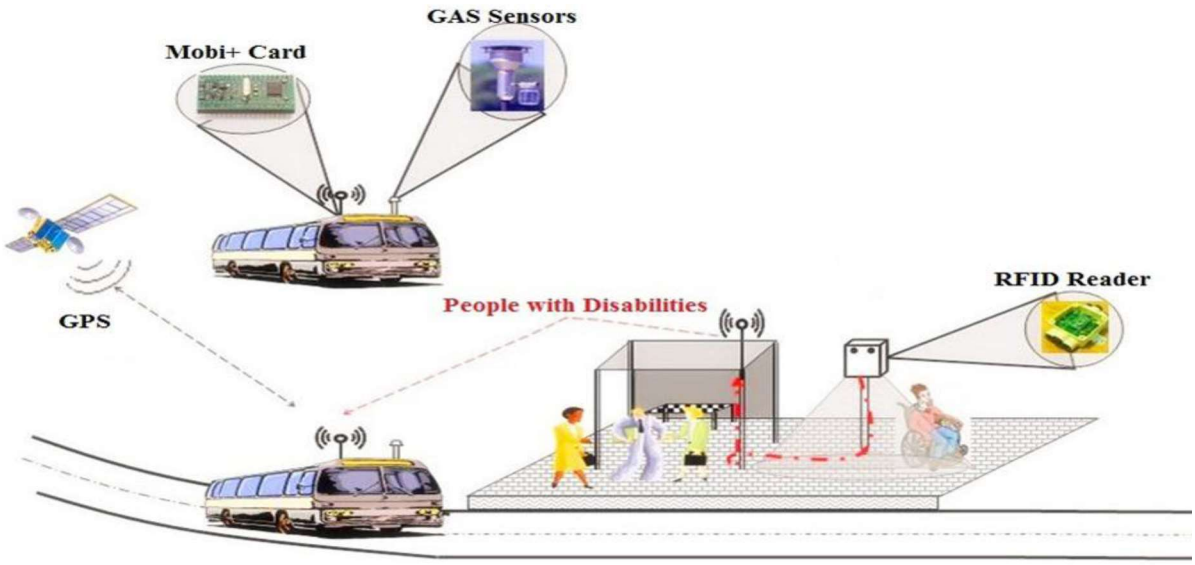

Figure 2.3: Functional bloc diagram of the Mobi+ system

(Source: Intelligent Urban Public Transportation for Accessibility Dedicated to People with Disabilities, 2012)

From the above context we can say that intelligent transportation system solutions can bring an undisrupted fluidity in the journey cycle of a person with disability.

2.1.8 Geographical Information System

The potential data accessible in managerial records oversaw by Public Administrations is boundless for its incentive in enhancing the social and monetary research and its utility to assess, judge and plan people in general arrangements.

A progress in the institutionalization and coordination of the data records and frameworks would diminish the minor cost of operations and would refresh information so as to maintain a strategic distance from the extortion and enhance the straightforwardness. In this manner, the point of this paper is combining three free open databases that they allude to individuals with inabilities, their area and their openness to urban transport. To do this, a new and one of a kind database is fabricated utilizing a Geographic Information System

(GIS). It is the capacity of GIS to accommodate spatial information from various sources that permits the formation of new informational indexes. This system may enhance the accessibility of required information, advance joining of innovation and empower joint effort among firms and general society division what might permit Public Administrations' basic leadership considering the financial and social qualities of the enlisted disabled people.

The arrangement of open transport to give access to socially hindered bunches has for quite some time been viewed as one of a few noteworthy administration improvement methods of reasoning (Larwin, 1999; Veeneman, 2002; Currie, 2004; Nielsen et al., 2005; Currie and Senbergs, 2007). This is considered the advance in the feasible regional improvement by consolidating monetary criteria, as well as ecological and social criteria in the arranging procedure that expects to achieve long haul adjust between financial improvement, assurance of nature, effective utilization of assets and social equity (Salado et al., 2008; Salado et al., 2011). Available transportation is an indispensable administration for some individuals with handicaps keeping in mind the end goal to live solid and satisfying lives. Individuals with inabilities have reliably portrayed how transportation obstructions influence their lives in vital ways. Availability is the primary component of a maintainable transport framework. Available transportation can change a man's life from one of detachment and reliance to one of social incorporation and freedom. At the point when transportation does not function admirably, it can be a wellspring of incredible individual dissatisfaction and monetary misfortune. Individuals who can't completely utilize the current transportation frameworks may encounter decreased access to open doors for business, medicinal services, instruction, shopping, diversion, and social and social occasions. European Commission empowers types of open transport available to all clients, incorporating individuals with decreased portability, uncommonly those with handicaps and the elderly ones (COM, 2001). By the by, there are an excessive number of deterrents for the general population with decreased versatility as respects the vehicle openness: exchanging between modes, data administrations, person on foot condition, activity security and others. Until these snags are not killed most by far of individuals with inabilities will keep on staying off guard and will be not able go as they would wish and

therefore restricted in the degree to which they can take an interest in the public eye (ECMT, 2006).

The issue of discovering satisfactory transportation might be intensified for individuals with inabilities, especially the individuals who require extraordinarily prepared vehicles. While Spanish Autonomous Communities have open and additionally private transportation administrations, none have created strategies for looking at how well the transportation administrations they have set up serve their group, particularly for the transportation impeded who live there. Finding out about the ampleness of built up transportation choices is the undeniable initial phase in creating plans for enhancing and refreshing administrations so groups can fittingly meet the transportation needs of the debilitated individuals. A result for this review is to make a strategy that Autonomous communities can use to evaluate the extensiveness of their transportation organize for individuals with inabilities. How data about open transportation administrations is exhibited can influence how well they comprehend the data. On the off chance that data is displayed in a composed organization, as is ordinarily the case, it is conceivable to get some thought of the transportation choices in a group, however it is difficult to see how these administrations are sorted out spatially. This is extraordinarily valid since this data is given independently by each specialist organization, abandoning it to the clients to sort out all the accessible alternatives. Maps demonstrating the areas served by a transportation supplier help to outline spatially where transportation is accessible, yet simply making maps that show benefit scope does not give enough data to satisfactorily examine available transportation in a region. These maps don't address other correlated issues that should be considered while inspecting available transportation.

These issues incorporate, who in the group is qualified for the administrations, the expenses of administrations, if there is more than one choice for administrations for a specific area, when the administrations are offered, what reason for which the administration can be utilized, and precisely what help the administration can give to the clients. One approach to survey these issues is to utilize the spatial systematic abilities of Geographic Information Systems (GIS) to envision and spatially dissect the transportation benefits in a group. GIS

are a unique kind of a data framework

Intended to make, store, coordinate, control, alter, oversee, examine and display different sorts of information or information utilized as a part of a basic leadership handle mapping spatial information (Vecchia et al., 2012). GIS can outline information with a spatial part; create extra spatial information as contributions to factual investigation; figure removes between elements of premium and characterize neighborhoods around articles (Over-man, 2010). One imperative part of GIS that won't be secured is the decision of programming. Longley et al. (2010) consider the subject of suitable programming in some profundity. Bosque Sendra et al. (2012) likewise show a few programming devices that expansion GIS applications to break down and take care of ideal area issues. An excess of data is regularly accessible with respect to any choice and the pertinence and materialness of that data can frequently be indistinct.

So we can say that GIS offer the guarantee of arranging and sorting through an exceptionally untidy universe of data, summing up that data in a few appropriate mold, joining it with other data, and delivering a realistic yield of reasonable effortlessness.

2.2 Mobility Challenges of Disabled People

2.2.1 Non-motorized Transport

2.2.1.1 Walking

Each excursion or trip begins and closes by walking. However in US, individuals matured 65 or above make as much as just eight percent trips as people on foot. (Oxley et al, 2007) While in sub-Saharan Africa this rate goes up to 50 percent of every day by day trip. **(**World Bank, 2005).

Crippled and older individuals will probably walk huge separations, in spite of their

troublesome conditions. Both absence of openness and cost amplify this issue. The prescribed most extreme strolling separation are constrained for the individuals who stroll with a help, for example, a stick. The figures in Table 1 are midpoints; a significant variety can be seen between the abilities of people. Different variables, for example, angles or climate conditions will have extra effects.

Table 2.3: Mobility limitations

Type of impairment	Recommended distance without a rest
Wheelchair user	150m
Mobility impaired person using stick	50m
Mobility impaired person without walking aid	100m

Source: Department for Transport, UK, 2002

More seasoned people on foot are at more serious hazard on account of their fragility, with a higher shot of death or genuine harm contrasted and more youthful grown-up walkers. They will probably support genuine or lethal wounds and to take more time to recoup. They are likewise more inclined to have some practical impedance which adds to the likelihood of mistake in managing movement at street intersections (Mitchell, 2005).

In many creating and transitional nations, a deadly blend of low quality street surfaces and unpracticed drivers has prompted a noteworthy increment in the quantities of more youthful walkers getting to be noticeably impaired subsequently of street mishaps.

Gravely looked after boulevards, absence of activity administration, absence of physical isolation amongst walkers and cyclists or mechanized vehicles all add to expanded hazard and, for more established individuals, dread of falling or being thumped over offices to build the security of crippled and more seasoned people on foot are being presented in many spots. In Seoul, the Republic of Korea, the development of mid-island asylums on wide streets is viewed as a need to ensure slower moving more seasoned people on foot **(**Lee et al., 2005).

Japan was the main nation (in 1967) to acquaint cautioning and direction surfaces with help daze individuals explore city boulevards freely. Material surfaces and perceptible signs at street intersections are currently basic in created nations to give direction and cautioning to dazzle and in part located individuals. In a few nations in Europe there is additionally broad utilization of way discovering methods utilizing material and capable of being heard direction to help individuals with low vision explore around urban communities.

However there is worry in many created nations that the absence of worldwide measures either for material surfaces or for capable of being heard cautioning signs can make it both troublesome and conceivably risky for visually impaired individuals who travel abroad. A report from the World Blind Union attracts consideration regarding the absence of institutionalization and requires the usage and authorization of 'general outline benchmarks for foundation, including sufficient width and division of strolling surfaces, and building plan'. **(**World Blind Union, 2010) Many created nations are additionally now presenting more refined way discovering frameworks utilizing radio signs and other innovation.

So we can say that more seasoned people on foot are more serious hazards on account of their fragility, with a higher shot death or genuine harm contrasted and more youthful grown-up walkers.

2.2.1.2 Wheelchairs

Accessibility of wheelchairs is a marker of fundamental levels of portability; there is a high connection between the level of wheelchair supply and GDP per capita. In created nations, yearly offers of wheelchairs normal around 30 units for every 10,000 populace – for whatever is left of the world the figure is roughly 2–3 wheelchairs for each 10,000 population.16 This implies even the most fundamental open air portability is past the scope of many in creating nations .It is crucial that wheelchairs are proper to nearby conditions. In many creating nations gave wheelchairs from created nations, intended for various territories and without support or extra parts, give constrained advantage. There are various plans both for neighborhood fabricate and supply of reason assembled wheelchairs to suit

nearby framework and in addition clinical requirements, regularly regulated by means of real universal organizations, for example, USAID. These incorporate Motivation (UK) and Whirlwind Wheelchair International (US), each providing 12,000 to 15,000 wheelchairs a year.

There are various plans both for neighborhood fabricate and supply of reason assembled wheelchairs to suit nearby framework and in addition clinical requirements, regularly regulated by means of real universal organizations.

2.2.1.3 Cycling

Cycling is impossible for some crippled individuals however there are significant ramifications for fragile more established and outwardly weakened individuals from the developing number of bikes in urban areas. They can speak to both a genuine and an apparent danger to wellbeing unless they are controlled and, where conceivable, isolated from people on foot.

In nations with a solid custom of cycling (for instance China) numerous more seasoned individuals do keep cycling securely into seniority and this can be an essential piece of nearby autonomous versatility. In the Netherlands, 25 for each penny of all excursions made by septuagenarians are by bicycle.17 In Germany 50–55 for each penny of all outings for grown-ups matured more than 65 are either by walking or by bike **(**Bailey, 2004).

In any case, similar components that can influence more seasoned drivers and people on foot are a security calculate here. Dutch reviews demonstrate that more established cyclists are more frequently required in accidents than different cyclists.

2.2.1.4 Rickshaws, Trishaws and Pedicabs

In many creating nations non-mechanized types of transport – including rickshaws, trishaws and pedicabs – are the least expensive, most solid, most generally accessible and

purchaser agreeable type of transport and give an important methods for nearby portability for those not able to walk long separations since they give a way to-entryway benefit. In Kolkata, India, for instance, rickshaws are a key methods for transport for ladies and for more seasoned and handicapped individuals (Whitelegg and Williams, 1998) Hand impelled tricycles can likewise give profitable neighborhood portability, regularly in zones with minimal option arrangement, for example, Dhaka, Bangladesh.

So there is little proof of ventures to enhance the openness of such vehicles. Notwithstanding, driver help can beat essential get to issues.

2.2.2 Public Transport

2.2.2.1 Bus

The bus is the most well-known type of urban open transport in many parts of the world. The pattern towards low floor transports in created nations has changed the openness of open transport. The pace of progress has been fast in numerous European urban communities. In the UK, the extent of the national transport armada that was low floor and available rose from 53 for every penny in 2004/2005 to 89 for each penny in 2009/2010 **(**Department for Transport, UK, 2010**)** the open vehicles arrived quicker in urban communities where open transport utilize was most astounding.

Extra openness highlights – for example, shading balance to help individuals with low vision and snatch handles for those temperamental on their feet – are not generally accessible in either creating or created nations despite the fact that they are shabby and simple to introduce. All the more exorbitant offices, for example, capable of being heard and visual 'next stop' data for the individuals who are visually impaired or hard of hearing are accessible just in the real urban communities of some created nations.

In numerous nations, both created and building up, the emphasis is on slow supplanting of

life-lapsed vehicles with more available plans. The City of Montevideo, Uruguay, declared plans in 2010 to supplant its armada of around 1,500 transports with low-floor vehicles fitted with slopes, staged in over a time of quite a while (Access Exchange International, 2010a).

In Singapore, the transport administrator SBS Transit has been buying low floor wheelchair open transports since 2006. They are presented course by course beginning with courses with a high grouping of impaired individuals, for instance running past recovery focuses. Over a large portion of the armada is as of now available and the arrangement is for the whole armada to be wheelchair open by 2023. (http://www.sbstransit.com.sg/, last got to 27 April 2011)

In less created nations, straightforward minimal effort elements, for example, raised boarding stages or slopes give an answer. In Projimo, Mexico, a wayside stage worked by nearby individuals gives access to high-floor buses (Venter et al., 2002).

In a few urban communities with a legacy of old distant vehicles, measures are being taken to help particular inability gatherings. In Sofia, Bulgaria, the neighborhood expert has worked with the National Association of Blind People to introduce capable of being heard constant data focuses at open transport stops. Despite the fact that the vehicles stay out of reach to anybody with a physical incapacity, this development has begun the move towards availability**.** (Mediate, 2010) Moscow, Russia, 600 transport stops have been altered with elements to help outwardly impeded individuals (Access Exchange International, 2011).

So we can say, bus which is one of the most crucial transportation for most people in many parts of the world has changed the openness of transportation after being introduced to low floor patterned design. But at present only a handful of countries including Uruguay, Singapore, Mexico, Bulgaria, and Russia provide these facilities for people with physical disabilities.

2.2.2.2 Bus Rapid Transit (BRT)

BRT is a famous answer for some less created locales and is bolstered by the World Bank and other worldwide subsidizing associations. There are plans in Latin America, Africa, China and India. Be that as it may, availability is not all around incorporated into BRT plans. In Lagos, Nigeria, even fundamental necessities for openness, for example, get to inclines and handrails have been precluded. Subsequently, the framework is unusable by numerous who could have profited from a more comprehensive outline (Odeleye, 2010). In Jakarta, Indonesia, the Transjakarta bus way highlights long flights of stairs at stations with no option methods for get to. (The Jakarta Post, 2010) By complexity, in the BRT in New Delhi, India, co-operation between impaired individuals and the organizers has prompted an a great deal more open framework.

Samarthyam, the National Centre for Accessible Environments in India, collaborated with BRT service providers to promote inclusive mobility. Vehicle accessibility was tested by users at early prototype stages and modifications were made in response to user suggestions. The involvement of users extended to the pedestrian environment around the BRT. Early results show that the BRT is providing a lifeline to many disabled people. The lessons learnt from the development phase will be rolled out to the rest of the system as it is built (Agarwal et al., 2010).

Access to vehicles has been incorporated from the outline phase of the express transport framework in Curitiba, Brazil **(**Access Exchange International, 2010). 81 stops have raised stages with inclines or lifts for wheelchair clients. Travelers' board at floor level by means of scaffold plates that lower consequently as transports achieve the stop. Curitiba has a high rate of open feeder administrations connecting with the BRT. Therefore, somewhere in the range of 21,000 outings are made every day by debilitated individuals, of which 1,000 are by wheelchair clients**.** (Access Exchange International, 2011)

The exclusive and worked TransMilenio BRT framework in Bogotá, Colombia, exhibits the significance of openness in the road condition and also in the vehicles and foundation.

(Menckhoff, undated.) Where access to the BRT stop is over a street by means of a footbridge, inclines are given and stairs. Feeder transports to the BRT are additionally open.

B.R.T is a renowned form of transportation for many developing & developed countries. But availability isn't always incorporated in all the designs of B.R.T for people with various physical disabilities. Only in India, Brazil, Colombia there are facilities such as inclines, lifts and open feeder systems to aid people with disabilities in their transportation.

2.2.2.3 Mainline Rail

For urban rail to be open, both the moving stock and the station must address the issues of debilitated and more seasoned individuals. In many parts of the world rail frameworks are old and difficult to reach. Packing further decreases openness. In many created nations, laws have been presented in the course of recent years requiring new frameworks to be available and including elements, for example, space for wheelchair clients and saved seats. Capable of being heard and visual declarations on board and at stations are additionally critical in empowering individuals with tactile impedance and learning handicaps to go with certainty.

In the UK, the Disability Discrimination Act 1995 acquainted prerequisites for trains with be open. As a result of the high cost of rejecting old moving stock rashly, prepare administrators have until 2020 to supplant all current stock with trains that meet availability norms.

Notwithstanding enactment, availability is just being executed gradually in numerous zones. In the US, just 20 for each penny of AMTRAK's stations are agreeable with US openness standards. (New York Times, 2010) However, railroad experts in India are accounted for to mean to enhance access to 1,500 rail route stations (out of a sum of 6,583) (Indian Railways, 2011) before the finish of 2010, including access highlights for stopping, signage, ticketing and holding up territories (Access Exchange International, 2010b).

Rail interfaces amongst air terminals and downtown areas are progressively normal and are opening new open doors for incapacitated and more seasoned vacationers. Cases incorporate the S-Bahn benefit from Hamburg airplane terminal (Germany) to the downtown area, and the city air terminal rail connect in Bangkok (Thailand).

For urban rail to be open both the moving stock & station must address the issues faced by disabled people. As the cost of supplying these facilities are exuberant only a handful of countries provide them.

2.2.2.4 Taxi

Taxicabs are a key segment of open transport for some debilitated and more established individuals since they give an on request way to-entryway benefit. For more seasoned individuals, they can be essentially less expensive for nearby trips than keeping up and running an auto.

Open cabs are accessible in a couple of nations, for the most part in little numbers and in light of van changes. The UK is right now the main nation in which most significant urban areas require every single authorized maneuver to be wheelchair open and to incorporate elements to help other incapacitated and more established individuals, for example, a swivel situate, additional handholds, and enlistment circles. All London's 19,000 authorized taxicabs are available. This implies a wheelchair client can go with an indistinguishable certainty and suddenness from others. A 2008 overview by wheelchair clients (Disability Holidays Guide, undated) demonstrates no issues in Sydney (Australia) and Dubai (United Arab Emirates) yet an entire nonappearance of open vehicles in Tokyo (Japan). In Paris (France) and Madrid (Spain) they should be reserved ahead of time. In Singapore various taxi firms offer administrations to crippled individuals. One uses lift-prepared vans, others are standard cantina autos which require a wheelchair client to move into a vehicle situate. (http://www.dpa.org.sg/, last got to 27 April 2011)

In numerous urban communities few taxicabs can suit a traveler going in their wheelchair. Endeavors to outline an available taxi suited to the necessities of both incapacitated and non-impaired travelers are proceeding in Japan and various different nations.

The New York City Taxi and Limousine Commission reports that albeit some American urban areas have wheelchair-available cabs, they speak to a little rate of their armadas. (http://www.nytim) It is for all intents and purposes difficult to hail one, and uncommon to discover one holding up at the airplane terminal.

In Hong Kong a few cabs are presently outfitted with a sound gadget to tell outwardly weakened travelers the taxi number, and the excursion toll in English, Cantonese and Putonghua (Grut and Ingstad, 2006).

Taxicabs may provide comfortable & time-efficient transportation but most of them don't have the prerequisite facilities to aid people with wheelchairs, walking sticks etc. At present measures are being implemented in urban communities for both the incapacitated & non-impaired travelers.

2.2.2.5 Impacts and Challenges

Here stay numerous urban communities around the globe with no available transport and few if any option wellsprings of portability. Reports from Iran, Armenia and Georgia **(**ArmeniaNow, 2010) demonstrate that there is no arrangement for debilitated individuals on open transport. In Iran there is some secretly worked extraordinary transport yet about 50 for every penny of incapacitated individuals are unemployed while in Armenia the figure is 92 for each penny. These figures underline the nearby connection amongst stability and neediness.

Examine among crippled individuals living in destitution in Yemen (Grut and Ingstad, 2006) accentuated that neediness among incapacitated individuals is exacerbated by:

- Absence of access to employments and the work showcase;
- Decreased chance to go to class or professional preparing;
- Decreased access to heath mind;
- Constrained capacity to take an interest in mutual life.

Indeed, even in urban communities with all around created available transport systems, transport issues can be a key hindrance to work. Information from London, UK, demonstrate that 23 percent of crippled individuals looking for work have needed to turn down a vocation offer, and a further 23 for every penny a prospective employee meeting, as a result of blocked off transport. (Transport for London, 2007)

A scope of issues stay in numerous urban areas. The most well-known is absence of co-appointment between vehicle administrators and those keeping up passerby and transport framework. Unless get to upgrades are made in parallel to the vehicle and the walker condition, a significant part of the advantage will be lost. This issue influences customary transport and BRT frameworks and also metro and cable car frameworks. At the foundation of this issue is the way that those in charge of working open transport are occasionally the same as those in charge of the road condition. Similarly vital is to guarantee access of feeder administrations which interface with real transport frameworks like BRT. On mainline rail, the cycle for moving stock reestablishment is long and the cost of repair is high so blocked off trains may proceed for a long time in a few zones. This will drag out vulnerability for some crippled voyagers who can't make certain which administrations will be given open moving stock.

Contrariness of get to norms between various frameworks can imply that impaired individuals can't finish a voyage. The European Union (EU) has had enactment set up since 2008 to bring new substantial rail moving stock crosswise over Europe under basic standards, **(**Official Journal of the European Union, 2008.)Yet there is as yet far to go.
In created nations, absence of ticket similarity between various modes additionally makes travel entangled. Shrewd ticketing and the utilization of advanced mobile phone "applications" ought to convey significant advantages to handicapped explorers gave that

their needs are outlined into the product.

Absence of driver preparing is a noteworthy hindrance to the utilization of open transport by and large and transports and taxicabs specifically. Data both before and amid the excursion is additionally key to empower individuals to see how to utilize the framework. In a few urban areas where available transports have been presented, impaired individuals are as yet hesitant to travel since they are uncertain how the framework functions. There are some great cases, for example, Stuttgart (Germany) and Vienna (Austria) (Mediate, 2010) where transport administrators arrange visits to warehouses and stations for debilitated individuals to experience open transport in a non-forced condition.

From the above context we can say that even in urban communities with all around created available transportation systems, transport issues can be a key hindrance to work and absence of driver preparing is a noteworthy hindrance to the utilization of open transport by and large and transports and taxicabs specifically.

2.3 Special Services for Disabled People

2.3.1 Para-transit Demand

Transportation frameworks that give benefits dominatingly to handicapped individuals are called paratransit frameworks. Since the center 1980s, there has been an extensive increment in the quantity of paratransit frameworks over the United States and the normal size of those frameworks. For instance, crosswise over 198 urban communities with under 400,000 individuals in 1980, trips expanded from 6.0 million in 1984 to 16.9 million in 1995 **(**Fitzgerald et al., 2000**).** Sadly, next to no is thought about the interest for such paratransit frameworks, how request relies on attributes of the neighborhood populace, or how the frameworks change after some time. While there are some contextual investigations portraying the ways that groups manage paratransit request **(**Everett, 1985; Fix, 1985), we have found no reviews utilizing accessible open national information or

individual traveler information.

Direct measured American urban communities have demonstrated amazing development sought after for paratransit. Our outcomes recommend that the greater part of that development is because of expanded investment as opposed to expanded request per client. It is not clear what has brought about expansive increments in investment. Indeed, in Charlottesville, over 100% of the assessed versatility incapacitated populace is utilizing paratransit. Our outcomes give some knowledge on the variety in utilization crosswise over clients. They firmly recommend that a generally little extent of clients speak to a vast part of aggregate outings. This infers Programs went for peripheral clients, for example, nursing home inhabitants won't be compelling in light of the fact that they speak to such a little extent of aggregate outings. An approach more prone to be productive is to arrange substantial clients all the more effectively. For instance, JAUNT tries to sort out numerous substantial clients into what are basically settled courses. Facilitate examination will require better data on the number of inhabitants in potential paratransit clients, their significant attributes, and their transportation decisions. Stern (1993) was a little, particular example of that sort.

Paratransit which is a special transportation framework isn't properly utilized for disabled people. It's very perplexing to use paratransit efficiently as the required data from potential users isn't adequately available.

Chapter 3

Methodology

3.0 Introduction

This chapter describes the data collection procedure, formulation of data and the methodology used. Logistic regression models will be used to identify the different factors affecting the solution preference of the disabled people. The formulation of these models will help us to understand how these models can be employed to fulfill the main objective of the study; that is, to identify the effects of different factors which play a key role in deciding whether a certain person will choose policy implementation or infrastructure development. The sources of database used in this study are discussed before describing the mathematical formulation of the model, its assumptions and estimation procedures.

3.1 Main Steps in Methodology

The methodology can be divided into three main steps:

(a) Preparation of Questionnaire to carry out the survey process.
(b) Selection of locations to conduct the survey.
(c) Carry out of the survey process and collecting feedback.
(d) Selection of statistical model analyze the collected data and perform analysis to find out key factors that contribute to the preference of either policy implementation or infrastructure development as an effective solution.
(e) Analysis and interpretation of model findings; that is, engineering judgment of factors affecting the solution preference choice.

3.2 Questionnaire Details

The questionnaire is prepared based on three fundamental sources. The first sources are the previous studies conducted on the topic, the second source is the local context and the third source is the initial feedback gathered from the stakeholders. The first set of questions based on the first criteria includes disability background, severity of impairment, access to public transport, ease of movement. The second set of questions includes socio-economic background, travel pattern, trip generation, and cost of traveling. The third set of questions came from the feedback of the disabled individuals. The feedback was collected through conduction of KII (Key Informant Interviews) on a particular group of disabled people that included people from different disability background.

3.3 Developing Questionnaire and Survey Details

The main steps in the survey processes are listed below

- Selection of the main locations. The locations selected are listed below:
    1. National Institute of Traumatology & Orthopedic Rehabilitation (NITOR).
    2. Bangladesh National Federation Of The Deaf
    3. Blind Education & Rehabilitation Development Organization(BERDO)
    4. Physically Disabled Organization (PDF)
    5. National Centre for Special Education (NCSE)
    6. Social Assistance and Rehabilitation for the Physically Vulnerable (SARPV)
    7. Other (relatives, disable people on street etc.)

- Preparation of applications to gain permit to conduct the survey on selected locations.
- Visit to each location and submission of applications
- Gaining of permission
- Carrying out the initial survey in form KII (key informant interview)

- Adjusting the questionnaire
- Carrying out the main survey
- Gathering feedback

The questionnaire is shown below:

1. Have you taken this survey before?

- Yes
- No

2. **Gender**

- Male
- Female

3. **Age** (**Survey on the Public Transport Needs of Persons with Disabilities Survey Report (Social Sciences Research Center the University of Hong Kong 15th January, 2007**)

- 12-14
- 15-19
- 20-24
- 25-29
- 30-34
- 35-39
- 40-44
- 45-49
- 50-54
- 55-59
- 60-64

4**. Cause of disability (Local Context)**

- By born
- Caused by accident

- Caused by a particular disease like polio, diabetes etc.
- Other

5**. What kind of disability do you have? (Survey on the Public Transport Needs of Persons with Disabilities Survey Report (Social Sciences Research Center the University of Hong Kong 15th January, 2007)**

- Physical handicap (PH)
- Hearing impairment (HI)
- Mental illness (MI)
- Visual impairment (VI)
- Autism
- Speech impairment (SI)
- Mental handicap (MH)

6. **Education level (National Organization on Disability-Harris Interactive, 2004)**

- Primary
- Secondary
- Tertiary
- Illiterate

7. **Working/ Studying Status**? (**National Organization on Disability-Harris Interactive, 2004)**

- Working full time
- Working part time
- Studying
- Retired
- Unemployed
- Cannot work/ go to school due to disability don't know
- Other

8. **Personal monthly income? (Taka) (Survey on the Public Transport Needs of Persons with Disabilities Survey Report (Social Sciences Research Center the University of Hong Kong 15th January, 2007)**

- less than 5,000
- 5,000-10,000
- 10,000-20,000
- 20,000-30,000
- 30,000-40,000
- 50,000-60,000
- more than 60,000
- don't know

9. Family monthly income? (National Organization on Disability-Harris Interactive, 2004)

- less than 10,000
- 10,000-20,000
- 20,000-40,000
- 40,000-50,000
- 50,000-70,000
- 70,000-90,000
- 90,000-1,00,000
- more than 1,00,000
- don't know

10. Do you use any of the following devices to help you manage activities? (Grut and Ingstad, 2006)

- Cane Walker Wheelchair
- Power scooter
- Scooter
- Eyeglasses/Contacts
- Hearing Aid
- Other (Please Specify.)

- none of the above

11. Do you have a valid driver's license? (Grut and Ingstad, 2006)

- Yes
- No

12. How easy is it for you to get to the bus stop or train station? (Mobility Needs and Bus Use Survey of Aging and Disabled Adults Living In Santa Cruz County)

- Very easy
- Kind of easy
- Okay
- Not very easy
- Very hard

13. Do you have any problems getting onto buses or trains? (Mobility Needs and Bus Use Survey of Aging and Disabled Adults Living In Santa Cruz County)

- Yes
- No

14. Do bus or train staff help you get on when you need it? ((Mobility Needs and Bus Use Survey of Aging and Disabled Adults Living In Santa Cruz County)

- Yes
- No

15. How much money do you spend on average for your daily transportation needs (BDT)? (Local context)

- 20-50
- 50-100
- 100-200
- 200-300
- 300-400
- 500+

16. Approximately how many miles do you live from your most frequent travel destinations (for example, work, study, grocery, pharmacy, neighbor, etc)? (Mobility Needs and Bus Use Survey of Aging and Disabled Adults Living In Santa Cruz County)

- 1 mile or less
- 1-5 miles
- 6-10 miles
- 11-20 miles
- More than 20 miles

17. Do you have access to a personal vehicle? (Whitelegg and Williams, 1998)

- Yes
- No

18. How often do you face difficulties in making any sort of trip? (Bailey, 2004)

- Always
- Sometimes
- Occasionally
- Never experience difficulties
- Never Travel\Don't make any journeys

19. Average trips per day (weekday) (Sawyer and Bright (2007),

- 0
- 1
- 2
- 3
- 4
- more than 4

20. Average trips per day (weekend) (Sawyer and Bright (2007)

- 0
- 1
- 2
- 3
- 4
- more than 4

21. Trip Purpose (Weekday) (Survey on the Public Transport Needs of Persons with Disabilities Survey Report (Social Sciences Research Center the University of Hong Kong 15th January, 2007)

- Go Home
- Social/Recreational activities
- Handling Daily living matters
- Go to work/ school
- Receiving Healthcare
- Relaxation/Exercise
- Personal Issues
- Leisure/volunteering activities
- Functions arranged by Organizations

22. Trip Purpose (Weekend) (Survey on the Public Transport Needs of Persons with Disabilities Survey Report (Social Sciences Research Center the University of Hong Kong 15th January, 2007)

- Go Home
- Social/Recreational activities
- Handling Daily living matters

- Go to work/ school
- Receiving Healthcare
- Relaxation/Exercise
- Personal Issues
- Leisure/volunteering activities
- Functions arranged by Organizations

23. How many times have you stayed home when you needed or wanted to go somewhere because you didn't have access to convenient transportation? (Michael Peck, "Barriers to Using Fixed-Route Public Transit for Older Adults." Green House Gas Emission Impacts of Car Sharing in North America No. CA-MTI-10-2402 (2010): 1-235)

- I never stayed home
- only a few times
- about once a week
- many times a week
- almost daily
- not sure/ don't know
- Attend job training/classes

24. During the past month, how many times have you traveled on the bus? (Michael Peck, "Barriers to Using Fixed-Route Public Transit for Older Adults." Green House Gas Emission Impacts of Car Sharing in North America No. CA-MTI-10-2402 (2010): 1-235)

- 0 times (Prefer to drive/ ride in a car)
- 0 times (Bus is not available)
- 0 times (Bus is not convenient)
- 0 times (Bus is too expensive)
- 1 or 2 times

- 2 to 10 times Several times a week Nearly

25. What, if anything, would encourage you to use or increase your use of public transit? (Stakeholder's feedback)

- Buses run more frequently.
- Less Expensive Fares.
- The bus stopped closer to home, amenities, or recreation.
- Travel times were shorter.
- Improved sidewalks, street lights, or benches.
- Buses went to more places.
- Access to training or mentoring programs to learn more about riding a bus.
- Dedicated seat
- Para-transit
- Comfortable & safe public transport

3.4 Statistic Model

The logistic regression model is used for performing analysis. A statistical model widely used for analysis which will be of interest to this study is the logistic regression model. The logistic regression is a suitable technique to use to predict a binary dependent variable as a function of predictor variables.

In this model, the logit is the natural logarithm of the odds or the likelihood ratio that the dependent variable is Y = 1 (Policy Implementation) as opposed to Y = 0 (Infrastructure Development). The probability P of an injury in the crash is given by

$Y = logitP = lnP_i / 1-P_i = \beta_0 + \beta_i X_i$ ……... (3.1)

Where$\beta 0$ is the model constant and the βi are the parameter estimates for the

independent variables Xi, = 1, 2, 3 … … …. nth set of independent variables. A simple transformation of equation 1.1 yields

$P_i/\ 1- = e\beta_0 + \beta_i X_i = e\beta_0 e\beta_i X_i$ …….. (3.2)

The fundamental equation for the logistic regression shows that when the value of an independent variable increases by one unit, and all other variables are held constant, the new probability ratio [Pi/ (1 – Pi)] is given as

$P_i/\ 1 - P_i = e\beta_0 e\beta_i X_i + 1 = e\beta_0\, e\beta_i X_i = \ (P_i/\ 1-)\ \beta_i$ ……... (3.3)

Thus when independent variable Xi increases by one unit, with all other factors remaining
Constant, the odds $Pi/\ 1-$, increases by a factor. ..The factor.$e\beta i$ is called the odds ratio (OR) and ranges from zero to positive infinity. It indicates the relative amount by which The odds of the outcome increases (OR > 1) or decreases (OR < 1) when the value of the corresponding independent variable increases by 1 unit.

The maximum likelihood method is employed for estimation and the likelihood function is given by:

$L\boldsymbol{\beta}\ = \mathrm{n}_{\ i\ =1}{}^{yi}(1\ -)\ 1^{-yi}$ ……..…… (3.4)

Whereyi denotes the i th observed outcome, with the value of either 0 or 1 only, and

i = 1, 2, 3…n, where n is the number of observations. The best estimate of $\boldsymbol{\beta}$ would be obtained by maximizing the log likelihood expression given below:

$LL = \ln\ \ = {}_i \ln\ \ +\ \ 1 - y_i \ln\ 1 - P_i$ ..... (3.5)

CHAPTER 4

RESULTS AND INTERPRETETION

4.1 Introduction

The analysis will be conducted in the study: Analysis of data for finding out key factors that affect the solution preference of the disabled people in the direction of either Policy Implementation or Infrastructure Development.

In the analysis one model is employed: logistic regression model. The logistic model is used to predict an outcome variable from predictor variables that are categorical and/or continuous

The logistic regression is used to describe data and to explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables.The preliminary analyses is performed, and the final model is estimated, using STATA 12.

4.2 Model Development

An important task in developing the models would be the selection of appropriate factors. Two approaches were used to select these factors. First, we reviewed similar research to determine which factors had been examined. Second, we focused on the local context to determine other variables that might have some influence.

For model development, feedback data from the survey process are used in this study. Data associated with different contexts are extracted from the main data set to develop the model. The data set are connected with the relevance of factors that might affect the solution preference outcome.

The dependent variable of this case study is categorized into two levels: Policy implementation and Infrastructure development and the factors associating with Policy implementation are less expensive fare, travel time reduction, safety and comfort improvement in public transport and stoppage points closer to destination. The factors relating to Infrastructure development are dedicated seats, para-transit, improved sidewalks and street signs, trained aiding staff.

The independent variable set consists of three main contexts. The contexts are disability background, socio-economic background and travel pattern of the disabled people. No variables were excluded in the model and all of them were incorporated in the model to figure out list of significant factors that affect the depended variables. Some of the independent variables are age, gender, type of disability, cause of disability, monthly income, education level, trips per day etc.

The model contains 145 variables formed from 25 factors as shown in Table 4.2. The definition of the variables together with their mean and standard deviation are also recorded in Table 4

4.3 Results

Table 4.1: Summary Statistics

Variables	Mean	Std. Dev
Gender		
Male	0.698	0.460
Female	0.294	0.457
Age		
12-14	0.007	0.085
15-19	0.132	0.340
20-24	0.198	0.400
25-29	0.132	0.340

30-34	0.154	0.362
35-39	0.132	0.340
40-44	0.095	0.296
45-49	0.031	0.221
50-54	0.029	0.169
55-59	0.002	0.093
60-64	0.003	0.076
Cause of Disability		
Born	0.448	0.499
Accident	0.382	0.487
Diseases	0.123	0.331
Other	0.022	0.134
Kind of Disability		
Physical Handicap	0.580	0.495
Hearing Impairment	0.132	0.340
Mental Illness	0	0
Visual Impairment	0.213	0.411
Autism	0	0
Speech Impairment	0.095	0.295
Mental Handicap	0	0
Educational Level		
Primary	0.110	0.314
Secondary	0.389	0.489
Tertiary	0.441	0.498
Illiterate	0.044	0.206

Working/Studying Status		
Working full time	0.213	0.343
Working part time	0.244	0.435
Studying	0.342	0.466
Retired	0.066	0.249
Unemployed	0.125	0.331
Cannot work	0.078	0.231
Other	0.033	0.314
Personal Monthly Income		
10-20k	0.125	0.331
20-30k	0.095	0.295
30-40k	0.022	0.147
40-50k	0.029	0.169
50-60k	0	0
More than 60k	0	0
Don't Know	0	0
Family Monthly Income		
Less than 10k	0.054	0.241
10-20k	0.224	0.324
20-40k	0.477	0.456
40-50k	0.232	0.067
50-70k	0.112	0.324
70-90k	0.043	0.076
90-1 lac	0.012	0.120
More than 1 lac	0	0
Device Used		
Cane/Walker	0.344	0.487
Wheelchair	0.044	0.206
Power Scooter	0	0
Scooter	0	0

Eyeglass	0.044	0.234
Hearing Aid	0.110	0.314
Other	0.045	0.204
None	0.433	0.497
Valid Driver's License		
Yes	0.088	0.284
No	0.904	0.295
Ease of Movement		
Very easy	0.028	0.169
Kind of easy	0.139	0.348
Okay	0.214	0.413
Not very easy	0.364	0.489
Very hard	0.245	0.436
Problems Getting onto Public Transport		
Yes	0.746	0.478
No	0.224	0.497
Staff Assistance		
Yes	0.325	0.468
No	0.648	0.472

0	0.138	0.348
1	0.089	0.046
2	0.053	0.246
3	0.356	0.066
4	0.322	0.094
More than 4	0.558	0.356
Trip Purpose (weekdays)		
Go home	0.551	0.499
Social activities	0.007	0.085
Daily matters	0.169	0.376

Go to work/school	0.225	0.097
Healthcare	0.476	0.042
Relaxation	0.663	0.974
Personal issues	0.042	0.087
Trip Purpose (weekends)		
Go home	0.353	0.035
Social activities	0.224	0.436
Daily matters	0.358	0.421
Go to work/school	0.325	0.235
Healthcare	0.363	0.604
Relaxation	0.093	0.085
Personal issues	0.042	0.098
Travel Cancellation Due to Lack of Accessibility		
Never	0.118	0.324
Only a few times	0.441	0.498
Once a week	0.147	0.355
Many times a week	0.169	0.376
Almost daily	0.083	0.135
Don’t know	0.143	0.092

Travelled on Bus During Last Month		
0 (Bus not available)	0.035	0.043
0 (Bus not convenient)	0.323	0.443
0 (Too expensive)	0.423	0.532
1-2 times	0.355	0.563
2-10 times	0.233	0.325
Improvement Solutions		
Busses run more frequently	0.323	0.464
Less expensive fare	0.225	0.365

The bus stopped closer to home/amenities	0.577	0.433
Shorter travel time	0.235	0.346
Improved sidewalk, streetlight, street signs	0.678	0.755
Staff training	0.122	0.242
Dedicated seat	0.256	0.437
Para-transit	0.334	0.223
Comfort and safety in public transport	0.322	0.433
Preferred Mode Choice		
Bus	0.446	0.325
Car	0.124	0.212
Auto/Taxi	0.198	0.245
Rickshaw	0.166	0.532
Bike	0.122	0.235

4.4 Model Evaluation

To confirm suitability of the fitted model, the log likelihood ratio index and the adjusted log likelihood ratio index, the usual practice is to ignore such goodness-of-fit measure in models since sometimes the value of the log likelihood ratio index is substantially less than one.

For overall goodness of fit the log-likelihood ratio index (ρ^2) and the adjusted log-likelihood ratio index ($\bar{\rho}^2$) were calculated and the values are 0.072 and 0.067 respectively (see Table 4.2). The model can be considered to fit satisfactorily.

4.5 Interpretation of Significant Variables in the Model

After performing the analysis, 13 factors were retained in the model. These factors are shown in under disability background and socioeconomic and demographic characteristics which were used mainly as control variables.

Example of some of significant factors included age, personal monthly income, number of trips per day, working status, cause of disability, ease of movement, average daily transportation cost. The final sample consisted of 136 disabled people

Table 4.2. Estimation Results for Logistics Regression

Number of observation = 136 Log likelihood = -54.42556 P-value < 0.1		$\rho^2 = 0.072$ $\bar{\rho}^2 = 0.067$		
Variables	**Coefficient**	**Std.Err**	**P-Value**	**Odd Ratio**
Disability Background				
Kind of Disability – Hearing Impairment	-2.192	0.1060	0.021	.11
Kind of Disability – Physical Handicap	-1.052	0.2054	0.074	0.35
Ease of Movement- Kind of easy	-1.349	2.1954	0.074	3.85
Cause of Disability –Caused By Particular Disease	-2.792	0.0603	0.005	0.06
Socio-Economic Background				
Age 15 to 19	-2.146	0.1022	0.014	0.12
Personal Monthly Income 10,000-20,000 taka	-3.348	1.121	0.003	0.03
Working status- Studying	2.293	7.326	0.002	9.90

Average Daily Transportation Cost 20-50 taka	1.998	5.076	0.004	7.38
Travel Pattern				
Preferred Mode choice-Bus	2.868	12.632	0.000	17.6

				1
Average Trips per Day (Week Days) - 3	1.473	3.738	0.085	4.36
Average Daily trip (Week Ends) -1	-2.080	0.090	0.004	0.12
Travelled by Bus or Public Transport in Past Month 1-2 Times	-2.306	0.069	0.001	0.09
Valid Driver License –No	1.610	4.792	0.092	5.00

`

4.6 Summary Findings

For the first two significant factors, estimated values of (coefficient -2.192, odd ratio .11 for hearing impairment and coefficient -1.052 and odd ratio 0.35) indicates that there is an increase in probability of preference towards policy implementation compared to infrastructure development among disabled people with hearing impairments and physical handicap with respect to other groups of people. These two groups prefer policy implementation as an effective solution to facilitate their daily movements. One probable reason for this result could be that the mentioned class of people can carry out their daily movements using the existing transports and facilities but a high degree difficulty. As such there is a strong preference towards policy implementation which includes improving safety and comfort of the public transport, increased number of stoppage points, travel time reduction and less expensive fair.

The next significant factor, with an estimated values of (coefficient -1.349, odd ratio 3.85) indicates that there is an increase in probability of preference towards policy implementation compared to infrastructure development among disabled people who face

a lesser degree of difficulty in daily movements compared to people who face higher difficulty. The solution preference moves towards infrastructure development with the increase in difficulty of movement. One probable reason for this result could be that the mentioned group of people found it effective to improve the accessibility and comfort of the existing public transport system rather than introducing new modes of specialized transport such as paratransit.

Cause of disability plays an essential role in solution preference. The groups of people who were impaired due to some particular disease have a higher preference towards policy implementation. The reason behind such behavior can be a bit complicated to elaborate. But one possible reason for this could be that some portion of this group had normal access to public transport before they became disabled due to some illness. They are familiar with the existing conditions, as a result they prefer adaptation over mitigation with new modes of transport system.

Age is an important factor in deciding between either solutions. It is evident from the results (coefficient -2.146, odd ratio 0.12) that there is a higher probability in preference towards policy implementation over young group of people. The choice shifts towards infrastructure development with the increase in age. One probable reason for this could be the increase level of difficulty with age. Older people face greater difficulty in movements and in most cases they have companions to provide them support. As such there is high preference towards infrastructure development (Paratransit services, dedicated seats, and trained staff) among older group of people. Again the movement of younger people are limited and simple compared to the working class age group. Thus there is lesser obstacles in their daily travel pattern. Another reason could be the lack of source. There would be higher cost input involved in specialized system as paratransit which might be out of range of affordability of the younger people.

Personal monthly income level has a significant effect on solution preference. The values obtained from the results (coefficient -3.348, odd ratio 0.03) suggests that there is an increase in preference towards infrastructure development with the increase in personal

monthly income. Individuals with lower income level prefer improvement of existing situation rather than applying new modes of transportation. One reason for this is most like the affordability level associated with income level. Higher income groups will be willing to pay the extra amount for new modes of system like paratransit or modernized movement facilities. Lower income groups will fail to meet the demands. Hence the preference towards policy implementation.

Average daily transportation cost level also has a similar significant effect on solution preference. The values obtained from the results (coefficient 1.998, odd ratio 7.38) suggests that there is an increase in preference towards infrastructure development with the increase in average daily transportation spending. Individuals with lower income level prefer improvement of existing situation rather than applying new modes of transportation. One reason for this is most like the affordability level associated with income level. Higher income groups will be willing to pay the extra amount for new modes of system like paratransit or modernized movement facilities. Lower income groups will fail to meet the demands. Hence the preference towards policy implementation.

Preferred mode choice of the people is significant in deciding whether they will opt for policy implementation or infrastructure development. The results suggest that people with mode choice of bus have a critically higher preference (coefficient 2.868, odd ratio 17.61) towards policy implementation. The people who use bus as their daily mode of travelling compared to other modes of transportation have lesser interest in new modes of transport as paratransit. It is more likely that they will prefer improvement of safety and comfort of the existing bus services. Other factors related to policy implementations are travel time reduction, less fare and higher stoppage points are associated with the bus services. The preference clearly indicates to those factors as well.

Average daily trips per day (Both weekdays and weekends) also have a significant effect on solution preference. The values obtained from the results (coefficient 1.473, odd ratio 4.62 for week days, coefficient -2.080 and odd ratio 4.36 for weekends) suggests that there is an increase in preference towards infrastructure development with the increase in

average daily trips per day in weekends. However in case of week days the situation is opposite resulting in decreasing of probability of choosing infrastructure development with increase in trips per day. One reason for this is most like the higher degree of obstacles faced with higher trips per day. Higher trips per day in weekdays indicates that the individual is most likely to use bus or taxi as mode of frequent movement which is why the preference towards policy implementation is more dominant in their case. Again, higher trips per day in weekends point to a group of people who have a higher severity of disability.

CHAPTER 5

CONCLUSIONS AND RECOMMANDATIONS

From our study, Age plays a key role in solution preference. We have found that, the younger people prefer Policy Implementation as an effective solution to increase ease of movement. With the increase of age, the solution preference moves towards infrastructure development.

The people who frequently travel by bus prefer policy implementation to a greater degree compared to the people who use other modes of transportation. Frequent Bus users prefer the improvements necessary to meet their accessibility demands and ensure safe and comfort ridership of public transport.

Personal monthly income is another significant factor which is essential for the solution preference choice. With the increase in personal monthly income, there is a noticeable increase in preference towards Infrastructure Development.
Low income people generally prefer policy implementation as a method for upgrading ease of movement.

Average daily transportation cost is a major factor in deciding the preference. With the increase in average daily transportation cost, there is a similar noticeable increase in preference towards infrastructure development

The study indicates that, both physically handicapped people and people with hearing impairment lean on towards the preference of Policy Implementation compared to people with other form of disabilities.

Difficulty of movement plays a key role in solution preference. With increasing difficulty, the preference of Infrastructure development becomes more prominent. People with lower trips per day views policy implementation as an effective solution to facilitate their

movement.

The feedbacks from students give an indication that policy implementation is a more feasible solution to enhance their movement.

6.2 Recommendations

In order to promote sustainable transportation system public transit service should be improved especially for disabled passengers. Accessible bus services should be provided. Improvements in sidewalks, street signs and lights should be implemented, major staff training should be provided for the staff dealing with public transport systems.

The study will provide policy makers as well as transportation engineers and planners with important information for adopting measures for facilitating transportation system and implementing proper solutions for a particular group of people or in a particular area. Based on the characteristics of the certain group of disabled individuals, the policy makers will be able to take precise steps to remove their problems.

It will help in efficient selection between effective solutions and alternative approaches to mitigate transportation problems for the disabled people. In case of considering alternative solutions, the task will become much easier when taking assist from the outcomes of this study.

6.3 Limitations and Future Research

The research has been conducted considering several limitations. In this study, some variables that might have significant effect on solution choice are omitted due to lack of data which is an inherent problem in many applied research.

The study was confined within the boundaries of Dhaka city. Same study can be done for Chittagong, Comilla etc. the different socio-economic and local context of different cities may produce significantly varied results and analysis.

We can get a comparison between different studies and find out new variables that are playing a significant role in solution preference. New variables will increase the predictability power of the model in general and outcome of the model will be much stronger and precise for practical implementations.
The data collected in the study can be used to develop other prediction models. The data used in this study can be used to formulate different models including travel pattern models, mode choice models etc.

The results of the current study and the future studies can be combined to get a very precise analysis for solution implication for the disabled people.

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