

**MEASURING & EVALUATING THE ROLE OF
INTANGIBLE URBAN PLANNING ASPECTS IN BRICK &
MORTAR RETAIL MARKETS: - A CASE STUDY OF
LUDHIANA CITY**

Thesis Submitted for the Award of the Degree of

DOCTOR OF PHILOSOPHY

**in
Architecture**

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DECLARATION

I, hereby declared that the presented work in the thesis entitled “Measuring & Evaluating the Role of Intangible Urban Planning Aspects in Brick & Mortar Retail Markets: - A case study of Ludhiana City” in fulfilment of degree of **Doctor of Philosophy (Ph. D.)** is outcome of research work carried out by me under the supervision of Dr. Mahendra Joshi, working as Professor, in the Architecture Department of Lovely Professional University, Punjab, India. In keeping with general practice of reporting scientific observations, due acknowledgements have been made whenever work described here has been based on findings of other investigator. This work has not been submitted in part or full to any other University or Institute for the award of any degree.

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CERTIFICATE

This is to certify that the work reported in the Ph. D. thesis entitled “Measuring & Evaluating the Role of Intangible Urban Planning Aspects in Brick & Mortar Retail Markets: - A case study of Ludhiana City” submitted in fulfillment of the requirement for the reward of degree of **Doctor of Philosophy (Ph.D.)** in the Lovely School of architecture and Design, is a research work carried out by Raminder Kaur, 41900323, is bonafide record of his/her original work carried out under my supervision and that no part of thesis has been submitted for any other degree, diploma or equivalent course.

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ABSTRACT

Introduction – In success of brick and mortar (B&M) retail markets, pedestrian friendly urban design plays a pivotal role. Variables affecting walkability have significant social, economic, and environmental benefits in B&M retail markets. Various cities across the globe have become proactive about their pedestrian environment, and are seeking to improve their B&M retail markets by adopting measures such as better facilities for walking, traffic control by making some streets NMZ (non-motorized zone), people oriented urban designs, traffic education and training programs and above all looking for intangible measures, like safety, comfort & convenience. Recognizing the benefits of pedestrian friendly retail environments, which is essential for sustainable development at the global level, the need of the hour is to analyze and assess intangible aspects in our Indian B&M retail markets from retail user perspective.

Design/ methodology/ approach – After intensive literature study research design was divided into two parts: - the first part deals with identification of factors and finding technique to analyze relationship of identified factors with pedestrian user satisfaction in B&M retail markets. GWI is universally adopted and vigorous model to understand pedestrian perception. For present research, out of three constructs of GWI, two i.e., safety-security (SS) and convenience-attractiveness (CA) are considered in this study. Factor analysis was conducted using principal component method to explore other essential factors for US in B&M markets. Finally, four independent variables (safety-security, convenience-attractiveness, comfort & convivial environment) are framed to find strength of their impact on user satisfaction in B&M retail markets.

Further, in second part B&M retail markets of Ludhiana are identified for the purpose of conscientious investigation about selected parameters and user perception through field survey at the segment level of selected markets. A total of 100 segments fairly distributed among 20 B & M Built environments were considered for the purpose. The scores obtained from study were subjected to Analysis of Variance (ANOVA), to understand and interpret their variability based on different groups. To determine the direction of variability of mean scores, further the post-hoc test was undertaken. In addition, data which was collected from Preference Survey Performa, Chi-square tests and Crosstab test were performed to find degree of association of the pedestrian user preferences with socio-economic characteristics

of the user. Lastly, the ranking against desired improvement was analyzed which was provided by 250 pedestrian users.

Data Analysis – Analysis is done in two sections: - The first section examines factor analysis using structure equation modelling (SEM), which have impact on pedestrian user satisfaction in B&M retail markets. Further, in second part, segment level parameters and attributes have been analyzed in terms of their prevalence at the overall city level. A total of 100 segments fairly distributed among 20 B & M Built environment s (mean length 150 m; min. 1600 m; max.) were considered for the purpose.

Originality – In the maze of continuously increasing automotive traffic, modern cities appear to have lost their pedestrian culture, yet there are also more and more vocal calls for rethinking walking. Professionals throughout the world are attempting to modify their built environments from a pedestrian perspective after realizing the impact that different built environment parameters can have on strengthening the social as well as economic culture. The data produced out of this research gives a conceptual model having parameters which have positive impact on footfall in B&M retail markets and has a quick useful application in Ludhiana as well as similar tier 2 cities in India. The 20 surveyed B&M retail markets might be quickly updated according to pedestrian viewpoint to act as a model to proliferate the soul of strolling at nearby level. Further, the willingness of the users to improve their walk habits is a definitive reason for the concerned agencies of development to upgrade the B&M markets from pedestrian perspective.

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List of Abbreviations	
AI	Artificial intelligence
AVE	Average Variance Extracted
B&M	Brick and Mortar
C	Comfort
CA	Convenience-Attractiveness
CE	Convivial Environment
CFA	Confirmative Factor Analysis
CMB	Common Method Bias
CR	Composite Reliability
CVR	Content Validity Ratio
DV	Dependent Variable
GDP	Gross Domestic Product
ITDP	Institute for Transportation & Development Policy
IV	Independent Variable
LOS	Level of Service
MC	Municipal Corporation
NMZ	Non-Motorized Zone
PA	Path Analysis
PDS	Public Distribution System
PEDS	Pedestrian Environmental Data Scan
PEQI	Pedestrian Environmental Quality Index
PLOS	Pedestrian Level of Service
PLS	Partial Least Squares
RSQS	Retail Service Quality Scale
SEM	Structural Equation Modelling
SPSS	Statistical Package for Social Sciences
SS	Safety-Security
US	User Satisfaction
USP	Unique Selling Proposition
UTTIPEC	Unified Traffic and Transportation (Planning and Engineering Centre)
VIF	Variance Inflation Factor

CHAPTER-I: INTRODUCTION

Retailing is an intrinsic and inseparable part of our daily lives. The retail industry is significantly important and plays a predominant role in the economic development of any country. For example, in The United States, the retail sector contributed to employment growth of 3% in six years. It is the largest private sector employer and supports more than one in four jobs. It contributes an annual 3.9 trillion dollars towards the GDP of the nation (Federation, 2020). Thus, proving that nations that have enjoyed the greatest economic and social progress have a vibrant and successful retail sector.

The terminologies used in this report for the brick and mortar (B&M) retail market and intangible aspects are: - B&M retail market describes companies that are confined to a physical location, such as a particular building where clients can make purchases. Intangible aspects refer to assets that cannot be touched, for example, attractive environment, safety & security, comfort & convenience, etc.

Broadly retail could be categorized as offline retail and online retail. Planning for each retail type depends on various factors, for instance, while planning offline (B&M) retail markets role of urban planners/architects is very important, as for the success of these markets the intangible planning aspects need to be addressed regarding the pedestrian user-friendly environment. On the other hand, in online retail, instead of urban planners/architects' the intangible planning aspects are catered by the information technology team. The ever-changing digital technologies have transformed digital retail and it has made it more organized, and accessible, the sand serviceability (Jiang & Stylos, 2021). For enhancing the customer's shopping experience, both retail markets have different aspects which need to be addressed.

1.1 GLOBAL SCENARIO OF RETAIL SECTOR

On the global front, next to agriculture, it is the largest revenue and employment generator. In countries like USA, UK, France etc. it is a top-tier industry, whereas in India it is an upcoming industry. In such countries over 50% of retail sales comes from the organized retail sector. Even in developing countries like Brazil, Mexico, and China the share of organized retail is much higher than in India (Hudson, 2022). As retail chains expand and spread their operations they are focusing on the development of private brands, which is licensed brand of a retailer. These are exclusive and only available at outlets of a specific retailer. For example, Marks & spencer is a private brand of St. Michael brand. The outbreak of coronavirus disease (COVID-19) acted as a massive restraint on the retail market in 2020. The supply chains were disrupted due to trade restrictions and consumption declined due to lockdowns imposed by governments globally. A

shift was seen from the physical retail markets to the e-commerce retail markets. Currently, the retail sector is facing the issues of post-lockdown changes, global inflation and recession and the ever-changing dynamics of the customers (Catherine Erdly, 2022).

1.2 INDIAN SCENARIO OF THE RETAIL SECTOR

As per the Indian brand equity foundation 2020, various new players are entering in Indian retail industry, due to which it has emerged as one of the most effectual and fast-paced industries. Approximately 8% of jobs in India are employed in the retail sector, which contributes over 10% of the GDP of the nation. India is the fifth-largest international retail market in the world. The Indian retail sector is incredibly fragmented, with unorganized retailers like traditional family-run shops and corner stores handling most of the country's sales. Although efforts are being made to grow it, organized retail is still in its infancy and presents a significant opportunity for potential new players.

In India, businesses are frequently characterized as formal, informal, organized, or unstructured. The informal sector, according to the Ministry of Labor and Employment, comprises of unincorporated enterprises that are owned and operated by people or households. These companies' owners are personally liable for all debts and obligations, and they cannot be legally considered separate from the firms they run because they raise funds at their own risk (Kumar Yadav, n.d.; Razli & Razak, n.d.). Family members and temporary workers without written agreements are frequently employed by informal enterprises. Corporations, limited liability firms, and businesses operated by or on behalf of cooperative organizations and trusts are examples of formal businesses. Organized retailing consists of chain stores, supermarkets, hypermarkets, department stores, and store inside stores in addition to some very big incorporated stores. All unorganized merchants, including as street hawkers, pushcart sellers, stalls, kirana stores, and paan shops, fall under the category of unorganized retailing (Burton & Mitchell, n.d.). It also comprises formal sector businesses including general merchants, pharmacies, appliance stores, and a variety of specialty shops that run as partnerships, private and limited companies, cooperatives, or trusts.

Phases in the evolution of the retail sector

- Weekly Markets, Village and Rural Melas: A venue for socializing and conducting business.
- Mom-and-pop businesses, convenience stores, and Kirana stores: - Local convenience stores, a longstanding and extensive reach.

- Cooperatives, Khadi stores, and PDS locations: Government support, accessibility, affordability, and distribution.
- Exclusive brand outlets, department stores, hypermarkets, supermarkets, and shopping centers: -Shopping efficiency and modern, international forms.

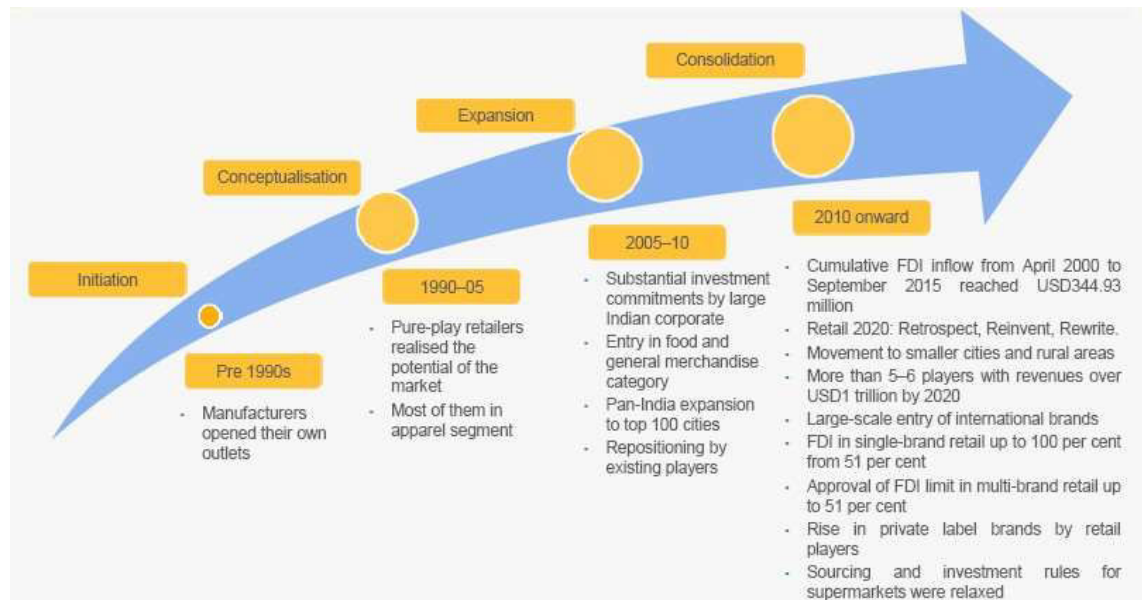


Figure 1.1: Evolution of retail in India

Source: Technopak Advisors Pvt Ltd, BCG, Tech Sciz Research

In process of the retail sector, like others also changed with advancements in technology and urban development, for instance with the passage of time retail changed from traditional stores to city-based shopping stores to lined showrooms or malls then to discount chains and, then to e-commerce & m-commerce. Each change does not eliminate the previous process but if considered appropriately they can complement each other.

Till now in most of Indian cities, B&M retail markets along streets are one of the main modes for retail shopping. This is not a new phenomenon; brick-and-mortar retail markets along streets have played this role ever since towns and cities first appeared. In addition, these locations play a crucial role for connecting people with the physical environment. Unfortunately, in these public precincts, private automobile traffic has recently outpaced pedestrian traffic. The situation is getting worse because the number of private vehicles is skyrocketing, which has a negative impact on both the quality of life and the public areas in many cities. As a result, there is an urgent need to pay attention to pedestrians in these areas so that they can walk, converse, buy, and engage in other social behaviors that are crucial to the socio-cultural features of cities.

1.3 SIGNIFICANCE OF PEDESTRIAN IN B&M RETAIL MARKETS

Traditionally, Asian cities were planned which supported walking and it was one of the main means of urban transport (Leather et al., 2011). Eventually with advancement in technology, urban planning shifted from pedestrian to motor-oriented designing, but keeping future in mind for sustainable urban environment, attention should be given to pedestrian friendly urban planning. Considering pedestrian friendly design well-established literature is available which depicts that along with social, economic, environmental benefits, it has positive impact on physical and mental health of user in urban environment. Undoubtedly, in pedestrian-oriented markets, social interaction is maximum and customer feels connected with their surroundings. For the health benefit of population, planners should create an environment which rely on walking and cycling rather on private motor vehicles (Stevenson et al., 2016). In urban environment, face-to-face contact is very important for efficient communication, socialization, solving incentive problems and provides psychological motivation (Storper & Venables, 2004). Pedestrian-oriented, mixed-used neighborhood design enhances social capital by increasing interaction among users (Furlan, 2015). For B&M retail markets, urban environment should be designed to keep pedestrian user safety, comfort, and convenience on priority for sustainable design. Significant evidence assist link between the urban environment and physical activity in B&M retail market.

Walkability is a measure to find the condition in favor of walking. It improves drastically when user feel command over the streets they walk, contrarily pedestrian users feel discomfort when streets seem to be commanded by no one (Furlan, 2015). To promote walkability, steps should be incorporated in policies which will enhance tourism (Vural Arslan et al., 2018). In retail market factor like, footpaths, walkways, traffic flow, entrance and exit of streets, shaded path etc., effects the walking behavior of customers. In urban environment factors like enclosure, edge condition and block length are significant to understand inner quality of walkable neighborhoods (Kaur & Joshi, 2022). By enhancing quality of the pedestrian environment regarding safety, quality of path, path context etc. user would be encouraged for walking over other means of motorized mode (Forsyth, 2015).

Pedestrian activity is often associated with built environment attributes like mixed uses, compact urban blocks, well-connected streets, markets, and well-performing street facilities. Generally, pedestrians prefer a market that has more to provide in terms of retail shops, cafes, convenience stores, entertainment services and leisure activities (Kashef, 2022). Variety and mix of land use that provides both functional and wide-ranging services and retail price choice is always preferred by pedestrian users. The shorter path street network, higher density, and

accessibility, both by car and pedestrians, further contributes to increased pedestrian activity and vitality in the retail markets (Kashef, 2022).

1.4 RESEARCH SIGNIFICANCE

Pedestrian users in B&M retail markets are influenced by a mix of diverse factors including individual preferences, socio-cultural setup, and the environment (Vural Arslan et al., 2018). The environment may further be understood as the tangible and intangible aspect of urban design (Mosler, 2019a). Pedestrian behavior plays an important role in urban planning of retail facilities (Borgers & Timmermans, 1986). Qualitative analysis of various B&M retail markets needs to be done for improving user experience. Intangible factors are the focus of this research, which is understood through its various planning and urban design parameters in existing B&M retail markets. In addition, intangible characteristics also play a pivotal role in maintaining the social & culture of any area, and as retail depicts one of the important elements of urban development so these non-physical characteristics should be incorporated in true spirit while planning B&M retail markets.

SIGNIFICANCE OF STUDY IN THE INDIAN CONTEXT

At the global level, walkability in all urban spaces is projected as an essential ingredient of new urbanism, compact city, smart growth and all other such approaches targeting sustainable development. Various cities across the globe have become proactive about their pedestrian environment, and are seeking to improve their B&M retail markets by adopting measures such as better facilities for walking, traffic control by making some streets NMZ (non-motorized zone), people-oriented urban designs, traffic education and training programs and above all looking for intangible measures, like safety, comfort & convenience. Recognizing the benefits of pedestrian-friendly retail environments, which is essential for sustainable development at the global level, the need of the hour is to analyze and assess intangible aspects in our Indian B&M retail markets from a retail user perspective.

1.5 SELECTION OF STUDY AREA

India is witnessing a great boom in the retail industry and in Punjab State, one of its major contributors is Ludhiana City (Aditya Bafna, 2022). This city accounts for over 90% of the country's hosiery industry. The hosiery goods from this city are in great demand not only across the nation, but also worldwide. This industry is a major foreign exchange earner for India and includes America and Russia among its clientele. Apart from hosiery, Ludhiana also boasts in a range of other retail markets like cycles, automobile parts, machine tools,

agricultural products etc. Apart from this, Ludhiana also plays a dominant role in the Indian economy as it contributes substantially to exports. Thus, Ludhiana city is selected for current study. The city is positioned at 40°56'N, 75°48'E with an area of approximately 310 km² an average elevation of 244 meters above mean sea level. Location map of Ludhiana district is shown in the figure 1.2 (Randhawa & Kumar, 2020).



Figure 1. 2: Location plan of Ludhiana District

Source: Ludhiana Master Plan 2031

The Ludhiana M.C zones (A, B, C & D) and positioning of major road & rail networks passing through the city is shown in fig 1.3.

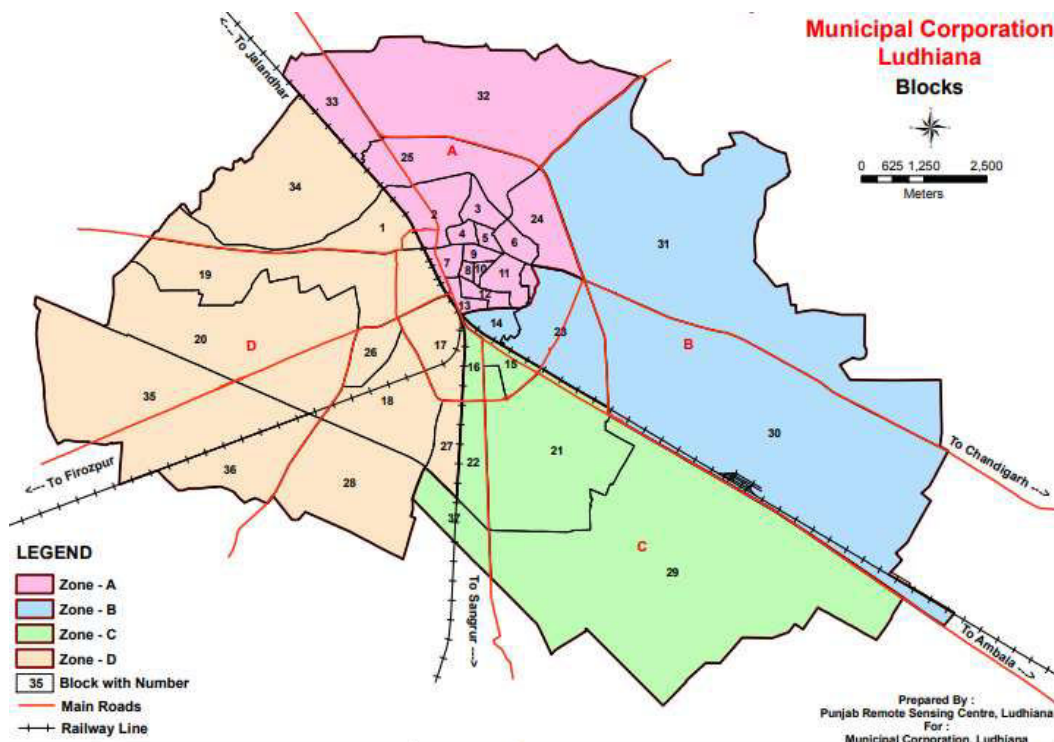


Figure 1. 3: Ludhiana MC Zones

Source: Municipal Corporation Ludhiana

The city is well connected to major cities (Chandigarh by NH 95 and to New Delhi, Amritsar via NH 1). The north Indian city is settled along the banks of the Sutlej River and hosts the largest agricultural university in Asia. The city is also a well-developed manufacturing and commercial hub in northern India, as well as being an important pilgrimage center for Sikhs.

1.6 RESEARCH HYPOTHESIS

The fundamental idea of this study is to find intangible planning aspects which affect pedestrian users in B&M retail markets. The research hypothesis is: -

“The intangible planning aspects of brick & mortar retail market will positively influence the user satisfaction.”

1.7 RESEARCH QUESTIONS

Which intangible urban planning aspects affect pedestrians while walking & shopping in brick & mortar retail markets?

What desired improvements are needed by pedestrians in brick & mortar retail markets?

1.8 AIM & OBJECTIVES OF THE PROPOSED WORK

The aim of this research is to have a perceptive understanding of intangible urban planning aspects of the built B&M retail markets.

Objectives to achieve the mentioned aim of this research are:

1. To investigate retail street planning aspects, which influence user satisfaction in brick-and-mortar retail markets.
2. To examine how urban landscape elements attract or repel pedestrian while walking & shopping in brick-and-mortar retail markets.
3. To analyze and interpret data by investigating attributes which are significant to brick-and-mortar retail markets.
4. To make recommendations for increasing footfall in brick-and-mortar retail markets for sustainable development.

1.9 SCOPE OF THE STUDY

The coverage of the current research to develop correlations user satisfaction and intangible planning aspects in B&M retail markets will be provided as mentioned below in order to test the hypothesis, identify solutions to the research questions, and accomplish the objectives: -

- The research will first identify the potential intangible urban planning aspects which have positive impact on user satisfaction in B&M retail markets by taking case study of B&M retail markets located in zone A and D, municipal corporation, Ludhiana.
- The study's later focus will be on impact of intangible planning aspects on user satisfaction in selected B&M retail markets of Ludhiana city.
- The research aims to suggest templates for B&M retail markets based on the problems and findings.

1.10 LIMITATIONS OF THE STUDY

Every research project is carried out according to a set of parameters that establish the scope of the study. However, it is not possible to include each part of the subject under study. For the same reason, the current study has the following general restrictions: -

- Research on intangible urban planning aspects of B&M retail markets are limited to selected four parameters (convenience & attractiveness, safety & security, comfort, and convivial environment).
- B&M retail market study is limited to A&D zones of Ludhiana city only with an objective to assess the effect of selected intangible urban planning aspects on user satisfaction in these markets.
- Policy framing of B&M retail markets is not considered in this research.

1.11 METHODOLOGY

An overview of the technique used for the study will aid in organizing the theoretical groundwork on various elements and the data needed to conduct an in-depth analysis to establish the impact of intangible urban planning aspects on user satisfaction in B&M retail markets.

Figure 1.4 depicts the step-by-step process used for the current study.

The process has been broadly split into the following five steps: -

- Problem formulation: - Problem is identified and based on that research hypothesis is framed.
- Theoretical framework: - Planning aspects of B&M retail markets will be explored and the importance of pedestrian user in these markets will be discussed.
- Data collection: - Firstly parameters will be finalized and then B&M retail markets in Ludhiana will be selected for further analysis.

- Data Analysis: - Relationship will be establish between selected parameters and user satisfaction through the application of various statistical techniques.
- Data interpretation & Recommendations: - Finally inferences templates for various groups of B&M retail markets would be suggested.

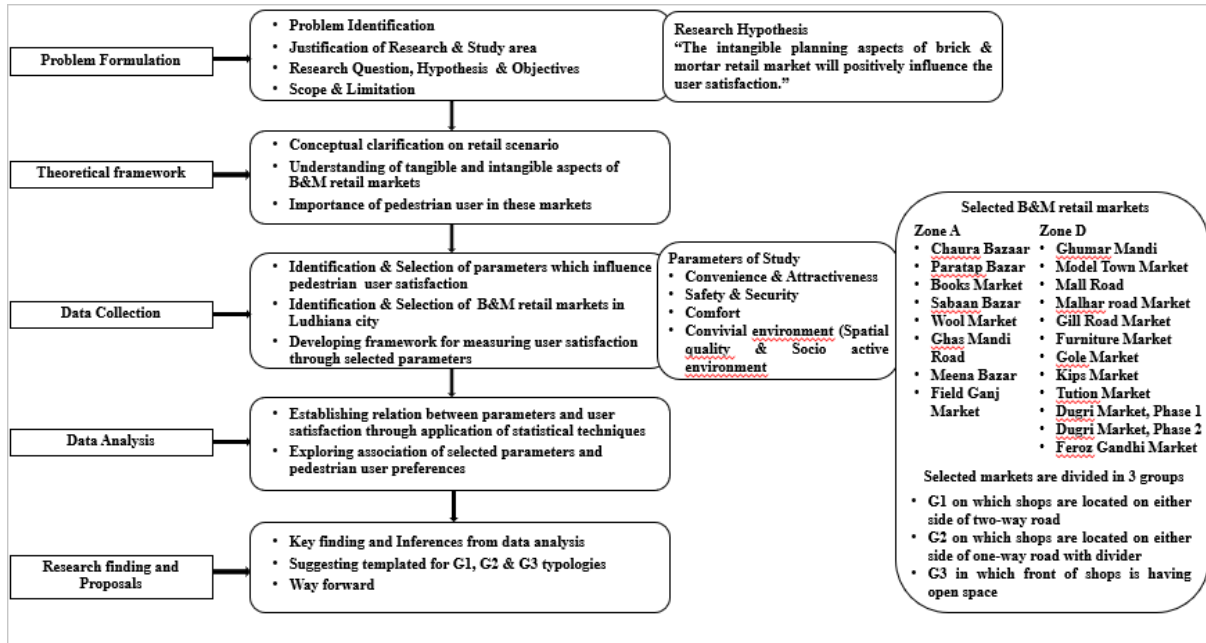


Figure 1. 4: Methodology

1.12 PROPOSED CHAPTERS

There are five chapters in the report on the current study. The following is a description of each chapter's outline:

Chapter-1: Introduction

This chapter includes an introduction to B&M retail markets, the significance of pedestrian in these markets, significance of the current study, the research objectives, the research hypothesis & research methodology.

Chapter-2: Literature Review

In this chapter the literature study is presented in five sections. The first section reviews the retail scenario over a period. The second section elaborates on the tangible and intangible aspects of the B&M retail market. The third section discusses pedestrians as one of the primary users in the B&M retail market environment. The fourth section describes urban planning and

street design elements for increased pedestrian movement. The final section includes significant studies pertaining to services and walkability.

Chapter 3: Research Design and Data Collection

This chapter aims to create and execute a system for identifying variables that positively affect pedestrian users in B&M retail markets. The first section of this chapter deals with the identification of determinants and the methods for analyzing factors related to pedestrian user satisfaction in B&M retail markets. The second portion deals with identifying B&M retail markets in order to conduct careful research into chosen criteria and user perception through field research at the segment level of chosen markets.

Chapter 4: Data Analysis

This chapter is divided into two parts: - The pedestrian user satisfaction in B&M retail marketplaces is examined in the first segment through the structural equation modelling (SEM) tool. Additionally, in the second section, segment-level metrics and traits have been examined in relation to their frequency across the entire city.

Chapter 5: Interpretation from Findings and Way Forward

The primary findings of the study are presented in this chapter to show the impact of intangible planning aspects on pedestrian users in B&M retail markets. Based on findings templates for selected typologies of B&M retail markets are proposed to enhance the user satisfaction in these markets. There are recommended next steps or new directions for study.

CHAPTER-2: LITERATURE REVIEW

In this chapter the literature review for the research topic is presented in five sections. The first part includes review on retail scenario over the period; second part elaborates tangible and intangible aspects of B&M retail market; third part covers pedestrian as one of the principal users in B&M retail market environment and Better Streets, Better Cities; fourth part describes urban planning and street design elements for increased pedestrian movement; and last section includes important studies in relation to services and walkability.

2.1 RETAIL SCENARIO

According to (Bahadir et al., 2008) the emerging organized retailing in India had witnessed revolutionary transformation. The author explains that although at present organized retail contribute only 2%, there is an existing customer potential in India and by the end of the decade the retail contribution is expected to grow by 20%. Similarly, (Kumar & Sarkar, 2011) elaborated the remarkable growth of organized sector in past years and presented that in the future, India will be an attractive retail destination for global retailers and it will emerge dynamically. They presented case example of tier I towns where development in organized retail is fast paced and in subsequent years this development would be witnessed by tier II cities and towns.

Change in customer behavior is main reason of organized retail growth in India is claimed by (Tesfay, 2016). Undoubtedly on one side various favorable factors for boost in organized retail are increased income, changing lifestyles, and patterns of demography, while on other hand values, culture and beliefs of customer arouse them to do shopping in traditional stores (Verma et al., 2016). Thus, author recommended that organized and unorganized retail sectors in India can co-exist and flourish side by side but both sectors need to keep customer satisfaction as their priority. The retail industry in India is severely fragmented, with unorganized retailers controlling 95% of the market but (Rathee & Rajain, 2022) claim that organized retail is preferred choice of consumer currently owing to better quality, diversity and added services (N. Y. m. Siu & Tak-Hing Cheung, 2001). They supported this through collecting data from NCR & Haryana region and analyzing it with statistical tools like SPSS and VARIMAX rotation, the result of the analysis was that the customer expected variety and added service next to quality. Omnichannel was described by (Frazer & Stiehler, 2014), as “an integrated sales experience that melds the advantages of physical stores with the implementation of rich experience of online”. According to author every 50 years retailing undergoes some kind of interference in the process, but the changes do not eliminate the previous process therefore

planners and retailers need to pick up the pace of changes and reshape the process in such way that customer expectations are fulfilled. The consumer behavior of customers wanting benefits of both physical and digital stores. Therefore, to promote omnichannel revolution retailers need to upgrade. Innovative omnichannel application is elaborated by (Anderie & Anderie, 2016). This application by becoming a personal shopping assistant to customers, can act as a bridge between physical and online stores. Additionally, it can also enhance the local shopping experience. Although in their research they found from customer point of view that, the application has some limitations as it was designed without direct consultation of majority of stakeholders due to limited time and team. Other limitations of this platform were not targeting any specific group; user felt security and trust issues and lacking previous experience. But overall, it was considered as an interesting development in the omnichannel world.

Arpita Agnihotri, (2015) discusses about the threat from online retailers to B&M retailers, as former is one of the major causes for decline in footfall in latter. Author finds, that to be a successful traditional B&M retailer one needs to adopt multichannel retailing strategies through which they can be present in both online and physical platform (Agnihotri, 2015). Additionally, resource utilization to benefit both the platforms is recommended (Garg & Garg, 2013). Thus, by integration multichannel B&M retailers could gain required competitive edge over pure online retailers. (Saha et al., 2016), investigated impact of offers given by e-commerce to consumers on brick-and-mortar stores. This they analyzed through data collected from Delhi and interpreting that price-choices is the main reason for consumer shifting from brick-and-mortar markets to online mode of shopping. They also reviewed that traditional brick-and-mortar stores are focusing on product variety to compete with e-commerce.

Nikaela Jacko Redd and Lutisha S. Vickerie, (2017) revealed through numerous case studies that management's ineffective use of technology is the primary cause of decline of international brick and mortar retail stores (Redd & Vickerie, 2017). This decline has negative impact on employers, low-income customers, and other related economic activities. Furthermore, it is elaborated by various approaches, like voluntarist, deterministic and strategic misalignment contribute to business failure. They suggest that brick and mortar retailers can by adopting omnichannel approach and integrating innovations such as artificial intelligence (AI), chatbots and cognitive computing, can survive in competition. Additionally, increasing retail store image, fusion of tangible and intangible measures, and decisive customer relationship with retailers can lead to success in terms of profit as well as can add value to the store (Tushar et al., 2020). Will Ashworth, (2021) described that retail industry is growing at fast pace every year and investors should concentrate on performance i.e., return on revenues, return on

invested capital, return on total assets, and return on capital employed, regardless of economic cycles or capital costs, in order to gain profit. Author also explains that customer service is unquestionably one of the most crucial factors in retail, but budgetary restraint should also be considered. A store can satisfy the four 'R's (relationship, relevance, reward, and reduction in cost) of retail more quickly the sooner it can recoup its original investment and investors in the Indian market should develop their plans while considering every potential risk if they want to make a return (Ashworth, 2021)

Jagdish Seth, (2021) describes the retail market of the post Covid world. In his paper, he elaborates the problems B&M retail is facing by comparing the growth of the global retail with e-commerce sector. The paper also elaborates the evolution of retail based on customer preference and behavior change. He highlights that the retail market changed from being local-centric to convenience-centric to experience-centric and will eventually transform into value and service-centric with the help of digital technology. To achieve this the paper suggests some strategies which can be adopted by traditional B&M retailers to become more digitalized and to provide their customers the best shopping experience. In the post Covid world these will help B&M retail to survive and thrive.

2.2 TANGIBLE AND INTANGIBLE MEASURES IN RETAIL ENVIRONMENT

Irreversibly, considering retail store image, fusion of tangible and intangible measures, and decisive customer relationship with retailers is accepted for its success in terms of profit, also it adds value to store. By taking an example in UK and Spain, (Burt & Carralero-Encinas, 2000), explained connection and contrast in customer perception of store image attribute both tangible and intangible, which must be handled carefully to have a consistent position in host market by international retail companies. Velitchka D. Kaltcheva and Barton A. Weitz, (2006) recommended that the consumer's motivational orientation controls the impact of the arousal produced by a store environment on the overall pleasant ambiance, which in turn affects shopping behavior. The two variables of affective response in a store environment are pleasantness and arousal. On the one hand, task-oriented customers focus on outcome rather than process, so high arousal reduces pleasantness and has a detrimental effect on shopping behavior. They also elaborated on recreational motivational orientation. Contrarily, high arousal improves the shopping experience for consumers who shop primarily for pleasure, which in turn boosts their propensity to visit stores and make purchases (V. Kaltcheva & Weitz, 2006).

Tony Kent, (2010) explored the role of creativity and retail industry in socio-cultural context. To analyze theoretical approaches to creativity and its applicability in retail industry, cross-disciplinary approach and stakeholder point of view is used. This revealed that by considering creativity as concept through design led approach, retailers could create opportunities in retail spaces. To stimulate consumer purchasing activity, retail design must be multi-faceted and in addition must be creative enough so that the customers can have best experience while shopping (Kent, 2010) . Ghosh in 2010 analyzed eleven variables related to retail store and shortlisted three factors i.e., convenience & merchandise mix, store atmospherics and services to have high impact on success in retail industry regarding customer satisfaction (Ghosh et al., 2010). The merit of consumer image factors and store familiarity on store brand purchase style were explored by Diallo. By choosing three French cities randomly, they discovered that a few variables, including value awareness, shop image perception, and price-image, have a big impact on the way people buy store brands (Fall Diallo et al., 2013).

Naushadul Haque Mullick, (2016) interpreted the shopping experience in Delhi retail stores. Author claims that along with shopping, the ambience should be created in such way that customer can relish the space with their family. Eventually leading to an increase in customer reliability and motivate them to visit store again. Concluding, these facilities can increase unique selling proposition (USP) of a retail center and will convert retail center into a successful brand (Mullick, n.d.). Tandon intended to understand the benefits sought by Allahabad and Kanpur city customers from retailers. From existing literature for the tangible and intangible customer benefits, variables were determined and analyzed so that retailers can attract or retain customers by establishing distinctive platform. They recommended that the increasing significance of intangible profits needs to be further explored (Tandon et al., 2016).

Teulings et al., (2018) discussed these developments from a land market point of view. They tested a microdata from big shopping area in Netherlands and found that consumers are simulated by amenities and facilities which is positive for B&M retail industry. Along with this they interpreted that retail profits and shop rents are affected by walking distance to the center of the shopping area (Teulings et al., 2018). Indeed, at global level different strategies regarding sustainability in terms of economics, environment and social are of utmost importance to all urban decision makers. F. Russo and A. Comi, (2017) described road safety impacts on social (accident victim) as well as economic (road accident) sustainability sphere. Usually while analyzing road safety flow of goods vehicles are considered but at the same time private flow due to private shopping is neglected, which also contributes to shopping flow. By concentrating

on the impact of transportation on social, economic, and environmental sustainability, they developed a general modelling framework for road safety assessment (Russo & Comi, 2017). Saruhan Mosler, (2019) elaborated that to engage activity and place, urban design should respond to urban landscape of that space. Urban landscape is composed of tangible as well as intangible qualities and form of architectural space where we live, work, and enjoy, so they should be designed as integral part of place-making process in the depth of time and space. Concluding, by considering Lynch approach of mental map, study claims that if urban landscape/space is designed with historic fabric of that city, it becomes a landmark and leaves a mark on tourist mental map (Mosler, 2019b).

Crispin Emmanuel Diaz and Konstantine Koh, (2022) explained in their study that the tangible aspects of pedestrianization are not the only desirable interventions to increase the visit of a user in a particular retail market. According to their research study, the users considered safety and security the most important factor to affect the visit in a particular area. Second to it was cleanliness and markets free of water logging. Improved walkways were the third priority of the users. This proved that it was the intangible factors like safety, security and cleanliness which affected the users from exploring a particular market area. Thus, both tangible and intangible interventions are required while designing a retail environment, which will help in increasing the daily footfall in that area (Diaz & Koh, 2022).

2.3 PEDESTRIAN NEEDS AND BETTER STREETS, BETTER CITIES

2.3.1 PEDESTRIAN NEEDS

The primary goal of identifying pedestrian needs is to offer a reasonable and persuasive justification for establishing standards for pedestrian infrastructure (*2017 Factors Influencing Retail Market and Its Infrastructure IJCIET_08_05_148*, n.d.; Shah, n.d.). Mobility, accessibility, safety, and health, which are commonly referred to as Gardner's "5Cs": Conviviality, Convenience, Connectedness, Conspicuousness, Comfort (1966) are the essential demands of pedestrians (Rae, 1966). By application of magnetic models and equation of motion, (Okazaki S., 1979) elaborated pedestrian movement regarding forces from different elements like column and other pedestrians present in architectural space. By displaying pedestrian behavior regarding given attributes on computer's cathode ray tube, author explained on one hand that pedestrian and an attraction attract each other, while on other hand pedestrian repel in presence another pedestrian and an obstruction exists in architecture space (Okazaki, 1979) . A Borgers and H. J. P. Timmermans, tested a microlevel Monte Carlo

simulation model to anticipate the destination and route choice action of pedestrian within city centers. Thus, by analyzing impact from model, growth of shopping streets could be envisioned and necessary actions could be taken to increase profitability of shopping streets.

Undoubtedly, in architecture, urban planning, land use, marketing, and the like, understanding the pedestrian's behavior and demand for retail facilities are valuable in many contexts (Borgers & Timmermans, 2005). A different perspective regarding total demand for retail facilities in inner-city shopping areas is suggested. They employed a route choice model with three sub models, one for destination choice, one for route choice, and one for impulse stops, to represent the walkable area and any movement occurring along the links between two successive nodes (Borgers & Timmermans, 2005). Antonini, used dataset which was collected by video sequences of actual pedestrians for depicting pedestrian behavior in presence of another pedestrian. Although standard image processing techniques are having limitation such as, illumination condition and image quality but, results obtained from videos generated by simulator using time-based approach showed significant improvement in noting and tracking pedestrians in real complex scenarios (Antonini et al., 2006a). While planning public facilities like squares, stations, airports and many others, perception of pedestrian flow in these crowded places to assure safety and to maintain the level of services in these facilities by planners is elaborated by (Miho Asano, 2009). Author suggested a microscopic model of simulation to determine the best route for a pedestrian taking other pedestrians into account, if the pedestrian wants to minimize their walking time by selecting intended trajectory without collision and unnecessary deviation that they find unacceptable in order to maximize their utility (Asano et al., 2009).

Marco Capitano, (2019) explained pleasurable influence of streetscape features on pedestrian behavior in urban design. In this research through case example of three radial streets in Kunitachi city, pedestrian behavior was analyzed with optional and compulsory routes. Simulation of pedestrian was done and found that pedestrian prefer the attractive route, irrespective of fact that it is longer than other optional routes which were also safe, short but had least streetscape elements (Russo & Comi, 2013). Thus, streetscape features like shading greenery of different kind and height, sitting opportunities and broad sidewalks make the route more interesting till our destination (Capitano, 2019). Paulo Anciaes and Peter Jones (2021) in their paper tell to prioritize walkability and to improve the various street uses through adapting various interventions. It introduces a new set of tools for generating and evaluating proposals for transferring street space to pedestrians in congested urban corridors. It provides detailed information of how options for street space reallocation translate into a complete

allocation of street space, in cross section, among different uses. Overall, the tools help practitioners to identify and assess options that address user needs and policy objectives, while considering the local conditions and technical constraints (Lu et al., 2022).

2.3.2 BETTER STREETS, BETTER CITIES

2.3.2.1 STREETS NEED ROOM FOR ALL USERS

The fact that Indian streets are built from the centerline outward, disregarding the demands of all users, is one of the major issues (León, 2023). The undefined outer portion is left for alternative uses while the median is demarcated and a highway built. Pedestrians, trees, utilities, street vendors, and social activities compete for the space left over after parking consumes a substantial portion of it. It is not surprising that, in most circumstances, the remaining space is insufficient to handle the crucial activities of the street in a safe and comfortable manner.



If a street does not provide separate space for pedestrian, people will walk in the carriageway.



A street with adequate space for walking and other activity, is safer for pedestrian

Figure 2.1: Streets need room for all users

Source: *Better streets, better cities, ITDP*

The primary goal of street design is to increase the mobility, safety, and livability of users. The reality they generate, however, is different, private motor vehicles occupy greater room frequently at the expense of other street activities. Pedestrian walkways may disappear, pedestrians do not, and because there is inadequate infrastructure for pedestrians, individuals are forced to cross the roadway. The same is true for sellers on the street and public transportation (Lam et al., 2009). For everyone involved, especially pedestrians, the resulting arrangement is unpleasant, uncomfortable, and unsafe. All streets need distinct slow zones in order to maximize mobility. The slow space is for livability—for people to walk, converse, and connect with one another; for adults to conduct business; and for kids to play. The mobility zone of a street can offer safe, largely uninterrupted mobility at moderate speeds with the

provision of a sufficient slow zone. Everyone will benefit from the safer and nicer street environment that results. It should be remembered that the speed at which cars can pass through crossings significantly determines the motor vehicle capacity of metropolitan streets.

2.3.2.2 PRINCIPLES FOR STREET DESIGN

The design approach is guided by the following principles:

Safety: - All users must feel comfortable on the streets. This suggests that there should be a slow zone where pedestrians have priority on every street. The entire street, including pedestrians, vendors, cyclists, and cars, becomes a slow zone in smaller streets with a shared space pattern.

Mobility: - Larger roadways may have a mobility zone for moving vehicles. The slow zone is physically divided from this mobility zone, which is for personal vehicles and public transportation. If there is a significant speed difference between cyclists and motor vehicles, the mobility zone may contain a separate cycle track. Dedicated bus lanes can also enhance the level of service provided to consumers of public transportation.

Pedestrian accessibility: - All streets must have uninterrupted pathways or safe shared areas with little to no grade separation and enough space for pedestrian through circulation.

Livability: - All streets must have uninterrupted pathways or safe shared areas with little to no grade separation and enough space for pedestrian through circulation.



Figure 2.2: Principles for Street design
Source: *Better streets, better cities, ITDP*

Sensitivity to local context: - Local Street activity, pedestrian movement patterns, and surrounding land uses should all be considered while designing streets.

Creative use of street space: - For instance, if a parking lane has intermittent bulb-outs for street vendors or street furniture, it might serve many purposes.

2.3.2.3 STREET DESIGN ELEMENTS

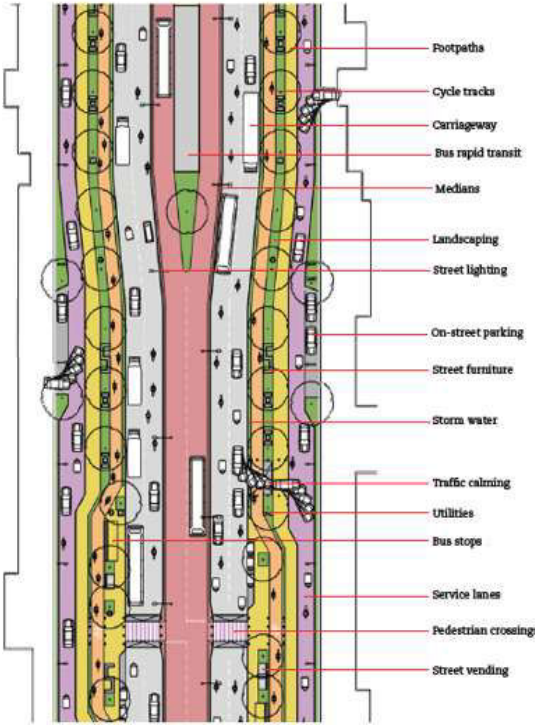


Figure 2.3: Street design elements,

Source: Better streets, better cities, ITDP

There are sixteen roadway design components that can accommodate or perform functions. For instance, a pathway encourages walking and street lights increase safety. All sixteen elements are depicted in figure 2.3. Street design components require careful planning and must be altered to meet the local environment. Every element interacts and affects one another. Utility-oriented features, for instance, are primarily underground, but when they emerge as manhole covers and utility boxes, they might affect the usability of components like walkways and bicycle lanes (S. Jain & Architecture, 2019).

STREET DESIGN GUIDELINES – UNIFIED TRAFFIC AND TRANSPORTATION (PLANNING AND ENGINEERING CENTRE)

The Unified Traffic and Transportation (Planning and Engineering Centre) promotes the idea that streets are important movement corridors and public places. The street hierarchy and

adjacent land uses influence street design. The following VISION, under which UTTIPEC operates, is stated in the National Urban Transport Policy (2006) of the Government of India:

- To recognize that people occupy center-stage in our cities and all plans would be for their common benefit and well-being.
- To make our cities the most livable in the world and enable them to become the “engines of economic growth” that power India’s development in the 21st century.
- To allow our cities to evolve into an urban form that is best suited for the unique geography of their locations and is best placed to support the main social and economic activities that take place in the city.



Figure 2.4: Need for Street Design Guidelines,

Source: *Street Design Guidelines* © UTTIPEC, DDA 2009

2.4 INCREASED ATTENTION OF PEDESTRIANS IN STREET DESIGN

- An improvement in comfort for those who currently stroll.
- Convenient last mile connectivity from MRTS Stations, resulting in increased bus and Metro travel.
- Less reliance on the car if shorter journeys can be successfully completed on foot.
- Better health for those who walk because they get more exercise.
- Prioritizing non-motorized private modes and public transportation in roadway design
- Lessening the number of cars on the road will reduce traffic and pollution.
- Greater equity in the distribution of public spaces and facilities to all societal groups.

2.4.1 ESSENTIAL GOALS

1. **Mobility Goals: Mobile Objectives: To encourage the usage of public transportation:**

- To retrofit streets to provide public transportation and pedestrians an equal or higher priority.
- Provide mixed land use patterns that are transit-oriented and re-densify the city within a 10-minute walking distance of MRTS stops.
- During rush hours, designate lanes for HOVs (high occupancy vehicles) for carpooling.

2. **Safety, Comfort Goals: To ensure pedestrian safety:**

- By reducing setbacks and boundary barriers and constructing right up to the border of the street ROW, you can create "eyes on the street." This would allow people to see the pavement from inside, deterring misbehaving, peeing in shadowy places, etc.
- If site enclosure is required, transparent fencing should be used higher than 300 mm above ground level.
- Establish a minimum transparency requirement of 30% for business facades.
- Provide sufficient street lighting for cyclists and pedestrians.
- To promote walkability, boost street activity, and ensure safety, establish commercial/hawking zones at regular intervals for example 10 minutes' walk from every dwelling in the city.

For climatic comfort:

- Trees are a necessary part of every street because they shield pedestrians from the sun and lower solar gain.
- Paving materials with high albedo (diffuse reflectivity) lessen the impact of urban heat islands.
- Buildings with overhangs and arcades that are built to the edge of the pavement offer good protection to pedestrians.

3. **To guarantee facilities and accessibility to all street users:**

- Install at-grade crosswalks and overpasses on highways, aligned with the locations of transit stops, the types of land use activities that take place on the street, and the entries and destinations of nearby buildings.

- To ensure high use, place trash cans, postboxes, signage, and other public utilities at street corners.
- Install accessible public restrooms every 500 to 800 metres, preferably adjacent to bus stations so that pedestrians and users of other forms of public transportation can easily reach them.
- Adhere to universal accessible design guidelines to ensure that people with physical disabilities may completely navigate public streets and crosswalks.

4. Ecological Goals: To help with natural storm water management and lessen the urban heat island effect:

- Reduce impermeable surfaces by using tree planting areas, permeable paving, and other techniques to boost ground water penetration and reduce seasonal flooding.
- Use bio-filter beds, bio-swales, and detention ponds to include natural storm water filtration and absorption into street design.
- Reduce the Heat Island Effect (HIE) by using reflective surfaces, more vegetation, and tree planting.



Figure 2.5: Essential components of all streets,

Source: *Street Design Guidelines* © UTTIPEC, DDA 2009

2.4.2 DESIGN TOOLKIT: MANDATORY COMPONENTS

- The Three Pavement Zones: - Pedestrian Only Zone

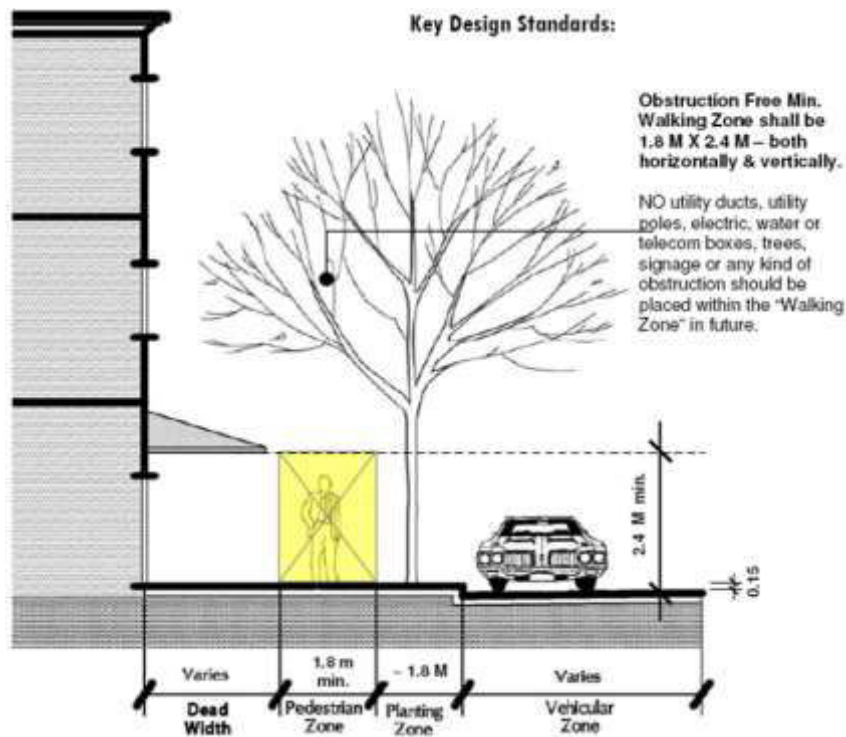


Figure 2.6: Pedestrian Only Zone,
Source: *Street Design Guidelines* © UTTIPEC, DDA 2009

- The Three Pavement Zones: - Dead Width or Frontage Zone

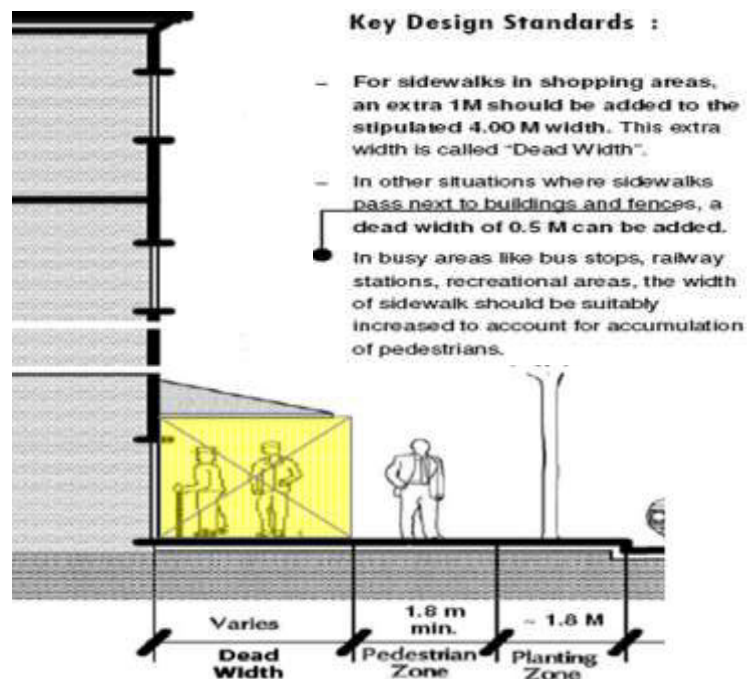


Figure 2.7: Dead Width or Frontage Zone,
Source: *Street Design Guidelines* © UTTIPEC, DDA 2009

- **The Three Pavement Zones: - Multi-Functional Zone with Planting**



Figure 2.8: Multi-Functional Zone with Planting,
 Source: *Street Design Guidelines* © UTTIPEC, DDA 2009

2.5 URBAN PLANNING

Imageability was introduced by Kevin A. Lynch in 1960, it means the perception of an urban environment which make mental image of any city or town in user's mind (*THE IMAGE OF THE CITY* Kevin Lynch, n.d.). Jacqueline Tyrwhitt, (1960) elaborated how clarity & legibility of urban events could leave impression on visitors by five elements: - paths, edges, districts, nodes, landmarks. To identify and recognize city, breakdown of urban events into five elements is explained through case examples of three American city -Boston, Jersey City & Los Angeles. Concluding review of book, author claimed that imageability plays pivotal role in urban settings and it can be done by interrelated planning of mentioned five elements (Tyrwhitt, 1961). Sanjay S. Jadon, (2007), comments that primary research in Indian context regarding urban space design have been negligible (Jadon, n.d.). Various western approaches, like Lynchian perception of imageability of city by five elements, Jane Jacobs, 1961 (Tavolari, 2019) guarded lively street life, crowded pedestrian sidewalks & traditional neighborhoods, Hall, 1966 perceptions of space are built and patterned by culture and the like, are analyzed (Rodwin & Jacobs, 1961). Further author claims that perception of urban development by overlapping western theories and concepts of urban planning without recognizing ground realities of socio-cultural patterns is not sufficient to achieve desired results (Stevens & Hall, 1966; Wendt, 2009).

Gert-Jan Hospers, (2010), in paper “Lynch’s the Image of the City after 50 Years: City Marketing Lessons from an Urban Planning Classic” claimed that even after fifty years of publication, still the study of perception of image by user in making city image in their mind, is applicable and up to date (G. J. Hospers, 2010) (Book, 2016). Importantly it is not only relevant for urban planners, but psychologists, geographers and today’s city marketers can also take advantage of highlighting the city with respect to five elements: - paths, edges, districts, nodes, landmarks (G.-J. Hospers, 2010). He reviewed three cities -Helsinki, Bielefeld & Enschede and recommended that for purpose of city marketing they should explore five elements, as a strong link exists between a city image and its built environment. (Patrick T Reardon, 2012), in his article Book review: “The Death and Life of Great American Cities” by Jane Jacobs claimed that even after fifty years of publication (1961), it is complicated book to study. Author comments that in fact, in her book, through hymn, she argues in fighting for planning from street level perspective, having mix use of building types is accepted, but at same time her criticism against high rise development ignores other set of people who are in favor of living in group towers (Bettencourt, 2019) .

Clara Greed, (2010) proclaimed by examining micro street level situation that inclusive urban design applications are not considered in many designs policies regarding sustainable urban settlements. In these policies although enough considerations are given to disabled but needs of older people & women are not considered and author claims that this is one of other reasons for their discomfort, as they cannot access and move comfortably in these public spaces (Greed, 2010). Afacan, discussed need and expectation of various users in shopping mall in Turkey. In survey, it was cleared from user’s point of view that exclusive approach in public space is more considered and by this approach expectations of diverse user is not fulfilled. Various factors of inclusive approach were elaborated which increase quality of life by making public space more user friendly (Afacan, 2012). A.K. Jain, (2012) elaborated need and evolvment for redevelopment process to enhance life and economic sustainability in one of the most important parts of Delhi. Author described the importance of renewal of selected area by improving infrastructure and adding urban landscape elements which will increase the interest of visitors along with our heritage could be preserved by restoration of important buildings without changing the traditional character (Matsuoka & Kaplan, 2008). Undoubtedly, various legal reforms are existing which also focuses on conservation and sustainable redevelopment (A. K. Jain & Cooper, 2012).

In recent years, globally numbers of private vehicles have increased manifold creating negative impact on social as well as environment aspect and in addition, it is one of other reasons for be

decline in pedestrian in many of public realm. Through case examples (Florina Dutt, 2016) emphasized for better health and environment condition in Indian cities, public realm should be redesigned by implementing design strategies which promote walkability and non-motorized mode of transport as these public places are central interaction space for all users (Dutt, 2015). In current urban scenario undoubtedly, pedestrians are exposed to danger in urban places like streets, airports, and the like public places. Meenakshi Singhal, (2018) perceives that pedestrian are considered minor player in guidelines and policies in India, but it does not mean that they are minority in road user. Undoubtedly, in B & M markets pedestrian plays pivotal role. Author elaborated collective social and physical factors which caused disintegration of the pedestrian from urban area. As safe walkable environment has positive impact on social, health and environment, thus at global level governments are making efforts to make their cities as well as neighborhood more pedestrian favorable is need of the hour (Singhal, 2018).

Undeniably, in rapid and densely urbanizing countries like India, expansion of extensive retail format raises deliberate concern for urban environment and town planning, thus demand for rational regulation cannot be neglected. Anuradha Kalhan and Martin Franz, (2009) claimed that restrictive regulations such as no ceiling on the size of retail outlet, effect on limited urban space & energy and the like are considered in retail urban planning regulations (Lall et al., n.d.). Lastly through comparative experience with countries like Germany, they recommended that India should improve regulatory frameworks regarding retail industry. Planning and laws, which interpret the relationship between collective interest and private interest, undoubtedly have a noticeable impact on activities in the private sector, such as retail (Kalhan & Franz, 2009). Jose Rio Fernandes and Pedro Chamusca, (2012) provide evidence from comparative analyses of France, Portugal, Sweden, and Turkey that regulations and planning systems are crucial to understanding urban retail structure in these nations and are unquestionably influenced by socio-cultural and economic factors unique to each one (Fernandes & Chamusca, 2014).

Undoubtedly, small retail stores, also known as “mom & pop” store covers dominated part of Indian retail industry. Valiaparampil Joseph Sebastian and Rakesh Gupta, (2018) claims that Indian retail on one hand had created interest among global players to set organize structure due to the future growth potential and on other hand it had created concern and worry in small retail stores (Kalhan & Franz, n.d.). They recommend before liberalization in retail sector, judicious and aggressive regulations and policies should be taken to transform traditional stores and make them to compete with modern retailers for better probability for overall retail sector in India (Sebastian & Gupta, 2018). Catharine Ward Thompson, (2013) suggested a strategy

through a model of action (pressure, state, exposure, effect and driving force) and context (social, cultural, economic, demographic, and behavioral perception of surrounding). In previous research it was highlighted that, policies are recommending green space and green infrastructure to improve quality and health of space. Author elaborated that urban landscape elements plays a pivotal role in aesthetic and activities performed in space, which is admired by all age groups (Thompson, 2013).

2.5.1 EXAMPLES OF INCLUSIVE APPROACH

Santosh Tiwari, (2013) focused on Abraham Maslow's theory for uplifting public-pedestrian zones as he believed that along with physical, psychologic needs of all human being should be taken care. Further considering international successful examples of city cores where planners were able to make these areas fully or partially pedestrianized, it was recommended same should be implemented in contemporary cities in India to preserve the original character of place for whom it was designed i.e. "The Pedestrians." For fulfilling needs of stakeholders in exclusive pedestrian precincts layouts, concern for behavior of all users including child, old age and physically challenged should be considered appropriately. In many cities of India, still a major mode of transport is walking, but in public precincts, absence of facilities and amenities for pedestrian and increased number of vehicles is main reason for road accidents, thus planners along with decision makers should fulfill pedestrian need for safety and comfort (Tiwari, 2013). Purnima Parida, Jiten Shah and S. Gangopadhyay, (2014) recommended that by providing grade separated, the movement of pedestrian would be safe and comfortable. For checking feasibility of skywalk, study considering both tangible and intangible measures was conducted in 1305 meters stretch in Chandni chowk area, interpreted that along with time savings to the pedestrian it is economically viable measure for safe and convenient for walking (*Chandni Chowk MEMOIRS OF A TRADITIONAL MARKET*, n.d.; Parida et al., 2014).

Ashima Krishna, (2016) discusses how economic interests, political support, and public involvement all serve as catalysts for the process of preserving culture and heritage. To back up this claim, a qualitative analysis of one of Lucknow's most famous traditional market precincts, Hazratganj, was conducted. It was concluded that all three of the catalysts were successful in improving the precinct, and that because the stakeholders were involved, they felt a sense of ownership over the project's success. The success of these kinds of initiatives can undoubtedly inspire towns to develop longer-lasting and more enduring local policies to conserve their cultural heritage (Krishna, 2016). Undisputedly, footfall in public areas like shopping streets is decreased drastically in recent years and one of major reason is safety issues due to increased vehicles (Krishna, 2020). Chanda Malhotra, has intended that for better socio-

economic and environment sustainability public spaces should retain its main purpose i.e., better accessibility and mobility for pedestrian movement which make space lively and vibrant. Through case example of Aminabad bazar author emphasized the need for restoration of market is need of hour to bring back the color, life and make it attractive place as it was in past (Mattone & Vaidya, 2016).

Kunal Doley, (2017) claimed that after adding urban landscape elements and restoration of existing façade in 1km stretch of Golden Temple heritage street, which earlier appeared congested but now same space appear to be huge and attractive resembling open monuments in Rome, Venice and Florence. Added features like identical signboards for the shops like the markets of Jaipur, improved services, various streetscape furniture and fountains depicting our heritage etc. are having positive impact on social as well as economical aspect (Doley, 2017). Monument erected in memory of martyrs who lost their life in 1919 massacre in front of Jallianwala Bagh gate is becoming main attraction. Aman Randhawa and Ashwani Kumar, (2020) sought to analyze the urban development difficulties in Ludhiana city core and offer appropriate measures based on the principles of smart development. This city has a strong economic foundation since it contains a commercial core and manufacturing businesses, which have sparked the population and led to fast urbanization (Randhawa & Kumar, n.d.).

2.6 VARIOUS TOOLS & TECHNIQUES TO MEASURE SERVICE QUALITY & WALKABILITY

2.6.1 APPROACHES FOR ASSESSMENT OF THE SERVICE QUALITY

Indisputably, concerning service quality of retail stores, consumer's satisfaction is one of the important factors which make them loyal to retail stores (Asadi-Shekari et al., 2014). Having strategic significance still to evaluate service quality, Indian merchants lack the necessary tools to quantify it, therefore (Subhashini Kaul, 2007) examined the applicability of international research perspectives in India. Analyses done in research indicates that service quality parameters of retail service quality scale (RSQS) are not relevant to measure service quality in Indian retail due to difference in culture and environmental factors (Kaul, 2007). The quality assessment of urban environment by (T Y Ovsiannikova and M N Nikolaenko, 2015) focuses on the research applicability of quality management issues with construction items. Urban environment quality evaluation is based on an integrated approach that considers all aspects as systems and applies both quantitative methods of assessment (such as the computation of specific and integrated indicators) and qualitative methods (expert estimates and surveys)(Ovsiannikova & Nikolaenko, 2015).

(Zohreh et al., 2014) present pedestrian design indicators based on various guidelines that take various pedestrian needs into consideration. This study introduces the pedestrian level of service (PLOS) for campuses, a tool to evaluate campus street amenities and pedestrian infrastructure. This method can be used to identify pedestrian-related problems on the roadway and make recommendations for improvements to the current campus streets (Asadi-Shekari et al., 2014). Noel Y. M. Siu and Jeff Tak-Hing Cheung, (2001) use a validated retail service quality scale to analyze how department store chains provide service and how it influences consumer behavior. As a result, convenience, policy, outward appearance, promises, and personal interaction are produced. The findings indicate that physical appearance and policy have the greatest effects on the overall service quality and future consumption, respectively (N. Y. M. Siu & Tak-Hing Cheung, 2001).

2.6.2 APPROACHES FOR ASSESSMENT OF THE PEDESTRIAN ENVIRONMENT

Various researchers attempted to study the influence of physical environment variables on walkability by considering the varied range of features – from a small subset to an entire comprehensive list. The variables, being large in number and too complicated and diverse in nature, do not offer themselves to a single method of query. While some aspects may be easily measured in objective terms, others are more subjective in their dispensation. Some features provide a macro-framework for analysis; the other features must be investigated at a micro-level in the urban environment. Baran et al., (2008) tried to understand how walking behavior and syntactical elements of street design are related. In the Chapel Hill-Carrboro neighborhood of North Carolina's Research Triangle region, researcher examined both a classic suburban neighborhood and a modern urbanist neighborhood (KUMARAN & BARANDHAMAN, n.d.). Three spatial syntactic measures—control, local integration, and global integration—were connected to residents' walking behavior in these communities while accounting for the effects of individual and household level characteristics (Figure 2.9). The reason for walking was also utilized to distinguish between leisurely and practical walking. It was anticipated that residents of streets with higher levels of control, local integration, and global integration would walk more frequently than residents of other streets.

According to space syntactic theory, the configurational characteristics of urban space can be described and quantified. According to the theory, the built environment either makes it easier to go from one location to another or makes it more difficult, as determined by its syntactical characteristics. Higher mobility densities will typically be attracted to places that are more physically connected to one another and have longer lines of sight. Imageability, confinement,

human size, transparency, and complexity are some of the subjective characteristics of the urban street environment that aimed to quantify completely and objectively.

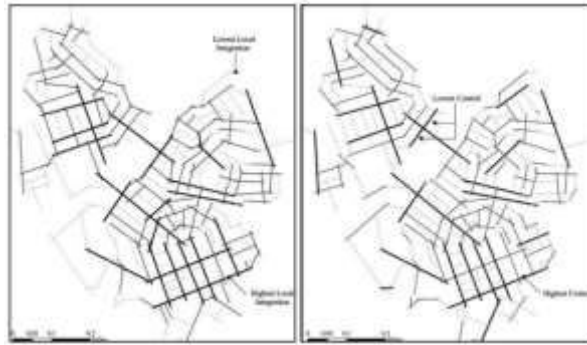


Figure 2.9: Illustrations for the Space Syntax Measures,
Source: Baran et al (2008)

In order to measure the urban design characteristics of the street environment and evaluate them for meaningful connections with walking behavior, the study sought to provide researchers with operational definitions. Ten specialists in urban design and planning from the academic and professional worlds were gathered on a panel. For practical reasons, streetscape videos rather than field trips were utilized to assess the aspects of urban design. The creation of a methodology that would replicate the experience of pedestrians came next. A visual evaluation was conducted on more than 200 scenes that were filmed in numerous American cities. In the creation of statistical models, the physical characteristics of the street environment served as the independent variables and expert panel evaluations as the dependent variables. Consensus qualitative definitions were developed for each of the five aspects of urban design, and major physical elements were noted. To maintain uniformity, specific operational guidelines for assessing each physical aspect were also devised (Ewing & Handy, 2009). Following are characteristics thought to strongly contribute to the five aspects of urban design:

- Imageability - While the number of people and outdoor dining were found to have an impact on how people walked, landmarks, distinctive architecture, and public art were determined to be unimportant.
- Enclosure - While average street width, average building setback, average building height, and the relationship between the width of the street and building height were not found to be significant, street walls and building facades, as well as views ahead and across the street, were found to be significant to walking behavior.
- Human scale – While the tall buildings on the same side of the street were considered distracting, the first story windows, tiny planters, and street furniture were all present and significant.

- Transparency - Windows at ground level and human activity along the street were found significant to the walking behavior; while windows above ground level were insignificant.
- Complexity - The amount of building materials, building projections, textured sidewalk surfaces, street lights, and other sorts of street furniture were all deemed to be negligible, however human activity and physical aspects were judged to be relevant.

The viability of utilizing Google Street View to audit urban landscapes was investigated by (Rundle et al., 2011). Data were acquired for 143 objects connected to seven urban environment constructions, and the agreement between the field audit and the Street View data was evaluated (aesthetics, physical disorder, pedestrian safety, motorized traffic and parking, infrastructure for active travel, sidewalk amenities, and social and commercial activity). The study claims that Google Street View may be used to examine urban environments (Rundle et al., 2011).

2.6.3 OVERVIEW OF AVAILABLE AUDIT TOOLS

As a means of encouraging planners to pay attention to the needs of pedestrians, researchers and planners have created a variety of walkability checklists and level of service (LOS) tools to assess the pedestrian environment. These evaluations differ substantially, especially in terms of the quantity of questions, the quality of documentation, and the level of information. Walking audits frequently gather quantitative and qualitative information about the social and physical factors influencing walking. The walking audits are intended to focus on and promote the needs of pedestrians as a mode of transportation. A variety of different stakeholders, including local community groups, transport planners or engineers, urban planners, urban designers, and local politicians or councilors, may participate (Lee et al., 2006).. The straightforward yet effective tool would provide information to traffic engineers, planners, and other decision-makers that can assist identify locations that are conducive to walking or that require adjustments, and it would build a foundation for implementing the necessary changes or enhancements. These can also be used to evaluate projects that aim to alter the physical environment, such as planned development plans or other initiatives.

There are many different walking audit technologies available, and they can differ in the amount and type of data they gather. Typically, the goal would be to develop an environmental inventory, evaluate the quality of the environment at the route or area level, or calculate the latent demand for walking. Some audits focus more intently on the specifics of the various street segments. A thorough and extensive assessment can be obtained by gathering data on

every roadway segment, but doing so would need a lot of labor for audit training, data collecting, and data processing. An overview of the walkability along routes to recreation or transportation can be provided by audit data collected at the neighborhood level, but it may not be indicative of any place that is a nuisance. There are a ton of walking audit tools, with the majority being American or Australian (Lee et al., 2006). Depending on the audit participants, the required data, and the available resources, the best form of audit instrument will be chosen. An overview of three frequently used audit tools is: -

- The Pedestrian Environmental Quality Index (PEQI),

APPENDIX B

Pedestrian Environmental Quality Index (PEQI) Survey

San Francisco Department of Public Health, Program on Health, Equity and Sustainability: www.sfphe.org
Last Revised: August 2008



Neighborhood:		Surveyed By:		Survey Date:	
Project:		Date Entered into Database:			
INTERSECTIONS					
Intersection CNN #:			Primary Street:		
			Secondary Street:		
	1. Crosswalk	2. Ladder Crosswalk	3. Pedestrian Signal		7. No Turn on Red Sign(s)
			WITH count-down	NO count-down	0
4 Directions					3
3 Directions					1
2 Directions					4
1 Direction					2
None					
4. Traffic Signal at Intersection:			Yes		
			No		
If Yes - Crossing Time: (seconds)					
Intersection Length: (feet, walking along Primary Street)					
5. Crossing Speed: (Length, feet / Crossing Time, seconds)			Faster than 3.5 ft/sec.		
			Slower than 3.5 ft/sec.		
6. Crosswalk Scramble:			Yes		
			No		
			9. Additional Signs for Pedestrians:		Yes
					No

















STREETS				
Street:		CNN #:		
Cross Street #1:		Cross Street #2:		
Domain:	Indicator:	Indicator Values:	Comments:	
Vehicle Traffic:	10. Number of Lanes: (not including turning only lanes)	4 + Lanes		
		3 Lanes		
		2 Lanes		
		1 Lane		
		No Lanes		
	11. Two Way Traffic:	Yes		
		No		
	12. Vehicle Speed - Is there a posted speed limit?	Yes		
		No		
	Speed Limit:	10 mph	35 mph	Note: San Francisco default street speed limit is 25 mph.
		15 mph	40 mph	
		20 mph	45 mph	
		25 mph	50 mph	
		30 mph	55 mph	
>55 mph				
	13. Street Traffic Calming Features:	Yes		
		No		
Check all that apply:				
Chicanes	Rumble Strips	Speed Tables		
	Speed Humps	Street Medians		
Pavement Treatments	Speed Limit Enforcements			

: should be able to observe while standing in one place


: best assessed while walking along the street

NOTE: From this point on, street conditions on each side of the street are recorded separately.

Northern or Eastern side = N/E; Southern or Western side = S/W.

Domain:	Indicator:	Indicator Values:	N/E	S/W	Comments:
Sidewalks:	 14. Width of Sidewalk:	No Sidewalk			Note: Measure at approximately mid-block (but not at a bulbout/curb extension).
		Less than 5 ft.			
		5-7 ft. 11 in.			
		8-12 ft.			
		Greater than 12 ft.			
	 15. Impediments in Sidewalk Surface	Significant			Note: 1 large impediment on segment is significant. Should be able to push a stroller without a problem.
		Few			
		None			
		No Sidewalk			
	 16. Large Sidewalk Obstructions:	Yes, Permanent			Note: 2 people should be able to walk side-by-side along the entire sidewalk.
		Yes, Temporary			
		No			
		No Sidewalk			
	 17. Presence of Curb:	Curb			
		No Curb			
 18. Driveway Cuts: (Please enter count and check a category)	Enter Count (#):				Note: Parking garages count as 2 (i.e., vehicle entry and exit in same driveway = 2 cuts)
	5 or more				
	Few (less than 5)				
	None				
 19. Trees:	Continuously Lined				
	Sporadically Lined				
	None				
 20. Planters/ Gardens:	Yes				
	No				
 21. Public Seating:	Yes				
	No				
 22. Presence of Buffer:	Bike Lane (BL)			Note: Street cleaning restrictions do not count as time-restricted parallel parking.	
	Parallel Parking - not time restricted (PP)				
	Time-restricted Parallel Parking (TPP)				
	BL and PP				
	BL and TPP				
	None				
Land Use:	 23. Storefront/ Retail Use:	3 or more			Note: This should reflect businesses only. Include ground floor businesses with window treatments, displays and open shades.
		1 or 2			
		0			
 24. Public Art / Historical Sites:	Yes				
	No				
Safety/ Other:	 25. Illegal Graffiti:	Yes			
		Little to None			
 26. Litter:	Yes				
	Little to None				
 27. Ped Scale Street Lighting Present:	Yes, Street Lighting				
	Yes, Private (business or residential)				
	No				
 28. Construction Sites:	Yes				
	No				
 29. Abandoned Buildings:	Yes				
	No				

 : should be able to observe while standing in one place

 best assessed while walking along the street

PEQI is a hybrid quantitative and qualitative measure, has been adapted by Austin's Planning and Development Review Department to create a tool that evaluates pedestrian needs, wants, and infrastructure gaps. The PEQI is a spatial index that mainly uses primary field data to quantify environmental parameters at intersections and on streets.

- Global Walkability Index (GWI)

GWI is a remarkable and subjective qualitative index which relies on the context-sensitivity. Walkability index under this method include three components i.e., safety, convenience, and policy support.

Table 2.1 Overview of components and variables, Source- (Krambeck & Shah, 2006)

Component	Variable
Safety & Security	<ul style="list-style-type: none"> • Proportion of road accidents that resulted in pedestrian fatalities • Walking path modal conflict • Crossing safety • Perception of security from crime • Quality of motorist behavior
Convenience & Attractiveness	<ul style="list-style-type: none"> • Maintenance and cleanliness of walking paths • Existence and quality of facilities for blind & disabled persons • Amenities (e.g., coverage, benches, public toilets) • Permanent and temporary obstacles on walking paths • Availability of crossings along major roads
Policy Support	<ul style="list-style-type: none"> • Funding & resources devoted to pedestrian planning • Presence of relevant urban design guidelines • Existence & enforcement of relevant pedestrian safety laws & regulations • Degree of public outreach for pedestrian & driving safety etiquette

Global walkability index includes, a field survey and a public agency survey, overview of which is provided in Table 2.

Table 2.2 Overview of two types of surveys, Source- (Krambeck & Shah, 2006)

Public agency survey	Field survey
<ul style="list-style-type: none"> • Data which could not be collected through physical infrastructure survey like, pedestrian fatality statistics, pedestrian related regulation and like, is collected under this survey. 	<ul style="list-style-type: none"> • It is used to collect data like, crossing safety, amenities, disability infrastructure, which is collected by surveys within local populations to prevent bias results.
<ul style="list-style-type: none"> • Data is collected from administrators in the selected area who are responsible for urban and transport planning. 	<ul style="list-style-type: none"> • 10 stretches of road are surveyed on a scale of measurement of 1 to 5 (1 entity is lowest, 5 highest) rating.

Method to calculate Walkability index Step1- For each surveyed area, field data was collected in peak time on business day, to record Level-of-Service (LOS) for mentioned nine variables

under field survey in data collection, on a scale of measurement of 1 to 5 (1 entity is lowest, 5 highest). To standardized results, calculation is done as per below mentioned equation 1: -

Each LOS X Pedestrian count X length of surveyed road X10 / 10 -----Equation 1

To evaluate final average, calculation is done as per below mentioned equation 2: -

Sum of unweighted averages / the total number of survey areas -----Equation 2

Step 2- To calculate scores of this survey, data was collected from administrator of municipality, Ludhiana, regarding each variable and points were assigned to response for 5 questions. Final average is acquired from the sum of points evaluated under 5 variables as per GWI method.

Step 3- The final GWI is derived by adding average of field survey and average of public agency survey. Through this method along with pedestrian preferences, government policies are also considered for final calculation of walkability index.

Table 2.3 Sample Filled-In Public Agency Survey, Source- (Krambeck & Shah, 2006)

1) Please rate degree of municipal funding and resources devoted pedestrian planning:	<input type="radio"/> Enough to sustain a high-quality program in long-term <input type="radio"/> Sufficient for short term, but not the long term <input type="radio"/> Neutral <input checked="" type="radio"/> Insufficient to achieve meaningful goals <input type="radio"/> Non-existent																																																		
2) Please check the pedestrian-related urban design guidelines that are already well-established. Feel free to add any relevant guidelines that are not included in the list.	<input checked="" type="checkbox"/> Sidewalk pavement type <input type="checkbox"/> Placement of benches and similar amenities on walk paths <input type="checkbox"/> Sidewalk widths <input type="checkbox"/> Design for disabled persons <input type="checkbox"/> Other _____ _____																																																		
3) Attach available data on pedestrian fatalities and injuries to survey materials. Enter estimated proportion of traffic fatalities involving pedestrians in 2004.	25 % _____																																																		
4) Have there been public outreach efforts (by this or other agency) to educate pedestrians or drivers on road and pedestrian safety?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No																																																		
5) Is there a law or regulation for any of the following items? If so, is the law or regulation enforced? Feel free to add any relevant laws or regulations that are not included in this list.	<table border="1"> <thead> <tr> <th colspan="2"></th> <th colspan="3">Enforced?</th> </tr> <tr> <th colspan="2">Is there a law or regulation for:</th> <th>Usually</th> <th>Sometimes</th> <th>Rarely</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/></td> <td>Jaywalking</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Vendors on sidewalks</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Parking on sidewalks</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Driving / riding on sidewalks</td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td>Drunk driving</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Other Littering</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td>Other _____</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td>Other _____</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table>			Enforced?			Is there a law or regulation for:		Usually	Sometimes	Rarely	<input checked="" type="checkbox"/>	Jaywalking	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Vendors on sidewalks	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Parking on sidewalks	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Driving / riding on sidewalks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Drunk driving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Other Littering	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Enforced?																																																	
Is there a law or regulation for:		Usually	Sometimes	Rarely																																															
<input checked="" type="checkbox"/>	Jaywalking	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>																																															
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<input checked="" type="checkbox"/>	Other Littering	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>																																															
<input type="checkbox"/>	Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																																															
<input type="checkbox"/>	Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																																															

Table 2.4 Field Data Collection Form, Source- (Krambeck & Shah, 2006)

Surveyed Road Stretch	1	2	3	4	5	6	7	8	9	10	$(\sum(x \cdot \text{length} \cdot 10 \cdot \text{count})) / \# / 10$
1) Walking Path Modal Conflict	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
2) Security from Crime	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
3) Crossing Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
4) Motorist Behavior	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
5) Amenities (Cover, benches, public toilets, street lights)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
6) Disability Infrastructure and Sidewalk Width	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
7) Maintenance and Cleanliness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
8) Obstructions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
9) Availability of Crossings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
10) Pedestrian Count	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
11) Length of Surveyed Stretch (km)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
	Unweighted Average										<input type="text"/>

- Pedestrian Environmental Data Scan (PEDS)

Name: _____		Date: _____		Study Area: _____	
Segment Number: _____		Time: _____		Weather: _____	

<p>G. Segment type</p> <p>Low volume road <input type="checkbox"/> 1</p> <p>High volume road <input type="checkbox"/> 2</p> <p>Bike or Ped path - skip section C <input type="checkbox"/> 3</p> <hr/> <p>A. Environment</p> <p>1. Uses in Segment (all that apply)</p> <p>Housing - Single Family Detached <input type="checkbox"/> 1</p> <p>Housing - Multi-Family <input type="checkbox"/> 2</p> <p>Housing - Mobile Homes <input type="checkbox"/> 3</p> <p>Office/Institutional <input type="checkbox"/> 4</p> <p>Restaurant/Café/Commercial <input type="checkbox"/> 5</p> <p>Industrial <input type="checkbox"/> 6</p> <p>Vacant/Undeveloped <input type="checkbox"/> 7</p> <p>Recreation <input type="checkbox"/> 8</p> <p>2. Slope</p> <p>Flat <input type="checkbox"/> 1</p> <p>Slight hill <input type="checkbox"/> 2</p> <p>Steep hill <input type="checkbox"/> 3</p> <p>3. Segment Intersections</p> <p>Segment has 3 way intersection <input type="checkbox"/> 1</p> <p>Segment has 4 way intersection <input type="checkbox"/> 2</p> <p>Segment has other intersection <input type="checkbox"/> 3</p> <p>Segment deadends but path continues <input type="checkbox"/> 4</p> <p>Segment deadends <input type="checkbox"/> 5</p> <p>Segment has no intersections <input type="checkbox"/> 6</p> <hr/> <p>B. Pedestrian Facility (skip if none present)</p> <p>4. Type(s) of pedestrian facility (all that apply)</p> <p>Footpath (worn dirt path) <input type="checkbox"/> 1</p> <p>Paved Trail <input type="checkbox"/> 2</p> <p>Sidewalk <input type="checkbox"/> 3</p> <p>Pedestrian Street (closed to cars) <input type="checkbox"/> 4</p> <p><i>The rest of the questions in section B refer to the best pedestrian facility selected above.</i></p> <p>5. Path material (all that apply)</p> <p>Asphalt <input type="checkbox"/> 1</p> <p>Concrete <input type="checkbox"/> 2</p> <p>Paving Bricks or Flat Stone <input type="checkbox"/> 3</p> <p>Gravel <input type="checkbox"/> 4</p> <p>Dirt or Sand <input type="checkbox"/> 5</p>	<p><i>If no sidewalk skip now to section C.</i></p> <p>11. Curb cuts</p> <p>None <input type="checkbox"/> 1</p> <p>1 to 4 <input type="checkbox"/> 2</p> <p>> 4 <input type="checkbox"/> 3</p> <p>12. Sidewalk completeness/continuity</p> <p>Sidewalk is complete <input type="checkbox"/> 1</p> <p>Sidewalk is incomplete <input type="checkbox"/> 2</p> <p>13. Sidewalk connectivity to other sidewalks/crosswalks</p> <p>number of connections <input type="text"/> 1</p> <hr/> <p>C. Road Attributes (skip if path only)</p> <p>14. Condition of road</p> <p>Poor (many bumps/cracks/holes) <input type="checkbox"/> 1</p> <p>Fair (some bumps/cracks/holes) <input type="checkbox"/> 2</p> <p>Good (very few bumps/cracks/holes) <input type="checkbox"/> 3</p> <p>Under Repair <input type="checkbox"/> 4</p> <p>15. Number of lanes</p> <p>Minimum # of lanes to cross <input type="text"/> 1</p> <p>Maximum # of lanes to cross <input type="text"/> 1</p> <p>16. Posted speed limit</p> <p>None posted <input type="checkbox"/> 1</p> <p>(mph): <input type="text"/> 1</p> <p>17. On-Street parking (if pavement is unmarked, check only if cars parked)</p> <p>Parallel or Diagonal <input type="checkbox"/> 1</p> <p>None <input type="checkbox"/> 2</p> <p>18. Off-street parking lot spaces</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>0-5</td> <td>6-25</td> <td>26+</td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> </tr> </table> <p>19. Must you walk through a parking lot to get to most buildings?</p> <p>Yes <input type="checkbox"/> 1</p> <p>No <input type="checkbox"/> 2</p> <p>20. Presence of med-hi volume driveways</p> <p><input type="checkbox"/></p>	0-5	6-25	26+	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	2	3	<p>24. Bicycle facilities (all that apply)</p> <p>Bicycle route signs <input type="checkbox"/> 1</p> <p>Striped bicycle lane designation <input type="checkbox"/> 2</p> <p>Visible bicycle parking facilities <input type="checkbox"/> 3</p> <p>Bicycle crossing warning <input type="checkbox"/> 4</p> <p>No bicycle facilities <input type="checkbox"/> 5</p> <hr/> <p>D. Walking/Cycling Environment</p> <p>25. Roadway/path lighting</p> <p>Road-oriented lighting <input type="checkbox"/> 1</p> <p>Pedestrian-scale lighting <input type="checkbox"/> 2</p> <p>Other lighting <input type="checkbox"/> 3</p> <p>No lighting <input type="checkbox"/> 4</p> <p>26. Amenities (all that apply)</p> <p>Public garbage cans <input type="checkbox"/> 1</p> <p>Benches <input type="checkbox"/> 2</p> <p>Water fountain <input type="checkbox"/> 3</p> <p>Street vendors/vending machines <input type="checkbox"/> 4</p> <p>No amenities <input type="checkbox"/> 5</p> <p>27. Are there wayfinding aids?</p> <p>No <input type="checkbox"/> 1</p> <p>Yes <input type="checkbox"/> 2</p> <p>28. Number of trees shading walking area</p> <p>None or Very Few <input type="checkbox"/> 1</p> <p>Some <input type="checkbox"/> 2</p> <p>Many/Dense <input type="checkbox"/> 3</p> <p>29. Degree of enclosure</p> <p>Little or no enclosure <input type="checkbox"/> 1</p> <p>Some enclosure <input type="checkbox"/> 2</p> <p>Highly enclosed <input type="checkbox"/> 3</p> <p>30. Powerlines along segment?</p> <p>Low Voltage/Distribution Line <input type="checkbox"/> 1</p> <p>High Voltage/Transmission Line <input type="checkbox"/> 2</p> <p>None <input type="checkbox"/> 3</p> <p>31. Overall cleanliness and building maintenance</p> <p>Poor (much litter/graffiti/broken facilities) <input type="checkbox"/> 1</p> <p>Fair (some litter/graffiti/broken facilities) <input type="checkbox"/> 2</p> <p>Good (no litter/graffiti/broken facilities) <input type="checkbox"/> 3</p>
0-5	6-25	26+									
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>									
1	2	3									

6. Path condition/maintenance Poor (many bumps/cracks/holes) <input type="checkbox"/> 1 Fair (some bumps/cracks/holes) <input type="checkbox"/> 2 Good (very few bumps/cracks/holes) <input type="checkbox"/> 3 Under Repair <input type="checkbox"/> 4	21. Traffic control devices (all that apply) Traffic light <input type="checkbox"/> 1 Stop sign <input type="checkbox"/> 2 Traffic circle <input type="checkbox"/> 3 Speed bumps <input type="checkbox"/> 4 Chicanes or chokers <input type="checkbox"/> 5 None <input type="checkbox"/> 6	32. Articulation in building designs Little or no articulation <input type="checkbox"/> 1 Some articulation <input type="checkbox"/> 2 Highly articulated <input type="checkbox"/> 3
7. Path obstructions (all that apply) Poles or Signs <input type="checkbox"/> 1 Parked Cars <input type="checkbox"/> 2 Greenery <input type="checkbox"/> 3 Garbage Cans <input type="checkbox"/> 4 Other <input type="checkbox"/> 5 None <input type="checkbox"/> 6	22. Crosswalks None <input type="checkbox"/> 1 1 to 2 <input type="checkbox"/> 2 3 to 4 <input type="checkbox"/> 3 > 4 <input type="checkbox"/> 4	33. Building setbacks from sidewalk At edge of sidewalk <input type="checkbox"/> 1 Within 20 feet of sidewalk <input type="checkbox"/> 2 More than 20 feet from sidewalk <input type="checkbox"/> 3
8. Buffers between road and path (all that apply) Fence <input type="checkbox"/> 1 Trees <input type="checkbox"/> 2 Hedges <input type="checkbox"/> 3 Landscape <input type="checkbox"/> 4 Grass <input type="checkbox"/> 5 None <input type="checkbox"/> 6	23. Crossing Aids (all that apply) Yield to Ped Paddles <input type="checkbox"/> 1 Pedestrian Signal <input type="checkbox"/> 2 Median/Traffic Island <input type="checkbox"/> 3 Curb Extension <input type="checkbox"/> 4 Overpass/Underpass <input type="checkbox"/> 5 Pedestrian Crossing Warning Sign <input type="checkbox"/> 6 Flashing Warning Light <input type="checkbox"/> 7 Share the Road Warning Sign <input type="checkbox"/> 8 None <input type="checkbox"/> 9	34. Building height Short <input type="checkbox"/> 1 Medium <input type="checkbox"/> 2 Tall <input type="checkbox"/> 3
9. Path Distance from Curb At edge <input type="checkbox"/> 1 < 5 feet <input type="checkbox"/> 2 > 5 feet <input type="checkbox"/> 3		35. Bus stops Bus stop with shelter <input type="checkbox"/> 1 Bus stop with bench <input type="checkbox"/> 2 Bus stop with signage only <input type="checkbox"/> 3 No bus stop <input type="checkbox"/> 4
10. Sidewalk Width < 4 feet <input type="checkbox"/> 1 Between 4 and 8 feet <input type="checkbox"/> 2 > 8 feet <input type="checkbox"/> 3		Subjective Assessment: Segment... Enter 1, 2, 3, or 4 for 1=Strongly Agree 2= Agree, 3=Disagree, 4=Strongly Disagreeis attractive for walking. <input type="checkbox"/> 1is attractive for cycling. <input type="checkbox"/> 1feels safe for walking. <input type="checkbox"/> 1feels safe for cycling. <input type="checkbox"/> 1

Kelly J. Clifton, PhD - National Center for Smart Growth - University of Maryland, College Park

PEDS combines subjective and objective assessment, is comprehensive as regards the study aspects, but compact for ease of administering. This may easily be filled by a layman but with some training. It is Observational (audit), which Review the built and natural environment with respect to pedestrian activity. Audit tool on a form with close-ended questions using a Likert scale.

Comprehensive table depicting parameters suggested by other researchers is shown below: -

Table 2.5 Parameters suggested by various researchers, Source- Literature as mentioned in five sections in this chapter

Parameters/ Variables	Reference from Literature
Entertainment and leisure activities	R. K. Srivastava (2008)
Community's pride and Sense of belonging	Vivek Kumar and Madhulika P. Sarkar (2011)
Customer behavior	Priya Vij (2013)
Omnichannel	Rigby (2011), Arpita Agnihotri (2015)
Local- centric to convenience-centric and experience-centric	Jagdish Seth, (2021)

Pleasantness & Arousal	Velitchka D. Kaltcheva & Barton A. Weitz (2006)
Role of creativity & retail industry in socio-cultural context	Tony Kent (2007)
Convenience& Merchandise Mix, Store Atmospherics & Services	Piyali Ghosh, Vibhuti Tripathi and Anil Kumar (2010)
Value awareness, store image impression and price-image	Mbaye Fall Diallo, Jean-Louis Chandon, Gerard Cliquet and Jean Philippe (2013)
Customer can relish the space with their family	Naushadul Haque Mullick (2016)
Consumers are simulated by amenities and facilities	Coen N. Teulings, Ioulia V. Ossokina and Jan Svitak (2018)
Road safety	F. Russo and A. Comi, (2013)
Urban landscape of that space	Saruhan Mosler (2019)
5 C's 'Conviviality, Convenience, Connectedness, Conspicuousness & Comfort'	Pedestrian needs by Gardner (1966)
Attraction & Obstruction in architecture space	Okazaki, S. (1979)
Route	Aloys Borgers and Harry Timmermans (1986b)
Safety and to maintain the level of services	Miho Asano, (2009)
Streetscape features	Marco Capitanio (2019)
Principles for Street Design- Safety, Mobility, Pedestrian accessibility, Livability, Sensitivity to local context, Creative use of street space	Better streets, better cities- Streets need room for all users
The Three Pavement Zones: - Pedestrian Only Zone, Dead Width or Frontage Zone & Multi-Functional Zone with Planting	Street Design Guidelines © UTTIPEC, DDA 2009

Kevin A. Lynch five elements: - paths, edges, districts, nodes, landmarks	Jacqueline Tyrwhitt (1960)
Lively street life, crowded pedestrian sidewalks & traditional neighborhoods	Jane Jacobs (1961)
Socio-cultural patterns	Sanjay S. Jadon (2007)
Inclusive urban design	Clara Greed (2010)
Infrastructure and urban landscape elements	A.K. Jain (2012)
Safe and convenient for pedestrian to walk	Purnima Parida, Jiten Shah and S. Gangopadhyay (2014)
Identical signboards, improved services, various streetscape furniture and fountains, Monument erected in memory of martyrs Street amenities and pedestrian infrastructure Walking behavior and syntactical elements of street design Imageability, confinement, human size, transparency, and complexity Aesthetics, physical disorder, pedestrian safety, motorized traffic and parking, infrastructure for active travel, sidewalk amenities, and social and commercial activity Vehicle traffic, sidewalks, land-use, safety, lighting and other Safety & security, convenience & attractiveness, policy support Pedestrian facilities, road attributes, walking/cycling environment	Kunal Doley (2017) Pedestrian level of service (PLOS) Baran et al. (2008) Ewing and Handy (2009) Rundle et al. (2011) The Pedestrian Environmental Quality Index (PEQI) Global Walkability Index (GWI) Pedestrian Environmental Data Scan (PEDS)

2.7 B&M RETAIL MARKETS EXAMPLES

- **Chandni Chowk Makeover, Delhi**

The Red Fort, which towers over one end of Chandni Chowk's 1.3-kilometer main road, and the smaller Fatehpuri Mosque, which stands watch at the other, have both been redeveloped, completely altering the area's appearance.



Figure 2.10: Old & New Look, Chandni Chowk
Source: Mansi Tewari, India Today, 2014

During the day, the corridor will strictly be a "no vehicle zone," with only non-motorized vehicles like rickshaws and e-rickshaws permitted to go along it. However, nighttime loading and unloading of cargo will be permitted.



Figure 2.11: Makeover of Chandni Chowk
Source: Raghav Goyal, Indian Masterminds, 2021

Analysis from the recent pictures, comments, and videos of the market: -

Demonstrate how the stretch of road from the Red Fort intersection to Fatehpur Masjid, which was previously congested with thousands of people, has been transformed into a wide road for pedestrians only, where they can stroll along a newly renovated concrete path without the usual commotion of rickshaws, e-rickshaws, private vehicles, and commercial vehicles. While strollers are seen enjoying the renovated Chandni Chowk, business owners have differing opinions. The market appears to have had a significant facelift, making it more attractive and well-organized.

- **Golden Temple Heritage Street, Amritsar**

After the beautification effort, the lengthy stretch between Town Hall and Golden Temple is completely devoid of the previous, accustomed activity.



Figure 2.12: Heritage Street, Amritsar

Source: The Tribune, 2023

A consistent architectural style has been used to reconstruct the façade of approximately 170 buildings on the street surrounding the Golden Temple, giving it a regal appearance reminiscent to the 400-year-old city of Amritsar. The signboards for the businesses have been maintained uniform, somewhat resembling the markets of Jaipur, and the Chowk also features artificial waterfalls, water animations, and a digital water show. All the buildings on the street, including the marketplaces and shops, now have pink facades

Analysis from the recent pictures, comments and videos of the market is: -

Even the overhead lines are removed; according to reports, they have now been funneled into underground tunnels, making the stretch more gorgeous. The entire 1-km stretch now

resembles a big, open monument a la European sites such as Rome, Venice, or Florence. But despite the intense heat, visitors are unaffected by the attractive plants on Heritage Street.



Figure 2.13: Need for Shaddy Trees, Heritage Street, Amritsar

Source: The Tribune, 2023

People believe that the relevant authorities should have planted shade trees instead of such saplings. It gets too hot for a leisurely walk throughout the day since the marble floor amplifies the heat. Physically challenged people find it challenging to traverse the steel barricades that have been put at the Heritage Street that leads to the Golden Temple. Even though there is a provision to do so, it could not be used in the absence of an official attendant.

2.8 RESEARCH GAP

Considering above mentioned studies by various researchers, factors which affects pedestrian users in B&M retail markets are: -

- **Private vehicles:** - Earlier private mode of transport was used for travelling from one city to another, but modern society has increased its dependence on the private transport mode for all basic needs within walkable range. As a result, major declines in health are caused by the combination of an over-reliance on the private car to make even the most local journeys and sedentary lifestyles. On other hand, the market street capacities have not increased correspondingly, the limited road infrastructure bears the burden of escalated vehicle demands(Munshi et al., 2014). This has literally choked majority of retail markets

in Indian cities. As a result, these markets have become hostile, dangerous, unhealthy, and insecure places for pedestrian. One of the major reasons for decline of footfall in B&M markets is increased private vehicle usage which is obviously not safe, especially for pedestrian shoppers. Urban policy maker, along with transportation planners, urban planners, environmentalists etc. need to solve these urban issues for sustainable development (Soni & Soni, 2016). Thus, urban planning measures in retail markets should focus on pedestrian friendly environment rather than vehicle-oriented planning.

- **Absence of basic amenities:** - Footpaths are created to separate the motorized traffic and the pedestrian traffic. They provide a safe space to walk and reduce crash risks between pedestrians and vehicles. Only about 30 per cent of the roads in most Indian cities provide for pedestrian footpaths; and almost 20 per cent of road accidents involve pedestrians (MoUD, 2008). Although, inadequate infrastructure makes it hard for a nation to prosper economically (Arshi Naim, 2022). But still in Indian cities, though a significant number of trips in B&M retail markets are made on foot, still pedestrians remain the neglected user in terms of required infrastructure, amenities, and services (Tyagi, 2022).
- **Social factors:** - Car travel assumes substantial social superiority in attributes such as status, wealth, and power in addition to fulfilling its transport function. Social acceptability of walking has been grossly marginalized by cultural dominance of car. To reduce automobile dependence, urban planners, policy makers, architects etc. acknowledge that various strategies should be implemented in planning public realm and it is only possible by changing cultural & social attitude of public (Croston, 2022) . Undoubtedly, walking, cycling, and public transport should be promoted for sustainable development.
- **Quality of streetscape elements and physical obstacles:** - As per study, in the US, there are 127 million walking excursions per day. As the percentage of automobile ownership in cities keeps rising, for many years urban planning has purposefully ignored or been unaware of the demands of people. Therefore, it is essential to improve urban morphology in order to create a higher quality of life for pedestrians (Brand, 2022). Undoubtedly, streetscape elements help in enhancing the walkability of an area. But unfortunately, most of the B&M retail markets are catering motorized traffic (Volume I, 2015). Such markets do not focus on street scape elements like climate control landscaping, street furniture, appropriate lighting, signage etc. These are either missing or if present, these elements are not up to mark. In addition, physical obstacles like street vendors, utility poles, parking on sidewalks, construction waste etc. take up majority of the footpath space, thus leaving no room for the pedestrians (*India's National Policy on Urban Street Vendors*,

n.d.). This often leads to pedestrians walking on roads leading to crashes leading to a negative perception on walking in retail markets (Assaf et al., 2012).

- **E-commerce/M-commerce:** - Since 1999, the popularity and accessibility of m-commerce & e-commerce devices has led to a considerable change in consumer buying habits that has an impact on various retail industries, including fashion, groceries, cars, and home products (Grewal et al., 2010). Brick-and-mortar (B&M) commerce has recently lost some of its importance due to the rivalry created by the growth of the internet retail sector, with some big chains cutting back on their physical retail operations or closing permanently (Kartzmark Kyle, 2022). However, physical shops have found it difficult to compete with online retailers, and many merchants have decided to operate both online and offline. Online retailing has helped businesses overcome geographic obstacles to selling and helped them gain operational savings (Ratchford et al., 2022).

Above mentioned factors have connived jointly towards decline in pedestrians from B&M retail markets, as a result negative impact is created on health, socio-cultural and environmental aspects. As an effect, there is decline in footfall in brick-mortar retail in recent years. Impact of intangible planning parameters (safety, comfort, convenience, pleasant environment, ambience, micro-climate etc.) along with other urban landscape elements are visible in sustaining different urban areas. In India, with respect to pedestrian interest and safety sufficient guidelines like appropriate lighting, signage, street furniture, sidewalk etc. are present, but in practical these amenities & facilities are absent in existing B & M markets; thus, pedestrians are declining at fast pace, which is one of major reasons of declining profit in these retail markets. By considering brick and mortar markets in Ludhiana city, this research intends to have a comprehensive understanding of the pedestrian user experience and their relationship with intangible characteristics of retail market infrastructure.

CHAPTER-3: RESEARCH DESIGN AND DATA COLLECTION

This chapter is divided into three parts: - the first part deals with identification of factors which have positive impact on pedestrian user in B&M retail markets in Indian context. Further, second part deals with the identification of B&M retail markets for the purpose of conscientious investigation regarding selected parameters and finally third part sampling, data collection and finding technique to analyze relationship of identified factors with pedestrian user satisfaction in B&M retail markets. Overall, this chapter discusses the parameters of study, methods of investigation selected factors, the procedure for data collection and analysis adopted for finding potential factors influencing pedestrian users' satisfaction.

3.1 IDENTIFICATION AND SELECTION OF FACTORS/PARAMETERS

In recent years, India had gained attention from domestic as well as foreign players in retail sector, as it is having huge potential to expand and globally it is at fifth position. In Indian context, B&M retail markets plays important role in increasing profit in retail industry as users still rely more on physical shopping as compared to online shopping, owing to advantages like, one can try and touch while purchasing, quality check on spot, better security etc. of former type of retail mode. From ancient time, B&M retail markets in India had played a significant role in connecting physical surroundings with user in those places. Historically, Asian cities were deliberated designed with focus on need of pedestrian user, which supported walking and it was one of the main means of urban transport. Unfortunately, in recent time private ownership of vehicles has increased manifold and as a result markets which were initially occupied by pedestrian, now that has been replaced by vehicles. Consequently, safety of pedestrian user in these markets is affected drastically, which is one of major cause of decline in footfall in these B&M retail markets. In addition to this spatial quality and socio-cultural engagements in these markets is affected negatively.

For sustainable development of these markets, attention should be given on pedestrian users of these markets as they are prime customer in Indian retail markets. Thus, for overall growth of retail sector, it is required to explore various factors which could enhance user satisfaction in these markets. In public areas like B&M retail market recognizing pedestrian user perception is important for planning basic amenities and facilities in these markets. The most basic general needs of public space quality evaluation include accessibility, maintenance, attractiveness, comfort, activity, purposefulness, safety, and security. To meet the needs of pedestrian, spatial quality analysis from pedestrian comfort point of view is important to enhance quality of street

environment. As per scale and scope of collected data, numerous tools are available to assess walkability index. In general, the purpose of these tools would be to create an inventory of environment; or assess the quality of environment at route or area level; or to estimate the latent demand for walking.

3.1.1 FACTOR FORMALIZATION

Although, in B&M retail markets, significant number of people prefer walking over driving in developing cities, still pedestrian infrastructure, amenities, and services are often not pedestrian user centric in these markets. GWI is universally adopted and vigorous model to understand pedestrian perception. For present research, out of three constructs of GWI, two i.e., safety-security (SS) and convenience-attractiveness (CA) are considered in this study. Third construct i.e., policy support is not under scope of this study. To analyze various path, which have significant impact on dependent variable i.e., user satisfaction (US), items/statements related to two independent variables i.e., CA and SS, were taken from GWI, thus for these two constructs no need for exploratory factor analysis was required. Further, to explore other essential factors for US in B&M markets, 15 items/statements were formed by referring related literature. For content validity, inceptive questionnaire as per Annexure I, has been pretested to 5 academicians and 5 field experts specialized in architecture field. CVR (content validity ratio) of 9 out of 15 statements were above 0.6, thus only those 9 statements were considered for further analysis. This procedure is relevant to provide face validity of measure and ensure significant degree of refinement. Table 3.1 depicts 9 items/statements, which were written to be index to form a particular construct as per interrelation among them.

Table 3.1: 9 items to be reduced in factors

<p>S1 Semi covered or shaded walkways are more comfortable for walking.</p> <p>S2 Green spaces, fountains and trees are important to regulate temperature of retail market.</p> <p>S3 Material used in pathway is important to regulate temperature of retail market.</p> <p>S4 Signage in street nodes and on front façade of shops could enhance ambience of retail market.</p> <p>S5 Along with Universal Accessibility, controlled zones for different age groups could enhance spatial quality.</p> <p>S6 Walking obstruction like electrical poles, parked vehicles, hoardings etc. should be avoided.</p> <p>S7 Pedestrian oriented street lighting should be designed.</p>
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S8 Depiction of socio-cultural expression through art pieces or articulation with respect to city is important.

S9 Music, Aroma (Fragrance) & Special Lighting effects can enhance enthusiasm in user while shopping.

Source: Developed by the author

Exploratory factor analysis, originated in the twentieth century, is extensively used by researchers from various fields including social, biological, engineering and like. In present paper, factor analysis was done in Statistical Package for Social Science (SPSS), to frame other latent variable through EFA, in which principal components method was used for extraction. For factor formation, questionnaire having 9 items/statements was floated online to 150 respondents (academicians, field experts, Ph.D. scholars, and alumni of architecture department of Lovely Professional university) on 5-point Likert scale and out of which data from 100 respondents was collected. First table from analysis was correlation matrix, as per assumption calculated determinant should be more than .0001 and if it is zero, then solutions for factor could not be obtained. In present case, value of determinant (a.) is .011 which is greater than said value, thus this assumption is met. Table 3.2 is correlation matrix, which depicts how 9 items are associated with other 8 items. As per correlation value i.e., 0.60 or greater, indicates that items having high value in different components would be grouped together.

Table 3.2 Correlation Matrix ^a

	S1	S2	S3	S4	S5	S6	S7	S8	S9
S1	1.000	0.730	0.438	0.351	0.184	0.582	0.478	0.324	0.328
S2	0.730	1.000	0.436	0.320	0.294	0.624	0.540	0.369	0.317
S3	0.438	0.436	1.000	0.247	0.138	0.551	0.450	0.257	0.190
S4	0.351	0.320	0.247	1.000	0.614	0.337	0.365	0.804	0.452
S5	0.184	0.294	0.138	0.614	1.000	0.247	0.263	0.672	0.397
S6	0.582	0.624	0.551	0.337	0.247	1.000	0.504	0.430	0.296
S7	0.478	0.540	0.450	0.365	0.263	0.504	1.000	0.374	0.307
S8	0.324	0.369	0.257	0.804	0.672	0.430	0.374	1.000	0.466
S9	0.328	0.317	0.190	0.452	0.397	0.296	0.307	0.466	1.000
a. Determinant = .011									

Source: Developed by the author by exploratory factor analysis in SPSS

Factor analysis was conducted using principal component method to find required number of factors based on eigenvalue, greater than 1, which is considered acceptable criteria for a factor

to be useful. Whether or not each component predicts enough items is determined by the Kaiser-Meyer-Olkin (KMO) test, and its value should be more than 0.70. Table 3.3 depicts KMO and Bartlett's Test, KMO measure is 0.833, thus items are adequate for factor analysis. The Bartlett test is also significant as its value is 0.000 which is less than 0.05, thus in present case the variables have sufficient correlation to offer a sound basis for factor analysis. Table 3.4 is Rotated component matrix and Fig 3.1 is Component plot in rotated space, in which items are clustered in two groups as per highest loading on each item.

Table 3.3 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.833
Bartlett's	Approx. Chi-Square	767.892
Test of	df	36
Sphericity	Sig.	0

Table 3.4 Rotated Component Matrix ^a

	Component	
	1	2
S2	0.818	0.217
S1	0.81	0.172
S6	0.796	0.225
S3	0.725	
S7	0.687	0.267
S8	0.242	0.877
S4	0.211	0.86
S5		0.84
S9	0.252	0.606

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 a. Rotation converged in 3 iterations.

Source: Developed by the author by exploratory factor analysis in SPSS

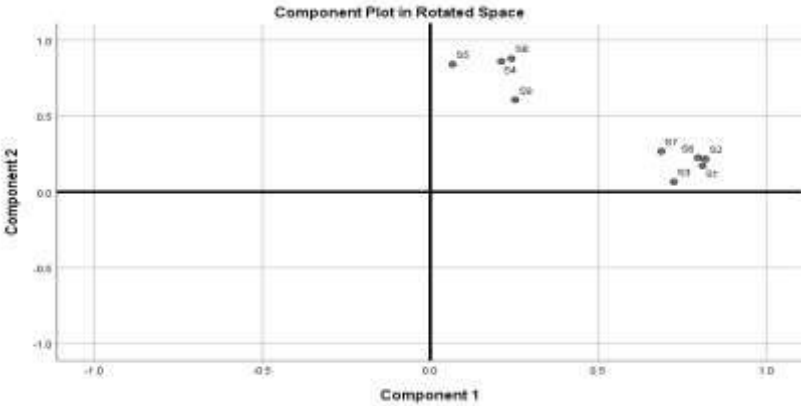


Figure 3.1: Component Plot in Rotated Space

Source: Developed by the author by exploratory factor analysis in SPSS

By application of varimax rotation under principal component analysis, 5 items i.e., S1, S2, S3, S6, S7 were clustered as one factor and it is named as comfort (C) and remaining 4 items i.e., S4, S5, S8, S9 were clustered in second factor, named convivial environment (CE) in which statement related to spatial quality and social active environment were clubbed. Naming of parameters was done by taking reference from literature study. Four independent variables are framed to find strength of their impact on user satisfaction in B&M retail markets.

3.1.2 FINAL 22 ATTRIBUTES UNDER 5 PARAMETERS

Table 3.5 depicts final parameters and its attributes, which were initially inspired by the global walkability index (GWI) and further after exploratory factor analysis, final survey format comprising 22 attributes under 5 parameters was framed to suit the Indian context. Brief of parameters and its attributes is as below: -

A. Convenience & Attractiveness (C&A)

For pedestrian users in retail market convenience plays important role in increasing footfall by attracting more customers. This parameter and below mentioned five attributes under C&A are taken from GWI.

- Availability of pedestrian amenities like water, public toilets, ATM etc. at walkable distance is essential.
- Availability of streetscape elements like street furniture, garbage bins etc. at regular interval is essential.
- Dedicated parking area at multiple location should be provided for ease of connectivity.
- Traffic volume and speed should be controlled in retail markets by various traffic claiming devices.
- Width of Pathway should be greater than 1.8m for unobstructed walking.

B. Safety & Security (SS)

For pedestrian users in retail market along with convenience, safety and security also plays important role in increasing footfall by attracting more customers. While planning for safety measures, along with safety from vehicles, safety from other obstruction should also be considered. This parameter and below mentioned five attributes under C&A are taken from GWI.

- Safety measures like CCTV, security guard etc. are essential.
- For safety in odd hours market layout should emphasize eye on street concept.
- Provision of non-motorized public transport mode is preferred.

- Pedestrian crossing should be provided at appropriate distance.
- Fire safety measures should be provided as per code.

C. Comfort (C)

The importance of thermal, physical, and psychological comfort in the wellbeing of pedestrians has been gradually emphasized. Despite the significance of the outdoor thermal environment for pedestrians, the thermal characteristics of the walking environment have not received enough attention. Thermal stress can, in fact, ruin the walking experience and negatively affect walkability. This parameter and below mentioned five attributes under C are taken through exploratory factor analysis as mentioned in section 3.1.1.

- Semi covered or shaded walkways are more comfortable for walking.
- Green spaces, fountains and trees are important to regulate temperature of retail market.
- Material used in pathway is important to regulate temperature of retail market.
- Walking obstruction like electrical poles, parked vehicles, hoardings etc. should be avoided.
- Pedestrian oriented street lighting should be designed.

D. Convivial Environment (CE)

The environment on the streets and walkways needs to be as inviting as possible so that people will prefer to stroll there rather than take another form of transportation. Enhancing spatial quality and improving socio active environment can make public areas more convivial. This parameter and below mentioned four attributes under CE are taken through exploratory factor analysis as mentioned in section 3.1.1.

- Along with natural/artificial sights, signage could enhance ambience of retail market.
- Along with Universal Accessibility, controlled zones for different age groups could enhance spatial quality.
- Depiction of socio-cultural expression through art pieces or articulation with respect to city is important.
- Music, Aroma (Fragrance) & Special Lighting effects can enhance enthusiasm in user while shopping.

E. User Satisfaction (US)

User satisfaction regarding selected parameters is divided in three attributes as mentioned below.

- Rating of Convenience & Attractiveness in existing B&M retail market

- Rating of Safety & Security in existing B&M retail market
- Rating of Comfort & Convivial Environment in existing B&M retail market

Table 3.5: Depicts various parameters along with its attributes

List of Parameters and its attributes
A Convenience & Attractiveness (CA)
A1 Availability of pedestrian amenities like water, public toilets, ATM etc. at walkable distance is essential
A2 Availability of streetscape elements like street furniture, garbage bins etc. at regular interval is essential
A3 Dedicated parking area at multiple location should be provided for ease of connectivity
A4 Traffic volume and speed should be controlled in retail markets by various traffic claiming devices
A5 Width of Pathway should be greater than 1.8m for unobstructed walking
B Safety & Security (SS)
B1 Safety measures like CCTV, security guard etc. are essential
B2 For safety in odd hours market layout should emphasize eye on street concept
B3 Provision of non-motorized public transport mode is preferred
B4 Pedestrian crossing should be provided at appropriate distance.
B5 Fire safety measures should be provided as per code.
C Comfort (C)
C1 Semi covered or shaded walkways are more comfortable for walking
C2 Green spaces, fountains and trees are important to regulate temperature of retail market
C3 Material used in pathway is important to regulate temperature of retail market
C4 Walking obstruction like electrical poles, parked vehicles, hoardings etc. should be avoided
C5 Pedestrian oriented street lighting should be designed
D Convivial Environment (CE)
D1 Signage in street nodes and on front façade of shops could enhance ambience of retail market
D2 Along with Universal Accessibility, controlled zones for different age groups could enhance spatial quality
D3 Depiction of socio-cultural expression through art pieces or articulation with respect to city is important
D4 Music, Aroma (Fragrance) & Special Lighting effects can enhance enthusiasm in user while shopping
E User Satisfaction (US)
E1 Rating of Convenience & Attractiveness in existing B&M retail market

E2 Rating of Safety & Security in existing B&M retail market
E3 Rating of Comfort & Convivial Environment in existing B&M retail market

3.2 IDENTIFICATION AND SELECTION OF THE CASE STUDY AREAS

3.2.1 CRITERIA FOR SELECTION

In the delineation of the study areas, there were two choices that emerged from past studies, namely, defined areas around a specific destination or urban development defined by administrative or other boundaries. The latter was preferred because it was expected that the administratively defined zones would offer some uniformity in built character and easy data availability. Ludhiana municipal corporation is divided in four zones. Under section 70(5) of the Punjab regional and town planning and development act (amended), 2006, the Master Plan Ludhiana 2007–2021 has been made public. Regulating and directing the area's development is necessary. As a result, a zonal plan that serves as a bridge between the master plan and the layout plan has been created.

Punjab's largest city in terms of both area and population is Ludhiana. The city has a total size of 159.37 sq. km. and can house about 16.00 lac people. It is a major educational and economic hub in northern India and a crossroads of various cultural traditions. Zones divided by municipal corporation Ludhiana is detailed below in table 3.6

Table 3.6: Zones Detail for Ludhiana City given by MC Ludhiana

MUNICIPAL CORPORATION LUDHIANA (ZONES)							
ZONE A Mata Rani Chowk Ludhiana		ZONE B Backside Shinagar Cinema Ludhiana		ZONE C Near Gill Chowk Ludhiana		ZONE D Sarabha Nagar Ludhiana	
Sub Zone	Wards	Sub Zone	Wards	Sub Zone	Wards	Sub Zone	Wards
A1	8,58,6, 61,85,86, 88	B1	20,52,53,55, 57(PARTLY), 63(PARTLY)	C1	42, 43(PARTLY), 49(PARTLY), 50,51	D1	77,78,79, 80,83,90 ,91,92,93
A2	54,56,62,63 (PARTLY), 64	B2	16,17,19, 24,25,26, 27(PARTLY)	C2	34,35,36,37	D2	43(PARTLY) ,44,45,46 ,47,48,49 (PARTLY),69
A3	1,2,3,4, 5,6,94,95	B3	7,9,10,11, 12,13,14,15	C3	28(PARTLY) 29,30,31 ,32,33	D3	70,71,72, 73,74,75
A4	57(PARTLY) 59,84,87,89	B4	18,21,22,23,27 ,28(PARTLY)	C4	28,39,40,41	D4	65,66,67, 68,76,82

3.2.2 FINAL SELECTION

As per municipal corporation, Ludhiana, spatial distribution of the 4 zones in master plan is depicted in Figure 3.2. Out of 4 zones, as per evolution and land use plan potential old retail market are in zone A and modern are in zone D. Zone B and C are having proximity to majority of industry, as a result development is supporting these industries. Thus, for case study, stretches of retail markets are selected from zone A (Old markets) and zone D (Modern markets).

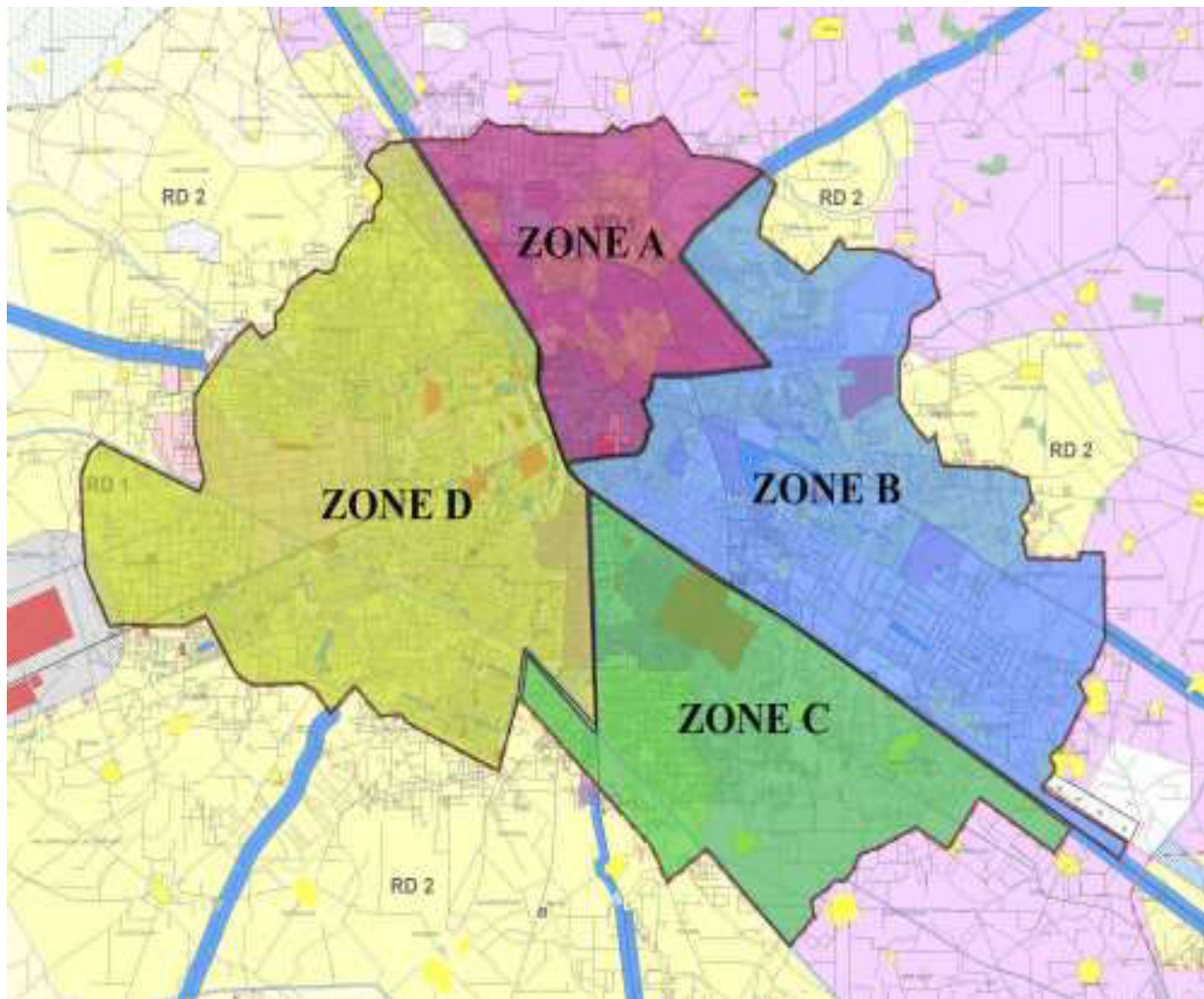


Fig 3.2 Zone A, B, C and D are highlighted in master plan, Ludhiana.

Source: Municipal Corporation Ludhiana

Markets can be classified based on different criteria such as function, competition, and area. Further retail markets from zone A and D are selected on basis of influence at district & local level, area, function, volume of business, density and footfall, case study areas hence shortlisted are briefed in Table 3.7. A total of 20 B&M retail markets were selected with boundaries demarcated based on Google maps. Eight market stretches are in Zone A, which accounts for old retail markets and remaining twelve market stretches are in Zone D, which is considered

in modern markets. Spatial distribution of the B&M retail market is depicted in Figure 3.3. For analysis of factors, selected markets were divided in three groups as per cross section of retail market, G1 was those markets on which shops are located on either side of two-way road; G2 was those markets on which shops are located on either side of one-way road with divider; G3 were those in which front of shops is having open space.

Table 3.7: Case Study Area

BM & Zone	Name of selected areas	Group	Latitude	Longitude	Total Length (m)	Number of segments
1 & A	Chaura Bazaar	G1	30.9159° N	75.8569° E	765	7
2 & A	Paratap Bazar	G1	30.9190°N	75.8514° E	310	5
3 & A	Books Market	G1	30.8401°N	75.975800	320	3
4 & A	Sabaan Bazar	G1	30.9965°N	75.857277	330	5
5 & A	Wool Market	G1	30.959° N	75.8561° E	395	4
6 & A	Ghas Mandi Road	G1	30.9178°N	75.8584° E	1045	10
7 & A	Meena Bazar	G1	30.912° N	75.8530° E	320	4
8 & D	Ghumar Mandi	G1	30.908° N	75.8305° E	1075	8
9 & D	Model Town Market	G2	30.883° N	75.8402° E	950	10
10 & A	Field Ganj Market	G2	30.9086°N	75.8574° E	520	6
11 & D	Mall Road	G2	30.968° N	75.8407° E	1000	6
12 & D	Malhar road Market	G2	30.8948°N	75.8234° E	1100	5
13 & D	Gill Road Market	G2	30.8473°N	75.8492° E	1600	8
14 & D	Furniture Market	G2	30.9005°N	75.85777° E	820	5

15 & D	Gole Market	G3	30.880° N	75.8413° E	150	1
16 & D	Kips Market	G3	30.893° N	75.8233° E	190	1
17 & D	Tution Market	G3	30.887° N	75.8316° E	150	2
18 & D	Dugri Market, Phase 1	G3	30.874° N	75.8430° E	220	3
19 & D	Dugri Market, Phase 2	G3	30.871° N	75.8399° E	240	3
20 & D	Feroz Gandhi Market	G3	30.910° N	75.8334° E	300	4
Total					11800	100

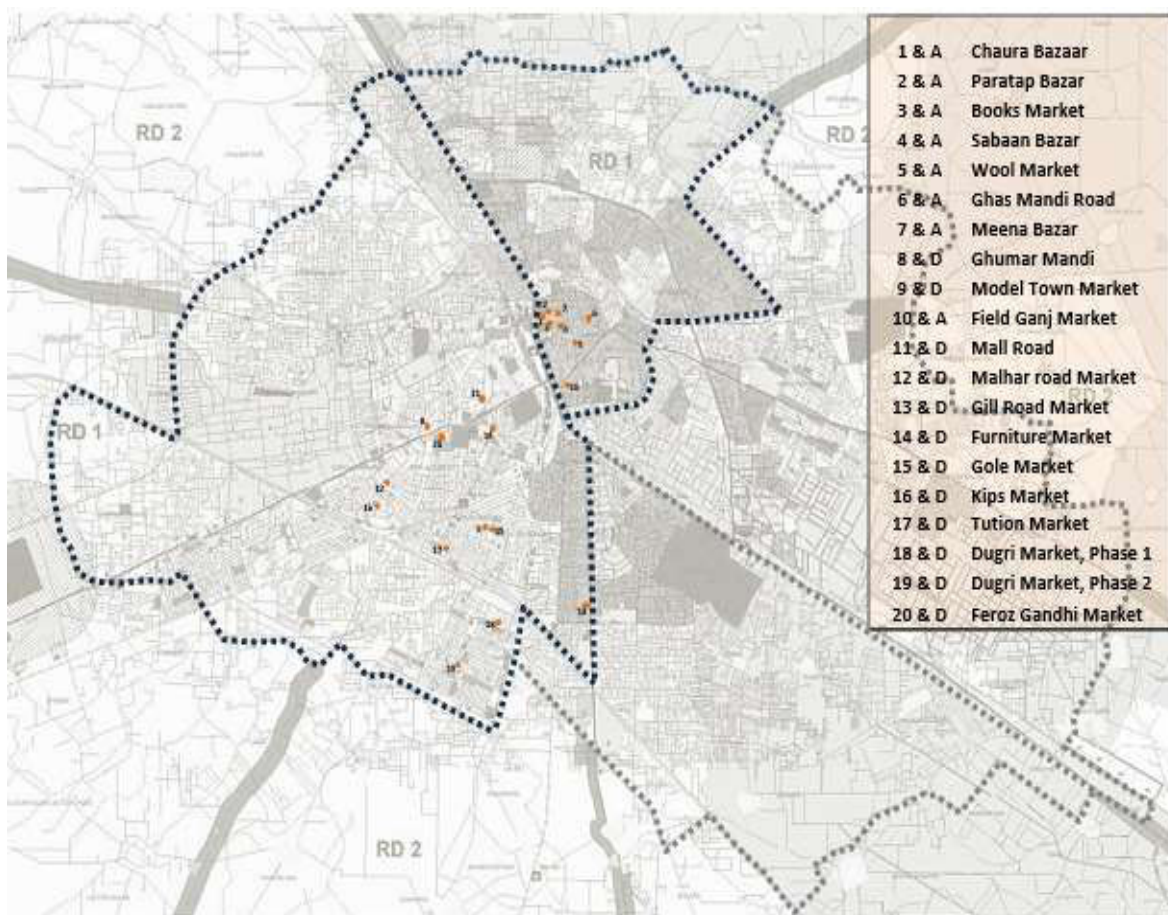


Figure 3.3 Spatial distribution of selected B&M retail markets

3.3 SAMPLING PROCEDURE

Sample Size

Ludhiana (Municipal corporation) area is divided into 4 zones and as per census 2011, the total population of all four zones is 1618879. As per the equation 1, the calculated sample size is 400, by considering 95% confidence interval and 5% margin of error. As mentioned in scope of study 2 zones i.e., Zone A & Zone D are considered, but due to limitation of actual population data of these 2 zones the studied sample size is confined to 250. As many as 250 pedestrians' users were interviewed in 20 selected markets with a sample size of 10 to 15 respondents per market. Further breakup of 250 sample is presented in table 3.8.

$$n = N/1+Ne^2 \text{ ----- Equation 1}$$

where n=No of sample size, N=Population size and e=Margin of error

Table 3.8: Respondent per B&M retail market

BM & Zone	Name of selected areas	Group	No of respondents
1 & A	Chaura Bazaar	G1	15
2 & A	Paratap Bazar	G1	10
3 & A	Books Market	G1	10
4 & A	Sabaan Bazar	G1	15
5 & A	Wool Market	G1	10
6 & A	Ghas Mandi Road	G1	15
7 & A	Meena Bazar	G1	10
8 & D	Ghumar Mandi	G1	15
9 & D	Model Town Market	G2	10
10 & A	Field Ganj Market	G2	15
11 & D	Mall Road	G2	15
12 & D	Malhar road Market	G2	10
13 & D	Gill Road Market	G2	15
14 & D	Furniture Market	G2	10
15 & D	Gole Market	G3	15
16 & D	Kips Market	G3	15
17 & D	Tution Market	G3	10
18 & D	Dugri Market, Phase 1	G3	10
19 & D	Dugri Market, Phase 2	G3	10

20 & D	Feroz Gandhi Market	G3	15
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Sampling Method

Convenience sampling was used to choose the sample for the current study since it is a simple and practical way to survey consumers in B&M retail markets.

3.4 DATA COMPILATION AND ANALYSIS METHOD

To establish relevant results, data through offline survey was collected from pedestrian users in diverse B&M retail market in Ludhiana through Annexure-II, III & V.

3.4.1 STRUCTURE EQUATION MODELLING (ANNEXURE II)

To find strength of relationship on dependent variable (DV) i.e., US, the proposed conceptual framework is framed, as shown in fig 3.2 which consists of four independent variable (IV), out of which two constructs i.e., CA and SS are considered as input variable, remaining two i.e., C and CE are analyzed as parallel mediators. Out of 250 responses, annexure II was filled by 225 respondents, out of which 175 rational survey samples were considered for analysis. Following six statements related to conceptual framework were framed to check relationship of selected parameters with user satisfaction.

Statement 1. Convenience-Attractiveness is positively related to pedestrian user satisfaction.

Statement 2. Safety-Security is positively related to pedestrian user satisfaction.

Statement 3. Comfort and Convivial Environment are positively supported as parallel mediator between Convenience-Attractiveness and pedestrian user satisfaction.

Statement 4. Comfort and Convivial Environment are positively supported as parallel mediator between Safety-Security and pedestrian user satisfaction.

Statement 5. Comfort is positively supported as mediator between Convenience-Attractiveness and pedestrian user satisfaction.

Statement 6. Convivial Environment is positively supported as mediator between Convenience-Attractiveness and pedestrian user satisfaction.

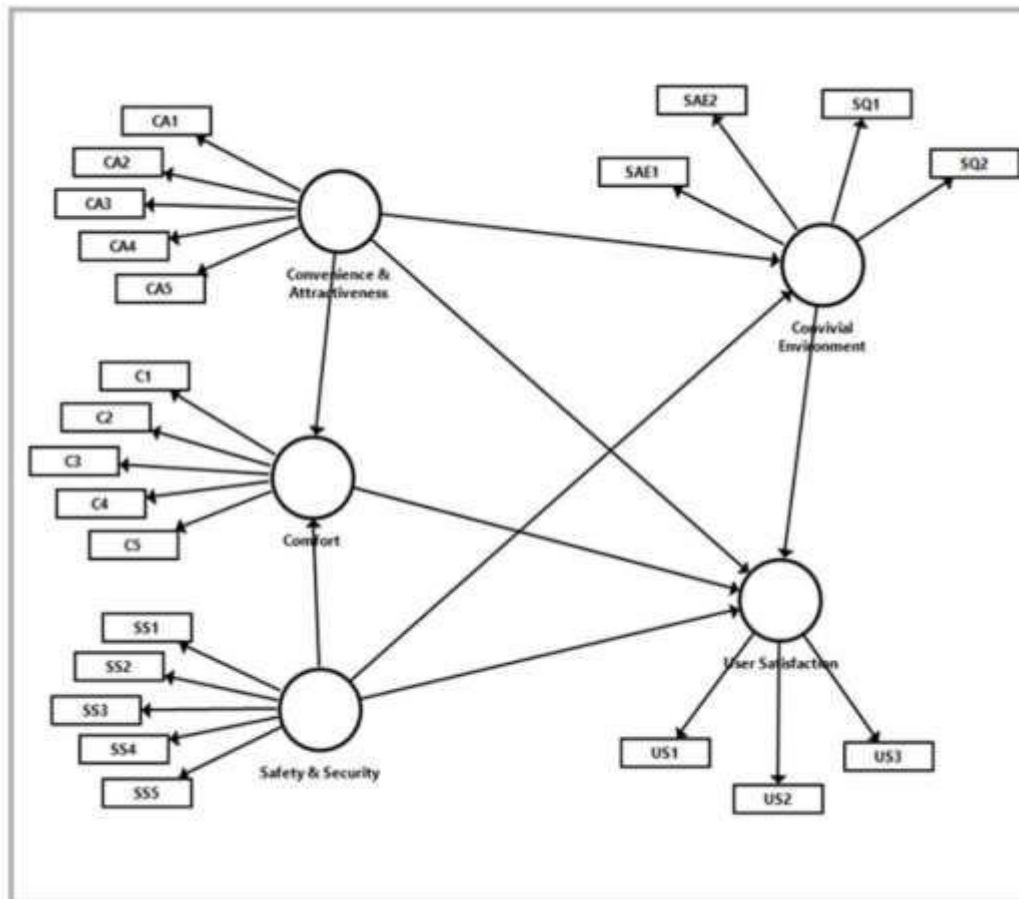


Figure 3.4 User satisfaction conceptual framework

Subsequently, to validate relationship among latent variable as per conceptual framework, partial least squares structural equation modelling (SEM) was used in smart PLS. Primary criteria for measuring significance of the dependent construct used in this structural model is explained variance. R^2 for endogenous latent variable model is assessed as substantial if value is ≥ 0.6 , moderate if value is ≥ 0.3 and weak if value is ≥ 0.2 . Q^2 establishes the predictive relevance of the endogenous constructs, to check predictability of model Q^2 is checked by blindfolding. In model if value is greater than 0.35, it means that model has substantial predictive relevance.

3.4.2 FIELD SURVEY FOR SEGMENT LEVEL PARAMETERS (ANNEXURE III)

In annexure III, survey form is divided into a total of five sections. The first four sections (A to D) objectively assessed the walkability of a particular segment through a total of 19 questions, before seeking subjective responses of pedestrian perception in the fifth section (E) through 3 questions. The objective and subjective responses were sought on a 5-point Likert scale, ranged from 1 Very Bad to 5 Very Good.

The data were entered and checked by utilizing MS Excel and IBM SPSS Statistics 21. Each of the parameters and attributes of study was subjected to diligent analysis for selected B&M markets as also cumulatively for the whole city. The main objective of field survey and pedestrian perception is finding important intangible parameters for pedestrian users in each B&M market which need to be compared and interpreted in respect of the various aspects.

As per Annexure IV, maximum scores were fixed for the various pedestrian user satisfaction parameters and attributes and summary is shown in below table 3.9. For calculating overall and segment level scores, each attribute is evaluated on 5 Likert scale, minimum score is 1 and maximum score is 5. As per calculation, overall minimum score could be $1 \times 22 = 22$ and maximum score would be $5 \times 22 = 110$. The total scores for parameter were obtained by average score of various attributes under that category. Formula for average calculation is: -

$$WA_i = \frac{\sum R_i \times N_i}{\sum N_i} \text{ ----- Equation 2}$$

where WA represents the average score for an attribute, R represents the score assigned to the various probable responses to a particular attribute and N represents the frequency of occurrence of such responses.

Table 3.9: Scoring Criteria for the Segment Level Walkability Parameters		
Codes	Parameters and Attributes	Maximum Scores
A	Convenience & Attractiveness (C&A)	25
B	Safety & Security (SS)	25
C	Comfort (C)	25
D	Convivial Environment (CE): -	20
E	User Satisfaction (US)	15
Total		110

The scores obtained from study were subjected to Analysis of Variance (ANOVA), to understand and interpret their variability based on different groups. To determine the direction of variability of mean scores, further the post-hoc test was undertaken.

3.4.3 PEDESTRIAN PERCEPTION AND PREFERENCE SURVEY (ANNEXURE V)

Pedestrian surveys will be conducted in each of the selected B&M retail markets to capture the views and preferences of pedestrians. These were considered important since the proposed

improvements must synchronize the expectations of the prime user to ensure significant improvement in the future. A short questionnaire on social characteristics and pedestrian preferences was designed based on previous studies (Annexure-V).

1) Socio-economic Profile This documented the social characteristics of the respondents in terms of gender, age, occupation, income, and vehicle ownership. This was a prerequisite to understand their preferences and the desired improvements.

2) Pedestrian Preferences The respondents were explored for their perception of the walking environment in retail market, their latent desire to walk while shopping more as also their desired improvements in the B&M built environment. For pedestrian preference, six questions were posed to them, with the former five on a 5-point Likert scale. The respondents were first interrogated about their preference for walking over driving, with the options ranging from ‘never’ to ‘almost every time.’ The second, third and fourth question pertained to the rating of B&M retail markets from pedestrian perspective. In fifth the pedestrians were further explored about their willingness to improve walkability conditions with the options ranging from ‘never’ to ‘almost every time.’ The last sixth question specifically sought their desired improvements in the built environment for better walkability. A total of five options were offered to 250 respondents, which they were required to rank as per their preference order.

Further, data which was collected from Preference Survey Performa, Chi-square tests and Crosstab test were performed to find degree of association of the pedestrian user preferences with socio-economic characteristics of the user. Lastly, the ranking against desired improvement was analyzed which was provided by 250 pedestrian users. The average of the desired improvement was calculated as under: -

$$WA_i = \frac{\sum R_i \times N_i}{\sum N_i} \text{----- Equation 3,}$$

where WA represents the average score for desired improvement, R represents the allocated score for rank and N represents the number of respondents.

For 1st rank allocated score was 5, 2nd rank as 4, 3rd rank as 3, 4th rank as 2 and 5th rank as 1.

Audit Protocol

Equipment’s for survey includes: - City map identifying the location and segments marked on it (map denoted with the street segment numbers), Copies of the Performa for Field Survey of Segment Level Parameters, Copies of the Questionnaire for Pedestrian Perception and Preference Survey, Measuring tape or a distance measuring device Cellular phone/ digital camera. Upon entering a street segment first noted on the Performa, the segment number as it corresponded to the B&M segment map. To get a feel of the surroundings for initial segments,

firstly walked till end and then walked again while filling out the Survey Performa. However, after surveying a few segments, found it more efficient to fill out the Survey Performa simultaneous in the first walk. It took approximately five minutes to ten minutes to administer the audit for each segment. Performa for pedestrian perception and preference survey also got filled as and when encountered pedestrian user of market. This ensured users' feedbacks from diverse settings. Both the field walkability survey and the pedestrian interview survey were undertaken simultaneously.

3.5 CONCLUSION

Altogether, this chapter developed the conceptual framework comprising of factors which affects pedestrian user satisfaction in B&M retail markets and analysis of selected markets shall bring forth those aspects that positively or negatively impact upon the pedestrian perception and the city in general. This would create a platform for recommending improvements in the existing setup and upcoming developments. The recommendations would get further strengthened based on feedback from the pedestrian user.

CHAPTER-4: DATA ANALYSIS

There are two sections in this chapter: - The first section examines factor analysis using structure equation modelling (SEM), which have impact on pedestrian user satisfaction in B&M retail markets. Further, in second part, segment level parameters and attributes have been analyzed in terms of their prevalence at the overall city level. A total of 100 segments fairly distributed among 20 B & M Built environment s (mean length 150 m; min. 1600 m; max.) were considered for the purpose. Overall, this chapter discusses the potential factors which influence pedestrian users' satisfaction in B&M retail markets.

4.1 STRUCTURE EQUATION MODELLING (SEM)

For analyzing the factors selected for B&M retail markets, out of various available techniques, structural equation modelling (SEM) is used. Reason for opting SEM is twofold, as along with confirmative factor analysis (CFA), it clearly specifies the relationship between various paths of model through path analysis (PA). As mentioned in previous chapter a conceptual framework has been framed in smart-PLS, with two input construct, two mediator construct & one output construct.

4.1.1 COMMON METHOD BIAS

For analyses of data, one hundred and seventy-five rational responses have been used. When we are collecting data of input and output variables from same respondents, it might happen that they can visualize the relationship which researcher wants to check, and then response can be biased, based on their past or personal experience, it is called common method bias (CMB). To check it in smart-PLS, variance inflation factor (VIF) method is used in this research. Result of inner VIF is shown in table 4.1, as in all cases value is less than 5, thus we can say there is absence of CMB

Table 4.1 Inner VIF Values

	User Satisfaction	Convenience & Comfort	Safety & Security	Convivial Environment
User Satisfaction		2.419	2.137	2.428
Comfort	2.248		2.153	2.202

Convenience & Attractiveness	2.084	2.229		2.413	2.473
Safety & Security	1.348	1.399	1.403		1.343
Convivial Environment	1.935	1.922	2.095	1.992	

Source: Authors' own calculations

4.1.2 CONFIRMATORY FACTOR ANALYSIS: - RELIABILITY & VALIDITY ANALYSIS

Confirmatory factor analysis (CFA) has been used to analyze cross-loading on variables. CFA technique is widely used to test the consistency between measures of construct framed in conceptual framework by researcher. Value of CFA ranges between 0 and 1, higher value indicate that items are more reliable for construct. Factor loading of all indicators of latent constructs in this conceptual framework is more than 0.5 as shown in Table 4.2. Value of Cronbach alpha is more than 0.7 as depicted in table 4.2, which is used to check internal consistency for reliability of all latent variables. Further under validity check, two tests i.e., convergent validity and discriminant validity were performed in smart-PLS. Value of Average variance extracted should be greater than 0.5 and composite reliability should be greater than 0.7 for all latent variables to be legitimate. As per table 4.2 value of AVE and CR are above 0.5 and 0.7 respectively, thus conceptual framework is valid for further analysis.

Table 4.2 Factor Loadings on items and value of Cronbach's α , AVE and CR on construct

Construct	Items	Factor Loading	Cronbach's α	AVE	CR
Convenience & Attractiveness (CA)	A1	0.885***	0.828	0.597	0.879
	A2	0.868***			
	A3	0.701***			
	A4	0.764***			
	A5	0.61***			
Safety & Security (SS)	B1	0.841***	0.851	0.625	0.892
	B2	0.864***			
	B3	0.819***			
	B4	0.647***			
	B5	0.763***			

Comfort (C)	C1	0.869***	0.843	0.62	0.889
	C2	0.883***			
	C3	0.831***			
	C4	0.57***			
	C5	0.744***			
Convivial Environment (CE)	D1	0.892***	0.837	0.678	0.892
	D2	0.81***			
	D3	0.912***			
	D4	0.654***			
User Satisfaction (US)	E1	0.858***	0.805	0.721	0.886
	E2	0.887***			
	E3	0.8***			
Note: All variable items of factor loading are significant; ***p<.001; **p<.01; *p<.05					

Source: Authors' own calculations

To check the extent to which selected factors are distinct from one other, discriminant validity is assessed by the heterotrait-monotrait ratio of correlations (HTMT) criteria. Table 4.3 exhibits that HTMT value of all latent variable is below 0.90, thus discriminant validity has been established between all constructs.

Table 4.3 Discriminant Validity as per Heterotrait-Monotrait Ratio (HTMT)

	C	CA	SS	CE	US
C					
CA	0.795				
SS	0.861	0.835			
CE	0.572	0.467	0.473		
US	0.766	0.775	0.72	0.54	

Source: Authors' own calculations

Further, to check multicollinearity among items, Variance Inflation Factor (VIF) was checked and found that for all the items value of VIF is less than 5 as per table 4.4, thus there is absence of multicollinearity, after CFA model is ready for further analysis.

Table 4.4 Multicollinearity among items

Item	VIF	Item	VIF
C1	2.633	SAE2	1.326
C2	3.063	SQ1	2.813

C3	2.219	SQ2	1.862
C4	1.429	SS1	2.306
C5	1.703	SS2	2.593
CA1	3.292	SS3	2.052
CA2	3.064	SS4	1.544
CA3	1.412	SS5	1.583
CA4	1.831	US1	2.068
CA5	1.46	US2	2.299
SAE1	3.227	US3	1.466

Source: Authors' own calculations

4.1.3 STRUCTURAL MODEL ASSESSMENT

Subsequently, to validate relationship among latent variable as per conceptual framework, partial least squares structural equation modelling (SEM) was used. R2 for endogenous latent variable model is assessed (substantial if value is ≥ 0.6 , moderate if value is ≥ 0.4 and weak if value is ≥ 0.2); for conceptual framework for this study, the value of R2 is 0.606, thus, in this case model is substantial in explaining pedestrian user satisfaction in B&M retail markets. Q2 establishes the predictive relevance of the endogenous constructs, to check predictability of model Q² is checked by blindfolding. In this case value of Q2 value of 0.432, which is greater than 0.35, it means this model has substantial predictive relevance.

Further, the conceptual framework specifies that out of six statements, all are significant (Table 4.5 and 4.6). Result of direct effect of C&E to US is ($\beta = 0.617$, SD = 0.05 and $p < 0.001$) and direct effect of S&S to US is ($\beta = 0.235$, SD = 0.055 and $p < 0.001$). Next total indirect effect of C&E to US is ($\beta = 0.226$, SD = 0.055 and $p < 0.001$) and total indirect effect of S&S to US is ($\beta = 0.082$, SD = 0.03 and $p < 0.01$). Further, specific indirect effect of C&E through CE to US is ($\beta = 0.095$, SD = 0.044 and $p < 0.033$) and specific indirect effect of C&E through C to US is ($\beta = 0.132$, SD = 0.052 and $p < 0.012$). Thus, Statements 1–6, all were supported.

Table 4.5 Path Analysis: Total Indirect Effect and Direct Effect

Path	Effect	SD	P Values	Result	
Convenience & Attractiveness -> Convivial Environment + Comfort -> User Satisfaction	Total Indirect Effect	0.226***	0.055	0	Supported

Convenience &					
Attractiveness -> User	Direct				
Satisfaction	Effect	0.617***	0.05	0	Supported
Safety & Security ->					
Convivial Environment +	Total				
Comfort -> User	Indirect				
Satisfaction	Effect	0.082**	0.03	0.007	Supported
Safety & Security -> User	Direct				
Satisfaction	Effect	0.235***	0.055	0	Supported
Note: ***p<.001; **p<.01; *p<.05					

Source: Authors' own calculations

Table 4.6 Path Analysis: Specific Indirect Effect

Path	Effect	SD	P Values	Result	
Convenience &					
Attractiveness -> Convivial	Specific				
Environment -> User	Indirect				
Satisfaction	Effect	0.095*	0.044	0.033	Supported
Convenience &					
Attractiveness -> Comfort -	Indirect				
> User Satisfaction	Effect	0.132*	0.052	0.012	Supported
Note: *p<.05; ns=not significant					

Source: Authors' own calculations

The first and second statement of this study was to analyze direct effect of C&A and S&S on user satisfaction respectively. The result showed that both plays a significant role toward pedestrian user satisfaction in retail markets. Results are in harmony with the former studies, which also explain positive influence of convenience- attractiveness and safety-security on pedestrian user satisfaction. Both input constructs in conceptual framework have significant positive impact on pedestrian user, thus enhancing convenience, attractiveness, safety, and security will increase footfall in these markets. Next, third and fourth statement were constructed to analyze total indirect effect of C&A and S&S by considering C and CE as mediator collectively through parallel mediation effect on user satisfaction. Result for both were significant which implies that C and CE are having significant mediation effect. The

significant influence of comfort and convivial environment on pedestrian user satisfaction is in harmony with the former studies.

Further, next two statement were framed by specific indirect effect of C&A, by considering C and CE, one by one on user satisfaction. Result depicts that specific indirect effect of C&A by C and CE are significant.

4.2 FIELD SURVEY FOR SEGMENT LEVEL PARAMETERS

Analysis is done in two parts, the first part deals with developing scores for B & M retail market environment to rank them based on user satisfaction in these markets. The scores for three groups i.e., G1 was those markets on which shops are located on either side of two-way road; G2 was those markets on which shops are located on either side of one-way road with divider; G3 were those in which front of shops is having open space, in 20 B & M retail markets were developed independently. The second part considers the residents general attitude towards walking, their probability for improving walk habits as also the specific improvements desired in the B & M retail market-built environment. The data collected from as many as 250 residents of various B & M retail markets ensured feedback from diverse set of residents that was subsequently utilized to generate information at cumulative city level as regards the residents' perceptions and preferences for improvements.

Table 4.7 Number and Length of Segments Surveyed

Group 1			
BM & Zone	Name	No of segments	Total Length (m)
1 & A	Chaura Bazaar	7	765
2 & A	Paratap Bazar	5	310
3 & A	Books Market	3	320
4 & A	Sabaan Bazar	5	330
5 & A	Wool Market	4	395
6 & A	Ghas Mandi Road	10	1045
7 & A	Meena Bazar	4	320
8 & D	Ghumar Mandi	8	1075
Group 2			
9 & D	Model Town Market	10	950
10 & A	Field Ganj Market	6	520

11 & D	Mall Road	6	1000
12 & D	Malhar road Market	5	1100
13 & D	Gill Road Market	8	1600
14 & D	Furniture Market	5	820
Group 3			
15 & D	Gole Market	1	150
16 & D	Kips Market	1	190
17 & D	Tution Market	2	150
18 & D	Dugri Market, Phase 1	3	220
19 & D	Dugri Market, Phase 2	3	240
20 & D	Feroz Gandhi Market	4	300

Source: Author's Observation

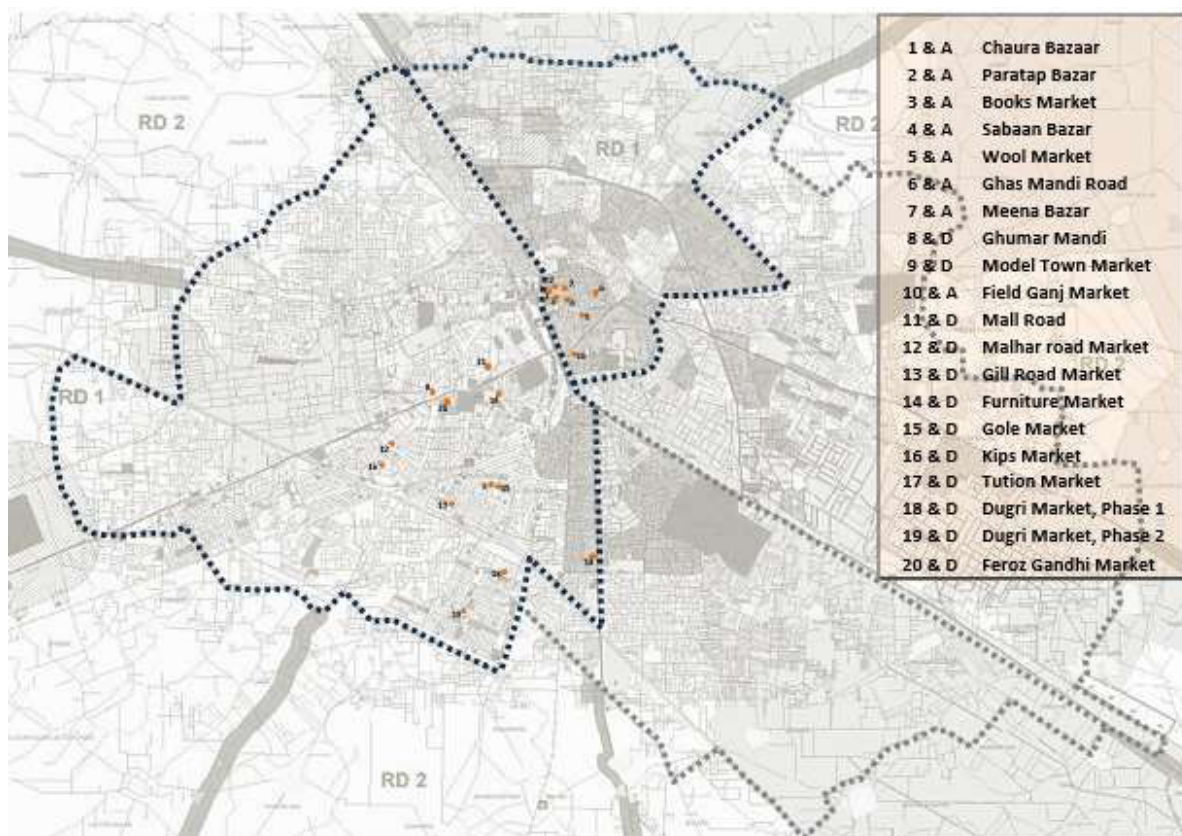


Figure 4.1 Spatial Distribution of selected B&M retail markets in Zone A & Zone D, Ludhiana.



Figure 4.2 (a)

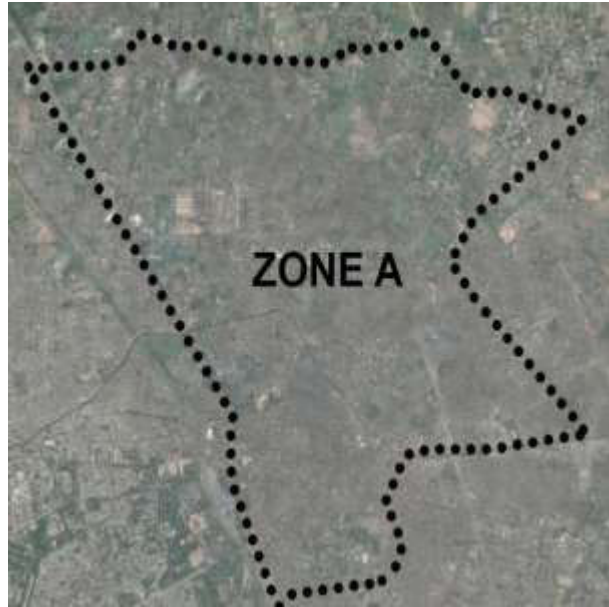


Figure 4.2(b)

Figure 4.3(a,b): Key Plan and Google image of B&M retail market in Zone A

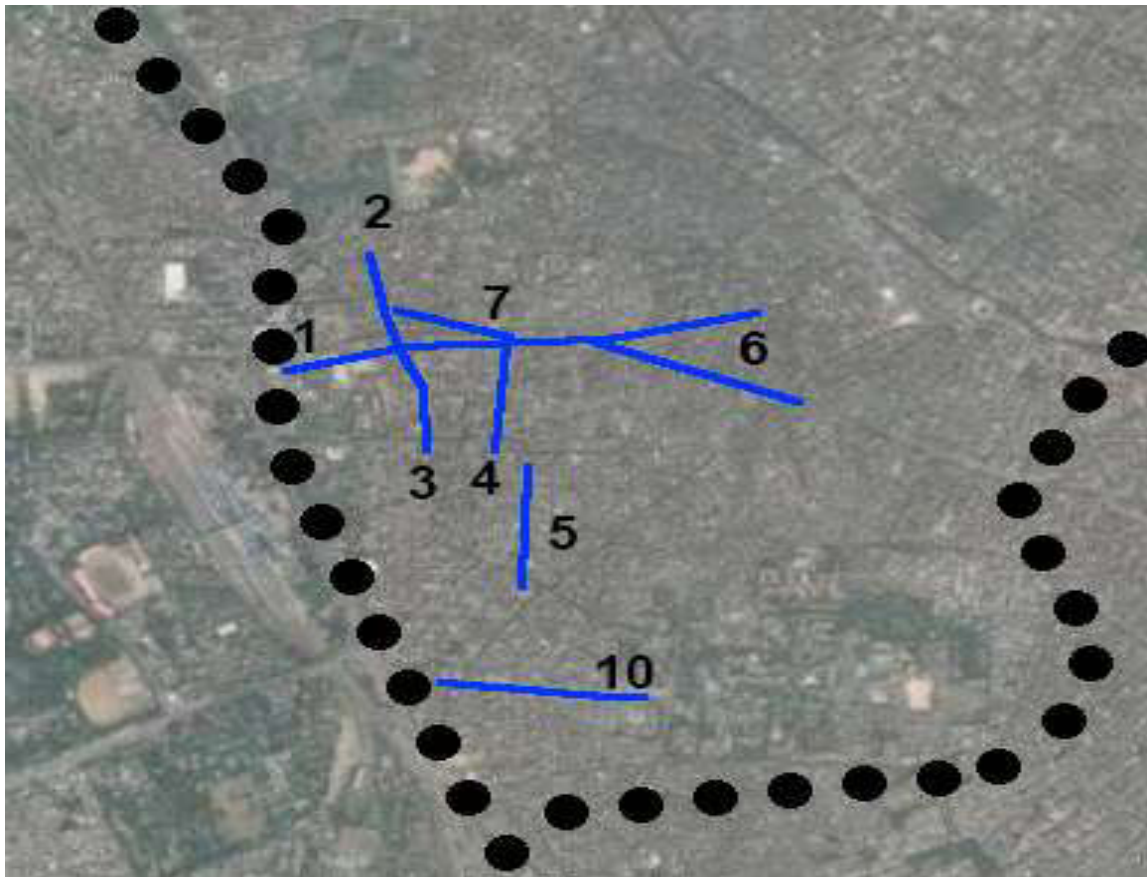


Figure 4.2 (c): Identified segments for survey of B&M retail market in Zone A



Figure 4.3 (a)



Figure 4.3 (b)

Figure 4.4 (a,b): Key Plan and Google image of B&M retail market in Zone D

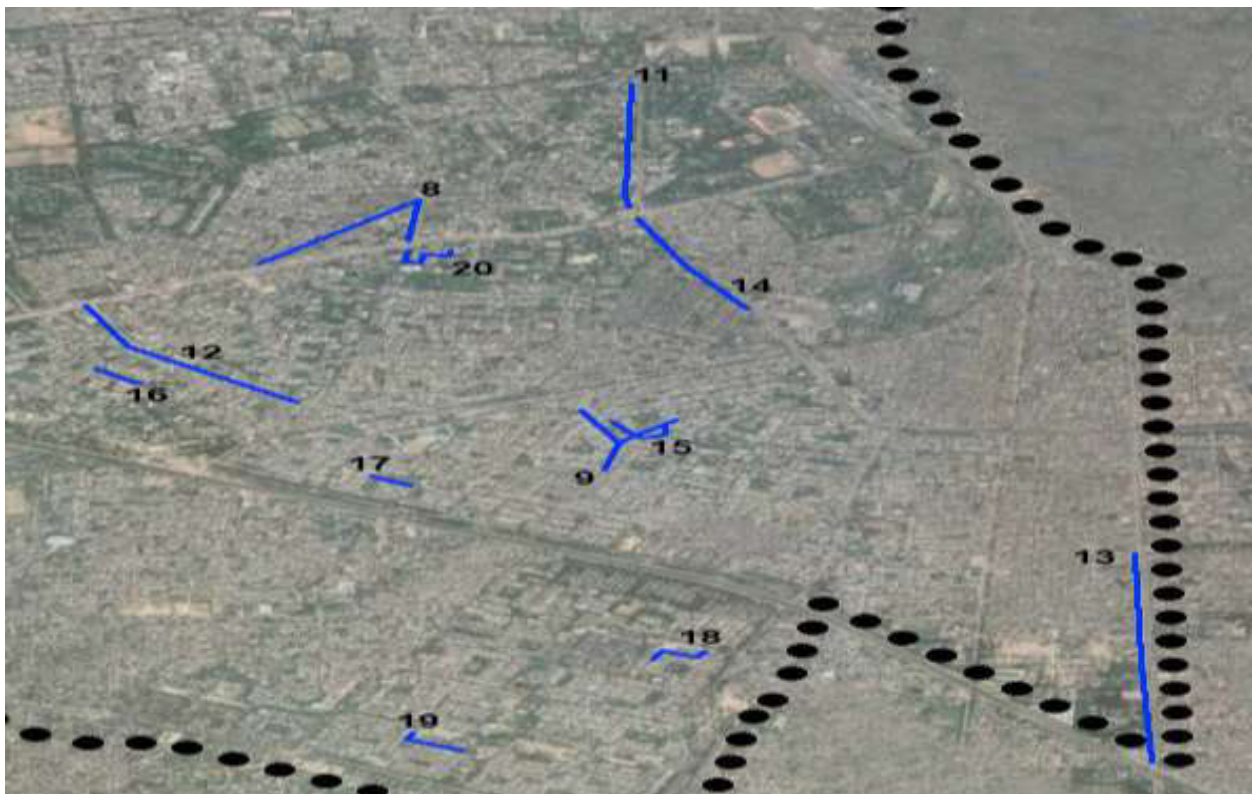


Figure 4.3 (c): Identified segments for survey of B&M retail market in Zone D

4.2.1 Glimpses of BM 1 Chaura Bazar Market at Zone A



Figure 4.4: Pedestrian Scenario in BM1 Chaura Bazaar

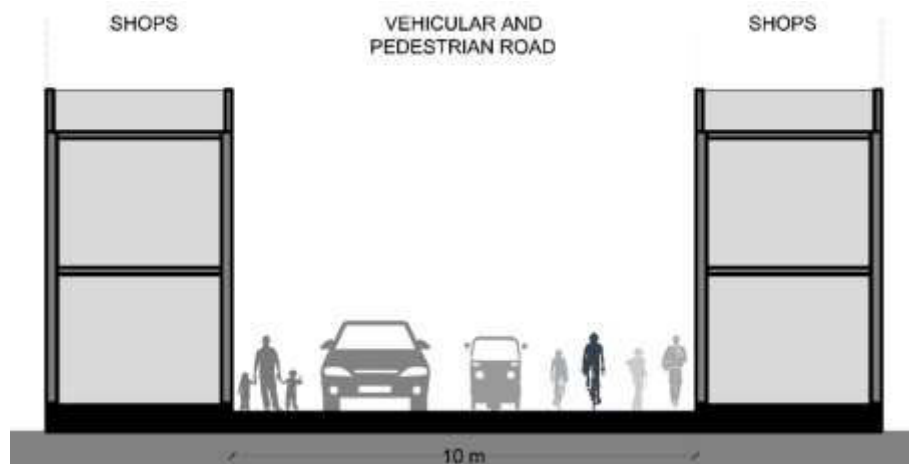


Figure 4.5: B&M Retail Street Section for BM1

- Lack of vehicular and pedestrian traffic segregation using elevated walkways or bollards.
- The dilapidated condition of the building façade does not promote a safe and inviting ambience.
- No dedicated parking zones
- Lack of pedestrian oriented street furniture, like street lights, benches for rest, signage, drinking water etc.
- Lack of green belts and trees which can be used to beat the harsh summer heat.

4.2.2 Glimpses of BM 2 Pratap Bazar at Zone A



Figure 4.6: Pedestrian Scenario in BM 2 Pratap Bazar

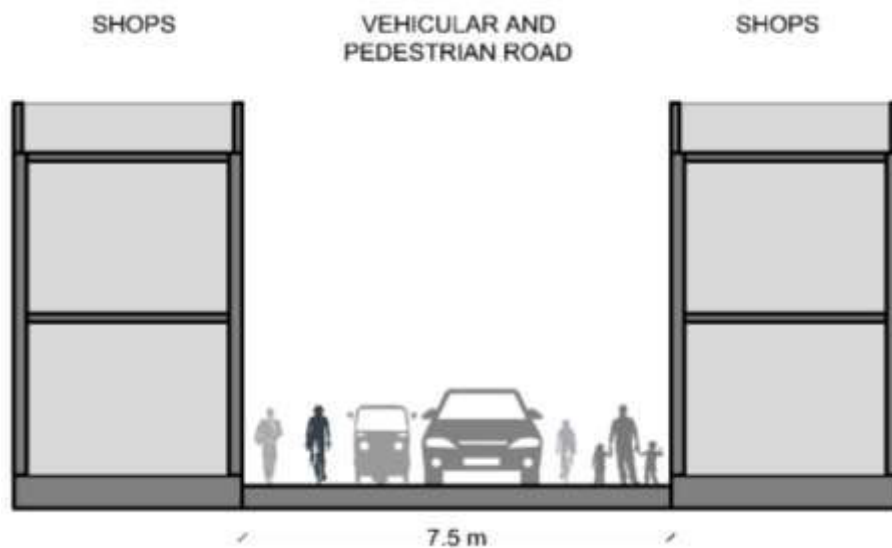


Figure 4.7: B&M Retail Street Section for BM2

- Lack of street vending zones
- Lack of dedicated parking zones
- The shopping activities encroach over the road which is used by pedestrians.
- No traffic segregation between vehicles and pedestrians
- Unplanned and disorganized building façade and sign boards
- Lack of street lights
- Traffic poles and shopping activities act as a hindrance to the pedestrian movement

4.2.3 Glimpses of BM 3 Books Market at Zone A



Figure 4.8: Pedestrian Scenario in BM 3 Books Market

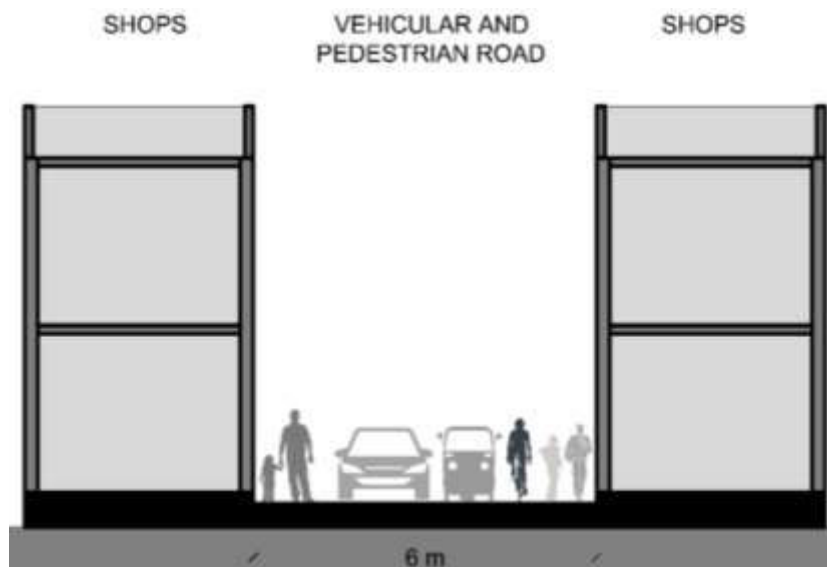


Figure 4.9: B&M Retail Street Section for BM3

- Lack of buffer space between the shopfront and the road.
- Lack of dedicated parking zones
- No segregation between vehicular and pedestrian traffic using elevated walkways or bollards.
- Uneven surface condition of road with portholes
- Electrical wires hinder the façade and signage of the shops.
- Lack of street amenities like street lights, dustbins, drinking water, signage, shaded walkways, green belts etc.

4.2.4 Glimpses of BM 4 Saban Bazar at Zone A



Figure 4.10: Pedestrian Scenario in BM 4 Saban Bazar

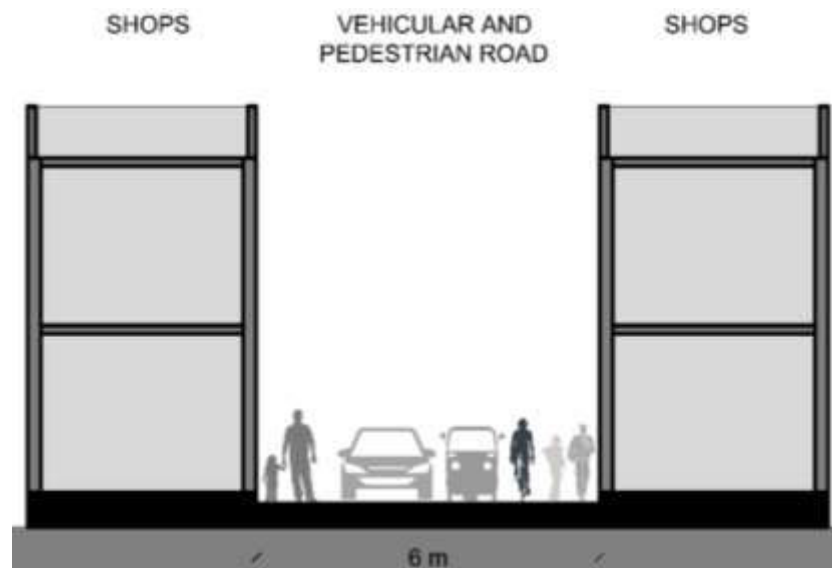


Figure 4.11: B&M Retail Street Section for BM4

- Lack of dedicated building zone in front of the shops
- Shopping activities encroach over the road
- Lack of dedicated parking zones, green belts, and trees
- Uneven surface condition of road with portholes in some parts
- Lack of street amenities like street lights, dustbins, drinking water etc.
- No traffic segregation in vehicles and pedestrians

4.2.5 Glimpses of BM 5 Wool Market at Zone A



Figure 4.12: Pedestrian Scenario in BM 5 Wool Market

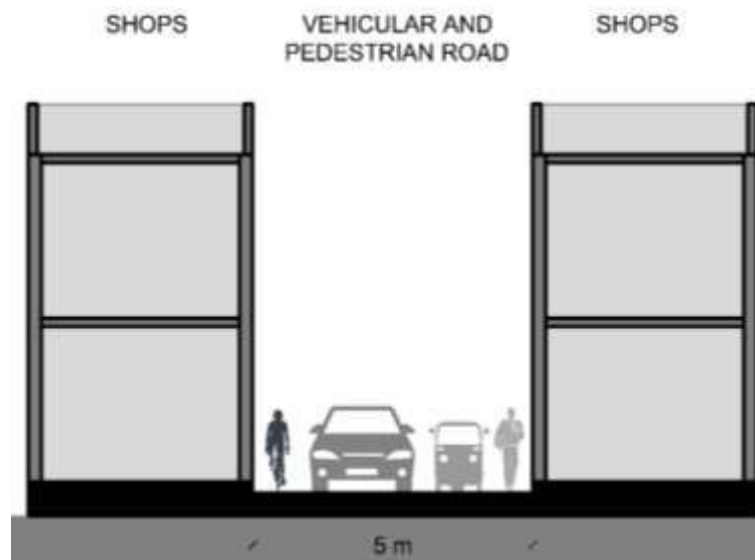


Figure 4.13: B&M Retail Street Section for BM5

- Shopping activities encroach over the road as there is no dedicated building zone
- No traffic segregation in vehicles and pedestrians
- Electrical wires hinder the façade and signage of the shops.
- Lack of street amenities like street lights, dustbins, drinking water, signage, shaded walkways, green belts etc.
- Uneven surface condition of road with portholes in some parts
- Haphazard parking as there is no dedicated parking lanes or zones

4.2.6 Glimpses of BM 6 Ghas Mandi Road at Zone A



Figure 4.14: Pedestrian scenario in BM 6 Ghas Mandi Road

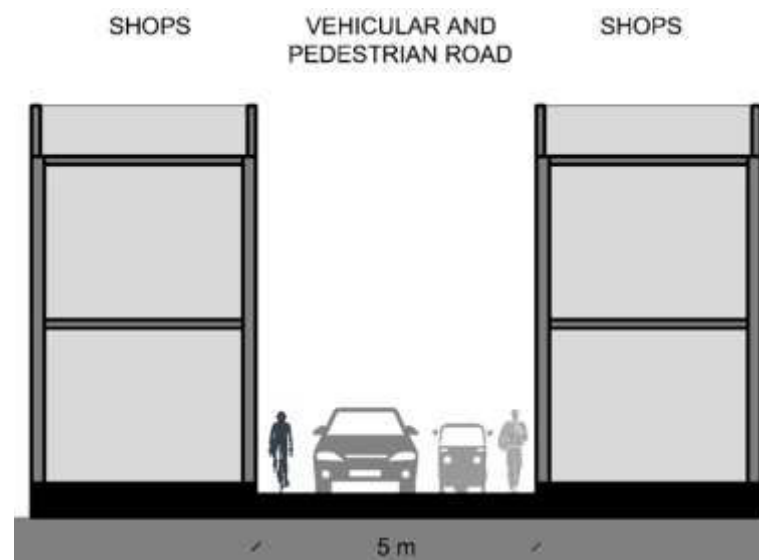


Figure 4.15: B&M Retail Street Section for BM 6

- No segregation between vehicular and pedestrian traffic using elevated walkways or bollards.
- Shopping activities encroach over the road as there is no dedicated building zone
- Haphazard parking as there is no dedicated parking lanes or zones
- Unplanned and disorganized building façade and sign boards
- Electrical wires hinder the façade and signage of the shops.
- Lack of street amenities like street lights, dustbins, drinking water, signage, shaded walkways, green belts etc.

4.2.7 Glimpses of BM 7 Meena Bazar at Zone A



Figure 4.16: Pedestrian scenario in BM 7 Meena Bazar

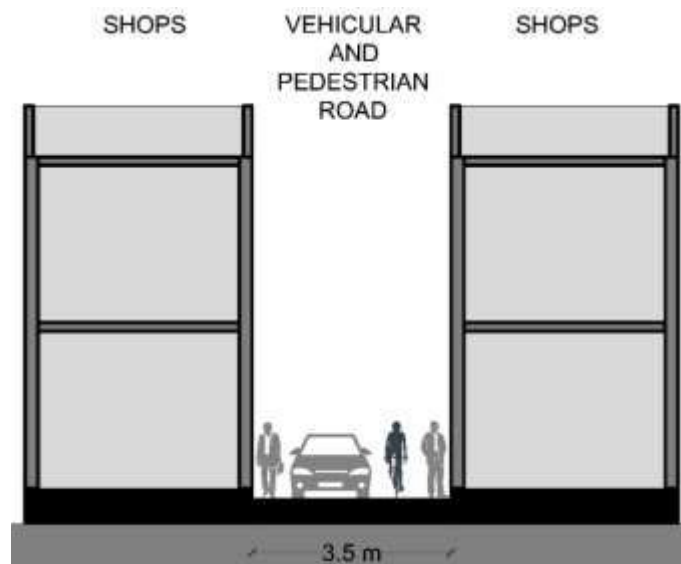


Figure 4.17: B&M Retail Street Section for BM 7

- Shopping activities encroach over the road as there is no dedicated building zone
- Lack of signage and sign boards.
- Haphazard parking as there is no dedicated parking lanes or zones
- Insufficient road width to accommodate both vehicular and pedestrian traffic
- Lack of street amenities like street lights, dustbins, drinking water, signage, shaded walkways, green belts etc.
- Uneven surface condition of road with portholes in some parts

4.2.8 Glimpses of BM 8 Ghumar Mandi at Zone D



Figure 4.18: Pedestrian scenario in BM 8 Ghumar Mandi

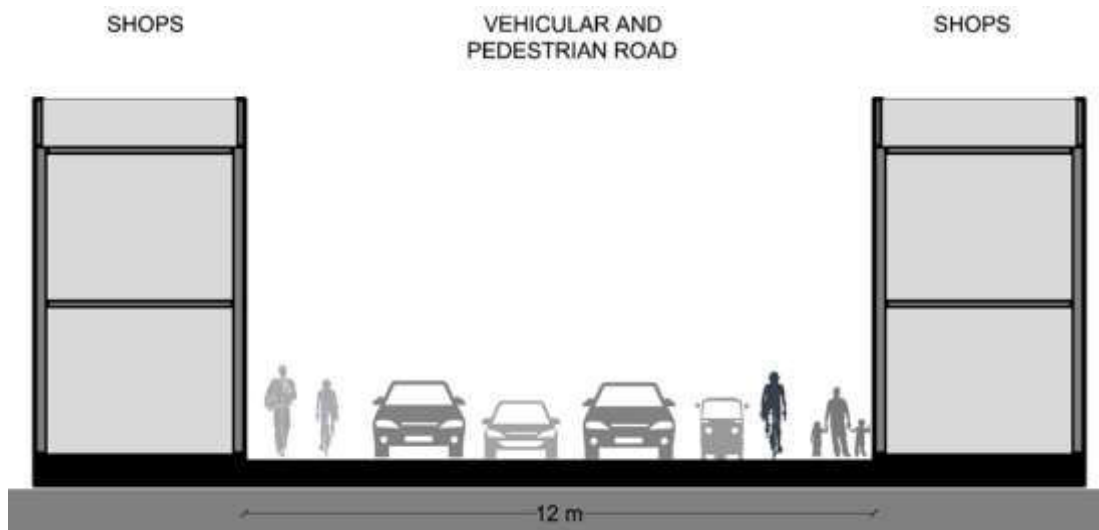


Figure 4.19: B&M Retail Street Section for BM 8

- Haphazard parking in front of the shops as there is no dedicated parking lanes or zones
- No segregation between vehicular and pedestrian traffic using elevated walkways or bollards.
- Lack of street amenities like street lights, dustbins, drinking water, signage, shaded walkways, green belts etc.
- Relatively better surface condition than other markets in zone A, but still uneven in some areas.
- Disorganized façade signage.

4.2.9 Glimpses of BM 9 Model Town Market at Zone D



Figure 4.20: Pedestrian scenario in BM 9 Modal Town Market

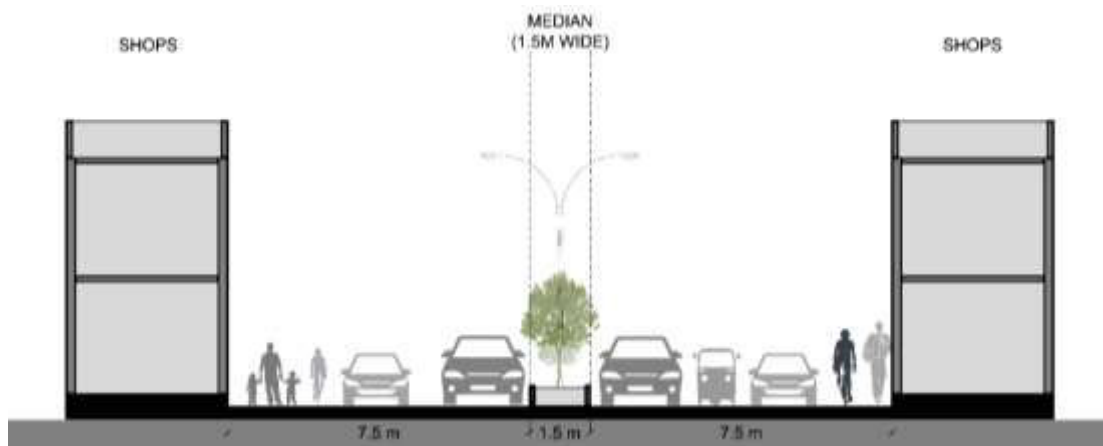


Figure 4.21: B&M Retail Street Section for BM 9

- Provision of paved walkways for pedestrians but no segregation using curbs or green belts or bollards.
- Parked cars obstruct the paved walkways for pedestrians
- The trees help in mitigating heat to some extent and create an individual zone for the area
- Lack of street vending zones
- Electrical wires obstruct the view of users.
- Lack of street amenities like bollards, dustbins, drinking water, signage, street art etc.
- Uneven surface leads to water stagnation poor hygiene of the area

4.2.10 Glimpses of BM 10 Field Ganj Road at Zone A



Figure 4.22: Pedestrian scenario in BM 10 Field Ganj Road Market

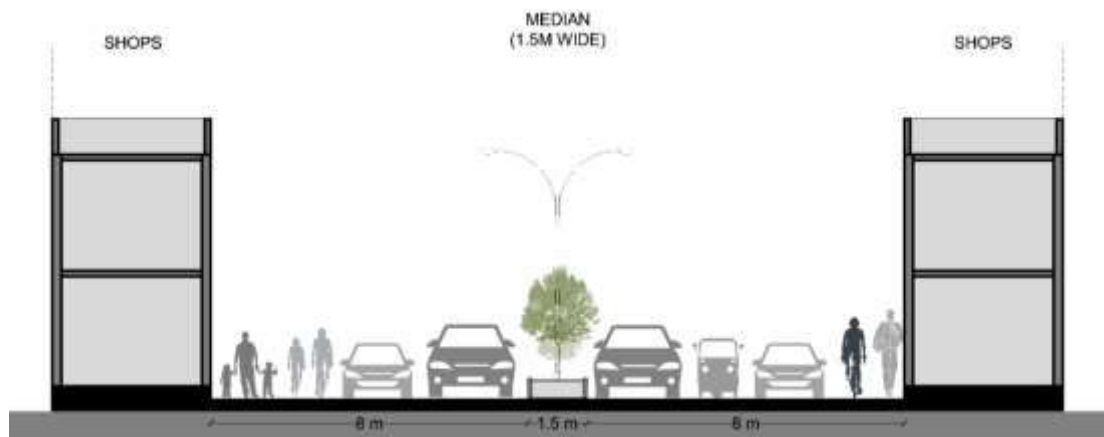


Figure 4.23: B&M Retail Street Section for BM 10

- Building zone of the shops being used as vending and parking zone not creating a viable situation
- Unplanned and disorganized building façade and signage.
- Lack of segregation between the pedestrian and vehicular traffic using elevated and dedicated pedestrian walkways.
- Lack of street amenities like bollards, dustbins, drinking water, signage, street art etc.

4.2.11 Glimpses of BM 11 Mall Road at Zone D



Figure 4.24: Pedestrian scenario in BM 11 Mall Road Market

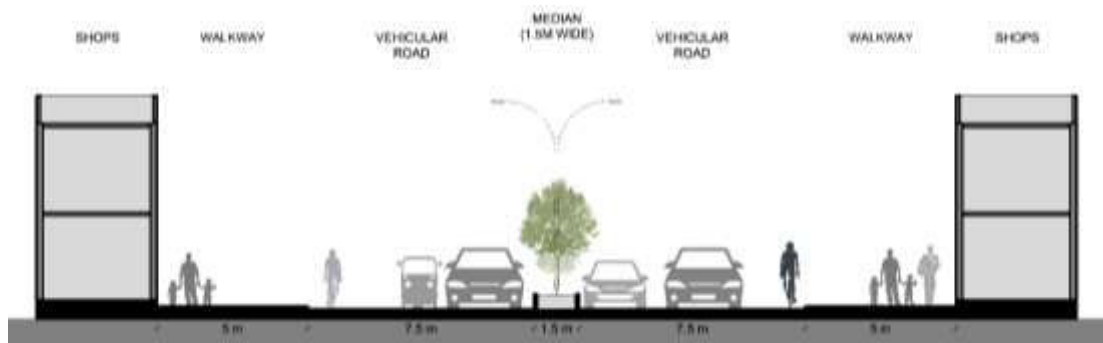


Figure 4.25: B&M Retail Street Section for BM 11

- Dedicated space for pedestrians, but no proper segregation using bollards, verge or railings
- Intermittent sights of greenery, but insufficient
- Lack of dedicated parking zones
- Electricity poles, short ramps, tree roots, parked vehicles, etc. create obstructions in the pedestrian walkways
- Lack of street amenities and street furniture like benches, dustbins, drinking water etc.
- Lack of dedicated street vending zones creating a haphazard situation

4.2.12 Glimpses of BM 12 Malhar Road Market at Zone D



Figure 4.26: Pedestrian scenario in BM 12 Malhar Road Market

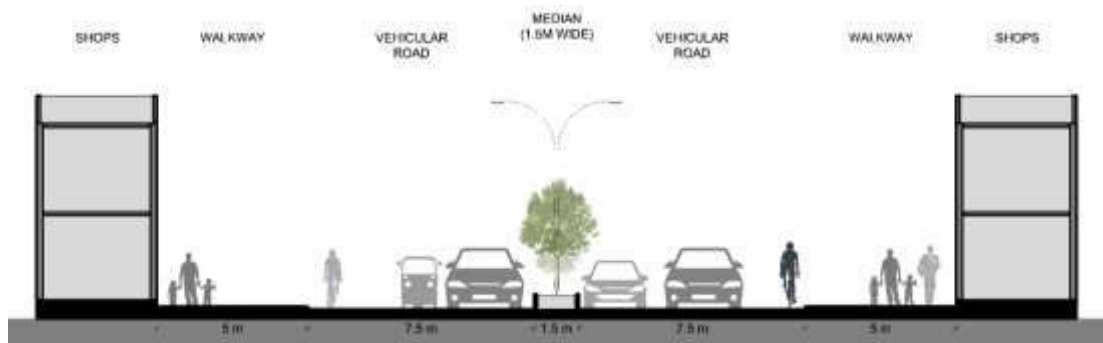


Figure 4.27: B&M Retail Street Section for BM 12

- Paved areas along both sides of carriageway but mostly encroached by parked vehicles
- Lack of dedicated parking zones
- Traffic segregation is done using bollards
- Building zone of the shops being used for parking which is not an ideal situation.
- Lack of directional and street signage
- Lack of street amenities like street furniture, dustbins, drinking water etc.
- Traffic calming measures like speed bumps and textured tiles applied

4.2.13 Glimpses of BM 13 Gill Road Market at Zone D



Figure 4.28: Pedestrian scenario in BM 13 Gill Road Market

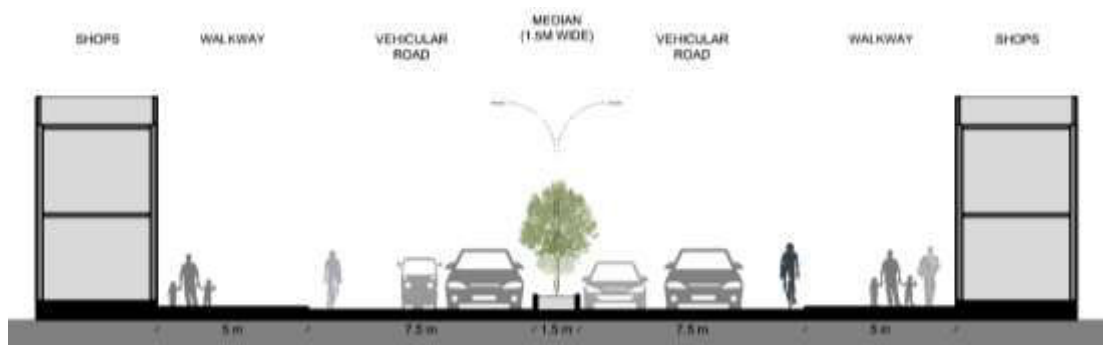


Figure 4.29: B&M Retail Street Section for BM 13

- Building zone utilized for parking
- Provision of pedestrian pathways but no segregation from vehicular traffic
- Intermittent pockets of greenery and trees act as visual segregation and help in defining spaces.
- Façade control measures can help uplift the market
- Lack of pedestrian street light leading to lack of sense of security and safety at evening and night times
- Tree roots, parked vehicles, etc. create obstructions in pedestrian flow in some parts of the stretch

4.2.14 Glimpses of BM 14 Furniture Market at Zone D



Figure 4.30: Pedestrian scenario in BM 14 Furniture market

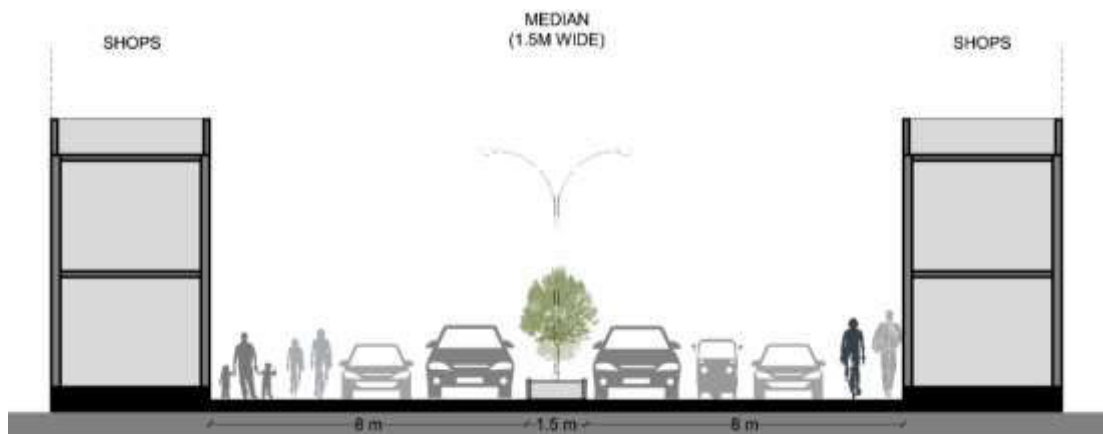


Figure 4.31: B&M Retail Street Section for BM 14

- Provision of pedestrian pathways but no segregation from vehicular traffic
- Building zone utilized for parking
- Tree roots, parked vehicles, etc. create obstructions in pedestrian flow in some parts of the stretch
- Lack of pedestrian street light leading to lack of sense of security and safety at evening and night times
- Provision of pedestrian pathways but no segregation from vehicular traffic
- Intermittent pockets of greenery and trees act as visual segregation and help in defining spaces.
- Façade control measures can help uplift the street

4.2.15 Glimpses of BM 15 Gole Market at Zone D



Figure 4.32: Pedestrian scenario in BM 15 Gole Market



Figure 4.33: B&M Retail Street Section for BM 15

- Lack of segregation between vehicular and pedestrian traffic
- Moderate sense of enclosure created using high railings and trees
- Shaded areas created using trees
- Façade control measures can help uplift the market
- Lack of dedicated parking lanes leading to encroachment of cars on the pedestrian space
- Lack of street amenities like street furniture, dustbins, drinking water etc.
- Uneven surface in some parts of the stretch
- Lack of directional, parking and street signage.

4.2.16 Glimpses of BM 16 Kips Market at Zone D

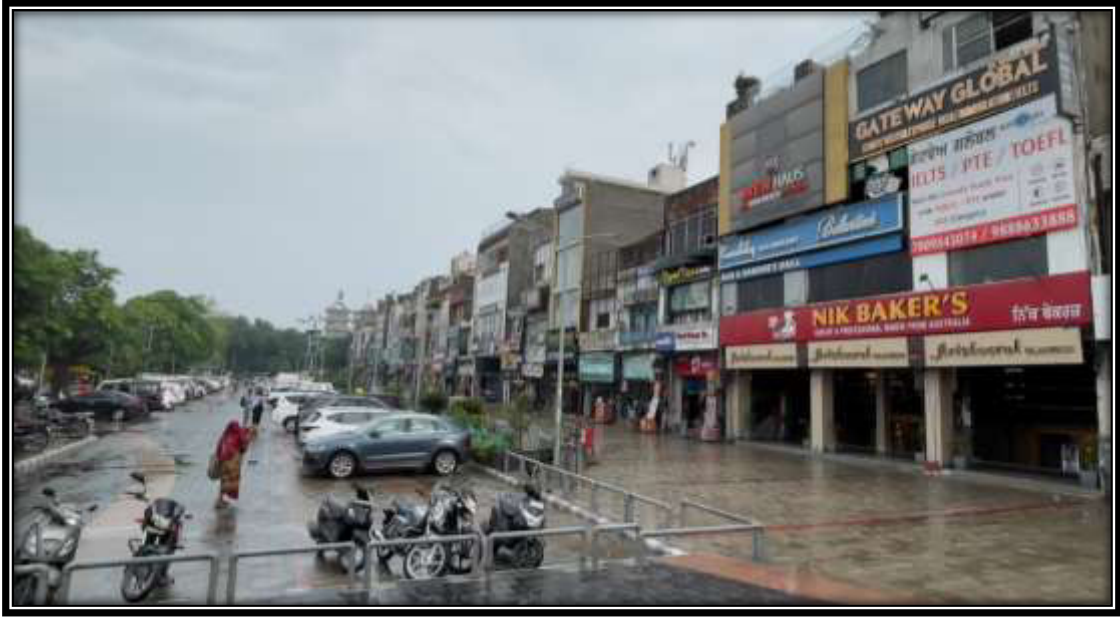


Figure 4.34: Pedestrian scenario in BM 16 Kips Market

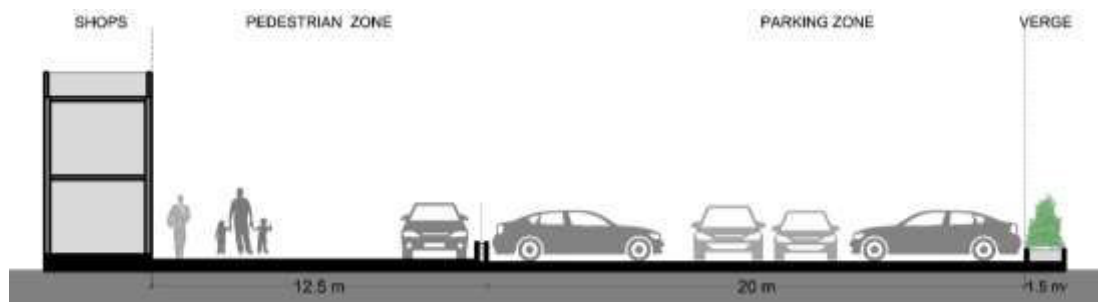


Figure 4.35: B&M Retail Street Section for BM 16

- Segregated pedestrian space defined using railings, curbs and different surface material
- Shaded walkways promote walking
- Visual and space enclosure created using trees and verges
- Dedicated parking space prevents vehicular traffic from interfering pedestrian traffic
- Façade control measures can help uplift the market
- Well defined building zone and pedestrian zone helps in making the shopping experience more comfortable.
- Lack of street amenities like benches, dustbins, drinking water etc.
- Addition of street art and landscape can boost this market.

4.2.17 Glimpses of BM 17 Tuition Market at Zone D



Figure 4.36: Pedestrian scenario in BM 17 Tuition Market

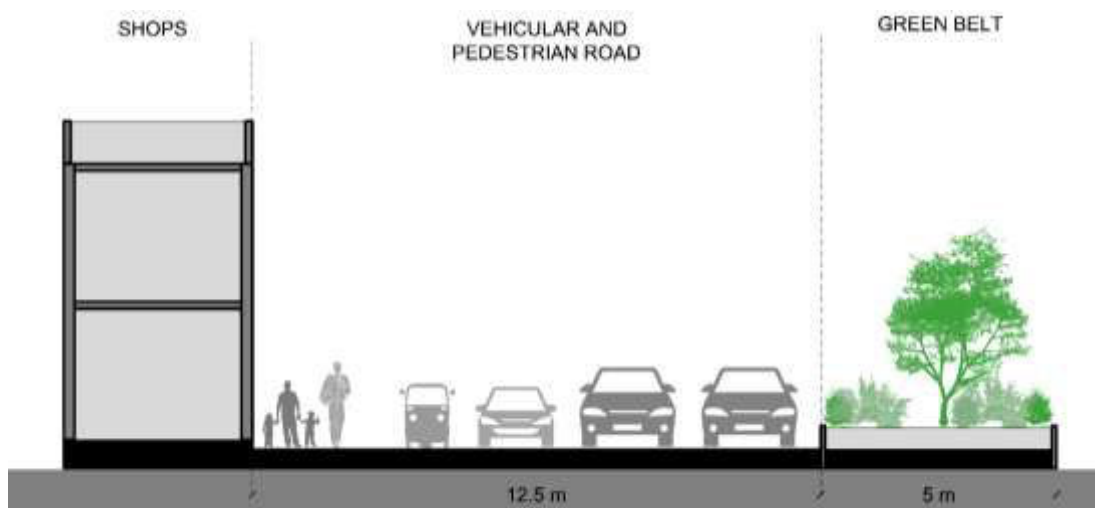


Figure 4.37: B&M Retail Street Section for BM 17

- Lack of segregation between vehicular and pedestrian traffic
- Moderate sense of enclosure created using high railings and trees
- Shaded areas created using trees
- Façade control measures required as not much building prominently visible
- Lack of dedicated parking lanes leading to encroachment of cars on the pedestrian space
- Lack of street amenities like street furniture, dustbins, drinking water etc.
- Uneven surface in some parts of the stretch
- Lack of directional, parking and street signage

4.2.18 Glimpses of BM 18 Dugri Market Phase 1 at Zone D



Figure 4.38: Pedestrian scenario in BM 18 Dugri Market, Phase1

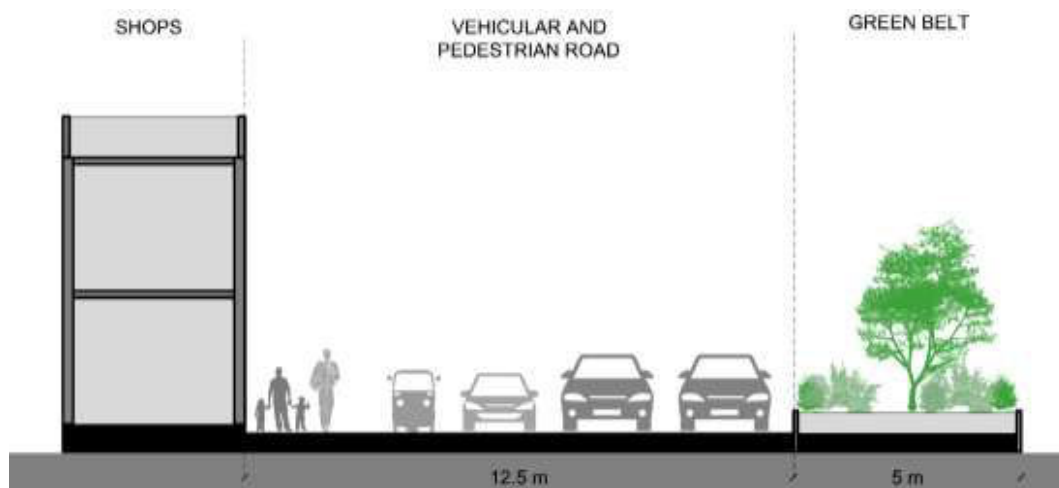


Figure 4.39: B&M Retail Street Section for BM 18

- Moderate sense of enclosure created using high railings and trees
- Lack of segregation between vehicular and pedestrian traffic
- Lack of directional, parking and street signage
- Lack of dedicated parking lanes leading to encroachment of cars on the pedestrian space
- Shaded areas created using trees
- Lack of street amenities like street furniture, dustbins, drinking water etc.
- Uneven surface in some parts of the stretch

4.2.19 Glimpses of BM 19 Dugri Market Phase II at Zone D



Figure 4.40: Pedestrian scenario in BM 19 Dugri Market, Phase II

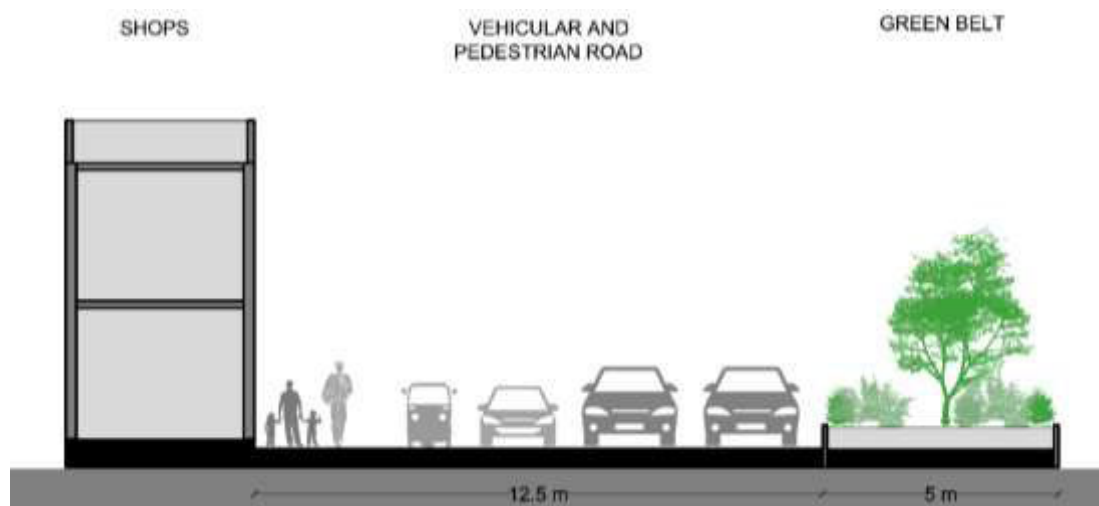


Figure 4.41: B&M Retail Street Section for BM 19

- Moderate sense of enclosure created using high railings and trees
- Lack of segregation between vehicular and pedestrian traffic
- Lack of directional, parking and street signage
- Lack of dedicated parking lanes leading to encroachment of cars on the pedestrian space
- Shaded areas created using trees
- Lack of street amenities like street furniture, dustbins, drinking water etc.
- Uneven surface in some parts of the stretch

4.2.20 Glimpses of BM 20 Feroz Gandhi Market at Zone D



Figure 4.42: Pedestrian scenario in BM 20 Feroz Gandhi Market



Figure 4.43: B&M Retail Street Section for BM 20

- Lack of segregation between vehicular and pedestrian traffic
- Lack of dedicated parking lanes leading to encroachment of cars on the pedestrian space
- Lack of directional, parking and street signage
- Lack of street amenities like street furniture, dustbins, drinking water etc.
- Uneven surface in some parts of the stretch
- Moderate sense of enclosure created using high railings and trees
- Shaded areas created using trees

4.3 PREVALENCE OF SEGMENT LEVEL PARAMETERS AND ATTRIBUTES

To analyze existing state in B&M (physical) retail markets, identified factors were evaluated as per annexure III by keeping pedestrian user satisfaction in mind. Survey form is divided into a total of five sections and frequency of all 22 attributes is evaluated using a five-point Likert scale, where 1 is Very Bad to 5 is Very Good rating. Below prevalence of five parameters is presented in tabular and pie chart form.

4.3.1 Prevalence of Attributes of Convenience and Attractiveness

Table 4.8: Percentage of Prevalence in Attributes of Convenience and Attractiveness

Codes	Parameter/Attribute	Frequency	Percentage
A1	Availability of pedestrian amenities like water, public toilets, ATM etc. at walkable distance.		
	Very bad	0	0
	Bad	0	0
	Average	46	46
	Good	54	54
A2	Availability of streetscape elements like street furniture, garbage bins etc. at regular interval		
	Very bad	0	0
	Bad	44	44
	Average	35	35
	Good	20	20
A3	Dedicated parking area at multiple location for ease of connectivity		
	Very bad	0	0
	Bad	7	7
	Average	42	42
	Good	47	47
A4	Control of traffic volume and speed by various traffic claiming devices		
	Very bad	0	0
	Bad	7	7
	Average	42	42
	Good	47	47

	Very bad	0	0
	Bad	0	0
	Average	73	73
	Good	27	27
	Very good	0	0
A5	Width of Pathway should be greater than 1.8m for unobstructed walking		
	Very bad	0	0
	Bad	0	0
	Average	37	37
	Good	62	62
	Very good	1	1

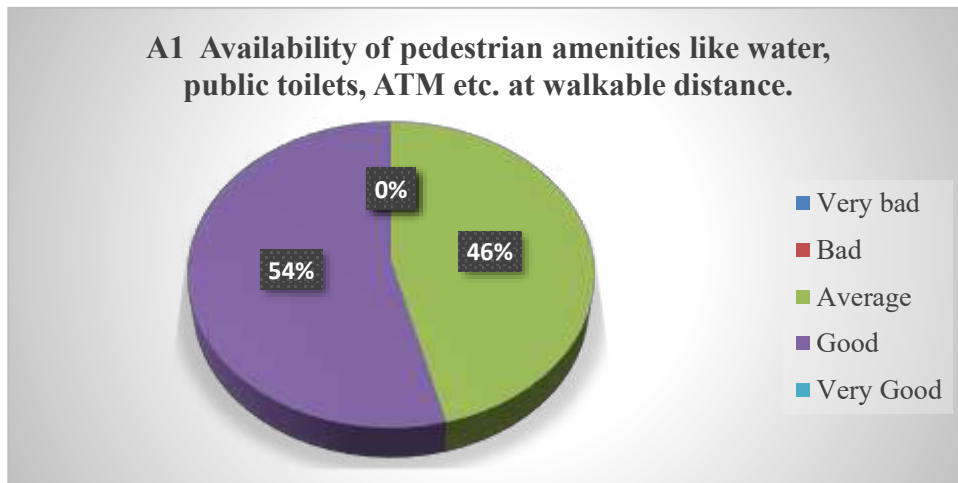


Figure 4.44: Prevalence of Attribute A1

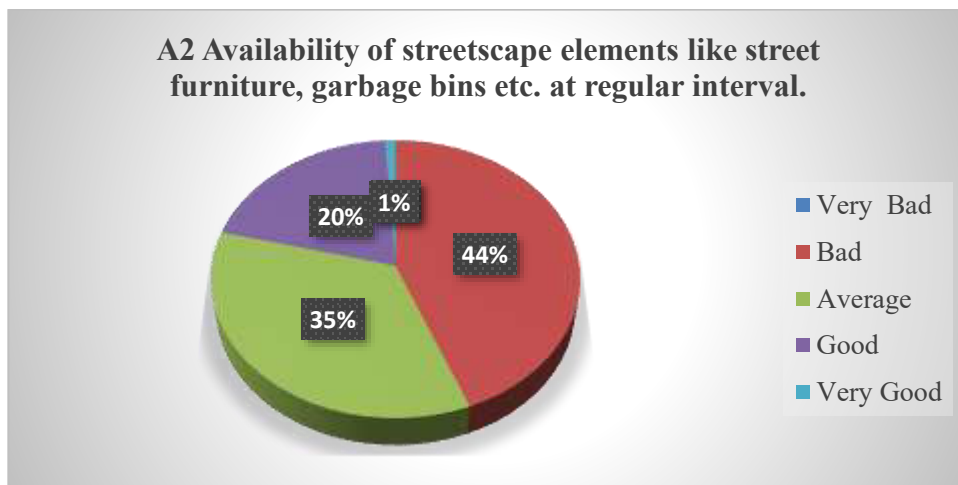


Figure 4.45: Prevalence of Attribute A2

A3 Dedicated parking area at multiple location for ease of connectivity.

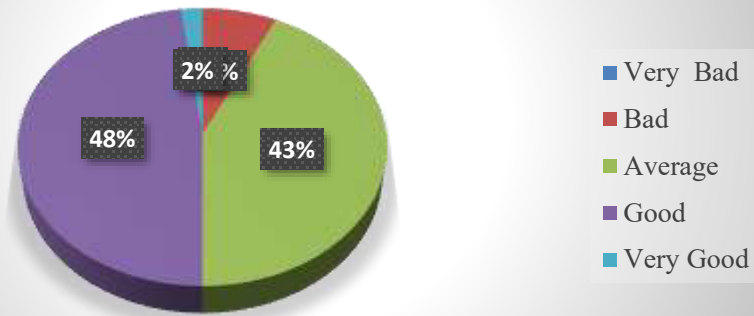


Figure 4.46: Prevalence of Attribute A3

A4 Control of traffic volume and speed by various traffic claiming devices.

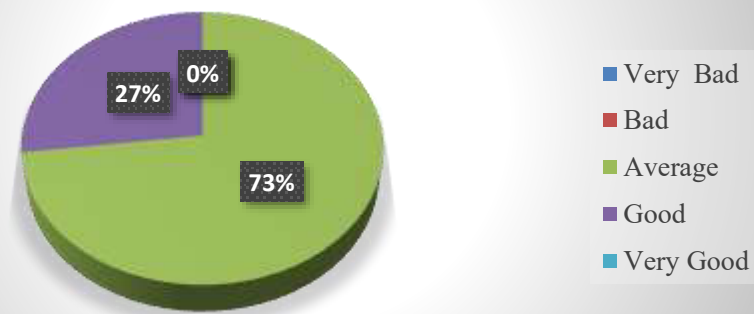


Figure 4.47: Prevalence of Attribute A4

A5 Width of Pathway should be greater than 1.8m for unobstructed walking.

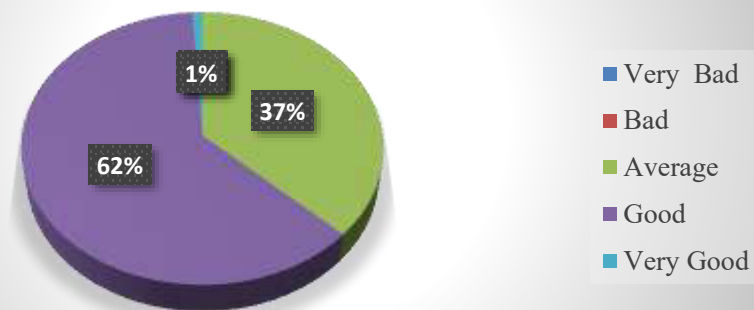


Figure 4.48: Prevalence of Attribute A5

4.3.2 Prevalence of Attributes of Safety & Security

Table 4.9: Percentage of Prevalence in Attributes of Safety and Security

Codes	Parameter/Attribute	Frequency	Percentage
B1	Safety measures like CCTV, security guard etc.		
	Very bad	0	0
	Bad	0	0
	Average	38	38
	Good	62	62
	Very good	0	0
B2	Layout emphasizing eye on street concept.		
	Very bad	0	0
	Bad	0	0
	Average	6	6
	Good	94	94
	Very good	0	0
B3	Provision of non-motorized public transport mode.		
	Very bad	84	84
	Bad	0	0
	Average	13	13
	Good	3	3
	Very good	0	0
B4	Pedestrian crossing should be provided at appropriate distance.		
	Very bad	0	0
	Bad	0	0
	Average	64	64
	Good	36	36
	Very good	0	0
B5	Fire safety measures should be provided as per code.		
	Very bad	0	0
	Bad	0	0

	Average	38	38
	Good	62	62
	Very good	0	0

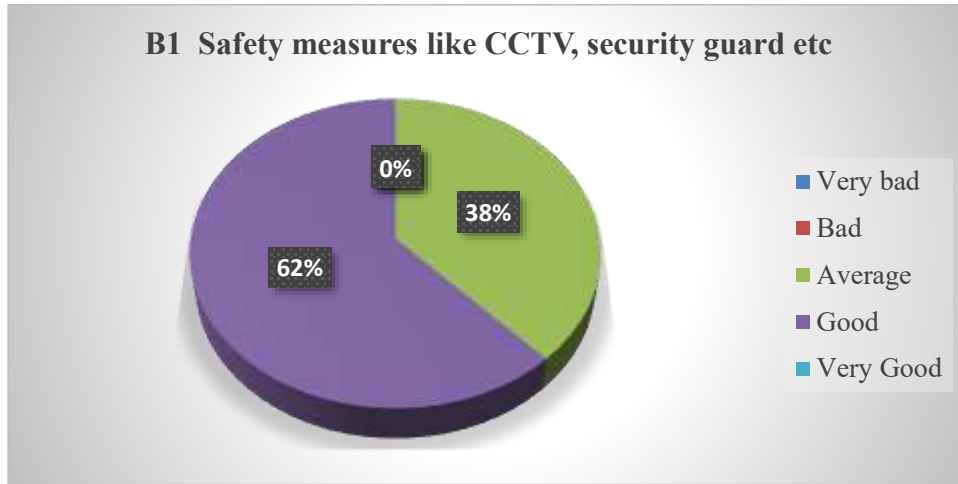


Figure 4.49: Prevalence of Attribute B1

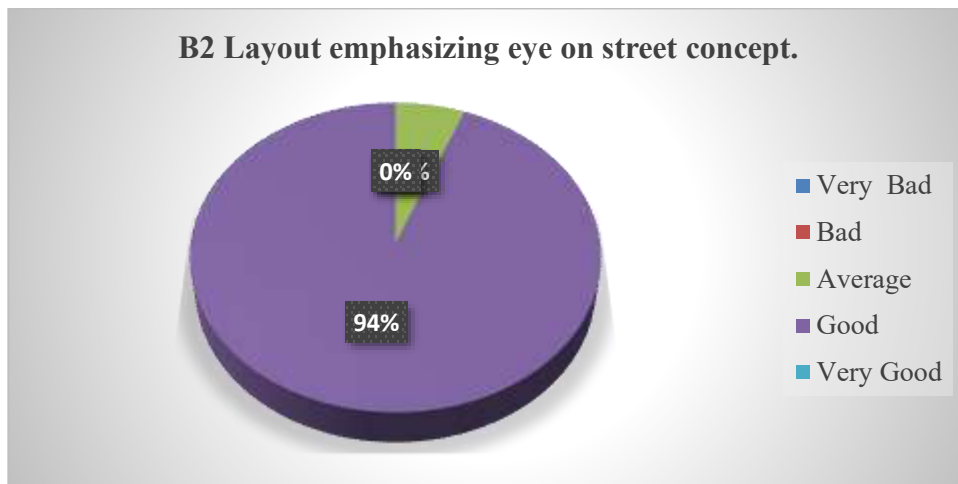


Figure 4.50: Prevalence of Attribute B2

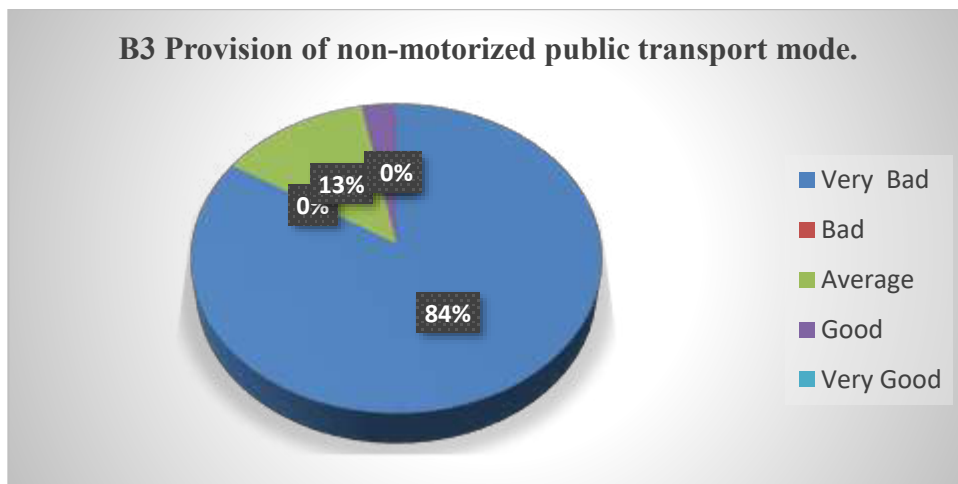


Figure 4.51: Prevalence of Attribute B3

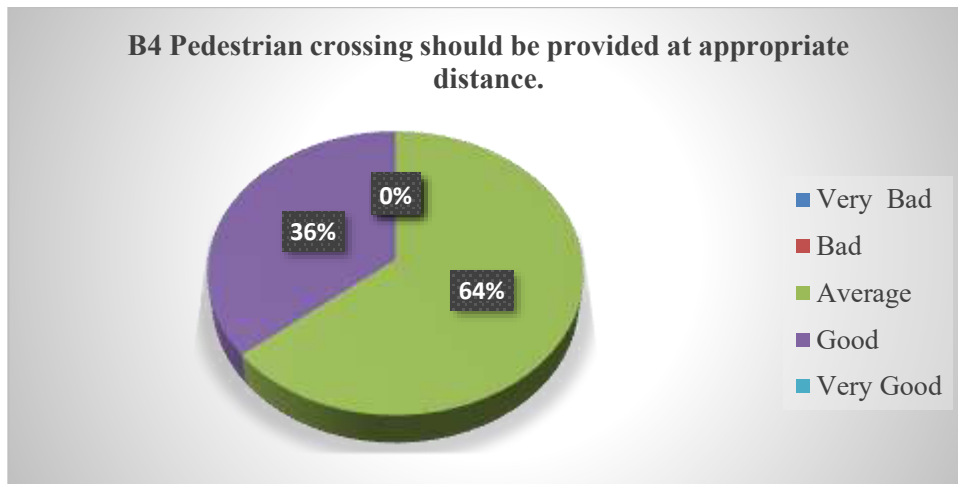


Figure 4.52: Prevalence of Attribute B4



Figure 4.53: Prevalence of Attribute B5

4.3.3 Prevalence of Attributes of Comfort

Table 4.10: Percentage of Prevalence in Attributes of Comfort

Codes	Parameter/Attribute	Frequency	Percentage
C1	Semi covered or shaded walkways.		
	Very bad	2	2
	Bad	39	39
	Average	45	45
	Good	13	13
C2	Green spaces, fountains and trees to regulate temperature.		
	Very bad	44	44
	Bad	13	13

	Average	29	29
	Good	13	13
	Very good	1	1
C3	Material used in pathway to regulate temperature.		
	Very bad	0	0
	Bad	0	0
	Average	92	92
	Good	8	8
	Very good	0	0
C4	Avoiding walking obstruction like electrical poles, parked vehicles, hoardings etc.		
	Very bad	0	0
	Bad	0	0
	Average	52	52
	Good	47	47
	Very good	1	1
C5	Pedestrian oriented street lighting.		
	Very bad	0	0
	Bad	0	0
	Average	51	51
	Good	49	49
	Very good	0	0

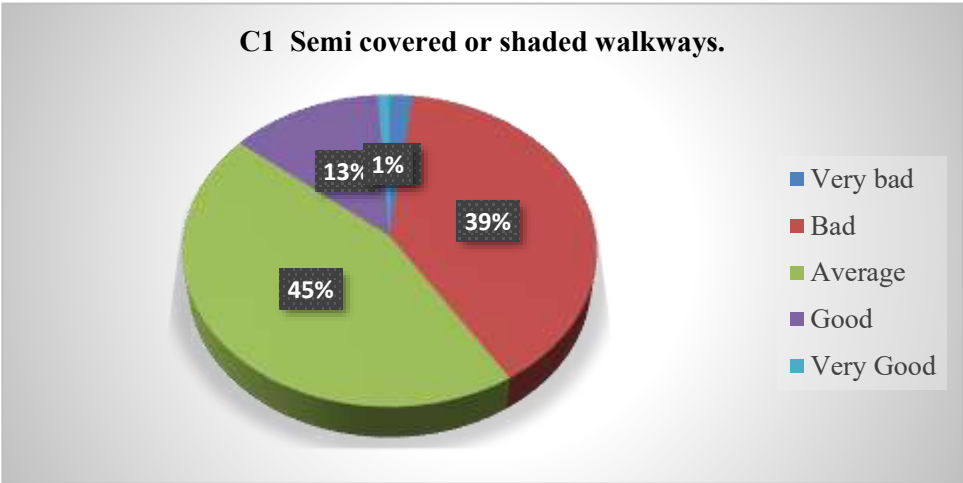


Figure 4.54: Prevalence of Attribute C1

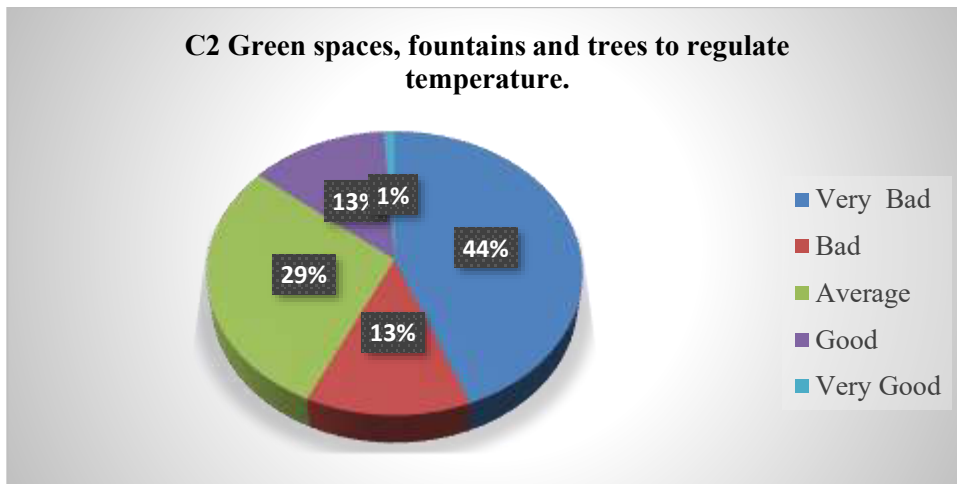


Figure 4.55: Prevalence of Attribute C2

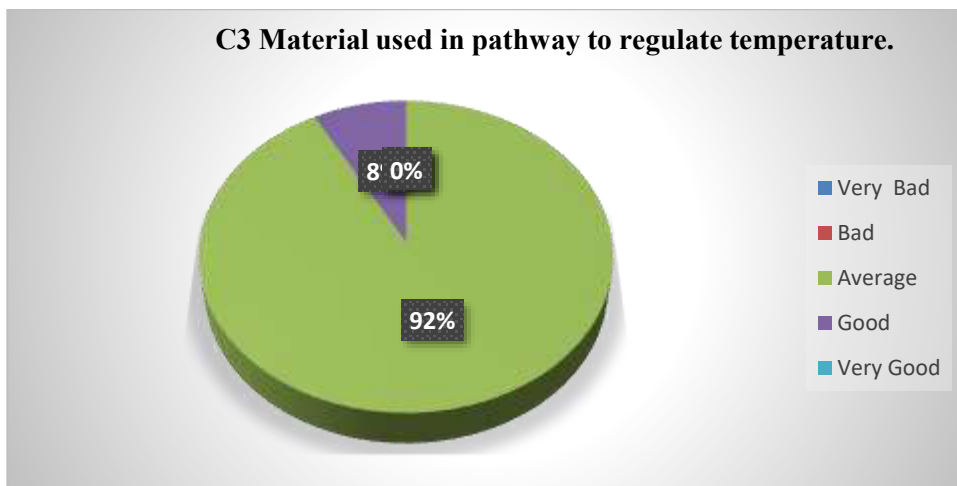


Figure 4.56: Prevalence of Attribute C3

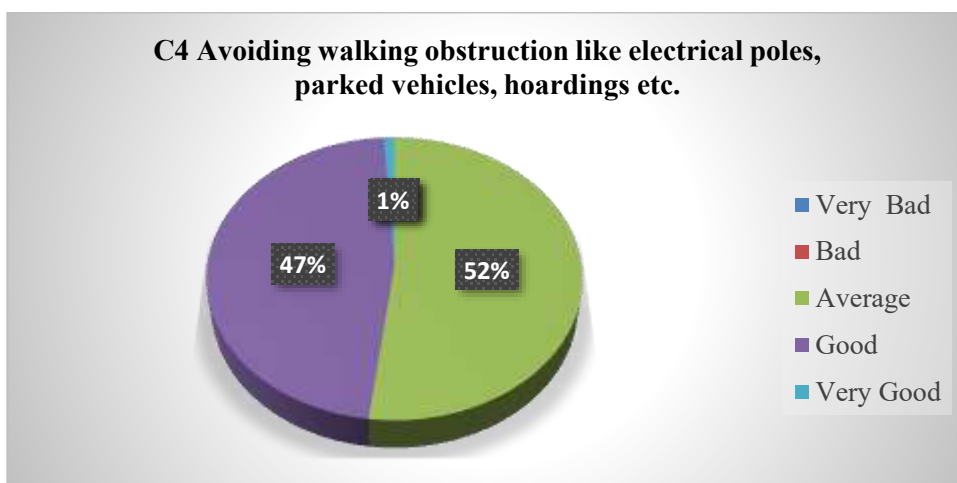


Figure 4.57: Prevalence of Attribute C4

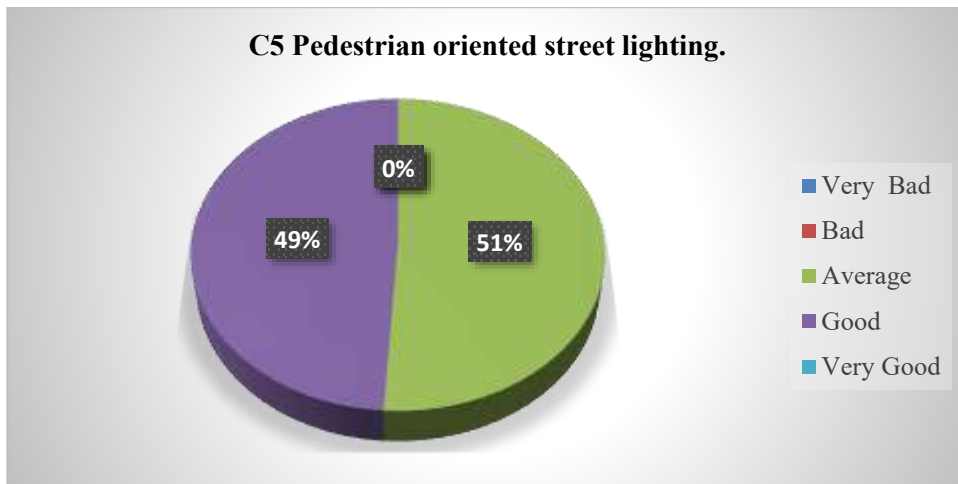


Figure 4.58: Prevalence of Attribute C5

4.3.4 Prevalence of Attributes of Convivial Environment

Table 4.11: Percentage of Prevalence in Attributes of Convivial Environment

Codes	Parameter/Attribute	Frequency	Percentage
D1	Spatial quality through natural/artificial sights, signage etc.		
	Very bad	0	0
	Bad	36	36
	Average	63	63
	Good	1	1
	Very good	0	0
D2	Spatial quality through universal accessibility, controlled zones for different age groups etc.		
	Very bad	0	0
	Bad	27	27
	Average	59	59
	Good	14	14
	Very good	0	0
D3	Depiction of socio-cultural expression through art pieces or articulation with respect to city context.		
	Very bad	0	0

	Bad	95	95
	Average	2	2
	Good	3	3
	Very good	0	0
D4	Enthusiasm through music, aroma (fragrance) & special lighting effects.		
	Very bad	0	0
	Bad	92	92
	Average	8	8
	Good	0	0
	Very good	0	0

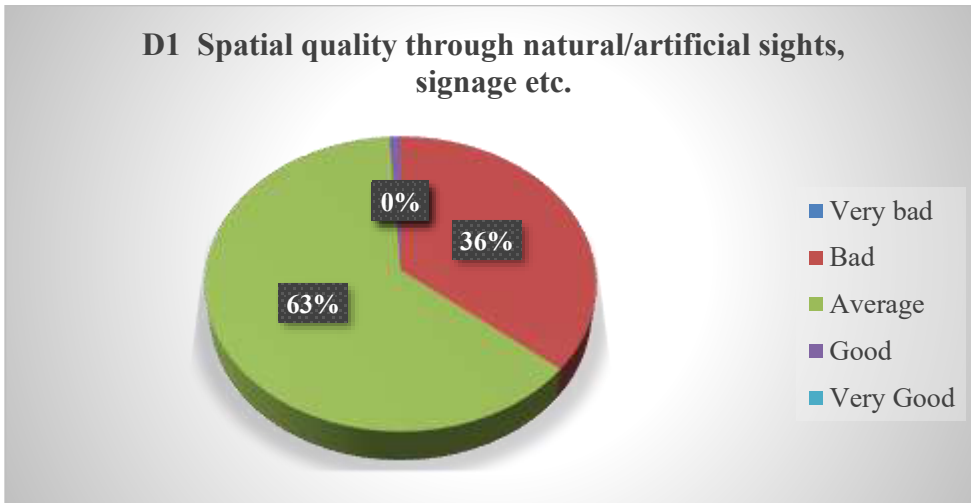


Figure 4.59: Prevalence of Attribute D1

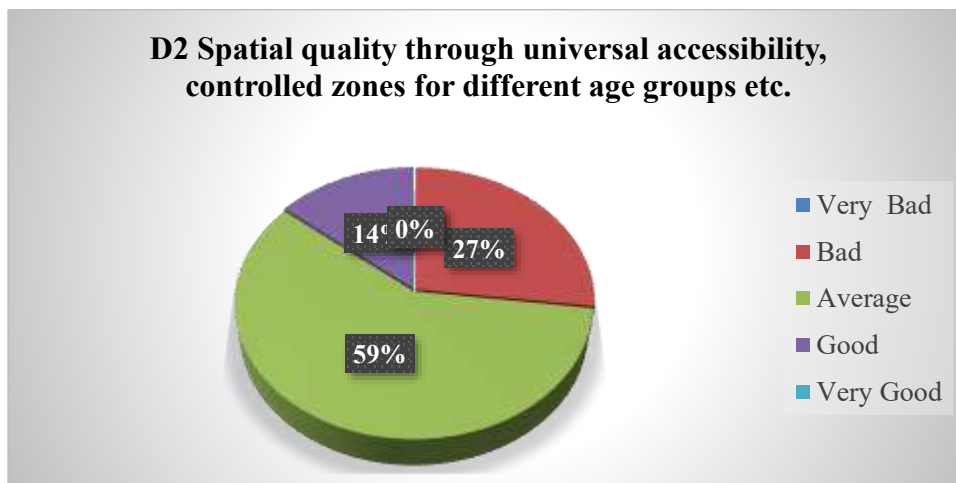


Figure 4.60: Prevalence of Attribute D2

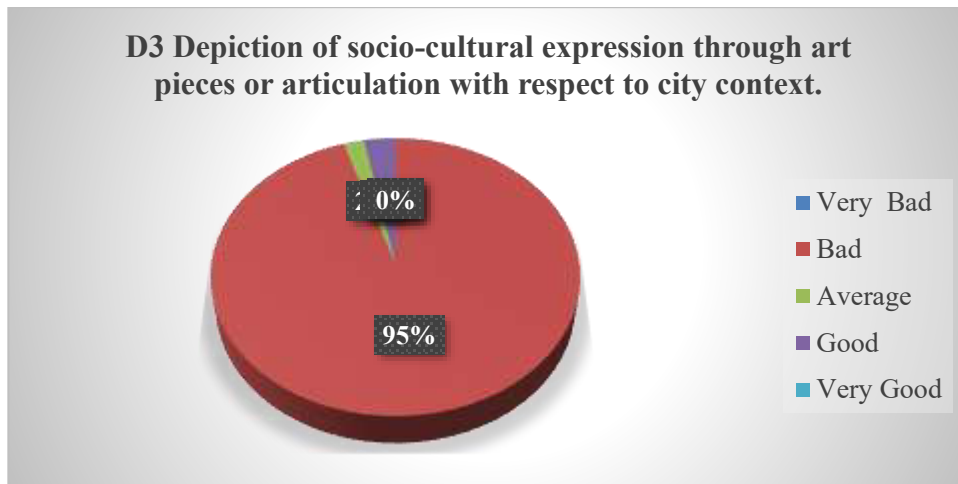


Figure 4.61: Prevalence of Attribute D3

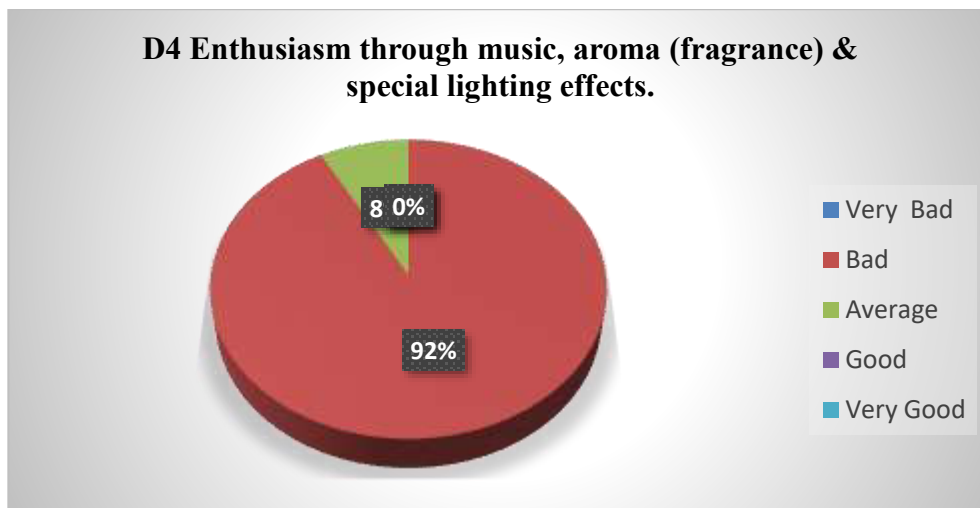


Figure 4.62: Prevalence of Attribute D4

4.3.5 Prevalence of Attributes of User Satisfaction (US)

Table 4.12: Percentage of Prevalence in Attributes of User Satisfaction

Codes	Parameter/Attribute	Frequency	Percentage
E1	Rating of Convenience & Attractiveness in existing B&M retail market		
	Very bad	0	0
	Bad	0	0
	Average	34	34
	Good	65	65
	Very good	1	1

E2	Rating of Safety & Security in existing B&M retail market		
	Very bad	0	0
	Bad	0	0
	Average	17	17
	Good	83	83
	Very good	0	0
E3	Rating of Comfort & Convivial Environment in existing B&M retail market		
	Very bad	0	0
	Bad	19	19
	Average	54	54
	Good	27	27
	Very good	0	0

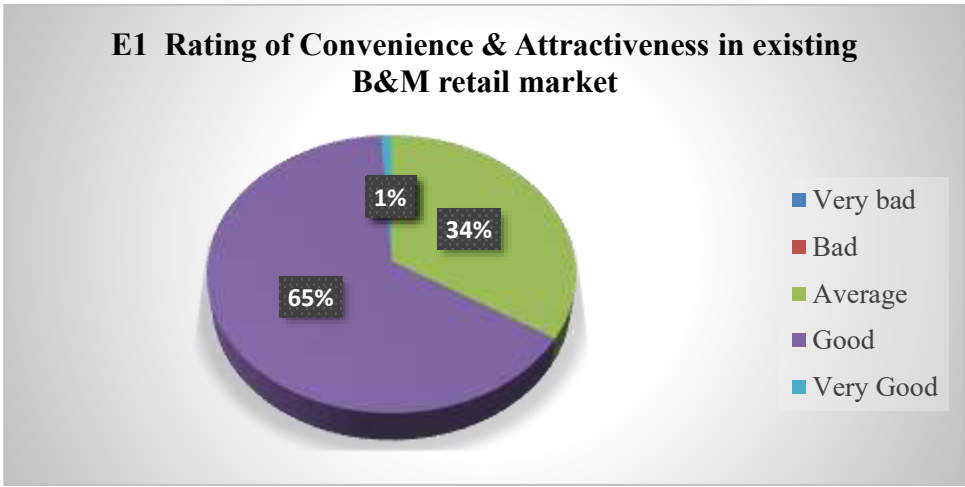


Figure 4.63: Rating of Convenience & Attractiveness

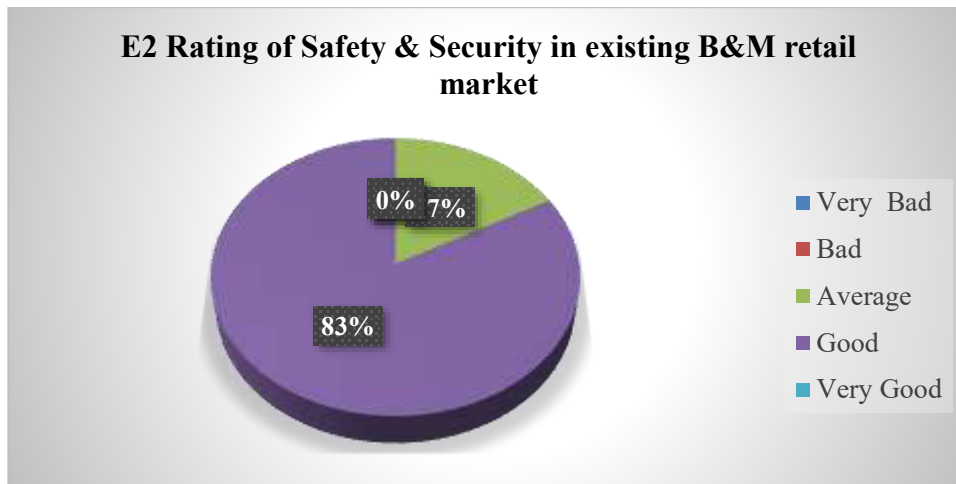


Figure 4.64: Rating of Safety & Security

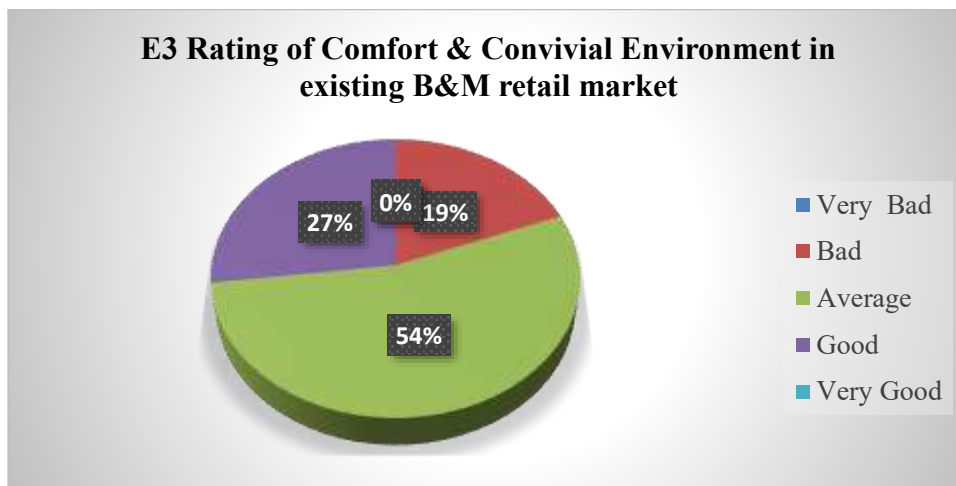


Figure 4.65: Rating of Comfort & Convivial Environment

4.4 WALKABILITY SCORES BASED ON SEGMENT LEVEL

Walkability score for each of the segment level parameters is the summation of weighted average scores of all its attributes. Annexure IV describes the maximum scores allotted to each of the attributes and the weights assigned to each of the probable responses to various attributes. Below score of 22 attributes under 5 parameters and overall score is presented in tabular and figure form.

4.4.1 Developing Scores for Convenience and Attractiveness

Table 4.13: Walkability score for Convenience and Attractiveness

Market Code	Attributes					Total score
	A1	A2	A3	A4	A5	
BM1	3.57	2	2.5	3	3.57	14.71

BM2	3.6	2	3.4	3	3	15
BM3	3.33	2	3.6	3	3	15
BM4	3.6	2	3	3	3	14.6
BM5	3.5	2	2.5	3	3.5	14.5
BM6	3.5	2	3.5	3	3.5	15.5
BM7	3	2	3	3	3	14
BM8	3.6	2.6	3.6	3	3.6	16.5
BM9	3.7	2.7	3.4	3.4	4	17.2
BM10	3.5	3	3	3	3	15.5
BM11	3.5	3.5	4	3.5	4	18.5
BM12	3.6	3.6	3.6	3.6	4	18.4
BM13	3.3	3.375	3.3	3.3	4	17.5
BM14	3	3	4	3	4	17
BM15	4	4	5	4	4	21
BM16	4	5	5	4	5	23
BM17	4	4	4	4	4	20
BM18	4	4	4	4	4	20
BM19	4	4	4	4	4	20
BM20	3.5	3.5	4	4	4	19

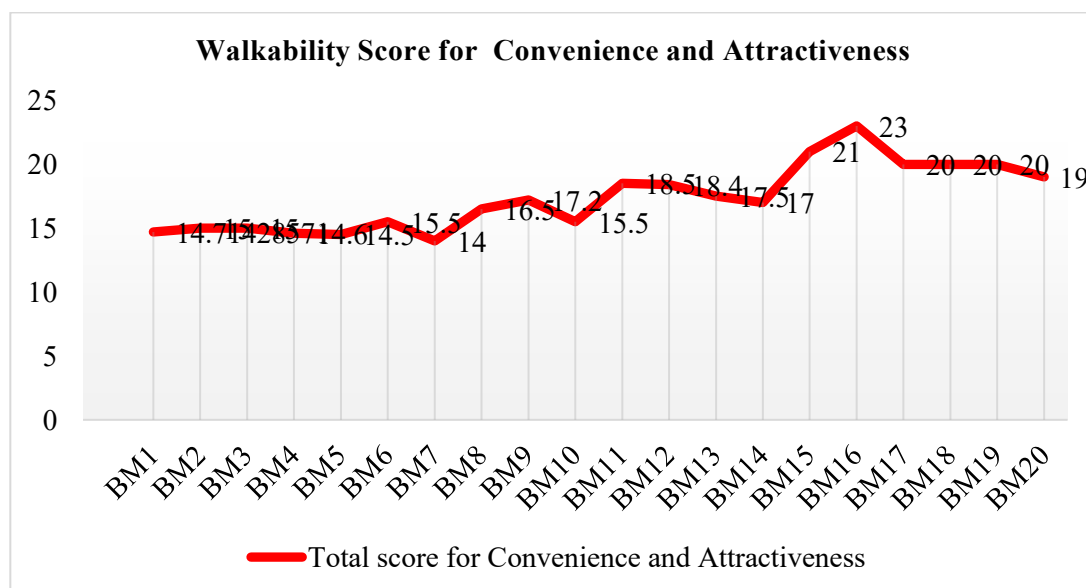


Figure 4.66: Walkability Score for Convenience and Attractiveness

4.4.2 Developing Scores for Safety & Security

Table 4.14: Walkability Score for Safety & Security

Market Code	Attributes					Total score
	B1	B2	B3	B4	B5	
BM1	3.7	4	1	3	3.6	15.29
BM2	3.6	4	1	3	3.4	15
BM3	3.3	4	1	3	3	14.3
BM4	3.6	4	1	3.4	3.6	15.6
BM5	3.5	4	1	3	3.5	15
BM6	3.5	4	1	3	3.5	15
BM7	3	4	1	3	3	14
BM8	3.63	4	1	3	3.6	15.25
BM9	3.7	4	1	3.3	4	16
BM10	3.3	4	1	4	4	16.3
BM11	4	4	1	3.5	3.5	16
BM12	4	4	1	4	3.4	16.4
BM13	3.5	4	1	4	3.5	16
BM14	3.4	4	1	4	3.6	16
BM15	4	4	3	3	4	18
BM16	4	4	3	4	4	19
BM17	4	4	3	3.5	4	18.5
BM18	4	4	3	3	4	18
BM19	4	4	3	3	4	18
BM20	3.5	4	3	3.5	4	18

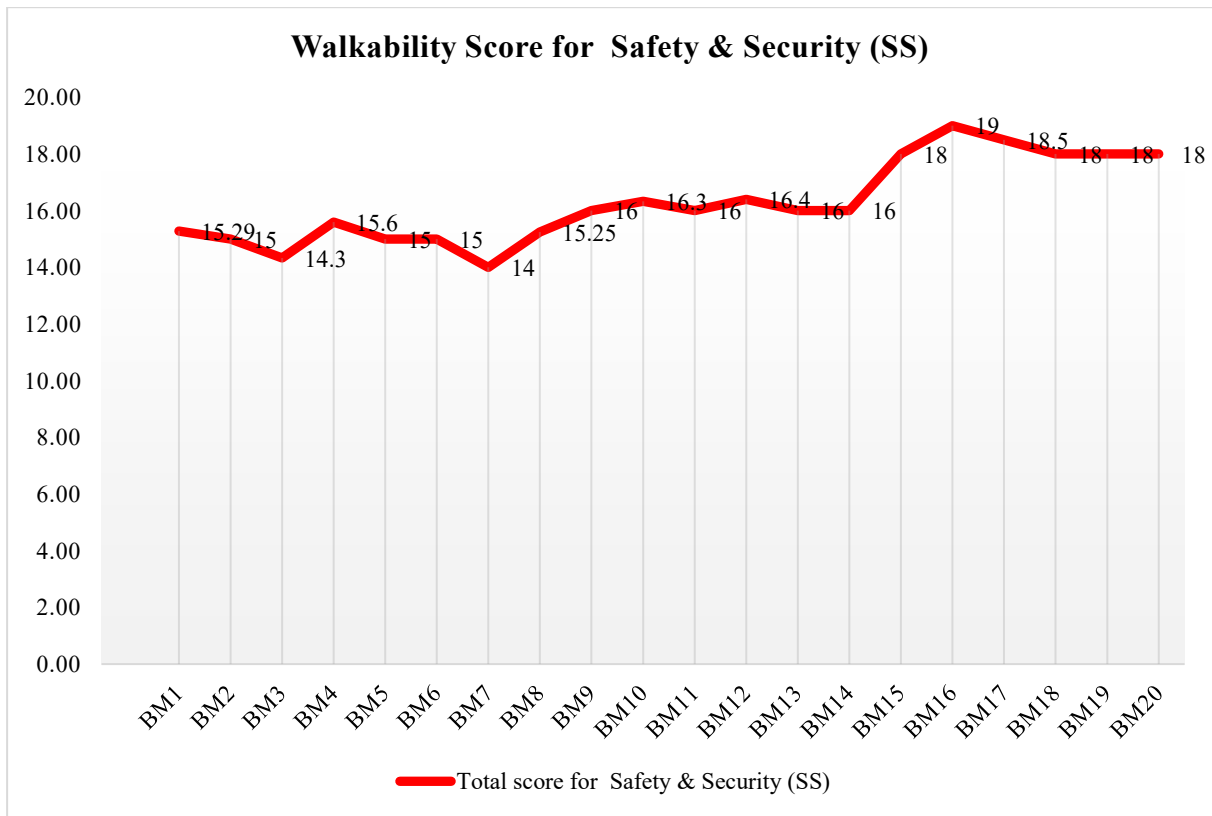


Figure 4.67: Walkability Score for Safety and Security

4.4.3 Developing Scores for Comfort

Table 4.15: Walkability Score for Comfort (C)

Market Code	Attributes					Total score
	C1	C2	C3	C4	C5	
BM1	2	1	3	3	3.7	13
BM2	2	1	3	3	4	13
BM3	2	1	3	3	4	13
BM4	1.6	1	3	3	4	12.6
BM5	2	1	3	3	3.5	12.5
BM6	3	1	3	3	3	13
BM7	2	1	3	3	3	12
BM8	2.9	2.6	3	3	3	14.5
BM9	2.4	2	3	3.8	4	15.2
BM10	2	1	3	3.5	4	13.5
BM11	3	3	3	3.83	3.67	16.5
BM12	3	3	3	4	3.6	16.6

BM13	3	3	3	4	3	16
BM14	3	3	3	4	3	16
BM15	4	4	4	4	4	20
BM16	5	5	4	5	4	23
BM17	4	4	4	4	4	20
BM18	4	4	3	4	3	18
BM19	4	4	3	4	3	18
BM20	4	4	3	4	3	18

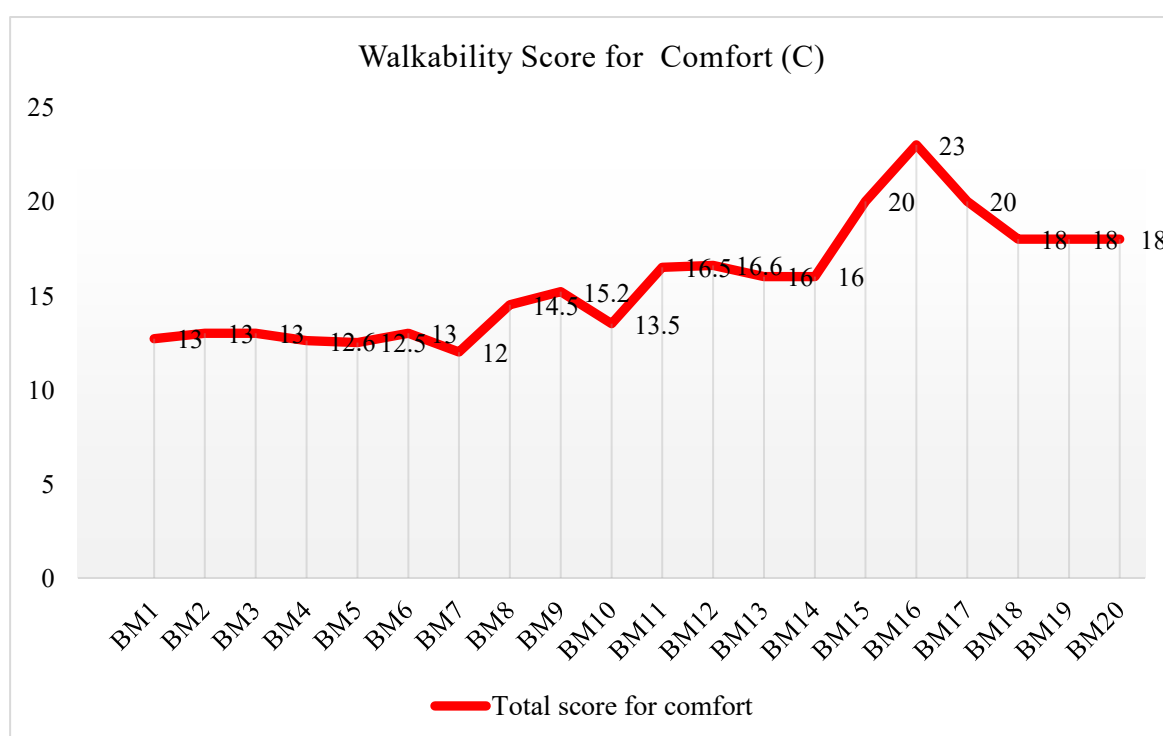


Figure 4.68: Walkability Score for Comfort

4.4.4 Developing Scores for Convivial Environment

Table 4.16: Walkability Score for Convivial Environment (CE)

Market Code	Attributes				Total score
	D1	D2	D3	D4	
BM1	2	2.6	2	2	8.6
BM2	2.6	2.6	2	2	9.2
BM3	2	2.3	2	2	8.3
BM4	2	2.3	2	2	8.3

BM5	2.5	2.5	2	2	9
BM6	2.5	2.5	2	2	9
BM7	2	2	2	2	8
BM8	3	3.4	2	2	10.4
BM9	2.7	3	2	2	9.7
BM10	2	2	2	2	8
BM11	3	3	2	2	10
BM12	3	3	2	2	10
BM13	3	3	2	2	10
BM14	3	3	2	2	10
BM15	3	3	3	3	12
BM16	4	4	2	3	13
BM17	3	3.5	2	3	11.5
BM18	3	4	2	2.7	11.7
BM19	3	4	2	2.7	11.7
BM20	3	4	2	2	11

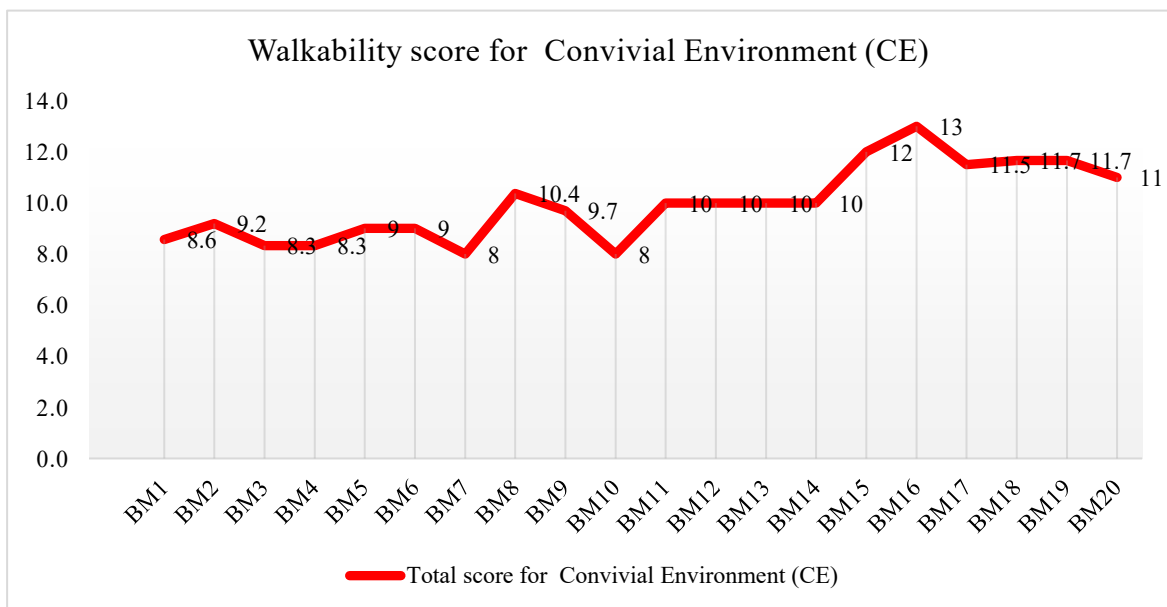


Figure 4.69: walkability score for Convivial Environment

4.4.5 Developing Scores for User Satisfaction (US)

Table 4.17: Walkability Score for User Satisfaction (US)

Market Code	Attributes			Total score
	E1	E2	E3	
BM1	3.3	4	2.7	10
BM2	3	4	2	9
BM3	3	3.7	2.3	9
BM4	3.6	3.7	2.4	9.7
BM5	3.5	4	2.5	10
BM6	3.5	3.5	2.5	9.5
BM7	3	3	3	9
BM8	3	4	3	10
BM9	4	4	3	11
BM10	4	4	3	11
BM11	4	4	4	12
BM12	4	4	4	12
BM13	4	4	3	11
BM14	4	4	3	11
BM15	4	4	4	12
BM16	5	4	4	13
BM17	4	4	4	12
BM18	4	4	4	12
BM19	4	4	4	12
BM20	4	4	4	12

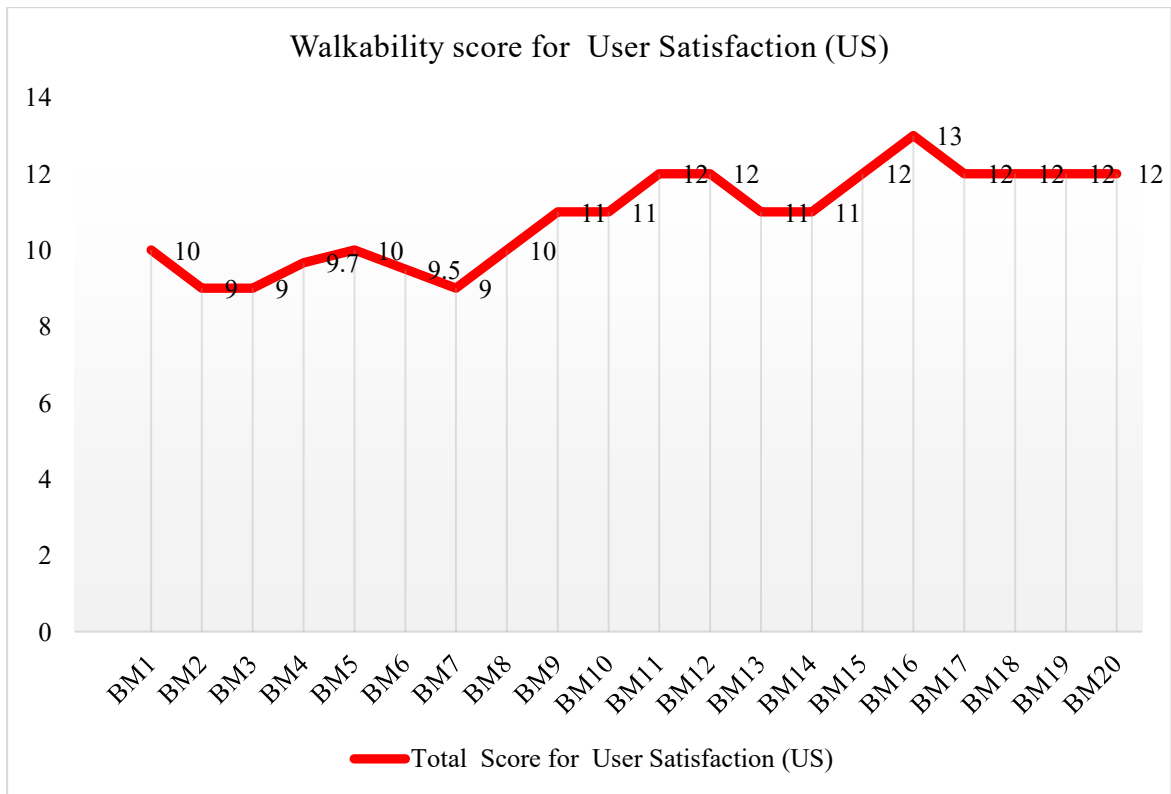


Figure 4.70: Walkability score for User Satisfaction (US)

4.4.6 Overall pedestrian walkability score based on segment level parameters

Overall pedestrian walkability scores of selected B&M in Ludhiana are the sum of the respective scores of segment level parameters, as depicted in Table 4.18 and Figure 4.74.

Table 4.18: Overall Pedestrian Walkability Scores

Market Code	Scores for various parameters					Overall Pedestrian Walkability Scores (110)
	A(25)	B(25)	C(25)	D(20)	E(15)	
BM1	14.7	15.3	11.9	8.6	9.6	61.3
BM2	15	15	11.6	9.2	10.2	61.2
BM3	15	14.3	12	8.3	9.7	59.7
BM4	14.6	14.8	11.2	8.4	9.8	60.8
BM5	14.5	15	12	9	10	61
BM6	15.5	15	12	9	9.5	62
BM7	14	14	11	8	10	57
BM8	16.5	15.3	14.3	10.4	10.5	66.6
BM9	17.2	15.1	13.9	9.7	10	69.1

BM10	15.5	14.8	12.5	8	9.5	64.3
BM11	18.5	16.7	17	10	10.7	73
BM12	18.4	16.4	17	10	11	73.4
BM13	17.5	16	17	10	10.5	70.5
BM14	17	16	17	10	10	70
BM15	21	19	20.5	11.5	12	83
BM16	23	19.5	22.5	13	12.5	91
BM17	20	19	20.5	11.5	12	82
BM18	20	19	20.5	11.5	12	79.7
BM19	20	19	20.5	11.5	12	79.7
BM20	19	18.5	20.5	11	11.5	78

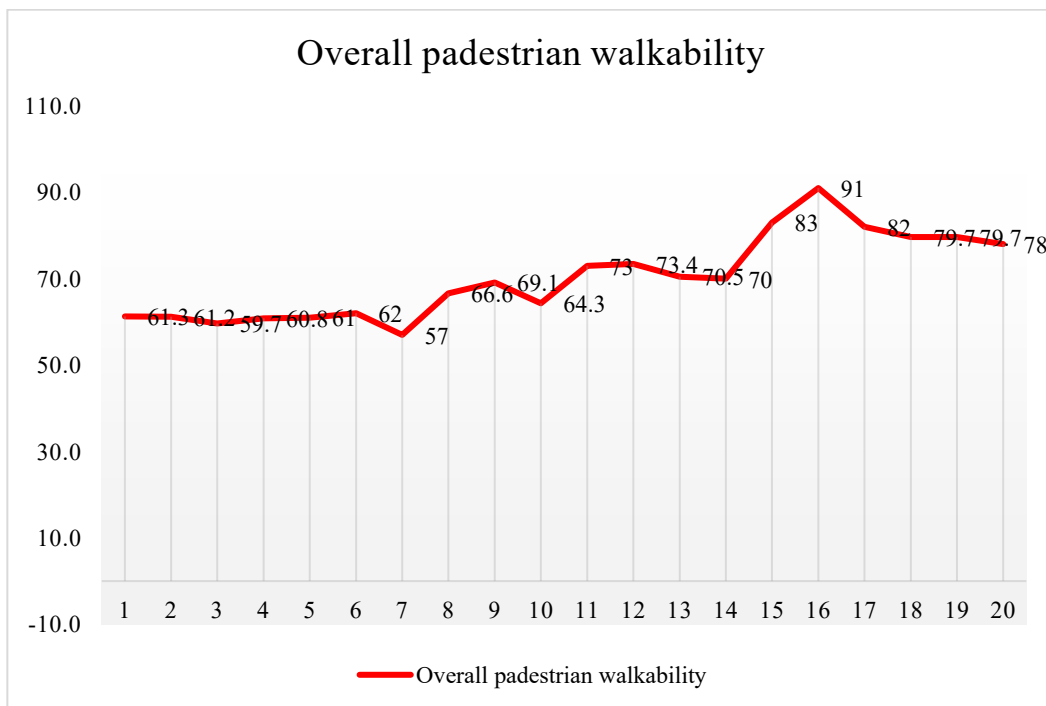


Figure 4.71: Overall Pedestrian Walkability

In Ludhiana city, the pedestrian walkability scores based on segment level parameters fall within a range of 57 to 90.5 (Maximum Scores assigned 110) for the various B&M retail markets.

4.5 ANALYSIS OF VARIANCE (ANOVA)

In this section ANOVA, which is a parametric test, is used to find out the significance of variation in the scores for various parameters of 3 groups from selected 20 B & M retail markets of Ludhiana city.

Requirements/Assumptions of One-way ANOVA

For conducting ANOVA, scale level dependent variable and three or more groups of categorical independent variable are required. In this research under independent variables 3 groups of B&M retail markets are selected from Ludhiana city and five dependent variables i.e., convenience-attractiveness (CA), safety-security (SS), comfort (C), convivial environment (CE) and user satisfaction (US) are analyzed. Basic three assumptions of one-way ANOVA are discussed below: -

1. Independence of Observation: - Sample should be randomly selected and there should be no hidden relationship among observations. In this research this assumption is fulfilled as samples are randomly selected from different zones in Ludhiana city and observations are taken from diverse users in B&M retail markets which do not have any relation among them.
2. Normal Distribution of dependent variable: - For 5 dependent variables, normality will be checked by one sample Kolmogorov-Smirnov and Shapiro-Wilk test in SPSS (Statistical Package for the Social Sciences).

For Normality, Null Hypothesis H_0 = Data is normal distributed and Alternative Hypothesis H_1 = Data is not normal distributed

Table 4.19 One-Sample Kolmogorov-Smirnov Test

		Convenience & Attractiveness	Safety & Security	Comfort	Convivial Environment	User Satisfaction
N		20	20	20	20	20
Normal Parameters	Mean	17.345	16.265	15.705	9.975	10.945
	Std. Deviation	2.5564	1.4798	3.0669	1.4567	1.3907

Most Extreme Differences	Absolute	0.165	0.179	0.164	0.143	0.176
	Positive	0.165	0.171	0.164	0.143	0.152
	Negative	-0.100	-0.179	-0.114	-0.102	-0.176
Test Statistic		0.165	0.179	0.164	0.143	0.176
Asymp. Sig. (2-tailed)		0.159	0.091	0.165	0.2	0.106

Table 4.20 Tests of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Convenience & Attractiveness	0.165	20	0.159	0.934	20	0.186
Safety & Security	0.179	20	0.091	0.916	20	0.083
Comfort	0.164	20	0.165	0.914	20	0.076
Convivial Environment	0.143	20	0.2	0.947	20	0.321
User Satisfaction	0.176	20	0.106	0.909	20	0.060

As the P-value depicted in table 4.19 and 4.20, is more than 0.05 for all 5 parameters (Under Kolmogorov-Smirnov value is 0.159, 0.091, 0.165, 0.2, 0.106 and Shapiro-Wilk value is 0.186, 0.083, 0.076, 0.321, 0.060 respectively), hence we accept the null hypothesis and conclude that data is normally distributed among the target population. Further Normal Q-Q plots and histograms of five dependent variables i.e., convenience-attractiveness (CA), safety-security (SS), comfort (C), convivial environment (CE) and user satisfaction (US) are shown below.

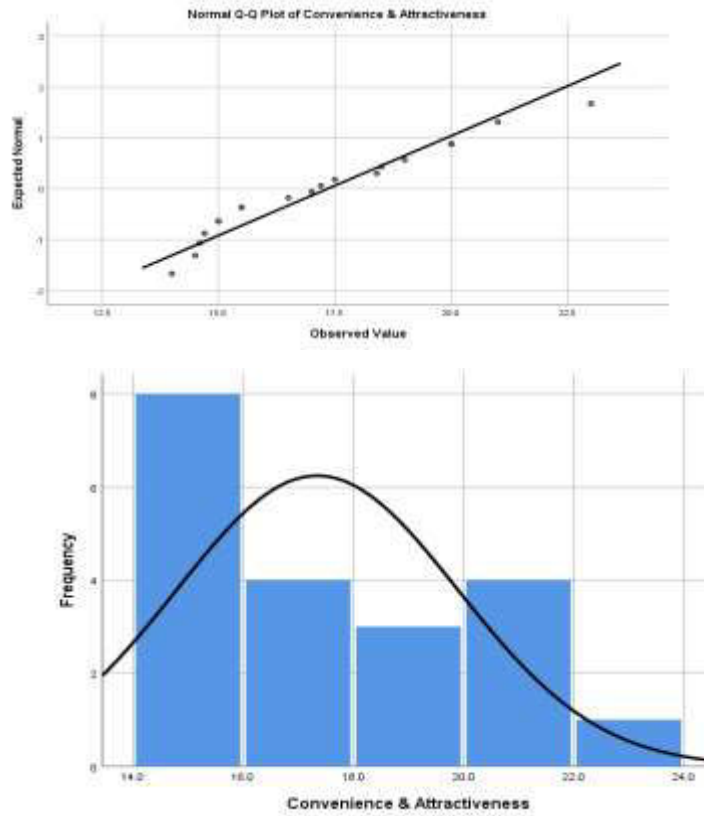


Figure 4.72 : Result observed for Convenience & Attractiveness

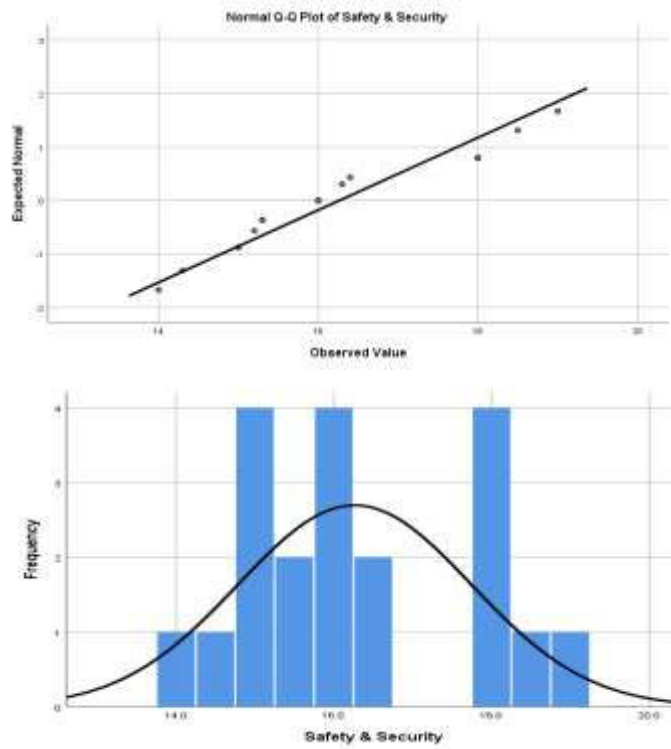


Figure 4.73 : Result observed for Safety and security

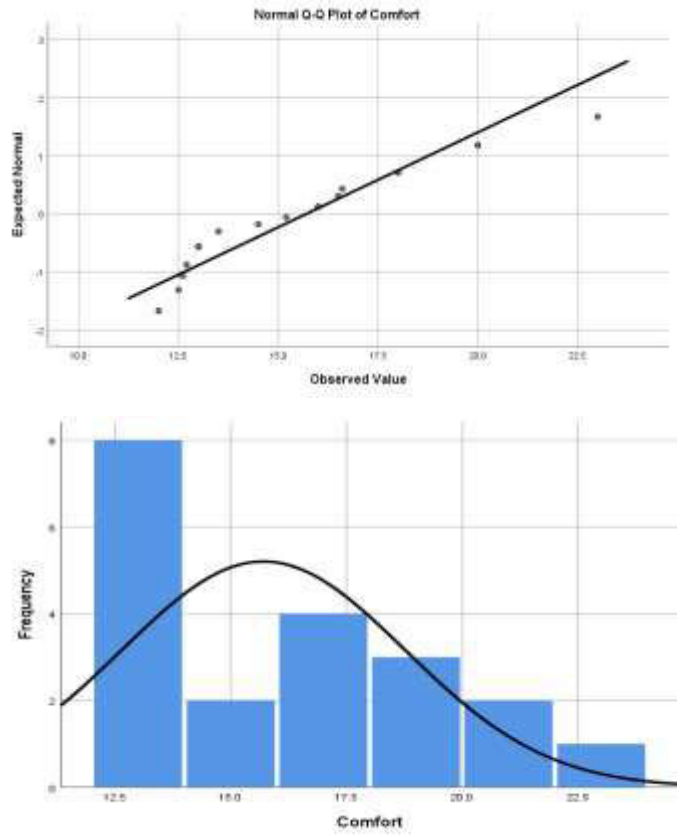


Figure 4.74 : Result observed for Comfort

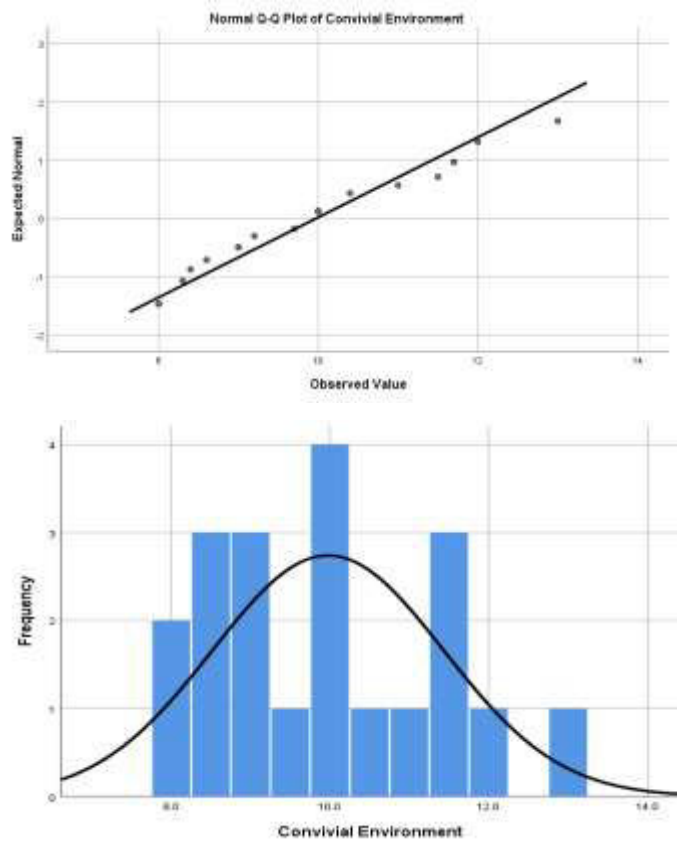


Figure 4.75 : Result observed for convivial environment

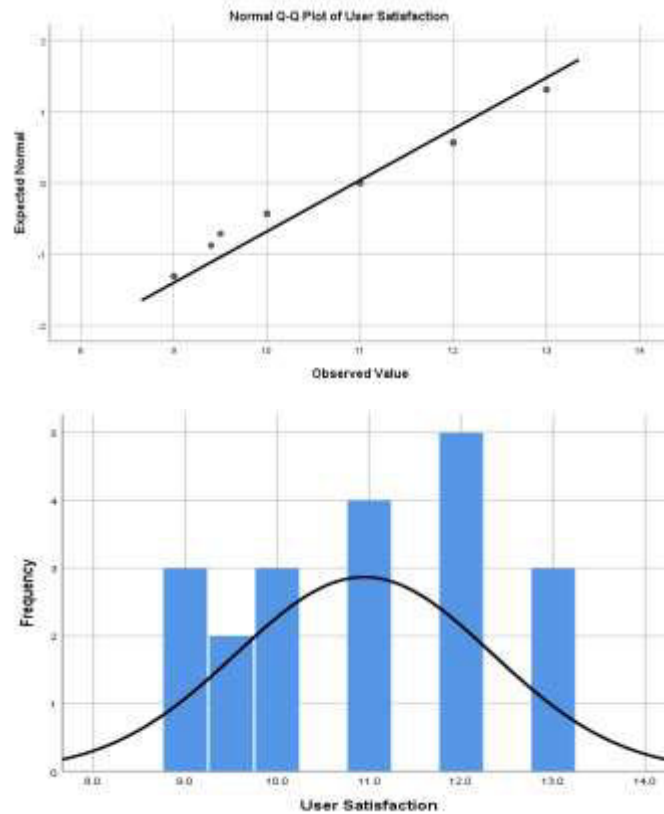


Figure 4.76 : Result observed for User Satisfaction
*(Normal Q-Q plots and histograms of five dependent variables
 Source: Developed by the author)*

Further below table 4.21, under frequencies in SPSS, skewness and kurtosis value are explored. Skewness measures the degree and direction of asymmetry and kurtosis value near zero indicates a shape close to normal. A normally distributed data has both skewness and kurtosis equal to zero. It is near-normal if skewness and kurtosis both ranges from -1 to 1. But value between -2 and +2 are also considered acceptable in order to prove normal univariate distribution.

Table 4.21: Statistics

		Convenience & Attractiveness	Safety & Security	Comfort	Convivial Environment	User Satisfaction
N	Valid	20	20	20	20	20
	Missing	0	0	0	0	0
Skewness		0.541	0.436	0.753	0.416	0.013

Std. Error of Skewness		0.512	0.512	0.512	0.512	0.512
Kurtosis		-0.594	-0.992	-0.067	-0.732	-1.317
Std. Error of Kurtosis		0.992	0.992	0.992	0.992	0.992

3. Homogeneity of variance: - It will be checked by Levene's test for homogeneity of variances. Null Hypothesis H_0 = The variance among selected parameters is same among the three groups. Alternative Hypothesis H_1 = The variance among selected parameters is not same among the three groups.

Table 4.22: Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Convenience & Attractiveness	Based on Mean	0.877	2	17	0.434
	Based on Median	0.301	2	17	0.744
	Based on Median and with adjusted df	0.301	2	11.213	0.746
	Based on trimmed mean	0.789	2	17	0.470
Safety & Security	Based on Mean	1.909	2	17	0.179
	Based on Median	0.575	2	17	0.573
	Based on Median and with adjusted df	0.575	2	13.790	0.576
	Based on trimmed mean	1.488	2	17	0.254
Comfort	Based on Mean	3.061	2	17	0.073

	Based on Median	2.354	2	17	0.125
	Based on Median and with adjusted df	2.354	2	12.271	0.136
	Based on trimmed mean	2.975	2	17	0.078
Convivial Environment	Based on Mean	0.061	2	17	0.941
	Based on Median	0.132	2	17	0.877
	Based on Median and with adjusted df	0.132	2	13.400	0.877
	Based on trimmed mean	0.053	2	17	0.949
User Satisfaction	Based on Mean	0.815	2	17	0.459
	Based on Median	0.450	2	17	0.645
	Based on Median and with adjusted df	0.450	2	7.375	0.654
	Based on trimmed mean	0.753	2	17	0.486

As the P-value associated with Levene test is more than 0.05 for all five parameters ($p > 0.05$, 0.738) at 5% LoS, hence we assume the equal variance among the three group. Thus, the condition of equal variance is also met in the research.

4.6 RESULTS OF ONE-WAY ANOVA

Descriptive statistics and mean plots for data describing central tendency and dispersion value of data is given below in table 4.23 and fig 4.80-4.84. For checking significance of variation in the scores, Null Hypothesis is that there is no significant difference in selected parameters among three groups i.e., $H_0: \mu_{\text{Group1}} = \mu_{\text{Group2}} = \mu_{\text{Group3}}$ and Alternative Hypothesis is

that there is significant difference in selected parameters among three groups i.e., $H_a: \mu_{\text{Group1}} \neq \mu_{\text{Group2}} \neq \mu_{\text{Group3}}$

Table 4.23: Descriptive

		N				95% Confidence Interval for Mean		Mini mum	Maximu m
			Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound		
Convenience & Attractiveness	1	8	14.975	0.7555	0.2671	14.343	15.607	14.0	16.5
	2	6	17.350	1.0968	0.4478	16.199	18.501	15.5	18.5
	3	6	20.500	1.3784	0.5627	19.053	21.947	19.0	23.0
	Total	20	17.345	2.5564	0.5716	16.149	18.541	14.0	23.0
Safety & Security	1	8	14.888	0.4794	0.1695	14.487	15.288	14.0	15.3
	2	6	16.117	0.1835	0.0749	15.924	16.309	16.0	16.4
	3	6	18.250	0.4183	0.1708	17.811	18.689	18.0	19.0
	Total	20	16.265	1.4798	0.3309	15.572	16.958	14.0	19.0
Comfort	1	8	12.913	0.7259	0.2567	12.306	13.519	12.0	14.5
	2	6	15.633	1.1570	0.4723	14.419	16.848	13.5	16.6
	3	6	19.500	1.9748	0.8062	17.428	21.572	18.0	23.0

	T o t a l	2 0	15.70 5	3.0669	0.685 8	14.27 0	17.140	12.0	23.0
Convivial Environment	1	8	8.863	0.7425	0.262 5	8.242	9.483	8.0	10.4
	2	6	9.617	0.8010	0.327 0	8.776	10.457	8.0	10.0
	3	6	11.81 7	0.6676	0.272 5	11.11 6	12.517	11.0	13.0
	T o t a l	2 0	9.975	1.4567	0.325 7	9.293	10.657	8.0	13.0
User Satisfaction	1	8	9.488	0.4643	0.164 1	9.099	9.876	9.0	10.0
	2	6	11.33 3	0.5164	0.210 8	10.79 1	11.875	11.0	12.0
	3	6	12.50 0	0.5477	0.223 6	11.92 5	13.075	12.0	13.0
	T o t a l	2 0	10.94 5	1.3907	0.311 0	10.29 4	11.596	9.0	13.0

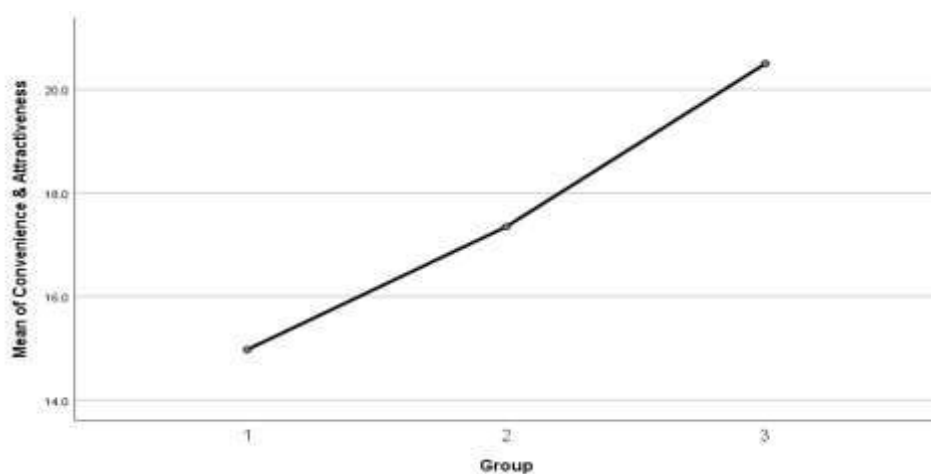


Figure 4.77 : Mean of convenience and attractiveness

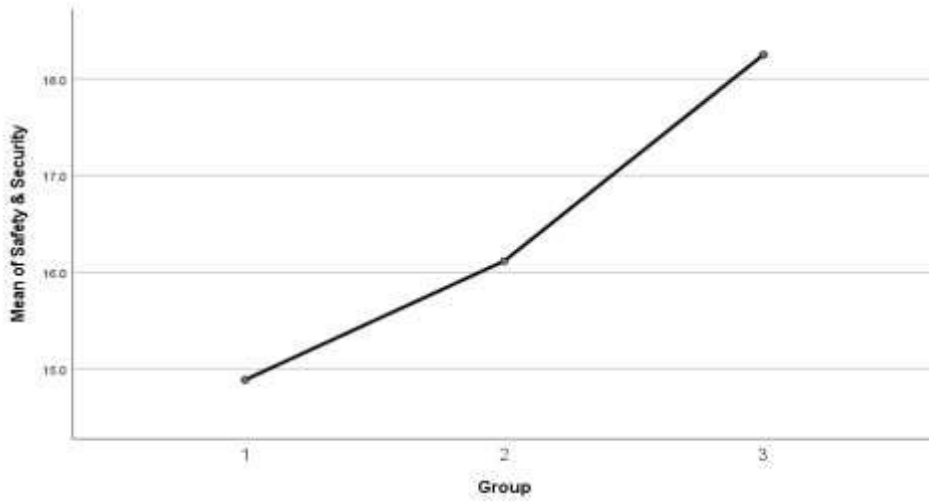


Figure 4.78 : Mean of Safety and security

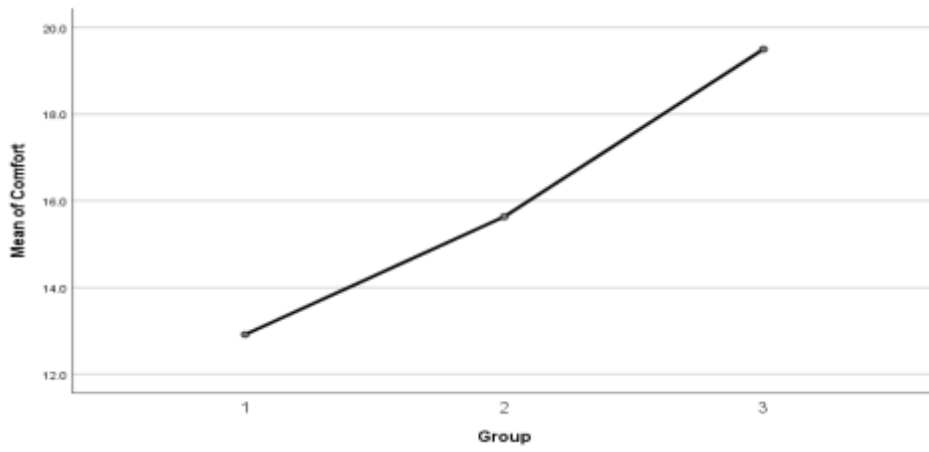


Figure 4.79: Mean of Comfort

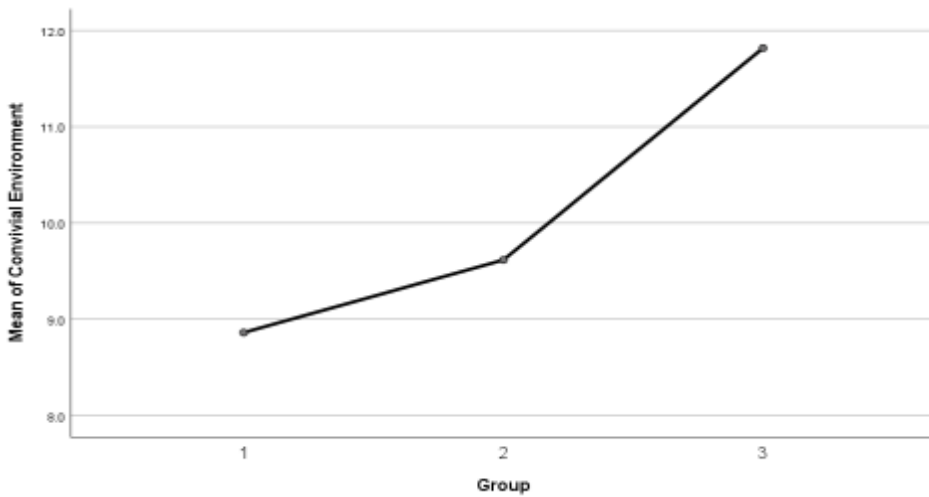


Figure 4.80 : Mean of convivial Environment

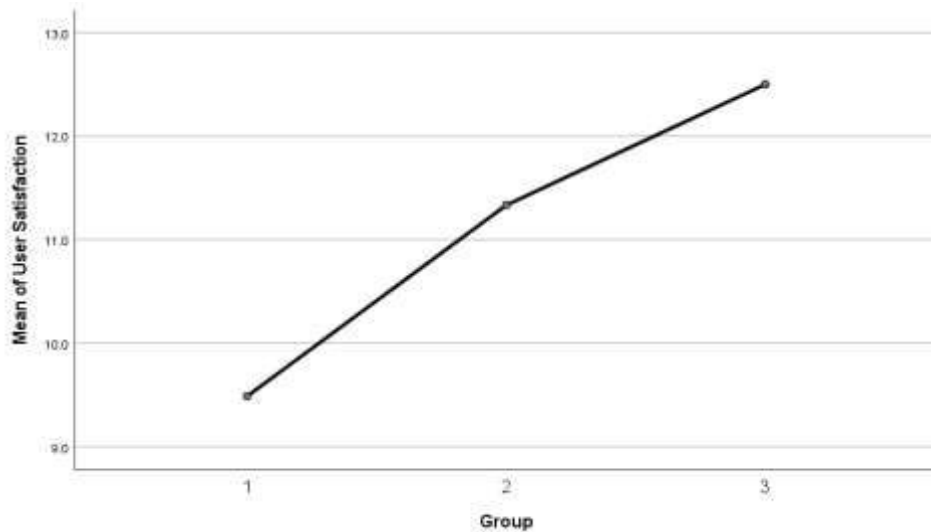


Figure 4.81: Mean of user Satisfaction

Further results of ANOVA are shown below in table 4.24

Table 4.24: Results of ANOVA

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Convenience Attractiveness	Between Groups	104.660	2	52.330	45.597	0.000
	Within Groups	19.510	17	1.148		
	Total	124.170	19			
Safety & Security	Between Groups	38.953	2	19.477	124.847	0.000
	Within Groups	2.652	17	0.156		
	Total	41.606	19			
Comfort	Between Groups	148.827	2	74.414	42.334	0.000
	Within Groups	29.882	17	1.758		
	Total	178.710	19			
Convivial Environment	Between Groups	31.022	2	15.511	28.367	0.000

	Within Groups	9.295	17	0.547		
	Total	40.318	19			
User Satisfaction	Between Groups	32.407	2	16.204	63.440	0.000
	Within Groups	4.342	17	0.255		
	Total	36.750	19			

As the P-value associated with ANOVA statistics for all five parameters is less than 0.05, hence we reject null hypothesis and conclude that the variation is statically significant for all parameters at segment level.

4.7 RESULTS OF THE PEDESTRIAN PERCEPTION AND PREFERENCE SURVEY

Pedestrian surveys were conducted in the 20 B&M in order to accumulate actual sentiments of the residents, and to ensure that the recommended improvements synchronize with their expectations from the built environment of B&M retail markets. A total of 250 survey forms were collected with feedback ranging from 10 to 15 respondents per B & M retail markets. The data procured from residents of diverse B & M Built environment s was aggregated for the whole city. To help the respondents better understand the questions, the surveyors conducted the surveys in their native tongue.

4.7.1 Socio- economic Profile of respondents

The socio-economic profile of the respondents is presented through Figure 4.85

Table 4.25: Socio- economic Profile of respondents

		Frequency	Percentage
Gender	male	126	50.4
	female	124	49.6
age (in years)	0-20	13	5.2
	20-35	129	51.6
	35-50	86	34.4
	>50	22	8.8

monthly household income (in rupees)	<20000	35	14
	20000-50000	113	45.2
	50000-2 Lakhs	67	26.8
	>2 Lakhs	35	14
vehicle ownership	No Vehicle	9	3.6
	Bicycles	18	7.2
	2-Wheelers	97	38.8
	Car	126	50.4
Occupation	Homemakers	50	20
	Employee	148	59.2
	Business man	39	15.6
	Students/Other	13	5.2

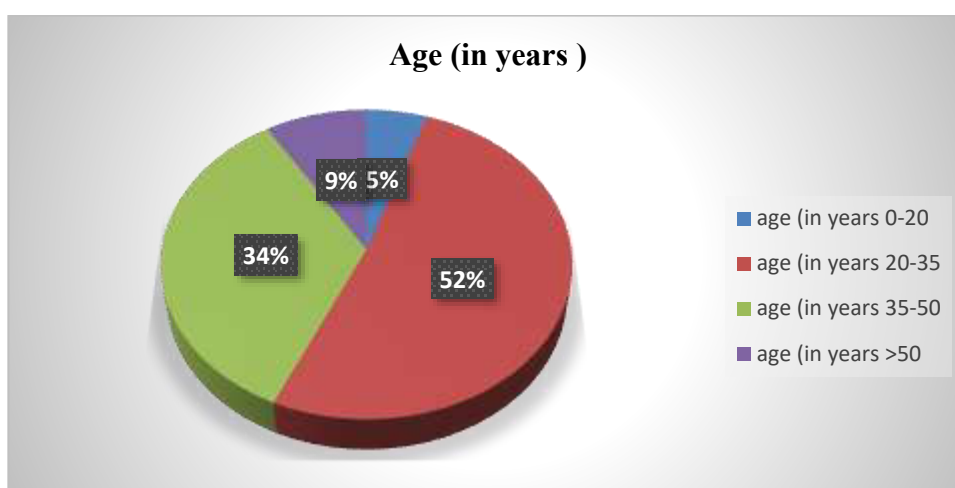


Figure 4.82: Age wise Distribution of the Respondents (percent)

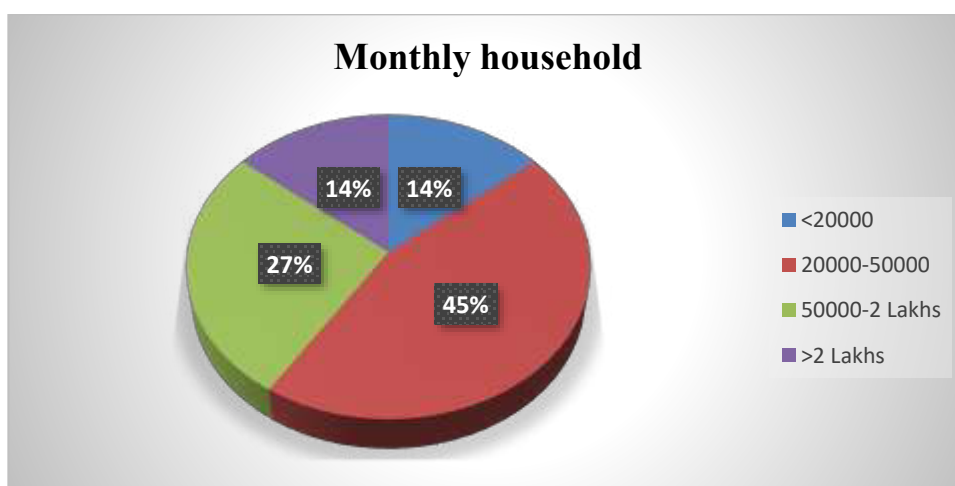


Figure 4.83: Monthly income wise Distribution of the Respondents (percent)

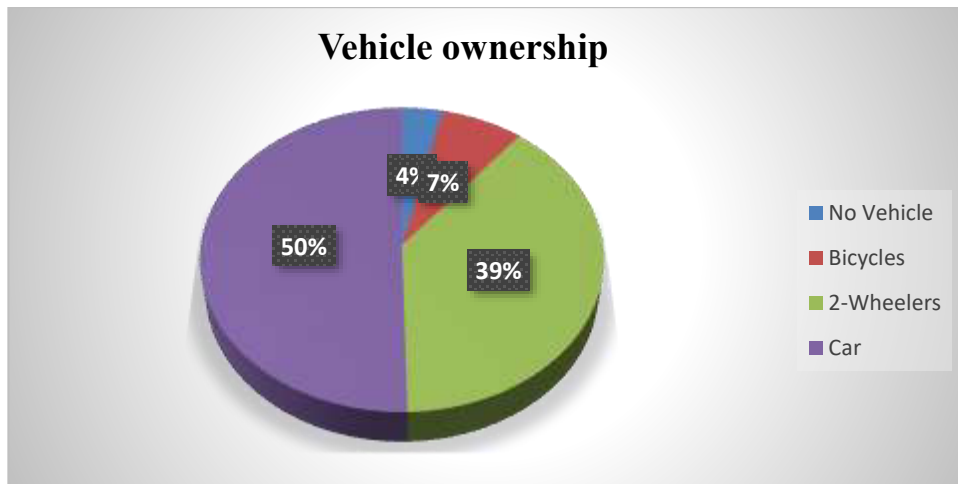


Figure 4.84: Vehicle ownership Distribution of the Respondents (percent)

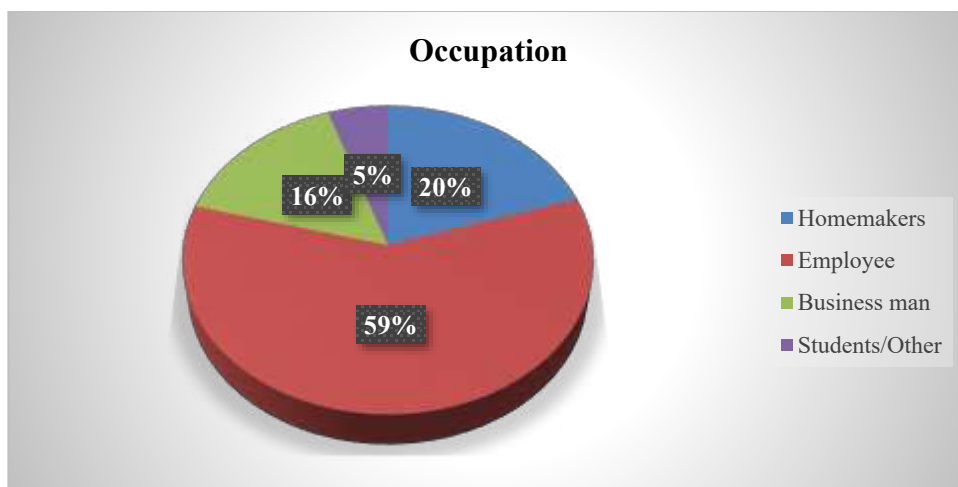


Figure 4.85: Occupation wise Distribution of the Respondents (percent)

4.7.2 Walk Perception and preference of the respondent.

Table 4.26: Walk Perception and Preference of the respondent

Walk Perception and preference of the respondent.		Frequency	percentage
How often do you prefer walking over driving in B & M Market?	Never	19	7.6
	Very few times	27	10.8
	Sometimes	104	41.6
	Frequently	83	33.2
	Almost every time	17	6.8
	Very Bad	0	0
	Bad	12	4.8

How do you rate Convenience & Attractiveness in existing B&M retail market	Average	133	53.2
	Good	105	42
	Very Good	0	0
How do you rate Safety & Security in existing B&M retail market	Very Bad	0	0
	Bad	4	1.6
	Average	63	25.2
	Good	183	73.2
	Very Good	0	0
How do you rate Comfort & Convivial Environment in existing B&M retail market	Very Bad	0	0
	Bad	68	27.2
	Average	182	72.8
	Good	0	0
	Very Good	0	0
If walkability conditions are enhanced, would you like to prefer walking	May be	28	11.2
	very few times	11	4.4
	Sometimes	9	3.6
	Frequently	97	38.8
	Almost every time	105	42

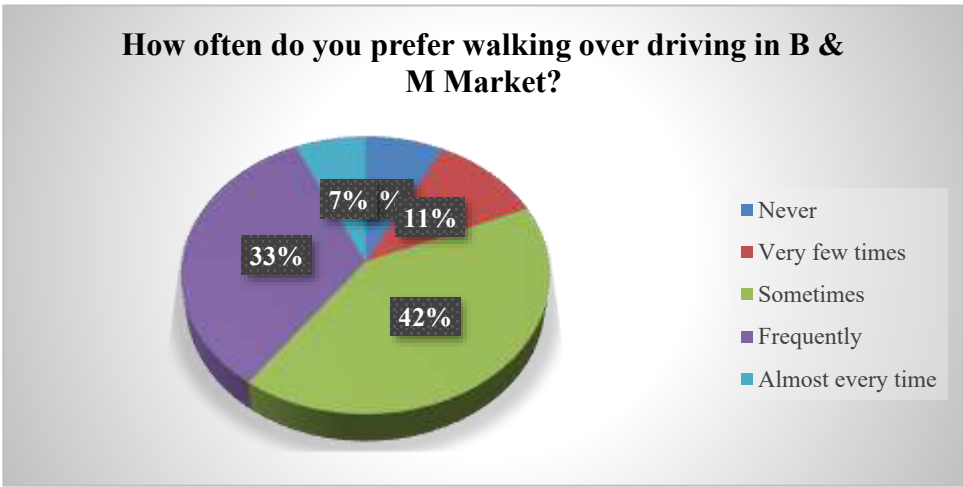


Figure 4.86: Walking over driving in B & M Market.

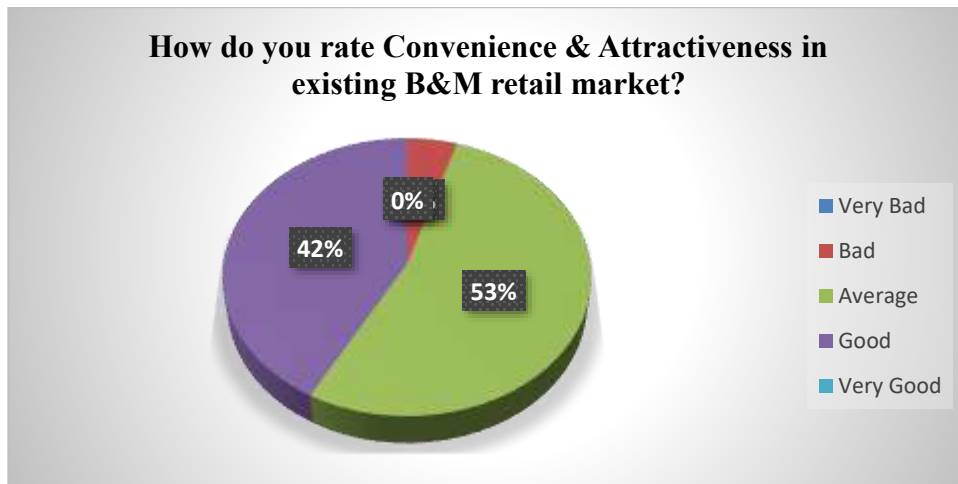


Figure 4.87: Convenience & Attractiveness in existing B&M retail market



Figure 4.88: Safety & Security in existing B&M retail market.

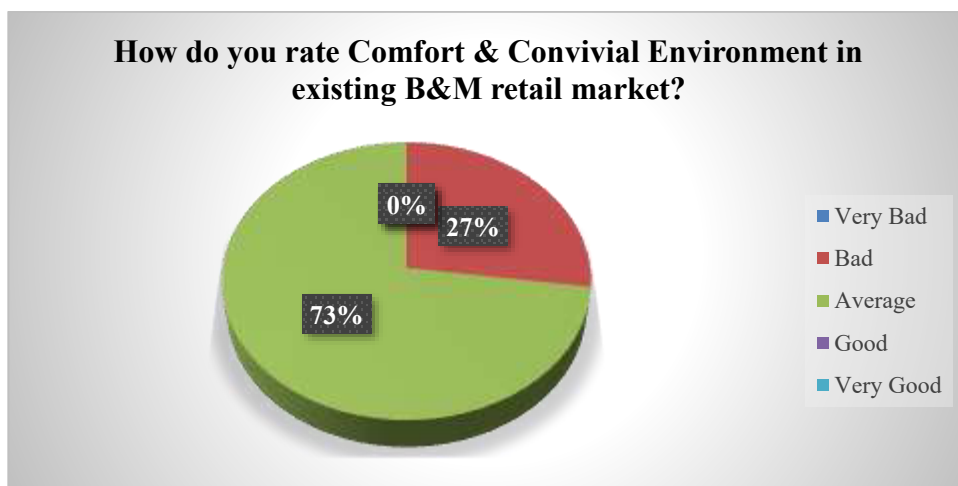


Figure 4.89: Comfort & Convivial Environment in existing B&M retail market

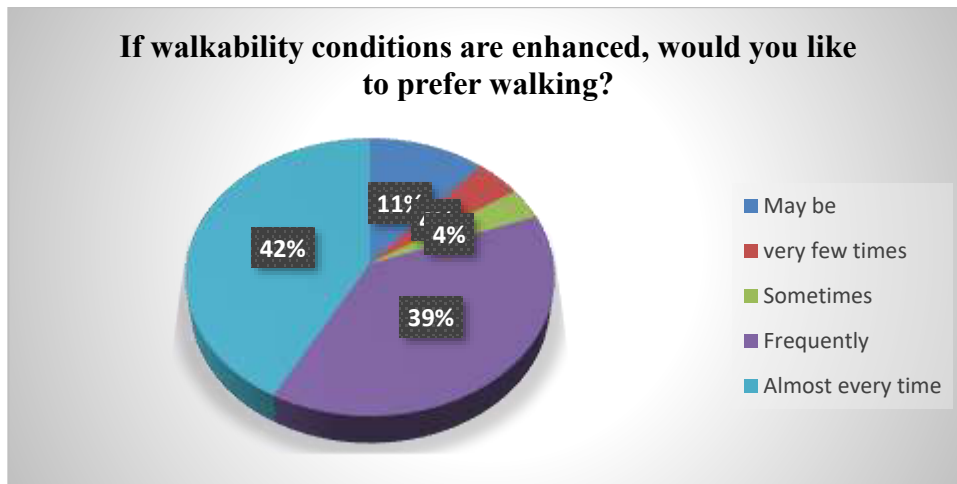


Figure 4.90: Scores of preferences for walking

4.8 CHI-SQUARE TESTS TO MEASURE ASSOCIATION

A statistical method called chi-square, a non-parametric distribution-free test, is used to look for significant correlations between variables. Chi-square does not require any presumptions about how a sample's population distribution will look and is called as King of all non-parametric test. An endeavor was made to see if response to the five questions presented to the respondent of various users in selected B&M retail markets under pedestrian preference had some relationship with gender, age, occupation, month income or vehicle ownership.

4.8.1 Conditions for Applying Chi-square test

Below three conditions are required to apply chi-square test: -

- Chi- Square should not be used if more than 20% of the expected frequencies have a value of less than 5 or if an expected frequency of all numbers is greater than 5, it's acceptable to use the chi-square test.
- The sample should consist of at least 50 observations and should be drawn randomly from the population.
- Data should not be presented in percentage or ratio form, rather they should be expressed in original units

4.8.2 Clustered bar charts of pedestrian perception

Under crosstab in SPSS cluster bar charts of pedestrian perception are shown below: -

Table 4.27: Gender wise preferences of walking over driving in B&M markets.

		Almost every time	Frequently	Never	Sometimes	Very few times	
Female	Count	8	40	17	52	7	124
	Expected						
Male	Count	8.4	41.2	9.4	51.6	13.4	124
	% within						
	Gender	6.50%	32.30%	13.70%	41.90%	5.60%	100.00%
	Count	9	43	2	52	20	126
Male	Count	8.6	41.8	9.6	52.4	13.6	126
	% within						
	Gender	7.10%	34.10%	1.60%	41.30%	15.90%	100.00%

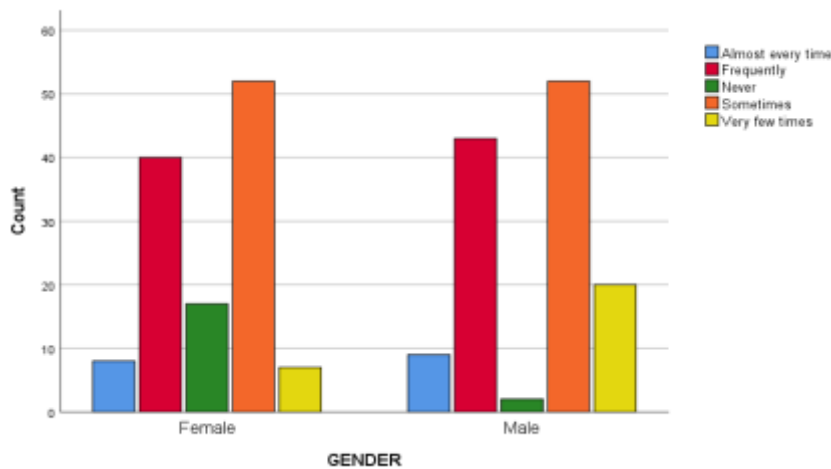


Figure 4.91: Clustered bar chart on preference of walking over driving (Gender wise)

Table 4.28: Age wise preferences of walking over driving in B&M markets.

		Almost every time	Frequently	Never	Sometimes	Very few times	
>50	Count	9	0	2	8	3	22
	Expected						
>50	Count	1.5	7.3	1.7	9.2	2.4	22
	% within						

		40.90				13.60	100.00
	% within Age	%	0.00%	9.10%	36.40%	%	%
0-20	Count	0	2	0	11	0	13
	Expected						
	Count	0.9	4.3	1	5.4	1.4	13
							100.00
20-35	% within Age	0.00%	15.40%	0.00%	84.60%	0.00%	%
	Count	8	60	17	37	7	129
	Expected						
	Count	8.8	42.8	9.8	53.7	13.9	129
				13.20			100.00
35-50	% within Age	6.20%	46.50%	%	28.70%	5.40%	%
	Count	0	21	0	48	17	86
	Expected						
	Count	5.8	28.6	6.5	35.8	9.3	86
						19.80	100.00
	% within Age	0.00%	24.40%	0.00%	55.80%	%	%

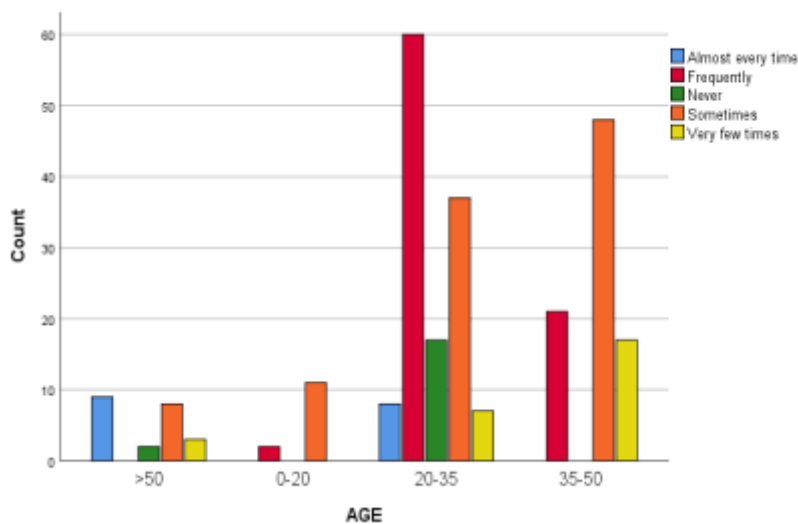


Figure 4.92: Clustered bar chart on preference of walking over driving (Age Wise)

Table 4.29: Occupation wise preferences of walking over driving in B&M markets

	Almost every time	Frequently	Never	Sometimes	Very few times	
Count	9	0	2	12	16	39

Business man	Expected Count	2.7	12.9	3	16.2	4.2	39
	% within Occupation	23.10%	0.00%	5.10%	30.80%	41.00%	100.00%
Employee	Count	0	65	9	63	11	148
	Expected Count	10.1	49.1	11.2	61.6	16	148
	% within Occupation	0.00%	43.90%	6.10%	42.60%	7.40%	100.00%
Homemakers	Count	8	16	8	18	0	50
	Expected Count	3.4	16.6	3.8	20.8	5.4	50
	% within Occupation	16.00%	32.00%	16.00%	36.00%	0.00%	100.00%
Students/ Other	Count	0	2	0	11	0	13
	Expected Count	0.9	4.3	1	5.4	1.4	13
	% within Occupation	0.00%	15.40%	0.00%	84.60%	0.00%	100.00%

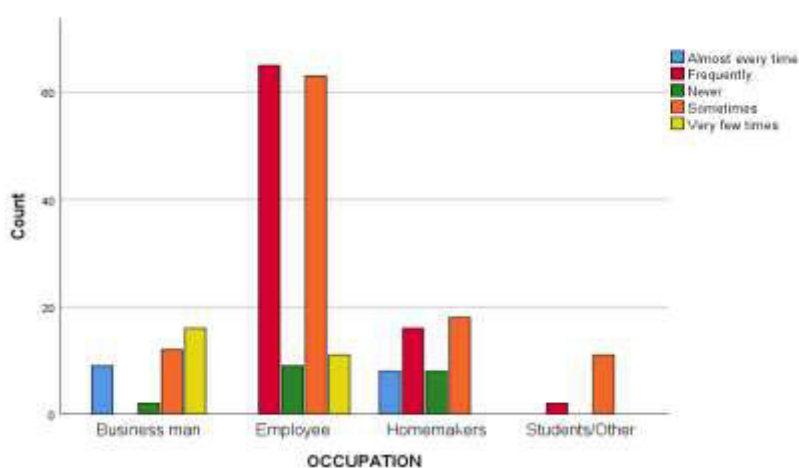


Figure 4.93: Clustered bar chart on preference of walking over driving (Occupation Wise)

4.8.3 Preferences of walking over driving in B&M markets

Table 4.30: Income wise preferences of walking over driving in B&M markets

		Almost every time	Frequently	Never	Sometimes	Very few times	
<20000	Count	8	16	0	11	0	35
	Expected Count	2.4	11.6	2.7	14.6	3.8	35
	% within Monthly Household Income	22.90%	45.70%	0.00%	31.40%	0.00%	100.00%
>2 Lakhs	Count	9	0	2	12	12	35
	Expected Count	2.4	11.6	2.7	14.6	3.8	35
	% within Monthly Household Income	25.70%	0.00%	5.70%	34.30%	34.30%	100.00%
20000-50000	Count	0	63	2	37	11	113
	Expected Count	7.7	37.5	8.6	47	12.2	113
	% within Monthly Household Income	0.00%	55.80%	1.80%	32.70%	9.70%	100.00%
50000-2 Lakhs	Count	0	4	15	44	4	67
	Expected Count	4.6	22.2	5.1	27.9	7.2	67
	% within Monthly Household Income	0.00%	6.00%	22.40%	65.70%	6.00%	100.00%

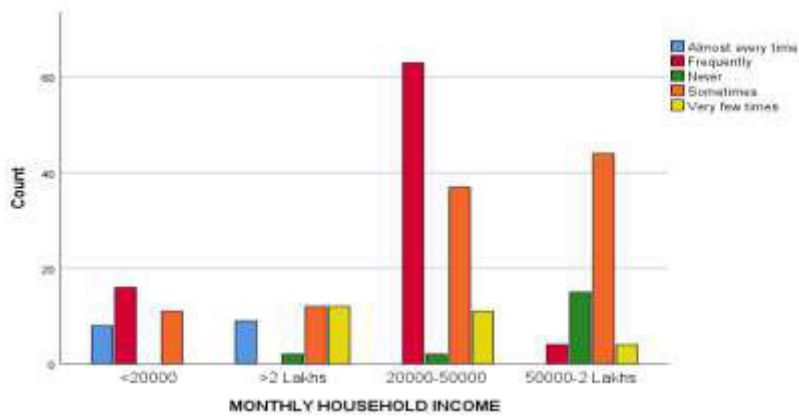


Figure 4.94: Clustered bar chart on preference of walking over driving (Monthly household income Wise)

Table 4.31: Vehicle ownership wise preferences of walking over driving in B&M markets

	Almost every time	Frequently	Never	Sometimes	Very few times	
Count	8	50	0	32	7	97
Expected Count	6.6	32.2	7.4	40.4	10.5	97
% within Vehicle Ownership	8.20%	51.50%	0.00%	33.00%	7.20%	100.00%
Count	0	7	0	11	0	18
Expected Count	1.2	6	1.4	7.5	1.9	18
% within Vehicle Ownership	0.00%	38.90%	0.00%	61.10%	0.00%	100.00%
Count	9	17	19	61	20	126
Expected Count	8.6	41.8	9.6	52.4	13.6	126
% within Vehicle Ownership	7.10%	13.50%	15.10%	48.40%	15.90%	100.00%
Count	0	9	0	0	0	9

Expected Count	0.6	3	0.7	3.7	1	9
% within Vehicle Ownership	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%

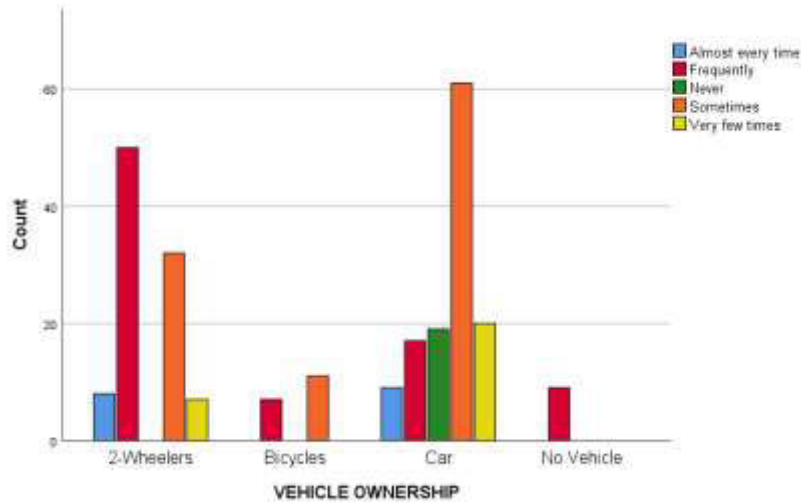


Figure 4.95: Clustered bar chart on preference of walking over driving in B&M (Vehicle ownership wise)

Table 4.32: Gender wise Rating of Convenience & Attractiveness in existing B&M retail market

		Bad	Average	Good	
Female	Count	10	82	32	124
	Expected Count	6	66	52.1	124
	% within Gender	8.10%	66.10%	25.80%	100.00%
Male	Count	2	51	73	126
	Expected Count	6	67	52.9	126
	% within Gender	1.60%	40.50%	57.90%	100.00%

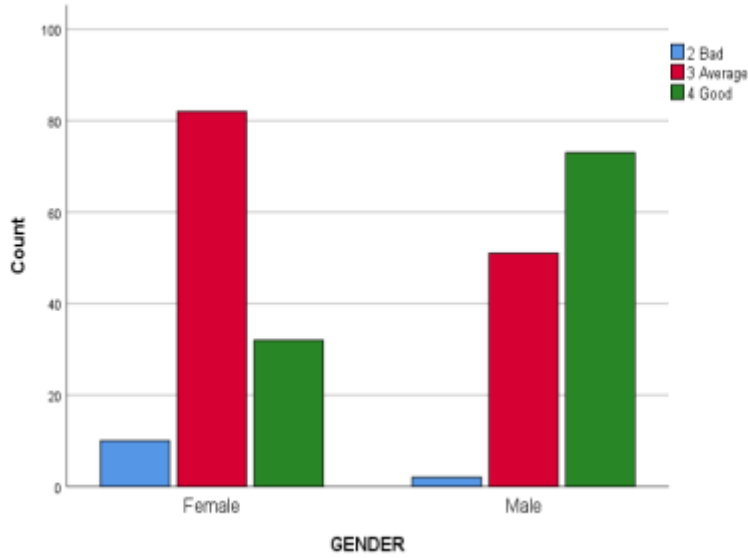


Figure 4.96: Gender wise Rating of Convenience & Attractiveness in existing B&M retail market.

Table 4.33: Age wise Rating of Convenience & Attractiveness in existing B&M retail market

		Bad	Average	Good	
>50	Count	2	16	4	22
	Expected				
	Count	1.1	11.7	9.2	22
	% within Age	9.10%	72.70%	18.20%	100.00%
0-20	Count	0	11	2	13
	Expected				
	Count	0.6	6.9	5.5	13
	% within Age	0.00%	84.60%	15.40%	100.00%
20-35	Count	10	56	63	129
	Expected				
	Count	6.2	68.6	54.2	129
	% within Age	7.80%	43.40%	48.80%	100.00%
35-50	Count	0	50	36	86
	Expected				
	Count	4.1	45.8	36.1	86
	% within Age	0.00%	58.10%	41.90%	100.00%

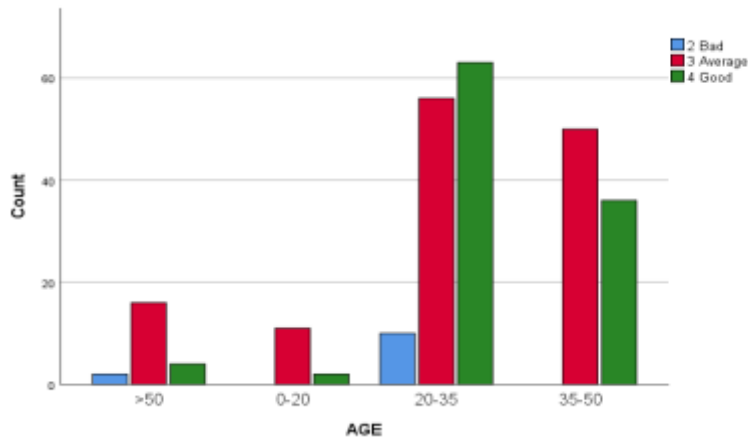


Figure 4.97: Age wise Rating of Convenience & Attractiveness in existing B&M retail market.

Table 4.34: Occupation wise Rating of Convenience & Attractiveness in existing B&M retail market

		Bad	Average	Good	
Business man	Count	2	20	17	39
	Expected Count	1.9	20.7	16.4	39
	% within				
	Occupation	5.10%	51.30%	43.60%	100.00%
Employee	Count	2	64	82	148
	Expected Count	7.1	78.7	62.2	148
	% within				
	Occupation	1.40%	43.20%	55.40%	100.00%
Homemakers	Count	8	38	4	50
	Expected Count	2.4	26.6	21	50
	% within				
	Occupation	16.00%	76.00%	8.00%	100.00%
Students/ Other	Count	0	11	2	13
	Expected Count	0.6	6.9	5.5	13
	% within				
	Occupation	0.00%	84.60%	15.40%	100.00%

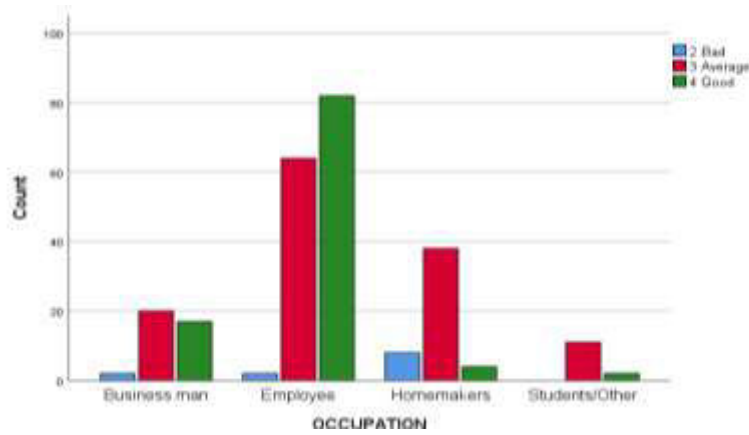


Figure 4.98: Occupation wise Rating of Convenience & Attractiveness in existing B&M retail market.

Table 4.35: Age wise Rating of Convenience & Attractiveness in existing B&M retail market

		Bad	Average	Good	
<20000	Count	0	29	6	35
	Expected Count	1.7	18.6	14.7	35
	% within Monthly Household Income	0.00%	82.90%	17.10%	100.00%
>2 Lakhs	Count	2	16	17	35
	Expected Count	1.7	18.6	14.7	35
	% within Monthly Household Income	5.70%	45.70%	48.60%	100.00%
20000-50000	Count	2	47	64	113
	Expected Count	5.4	60.1	47.5	113
	% within Monthly Household Income	1.80%	41.60%	56.60%	100.00%
50000-2 Lakhs	Count	8	41	18	67
	Expected Count	3.2	35.6	28.1	67
	% within Monthly Household Income	11.90%	61.20%	26.90%	100.00%

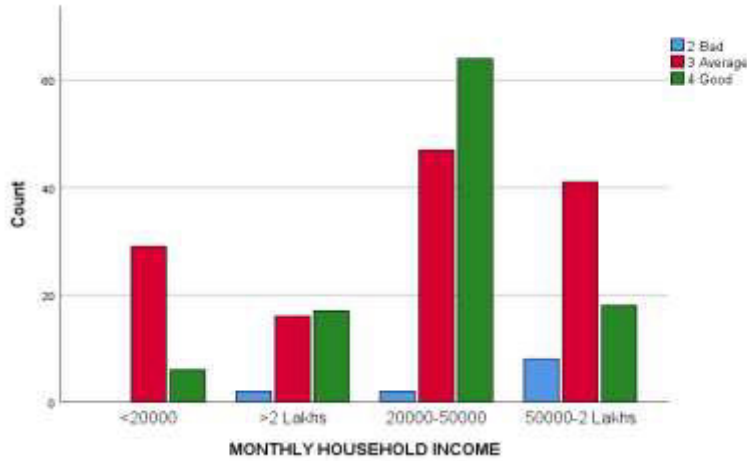


Figure 4.99: Monthly household income wise Rating of Convenience & Attractiveness in existing B&M retail market.

Table 4.36: Vehicle ownership wise Rating of Convenience & Attractiveness in existing B&M retail market

		Bad	Average	Good	
2-Wheelers	Count	0	19	78	97
	Expected Count	4.7	51.6	40.7	97
	% within Vehicle Ownership	0.00%	19.60%	80.40%	100.00%
Bicycles	Count	0	18	0	18
	Expected Count	0.9	9.6	7.6	18
	% within Vehicle Ownership	0.00%	100.00%	0.00%	100.00%
Car	Count	12	89	25	126
	Expected Count	6	67	52.9	126
	% within Vehicle Ownership	9.50%	70.60%	19.80%	100.00%
No Vehicle	Count	0	7	2	9
	Expected Count	0.4	4.8	3.8	9
	% within Vehicle Ownership	0.00%	77.80%	22.20%	100.00%

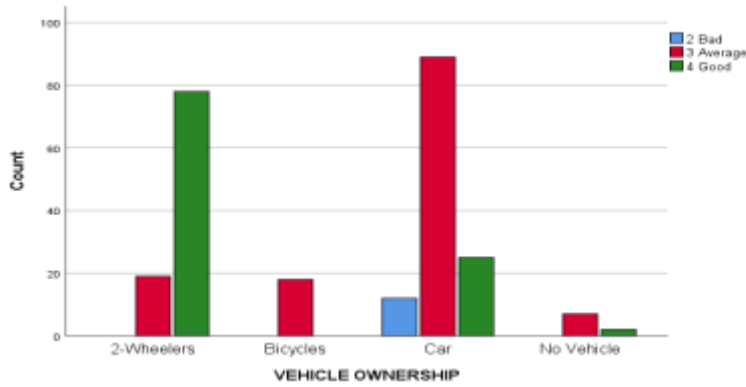


Figure 4.100: Vehicle Ownership wise Rating of Convenience & Attractiveness in existing B&M retail market.

4.8.4 How will you rate Safety & Security in existing B&M retail market?

Table 4.37: Gender wise Rating Safety & Security in existing B&M retail market

		Bad	Average	Good	
Female	Count	4	39	81	124
	Expected Count	2	31.2	90.8	124
	% within Gender	3.20%	31.50%	65.30%	100.00%
Male	Count	0	24	102	126
	Expected Count	2	31.8	92.2	126
	% within Gender	0.00%	19.00%	81.00%	100.00%

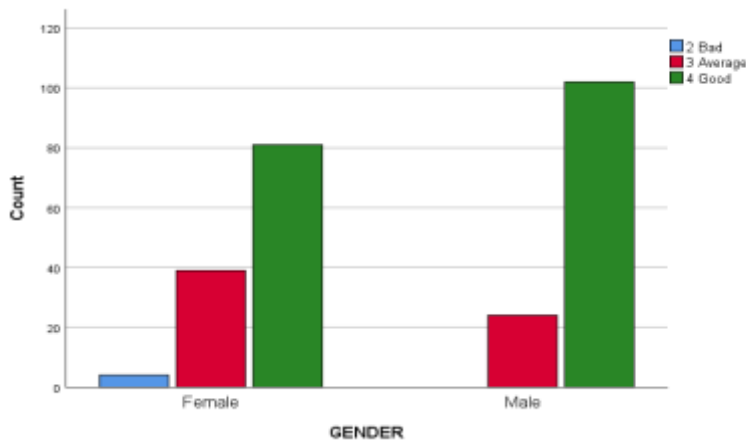


Figure 4.101: Gender wise Rating of Safety & Security in existing B&M retail market.

Table 4.38: Age wise Rating Safety & Security in existing B&M retail market

		Bad	Average	Good	
>50	Count	0	5	17	22
	Expected Count	0.4	5.5	16.1	22

	% within Age	0.00%	22.70%	77.30%	100.00%
0-20	Count	0	0	13	13
	Expected Count	0.2	3.3	9.5	13
	% within Age	0.00%	0.00%	100.00%	100.00%
20-35	Count	4	39	86	129
	Expected Count	2.1	32.5	94.4	129
	% within Age	3.10%	30.20%	66.70%	100.00%
35-50	Count	0	19	67	86
	Expected Count	1.4	21.7	63	86
	% within Age	0.00%	22.10%	77.90%	100.00%

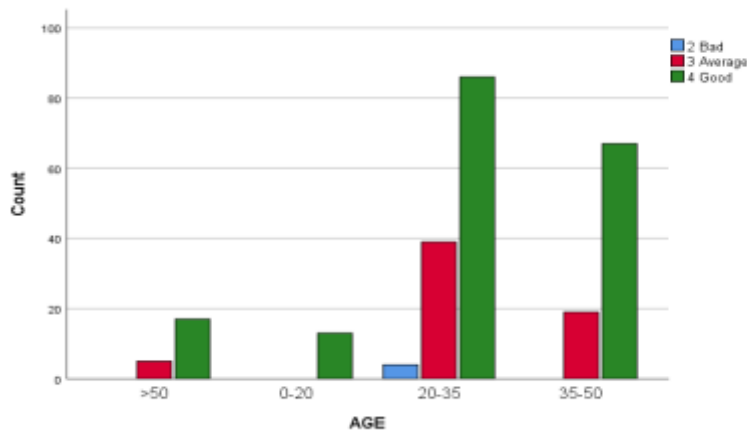


Figure 4.102: Age wise Rating of Safety & Security in existing B&M retail market.

Table 4.39: Occupation wise Rating Safety & Security in existing B&M retail market

		Bad	Average	Good	
Business man	Count	0	9	30	39
	Expected Count	0.6	9.8	28.5	39
	% within Occupation	0.00%	23.10%	76.90%	100.00%
Employee	Count	4	39	105	148
	Expected Count	2.4	37.3	108.3	148
	% within Occupation	2.70%	26.40%	70.90%	100.00%
Homemakers	Count	0	15	35	50
	Expected Count	0.8	12.6	36.6	50

	% within Occupation	0.00%	30.00%	70.00%	100.00%
Students/ Other	Count	0	0	13	13
	Expected Count	0.2	3.3	9.5	13
	% within Occupation	0.00%	0.00%	100.00%	100.00%

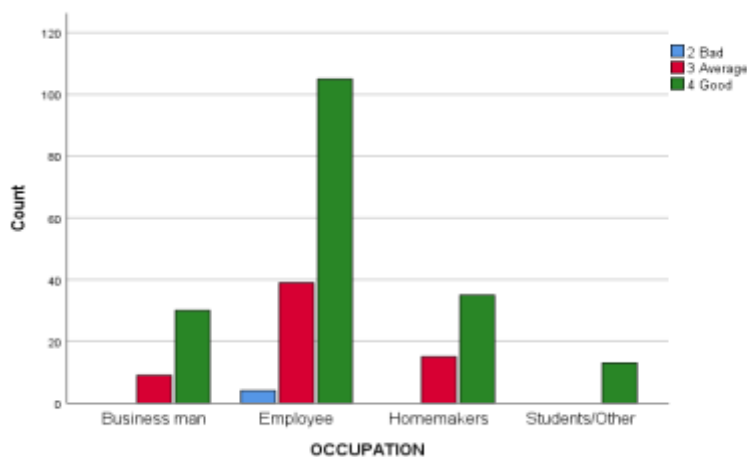


Figure 4.103: Occupation wise Rating of Safety & Security in existing B&M retail market.

Table 4.40: Monthly Household Income wise Rating Safety & Security in existing B&M retail market

		Bad	Average	Good	
<20000	Count	0	0	35	35
	Expected Count	0.6	8.8	25.6	35
	% within Monthly Household Income	0.00%	0.00%	100.00%	100.00%
>2 Lakhs	Count	0	5	30	35
	Expected Count	0.6	8.8	25.6	35
	% within Monthly Household Income	0.00%	14.30%	85.70%	100.00%
20000-50000	Count	4	25	84	113
	Expected Count	1.8	28.5	82.7	113
	% within Monthly Household Income	3.50%	22.10%	74.30%	100.00%

50000-2	Count	0	33	34	67
Lakhs	Expected Count	1.1	16.9	49	67
	% within Monthly Household Income	0.00%	49.30%	50.70%	100.00%



Figure 4.104: Monthly household income wise Rating of Safety & Security in existing B&M retail market.

Table 4.41: Vehicle ownership Income wise Rating Safety & Security in existing B&M retail market

		Bad	Average	Good	
2-Wheelers	Count	4	4	89	97
	Expected Count	1.6	24.4	71	97
	% within Vehicle Ownership	4.10%	4.10%	91.80%	100.00%
Bicycles	Count	0	0	18	18
	Expected Count	0.3	4.5	13.2	18
	% within Vehicle Ownership	0.00%	0.00%	100.00%	100.00%
Car	Count	0	59	67	126
	Expected Count	2	31.8	92.2	126
	% within Vehicle Ownership	0.00%	46.80%	53.20%	100.00%
No Vehicle	Count	0	0	9	9
	Expected Count	0.1	2.3	6.6	9

	% within Vehicle Ownership	0.00%	0.00%	100.00%	100.00%
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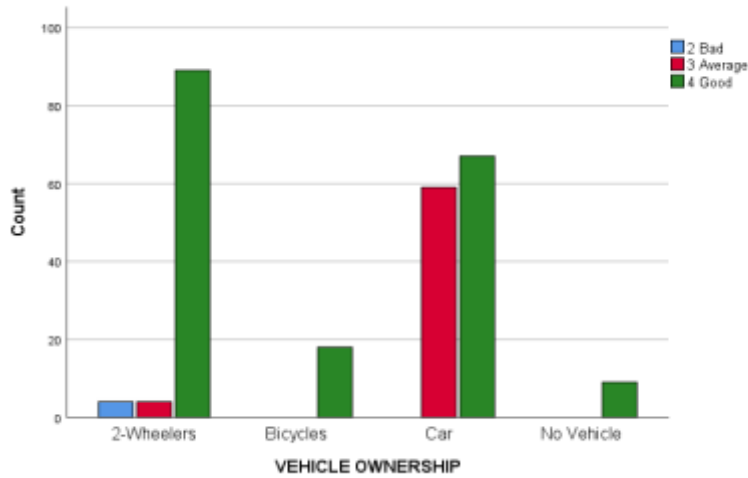


Figure 4.105: Vehicle ownership wise Rating of Safety & Security in existing B&M retail market.

4.8.5 How do you rate Comfort & Convivial Environment in existing B&M retail market?

Table 4.42: Gender wise Rating Comfort & Convivial in existing B&M retail market

		Bad	Average	
Female	Count	24	100	124
	Expected Count	33.7	90.3	124
	% within Gender	19.40%	80.60%	100.00%
Male	Count	44	82	126
	Expected Count	34.3	91.7	126
	% within Gender	34.90%	65.10%	100.00%

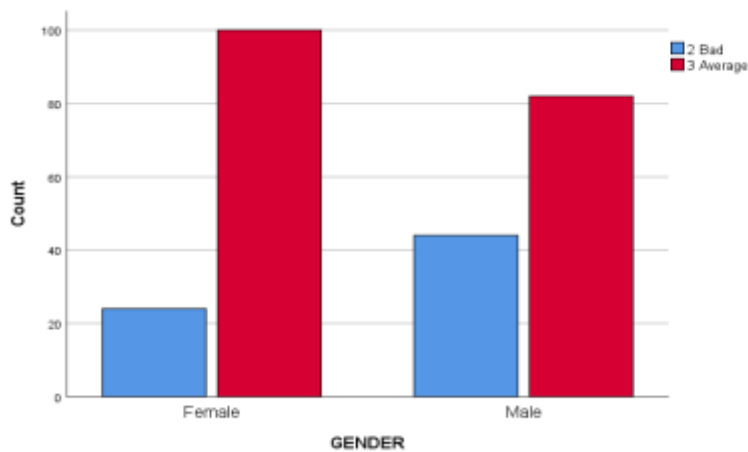


Figure 4.106: Gender wise Rating of Comfort & Convivial in existing B&M retail market.

Table 4.43: Age wise Rating Comfort & Convivial in existing B&M retail market

		Bad	Average	
>50	Count	5	17	22
	Expected Count	6	16	22
	% within Age	22.70%	77.30%	100.00%
0-20	Count	7	6	13
	Expected Count	3.5	9.5	13
	% within Age	53.80%	46.20%	100.00%
20-35	Count	45	84	129
	Expected Count	35.1	93.9	129
	% within Age	34.90%	65.10%	100.00%
35-50	Count	11	75	86
	Expected Count	23.4	62.6	86
	% within Age	12.80%	87.20%	100.00%

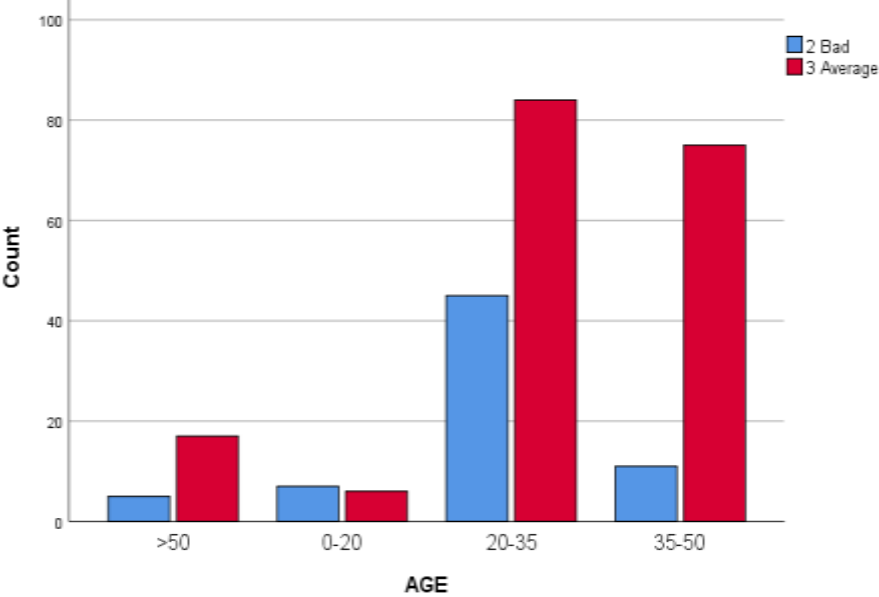


Figure 4.107: Age wise Rating of Comfort & Convivial in existing B&M retail market.

Table 4.44: Occupation wise Rating Comfort & Convivial in existing B&M retail market

		Bad	Average	
	Count	14	25	39

Business man	Expected Count	10.6	28.4	39
	% within Occupation	35.90%	64.10%	100.00%
Employee	Count	37	111	148
	Expected Count	40.3	107.7	148
	% within Occupation	25.00%	75.00%	100.00%
Homemakers	Count	10	40	50
	Expected Count	13.6	36.4	50
	% within Occupation	20.00%	80.00%	100.00%
Students/ Other	Count	7	6	13
	Expected Count	3.5	9.5	13
	% within Occupation	53.80%	46.20%	100.00%

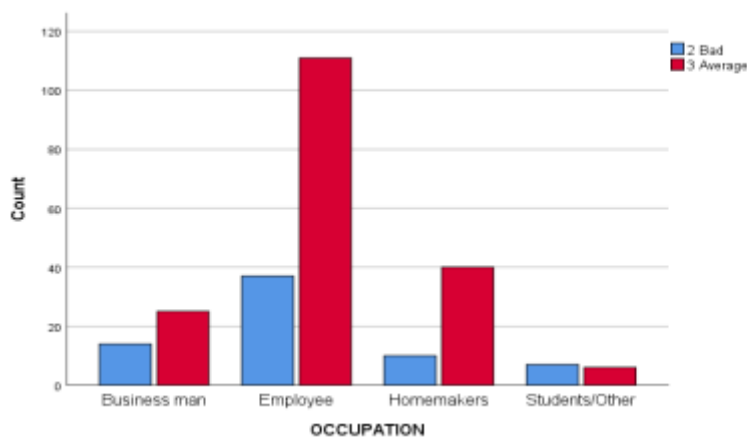


Figure 4.108: Occupation wise Rating of Comfort & Convivial in existing B&M retail market.

Table 4.45: Monthly household income wise Rating Comfort & Convivial in existing B&M retail market

		Bad	Average	
<20000	Count	7	28	35
	Expected Count	9.5	25.5	35
	% within Monthly Household Income	20.00%	80.00%	100.00%
>2 Lakhs	Count	14	21	35
	Expected Count	9.5	25.5	35
	% within Monthly Household Income	40.00%	60.00%	100.00%

20000-50000	Count	30	83	113
	Expected Count	30.7	82.3	113
	% within Monthly Household Income	26.50%	73.50%	100.00%
50000-2 Lakhs	Count	17	50	67
	Expected Count	18.2	48.8	67
	% within Monthly Household Income	25.40%	74.60%	100.00%

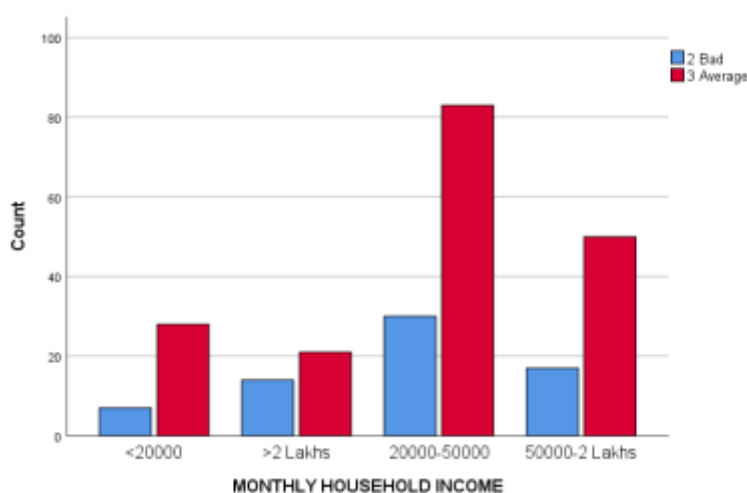


Figure 4.109: Monthly household income wise Rating of Comfort & Convivial in existing B&M retail market.

Table 4.46: Vehicle ownership wise Rating Comfort & Convivial in existing B&M retail market

		Bad	Average	
2-Wheelers	Count	31	66	97
	Expected Count	26.4	70.6	97
	% within Vehicle Ownership	32.00%	68.00%	100.00%
Bicycles	Count	7	11	18
	Expected Count	4.9	13.1	18
	% within Vehicle Ownership	38.90%	61.10%	100.00%
Car	Count	30	96	126
	Expected Count	34.3	91.7	126
	% within Vehicle Ownership	23.80%	76.20%	100.00%

No Vehicle	Count	0	9	9
	Expected Count	2.4	6.6	9
	% within Vehicle Ownership	0.00%	100.00%	100.00%

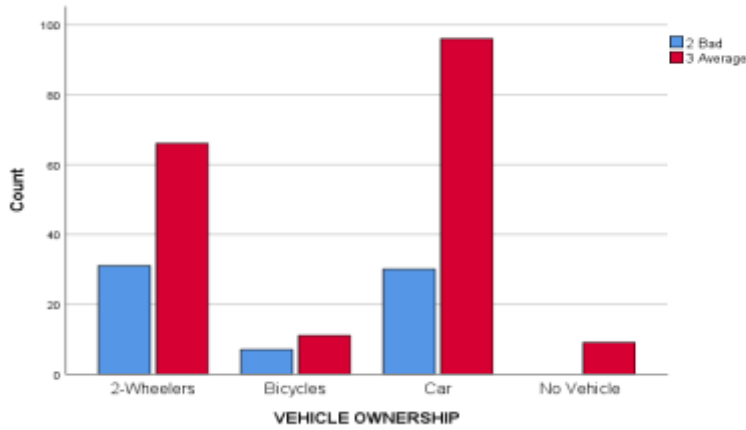


Figure 4.110: vehicle ownership wise Rating of Comfort & Convivial in existing B&M retail market.

4.8.6 Chi- Square for preference of walking if walkability conditions are enhanced.

Table 4.47: Gender wise preference of walking if walkability conditions are enhanced. in existing B&M retail market

		Almost every time	Frequently	May be	Sometimes	Very few times	
Female	Count	63	40	14	0	7	124
	Expected Count	52.1	48.1	13.9	4.5	5.5	124
	% within Gender	50.80	32.30	11.30	0.00	5.60	100.00
Male	Count	42	57	14	9	4	126
	Expected Count	52.9	48.9	14.1	4.5	5.5	126
	% within Gender	33.30	45.20	11.10	7.10	3.20	100.00

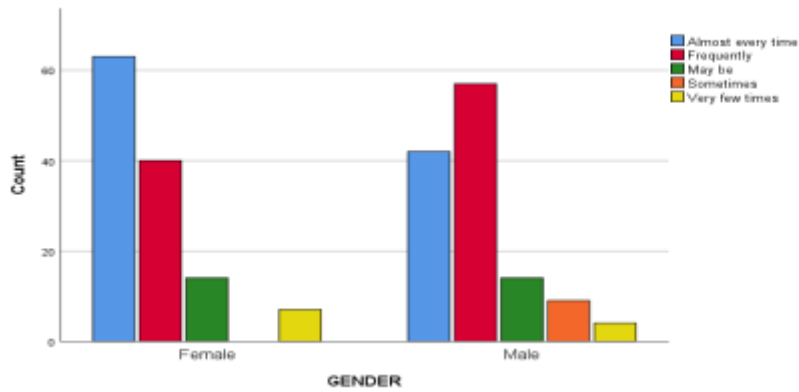


Figure 4.111: Gender wise preference of walking if walkability conditions are enhanced.

Table 4.48: Age wise preference of walking if walkability conditions are enhanced. in existing B&M retail market

	Almost every time	Frequently	May be	Sometimes	Very few times	
Count	9	11	2	0	0	22
Expected Count	9.2	8.5	2.5	0.8	1	22
% within Age	40.90%	50.00%	9.10%	0.00%	0.00%	100.00%
Count	0	13	0	0	0	13
Expected Count	5.5	5	1.5	0.5	0.6	13
% within Age	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
Count	72	32	18	0	7	129
Expected Count	54.2	50.1	14.4	4.6	5.7	129
% within Age	55.80%	24.80%	14.00%	0.00%	5.40%	100.00%
Count	24	41	8	9	4	86
Expected Count	36.1	33.4	9.6	3.1	3.8	86
% within Age	27.90%	47.70%	9.30%	10.50%	4.70%	100.00%

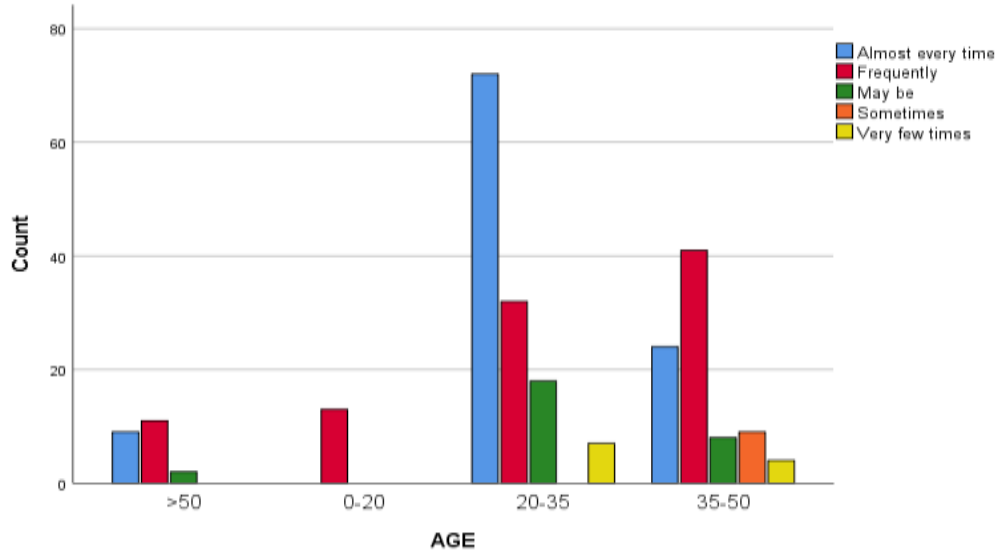


Figure 4.112: Age wise preference of walking if walkability conditions are enhanced.

Table 4.49: Occupation preference of walking if walkability conditions are enhanced. in existing B&M retail market

		Almost every time	Frequently	May be	Sometimes	Very few times	
Business man	Count	9	20	6	0	4	39
	Expected Count	16.4	15.1	4.4	1.4	1.7	39
	% within Occupation	23.10%	51.30%	15.40%	0.00%	10.30%	100.00%
Employee	Count	67	51	14	9	7	148
	Expected Count	62.2	57.4	16.6	5.3	6.5	148
	% within Occupation	45.30%	34.50%	9.50%	6.10%	4.70%	100.00%
Homemakers	Count	29	13	8	0	0	50
	Expected Count	21	19.4	5.6	1.8	2.2	50
	% within Occupation	58.00%	26.00%	16.00%	0.00%	0.00%	100.00%
Students/ Other	Count	0	13	0	0	0	13
	Expected Count	5.5	5	1.5	0.5	0.6	13

	% within Occupation	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
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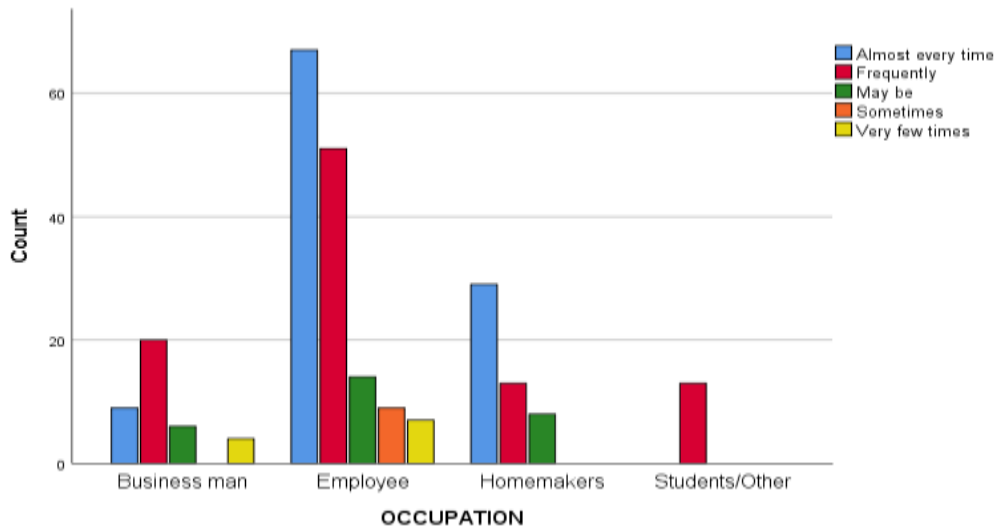


Figure 4.113: Occupation wise preference of walking if walkability conditions are enhanced.

Table 4.50: Monthly household income wise preference of walking if walkability conditions are enhanced. In existing B&M retail market

		Almost every time	Frequently	May be	Sometimes	Very few times	
<20000	Count	22	13	0	0	0	35
	Expected Count	14.7	13.6	3.9	1.3	1.5	35
	% within Monthly Household Income	62.90%	37.10%	0.00%	0.00%	0.00%	100.00%
>2 Lakhs	Count	9	20	2	0	4	35
	Expected Count	14.7	13.6	3.9	1.3	1.5	35
	% within Monthly	25.70%	57.10%	5.70%	0.00%	11.40%	100.00%

	Household Income						
20000-50000	Count	65	34	14	0	0	113
	Expected Count	47.5	43.8	12.7	4.1	5	113
	% within Monthly Household Income	57.50%	30.10%	12.40%	0.00%	0.00%	100.00%
50000-2 Lakhs	Count	9	30	12	9	7	67
	Expected Count	28.1	26	7.5	2.4	2.9	67
	% within Monthly Household Income	13.40%	44.80%	17.90%	13.40%	10.40%	100.00%

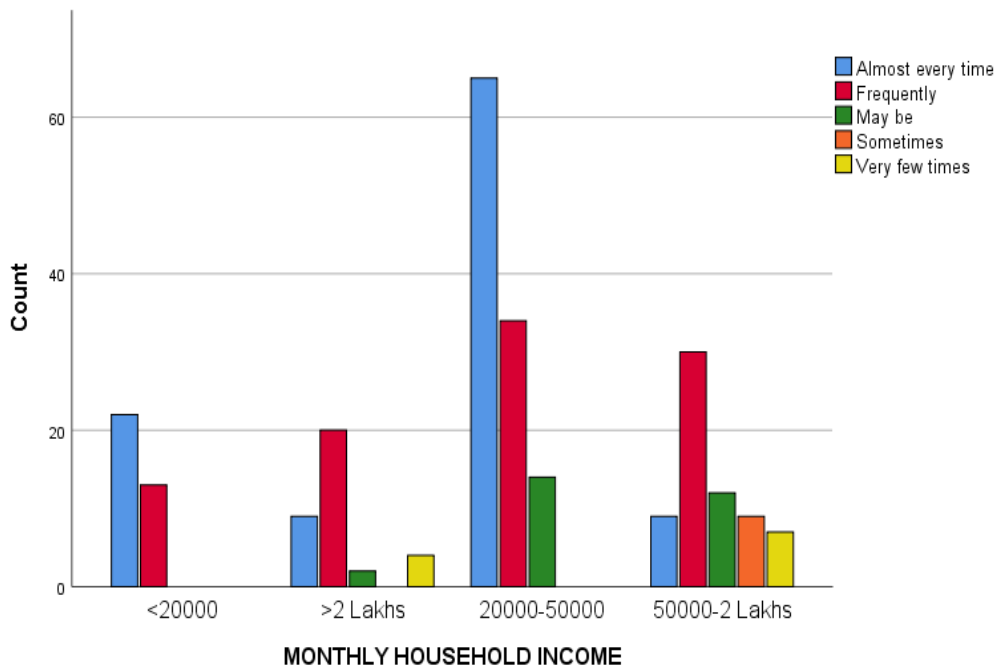


Figure 4.114: Monthly household income wise preference of walking if walkability conditions are enhanced.

Table 4.51: Vehicle ownership wise preference of walking if walkability conditions are enhanced. in existing B&M retail market

		Almost every time	Frequently	May be	Sometimes	Very few times	
2-Wheelers	Count	62	22	4	9	0	97
	Expected Count	40.7	37.6	10.9	3.5	4.3	97
	% within Vehicle Ownership	63.90%	22.70%	4.10%	9.30%	0.00%	100.00%
Bicycles	Count	7	11	0	0	0	18
	Expected Count	7.6	7	2	0.6	0.8	18
	% within Vehicle Ownership	38.90%	61.10%	0.00%	0.00%	0.00%	100.00%
Car	Count	29	62	24	0	11	126
	Expected Count	52.9	48.9	14.1	4.5	5.5	126
	% within Vehicle Ownership	23.00%	49.20%	19.00%	0.00%	8.70%	100.00%
No Vehicle	Count	7	2	0	0	0	9
	Expected Count	3.8	3.5	1	0.3	0.4	9
	% within Vehicle Ownership	77.80%	22.20%	0.00%	0.00%	0.00%	100.00%

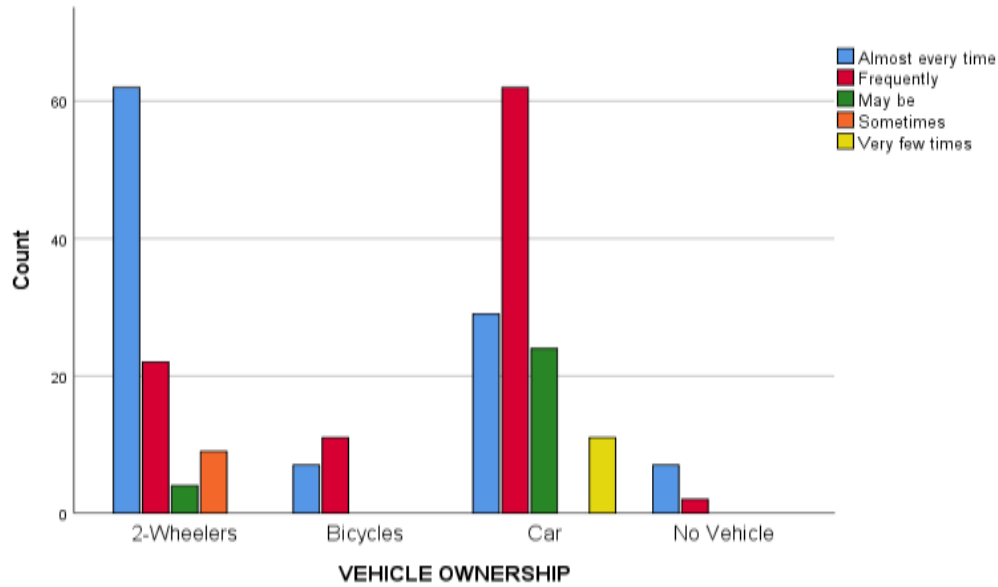


Figure 4.115: Vehicle ownership wise preference of walking if walkability conditions are enhanced.

Expected Frequencies for acceptance of Chi-square test in SPSS was performed to concentrate on this affiliation. The outcomes are portrayed in Table 4.52 underneath.

Table 4.52: Expected Frequencies for acceptance of Chi-square Tests

		Gender	Age	Occupation	Monthly Household Income	Vehicle ownership
How often do you prefer walking over driving in B&M markets?	Pearson Chi-Square Value	18.254 ^a	101.439 ^{a1}	106.735 ^{a2}	152.631 ^{a1}	73.299 ^{a3}
	Asymptotic Significance (2-sided)	0.001	0.000	0.000	0.000	0.000
How do you rate Convenience & Attractiveness in existing B&M retail market?	Pearson Chi-Square Value	28.554 ^a	21.245 ^{a4}	49.759 ^{a4}	35.767 ^{a4}	105.247 ^{a5}
	Asymptotic Significance (2-sided)	0.000	0.002	0.000	0.000	0.000
How do you rate Safety &	Pearson Chi-Square Value	9.966 ^{a6}	11.045 ^{a5}	8.160 ^{a5}	39.949 ^{a7}	67.708 ^{a8}

Security in existing B&M retail market?	Asymptotic Significance (2-sided)	0.007	0.087	0.227	0.000	0.000
How do you rate Comfort & Convivial Environment in existing B&M retail market?	Pearson Chi-Square Value	7.647 ^a	17.747 ^{a9}	7.822 ^{a9}	3.949 ^a	6.445 ^{a6}
	Asymptotic Significance (2-sided)	0.006	0.000	0.050	0.267	0.092
If walkability conditions are enhanced, would you like to prefer walking?	Pearson Chi-Square Value	16.983 ^{a6}	58.628 ^{a2}	44.701 ^{a3}	79.513 ^{a10}	76.961 ^{a11}
	Asymptotic Significance (2-sided)	0.002	0.000	0.000	0.000	0.000

As per 1st condition, only 4 options were accepted to explore further by chi-square test. Further significance of relationship and strength of accepted options was done by cross tabulation and Phi/Cramer's value.

4.8.7 Cross tabulation and Phi/Cramer's value

For checking significance of variation in the scores of 4 options, Null Hypothesis is that there is no significant association between variable 1 and variable 2; and Alternative Hypothesis is that there is significant association between variable 1 and variable 2. Decision rule for test is If p-value is less than 0.05, Ho is rejected means, there is a significant association between variable 1 and variable 2. On other hand if p-value is more than 0.05, Ho is accepted means there is no significant association between variable 1 and variable 2. Chi-square test revealed a significant association of responses of, "How often do you prefer walking over driving in B&M markets?" with gender. The question, "How do you rate Convenience & Attractiveness in existing B&M retail market?" and "How do you rate Comfort & Convivial Environment in existing B&M retail market?" also found significant association with gender. But in fourth option i.e., "How do you rate Comfort & Convivial Environment in existing B&M retail market?" found no significance with monthly household income. In order to further explore the degree of association of responses in the above three options, crosstab and Phi/Cramer's analysis was undertaken.

Table 4.53: Crosstab Test to Measure the Degree of Association

		GENDER		Total	
		Female	Male		
How often do you prefer walking over driving in B&M markets?	Almost every time	Count	8	9	17
		Percent*	47.10%	52.90%	100.00%
		Percent**	6.50%	7.10%	6.80%
	Frequently	Count	40	43	83
		Percent*	48.20%	51.80%	100.00%
		Percent**	32.30%	34.10%	33.20%
	Never	Count	17	2	19
		Percent*	89.50%	10.50%	100.00%
		Percent**	13.70%	1.60%	7.60%
	Sometimes	Count	52	52	104
		Percent*	50.00%	50.00%	100.00%
		Percent**	41.90%	41.30%	41.60%
	Very few times	Count	7	20	27
		Percent*	25.90%	74.10%	100.00%
		Percent**	5.60%	15.90%	10.80%
	Total	Count	124	126	250
		Percent*	49.60%	50.40%	100.00%
		Percent**	100.00%	100.00%	100.00%
Percent* % within How often do you prefer walking over driving in B&M markets					
Percent** % within GENDER					
Table 4.27 Symmetric Measures					

		Value	Approximate Significance
Nominal by Nominal	Phi	0.27	0.001
	Cramer's V	0.27	0.001
N of Valid Cases		250	

As per cross tabulation, it is observed that, in compassion to male, more female preferred walking over driving in B&M markets. Further value of phi value reveals that strength of relationship is weak as its value is less than 0.3,

Table 4.54: Crosstab Test to Measure the Degree of Association

		GENDER			
			Female	Male	Total
How do you rate Convenience & Attractiveness in existing B&M retail market	Bad	Count	10	2	12
		Percent*	83.30%	16.70%	100.00%
		Percent**	8.10%	1.60%	4.80%
	Average	Count	82	51	133
		Percent*	61.70%	38.30%	100.00%
		Percent**	66.10%	40.50%	53.20%
	Good	Count	32	73	105
		Percent*	30.50%	69.50%	100.00%
		Percent**	25.80%	57.90%	42.00%
	Total	Count	124	126	250
		Percent*	49.60%	50.40%	100.00%
		Percent**	100.00%	100.00%	100.00%
Percent* % within How do you rate Convenience & Attractiveness in existing B&M retail market					
Percent** % within GENDER					
Table 4.27 Symmetric Measures					

		Value	Approximate Significance
Nominal by Nominal	Phi	0.338	0.000
	Cramer's V	0.338	0.000
N of Valid Cases		250	

As per crosstabulation, it is observed that, in comparison to female, more male gave better rating to Convenience & Attractiveness in existing B&M retail market. Further value of phi value reveals that strength of relationship is moderate as its value is more than 0.3 and less than 0.05.

Table 4.55: Crosstab Test to Measure the Degree of Association

		GENDER			
			Female	Male	Total

How do you rate Comfort & Convivial Environment in existing B&M retail	Bad	Count	24	44	68	
		Percent*	35.30%	64.70%	100.00%	
		Percent**	19.40%	34.90%	27.20%	
	Average	Count	100	82	182	
		Percent*	54.90%	45.10%	100.00%	
		Percent**	80.60%	65.10%	72.80%	
	Total	Count	124	126	250	
		Percent*	49.60%	50.40%	100.00%	
		Percent**	100.00%	100.00%	100.00%	
	Percent* % within How do you rate Comfort & Convivial Environment in existing B&M retail market					
	Percent** % within GENDER					
	Symmetric Measures					
			Value	Approximate Significance		
Nominal by Nominal	Phi		-0.175	0.006		
	Cramer's V		0.175	0.006		
N of Valid Cases			250			

As per crosstabulation, it is observed that, in compassion to male, more female gave better rating to Comfort & Convivial Environment in existing B&M retail market. Further value of phi value reveals that strength of relationship is weak as its value is less than 0.3.

4.8.8 Preference of the Respondents as regards Desired Improvements in Pedestrian Environment

The pedestrian respondents were further explored about the specific improvements they would like to have in the B & M retail market environment. Based on study, five possible desired improvements were identified for the B & M built environment of Ludhiana city. The 250 respondents were asked to rank these from 1st to 3rd based on their priority for specific improvements desired from pedestrian perception. Feedback sought from the user would signify a wider social acceptability for the improvements recommended to enhance the pedestrian environment in the B & M built environment of Ludhiana city.

Table 4.56: List of Desired Improvements

Code	Desired Improvement
DI 1	Convenience & Attractiveness (Availability of pedestrian amenities, streetscape elements etc.)
DI 2	Safety & Security (Safety measures like CCTV, security guard etc.)
DI 3	Comfort (Enhancing quality of facilities like surface conditions, street lighting etc.)
DI 4	Spatial Quality (Enhancing by natural sights, articulation in building design etc.)
DI 5	Socio Active Environment (enthusiasm by Music, accessible to people with disabilities etc.)

The rankings given by the 250 pedestrian respondents are aggregated in Table 4.57

Table 4.57: Users' Rankings and Weighted Averages for Desired Improvements

Ranks	No. of Respondents in Each Rank Category					Weighted Averages for Desired Improvements
	1st	2nd	3rd	4th	5th	
Codes for Desired Improvement						
DI 1	43	85	115	7	0	3.66
DI 2	105	47	7	45	46	3.48
DI 3	72	86	55	21	16	3.71
DI 4	20	24	58	73	75	2.36
DI 5	10	8	15	104	113	1.79

As many as 105 users have placed Safety & Security (DI-2) for pedestrians in B&M retail market at the 1st rank followed by 72 respondent who placed Comfort (DI-3) at the 2nd rank. Further 43 respondents placed Convenience & Attractiveness (DI-1) at 3rd rank. However, weighted average of Comfort (DI-3) is maximum, followed by Convenience & Attractiveness (DI-1), next is Safety & Security (DI-2) which is otherwise ranked at 1st position. Spatial Quality (DI-4) and Socio Active Environment (DI-5) are ranked at 4th and 5th rank respectively. Overall pedestrian user gave low preference to Spatial Quality (DI-4) and Socio Active Environment (DI-5) from desired list of improvements.

4.9 CONCLUSION

This chapter assesses the B&M retail market of Ludhiana city considering intangible parameters from pedestrian perspective. The intangible parameters with help of tangible/intangible attributes were analyzed from field survey and pedestrian perception. Lack of pedestrian paths and lack of shade are widespread concerns, which eventually make built environment unsafe and thermally uncomfortable. In general, it may be understood that the B&M retail markets have a huge potential for improvement. Further, the willingness of the users to improve their walk habits is a definitive reason for the concerned agencies of development to upgrade the B&M markets from pedestrian perspective.

CHAPTER-5 INTERPRETATION & WAY FORWARD

Even though the current urbanization and mobility trends have badly bruised the pedestrian realm in B&M retail-built environment, the benefits of walking while shopping cannot be denied or undermined even with the utmost level of development. In the maze of continuously increasing automotive traffic, modern cities appear to have lost their pedestrian culture, yet there are also more and more vocal calls for rethinking walking. Professionals throughout the world are attempting to modify their built environments from a pedestrian perspective after realizing the impact that different built environment parameters can have on strengthening the social as well as economic culture. Various policies and strategies are formulated, guidelines are prepared and specific proposals are implemented across the globe; and the Indian cities too have started responding to these changing attitudes. Undoubtedly, awareness is becoming apparent in India in the shape of pertinent laws, rules, and initiatives, but this movement still needs to gain traction. To enhance pedestrian user experience in B&M retail markets, intangible factors like convenience-attractiveness, safety-security, comfort & convivial environment need to be addressed either through the construction of pedestrian infrastructure throughout B&M retail markets or through the pedestrianization of some segments of markets. The goal of the current study is to strengthen and advance the pedestrian spirit at B&M retail markets. Promoting and fostering pedestrian culture at the segment level will be crucial in encouraging consumers to walk more frequently in their daily lives. This targets everybody equally irrespective of socio-economic and cultural variations. Exploring parameters having positive impact on pedestrian user in B&M retail market is need of an hour. Further, intangible parameters regarding pedestrian oriented planning and design of B&M markets are investigated in the 20 diverse area of Ludhiana city in terms of selected segment level parameters.

5.1 FINDINGS OF THE RESEARCH

5.1.1 Interpretation of conceptual framework by structure equation modeling

The objective of this section of research was to identify the factors affecting pedestrian user satisfaction in B&M retail markets. The outcome of this study provides significant insights about pedestrian user perception regarding B&M retail markets. Figure 5.1 represent structural path analysis model with path coefficients and significance of direct path.

Results from study of conceptual framework, clearly depict that all four latent constructs variables i.e., convenience-attractiveness (CA), safety-security (SS), comfort (C) and convivial environment (CE) are having significant positive impact on pedestrian user satisfaction in Indian B&M retail markets.

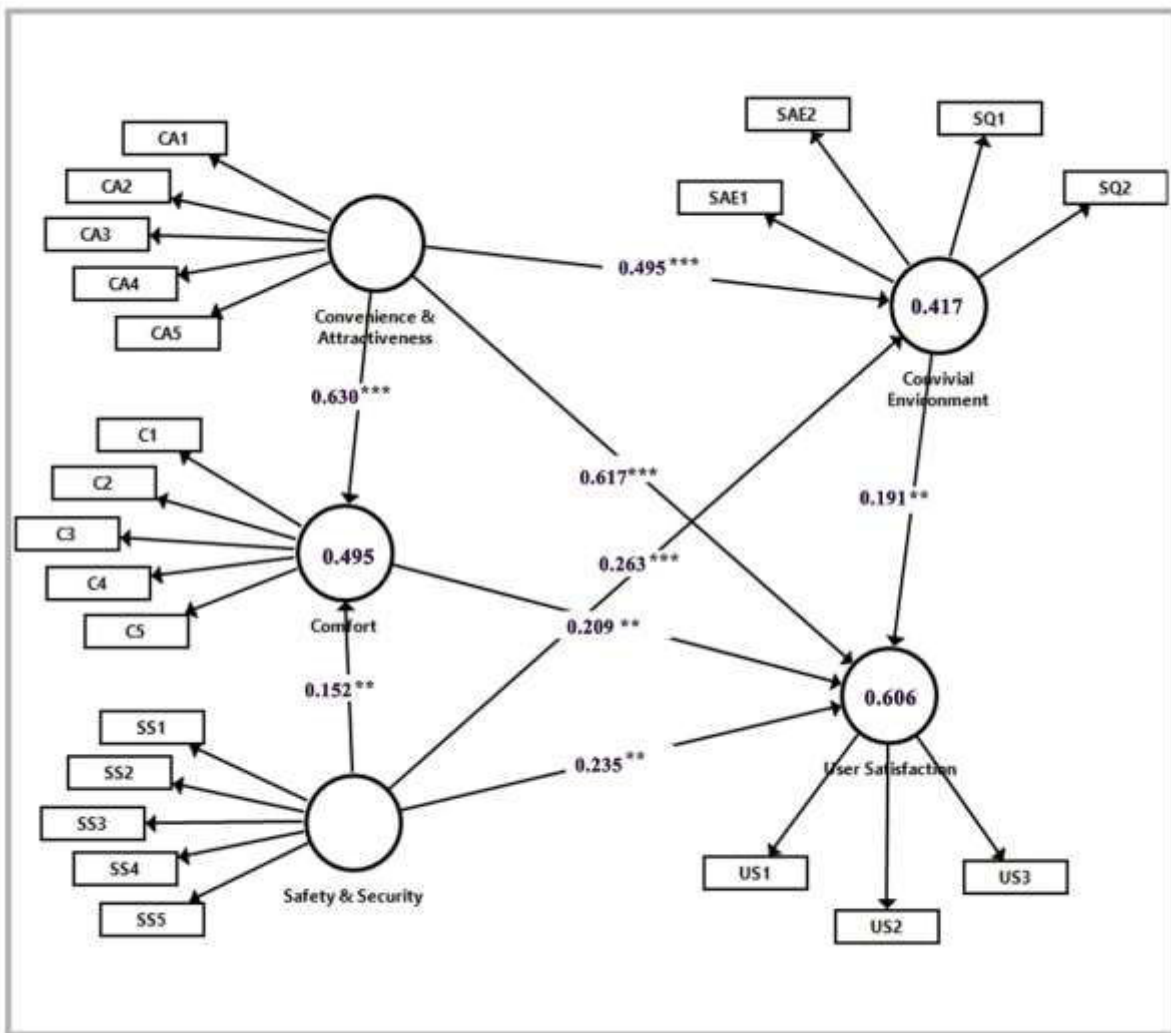


Figure 5.1 Structural Path for Conceptual framework

As, R² value (0.606), for conceptual framework is moderate with which indicates that 60.6% of user satisfaction is explained by four independents. Further as Q² values (0.432), is more than zero, which indicate that framed conceptual framework is well constructed and the model has predictive relevance. Overall, this research would contribute to the understanding of the factors which have impact on pedestrian user satisfaction in Indian B&M retail markets.

5.1.2 Interpretation from field study of B&M retail market in Ludhiana City

As per results of ANOVA null hypothesis is rejected and concluding that the variation is statically significant for all parameters at segment level, post-hoc tests by Tukey's was executed in SPSS to find the direction of mean score variability in three groups. The results of test are depicted in table 5.1 and 5.2.

Table 5.1 Multiple Comparisons (Tukey HSD)

Dependent Variable			95% Confidence Interval				
			Mean Difference	Std. Error	Sig.	Lower Bound	Upper Bound
Convenience & Attractiveness	1	2	-2.3750*	0.5786	0.002	-3.859	-0.891
		3	-5.5250*	0.5786	0.000	-7.009	-4.041
	2	1	2.3750*	0.5786	0.002	0.891	3.859
		3	-3.1500*	0.6185	0.000	-4.737	-1.563
	3	1	5.5250*	0.5786	0.000	4.041	7.009
		2	3.1500*	0.6185	0.000	1.563	4.737
Safety & Security	1	2	-1.2292*	0.2133	0.000	-1.776	-0.682
		3	-3.3625*	0.2133	0.000	-3.910	-2.815
	2	1	1.2292*	0.2133	0.000	0.682	1.776
		3	-2.1333*	0.2280	0.000	-2.718	-1.548
	3	1	3.3625*	0.2133	0.000	2.815	3.910
		2	2.1333*	0.2280	0.000	1.548	2.718
Comfort	1	2	-2.7208*	0.7160	0.004	-4.558	-0.884
		3	-6.5875*	0.7160	0.000	-8.424	-4.751
	2	1	2.7208*	0.7160	0.004	0.884	4.558
		3	-3.8667*	0.7655	0.000	-5.830	-1.903
	3	1	6.5875*	0.7160	0.000	4.751	8.424
		2	3.8667*	0.7655	0.000	1.903	5.830
Convivial Environment	1	2	-0.7542	0.3993	0.172	-1.779	0.270
		3	-2.9542*	0.3993	0.000	-3.979	-1.930
	2	1	0.7542	0.3993	0.172	-0.270	1.779
		3	-2.2000*	0.4269	0.000	-3.295	-1.105
	3	1	2.9542*	0.3993	0.000	1.930	3.979
		2	2.2000*	0.4269	0.000	1.105	3.295

User Satisfaction	1	2	-1.8458*	0.2729	0.000	-2.546	-1.146	
		3	-3.0125*	0.2729	0.000	-3.713	-2.312	
	2	1	1.8458*	0.2729	0.000	1.146	2.546	
		3	-1.1667*	0.2918	0.003	-1.915	-0.418	
	3	1	3.0125*	0.2729	0.000	2.312	3.713	
		2	1.1667*	0.2918	0.003	0.418	1.915	
*. The mean difference is significant at the 0.05 level.								

Table 5.2 Means for groups in homogeneous subsets

Convenience & Attractiveness

Tukey

HSD Subset for alpha = 0.05

Group	N	1	2	3
1	8	14.975		
2	6		17.350	
3	6			20.500
Sig.		1.000	1.000	1.000

Safety & Security

Tukey

HSD Subset for alpha = 0.05

Group	N	1	2	3
1	8	14.888		
2	6		16.117	
3	6			18.250
Sig.		1.000	1.000	1.000

Comfort

Tukey

HSD Subset for alpha = 0.05

Group	N	1	2	3
1	8	12.91		
2	6		15.63	
3	6			19.500
Sig.		1.000	1.000	1.000

Convivial Environment

Tukey

HSD Subset for alpha = 0.05

Group	N	1	2
1	8	8.863	
2	6	9.617	
3	6		11.81
Sig.		0.185	1.000

User Satisfaction

Subset for alpha =

Tukey HSD

0.05

Group N 1 2 3

1	8	9.488		
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2	6	11.33		
3	6		12.5	
Sig.		1.000	1.000	1.00

While considering Turkey test, it is observed that objective and subjective assessment of parameters, that the variance in the mean scores for all possible pair of groups is statistically significant for four parameters i.e., convenience-attractiveness, safety-security (SS), comfort (C), and user satisfaction (US). While considering convivial environment (CE) the variance in the mean scores is not significant among G1 and G2, but among G1 and G3; and among G2 and G3, it is statistically significant. Results of test are summarized in table 5.3 below.

Table 5.3 Result Summary

Convenience & Attractiveness			Safety & Security		
Group	p-value (sig.)	Significant	Group	p-value (sig.)	Significant
G1 vs					
G2	0.002	Yes	G1 vs G2	0.000	Yes
G2 vs					
G3	0.000	Yes	G2 vs G3	0.000	Yes
G1 vs					
G3	0.000	Yes	G1 vs G3	0.000	Yes
Comfort			Convivial Environment		
Group	p-value (sig.)	Significant	Group	p-value (sig.)	Significant
G1 vs					
G2	0.004	Yes	G1 vs G2	0.172	No
G2 vs					
G3	0.000	Yes	G2 vs G3	0.000	Yes
G1 vs					
G3	0.000	Yes	G1 vs G3	0.000	Yes
User Satisfaction					
Group	p-value (sig.)	Significant			

G1 vs G2	0.004	Yes
G2 vs G3	0.000	Yes
G1 vs G3	0.000	Yes

Further interpretation for objective and subjective assessment of five parameters by post-hoc tests reveal the following:

Convenience-Attractiveness: - For convenience-attractiveness, significant difference in the means scores exists among each pair of groups (G1-G2; G2-G3 and G1-G3), with highest scores in G3. G3 scored better than other two groups, means convenience-attractiveness is better in these B&M retail markets as compared to other B&M retail markets group.

Safety-Security: - For safety-security, significant difference in the means scores exists among each pair of groups (G1-G2; G2-G3 and G1-G3), with highest scores in G3. G3 scored better than other two groups, means safety-security is better in these B&M retail markets as compared to other B&M retail markets group.

Comfort: - For comfort, significant difference in the means scores exists among each pair of groups (G1-G2; G2-G3 and G1-G3), with highest scores in G3. G3 scored better than other two groups, means comfort is better in these B&M retail markets as compared to other B&M retail markets group.

Convivial environment: - For convivial environment, significant difference in the means scores exists among G1 and G3 and among G2 and G3, but among G1 and G2 there is no significant difference; with highest scores in G3. G3 scored better than other two groups, means convivial environment is better in these B&M retail markets as compared to other B&M retail markets group.

User satisfaction: - For user satisfaction, significant difference in the means scores exists among each pair of groups (G1-G2; G2-G3 and G1-G3), with highest scores in G3. G3 scored better than other two groups, means user satisfaction is better in these B&M retail markets as compared to other B&M retail markets group.

Overall, conclusion is that G3 type of retail markets are more pedestrian user friendly as compared to other two types.

5.1.3 Interpretation from B&M retail market pedestrian perception in Ludhiana City

- As per response from pedestrian user in B&M retail market, Convenience & Attractiveness (DI-1), Safety & Security (DI-2) and Comfort (DI-3) are considered as basic pillars for enhancing users experience in these markets.
- Spatial Quality (DI-4) and Socio Active Environment (DI-5) are considered as icing on cake, as definitely enhancement in these parameters will have positive impact on user mind.

Feedback sought from the pedestrian user in B&M retail market would signify a wider social acceptability for the improvements recommended to enhance the pedestrian environment in the B & M retail-built environment of Ludhiana city.

5.2 VALIDITY OF HYPOTHESIS

From current study, it is evident that all selected intangible variables (convenience & attractiveness, safety & security, comfort, spatial quality, and socio active environment) have positive influence on user satisfaction in B&M retail markets. Thus, hypothesis stated in chapter 1 is validated.

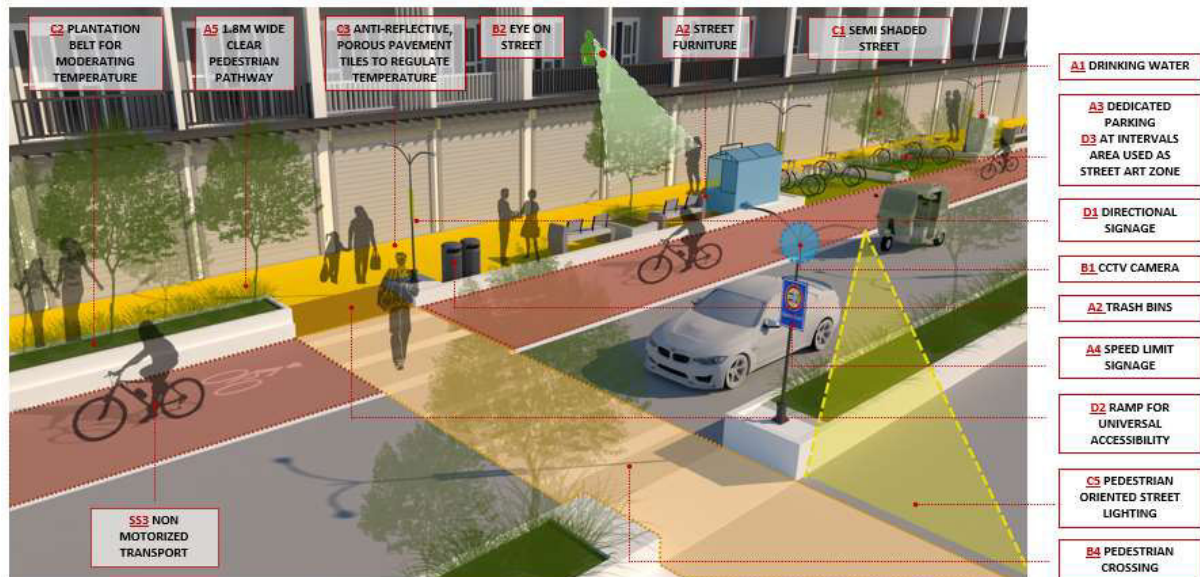
5.3 RECOMMENDATIONS FROM FINDINGS

To enhance pedestrian user satisfaction in B&M retail markets in Indian context, following recommendations has been given according to the objectives of the current study.

- Through intensive literature study, identified intangible urban planning aspects (convenience & attractiveness, safety & security, comfort, spatial quality, and socio active environment) are important in B&M retail markets. Thus, it is recommended that these parameters should be considered from planning to implementation phase in B&M retail markets.
- It was seen that the pedestrian users were not effectively considered in the street section of 20 surveyed B&M retail markets in Ludhiana city. Retrofitting of surveyed B&M retail markets according to pedestrian viewpoint is recommended and it would act as a model to proliferate the soul of strolling at nearby level.
- The data produced through statistical techniques gives a conceptual framework having parameters (convenience & attractiveness, safety & security, comfort, spatial quality, and socio active environment) which have positive impact on footfall in B&M retail markets and has a quick useful application in Ludhiana as well as similar tier 2 cities in

India. Thus, it recommended to implement said parameters in planning of new B&M retail markets and retrofitting of old markets.

- To inject pedestrian-oriented improvements into the B&M retail-built environment general recommendation is depicted in template 1 and same is discussed below.



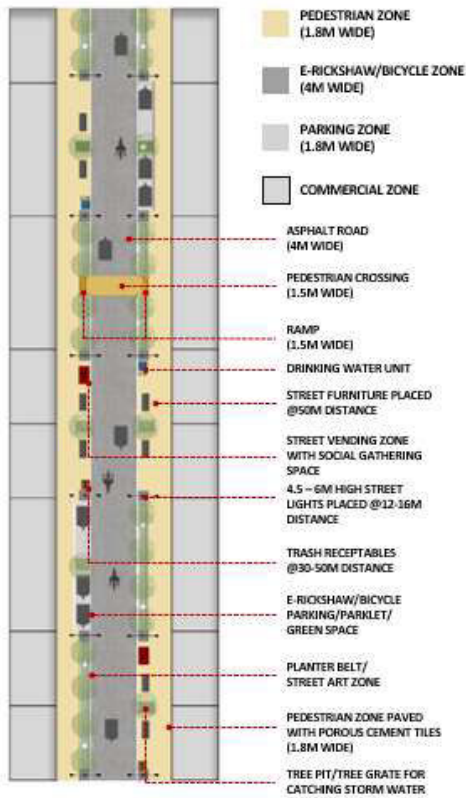
Template 1: - General Recommendations

- According to NUTP (National Urban Transport Policy) 2006, the movement of people, rather than that of vehicles, is currently the center of mobility planning. Equal distribution for pedestrian user in road section is suggested by merging a focus on NMT. Also, NMT could be promoted by providing surface demarcated bicycle lanes
- B&M retail markets are used by all age groups from morning till late evening, thus drinking water facilities for the pedestrians to be provided so that it becomes comfortable for them while walking and getting refreshments at regular intervals. Also, street furniture elements like benches for resting & trash bins to be provided at regular intervals so that the pedestrian journey remains clean and hygienic
- Hawkers and street vendors should not be permitted on pedestrian zone in street, rather they should have dedicated space along the street. Additionally, dedicated parking zones to be demarcated so that no on street parking is attempted and vehicle free spaces are promoted.

- For convenience of pedestrian, a minimum of 1.8 m wide clear pedestrian pathways is recommended after the building zone in the market. For vehicles speed limit signage to be provided at regular intervals to make it safer for the pedestrians along the way.
- For safety and security of user, CCTV camera to be installed at regular intervals to keep a check on the activities around the market area. Dead corners should be avoided and “eye on the street” concept to be introduced to keep a check on the movements of people and act as a safety feature, especially for kids and ladies.
- Plantation belts to be introduced to moderate the temperature variations in extreme weather. These not only add visual aesthetics but also be used as bio-swales for rain water harvesting. In all B&M retail markets, thermal comfort is a significant issue, on one hand which recommends enormous scope of planting shade giving trees and on other hand material used for pathways could be upgraded to regulate micro climate of area.
- For smooth movement of pedestrian, pathways levels should be maintained throughout the stretch without any bumps and material for pathways should have an anti-reflective porous pavement tile which will help in regulating temperature and assist in percolation of rainwater so that no water stagnation occurs, obstruct the pedestrian flow.
- In all B&M retail markets, spatial quality & socio active environment could be enhanced by natural/artificial sights, signage, enthusiasm through music, aroma & special lighting effects, installing art pieces or articulation with respect to city context. In addition, local artisans can be promoted to create a vibrant atmosphere and make the space more socially active and lively.
- Further, B&M retail markets will be used by everyone, thus well maintained universally accessible pedestrian crossing to be incorporated, with ramps for wheel chair access & audio tactile signals for visually impaired people.

In addition to general recommendations, templates are proposed for all three typologies, while making proposal, guidelines were considered by taking reference from IRC 103:2012.

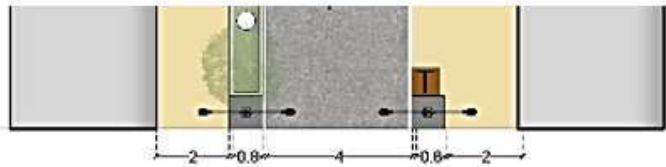
G1 Typology: - Template 2 and 3 are depicting recommendations for G1 markets



ZONING PLAN



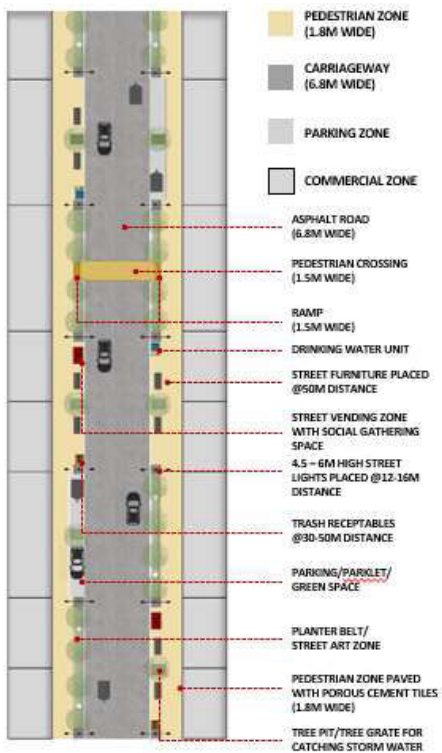
SECTION



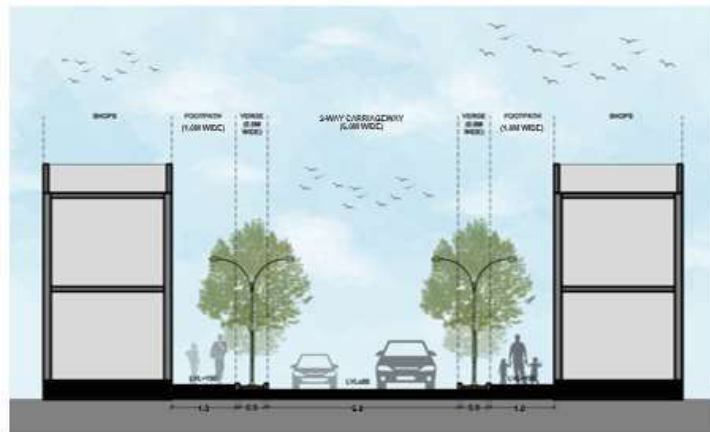
PLAN

G1 – TYPOLOGY (ROW 10M)

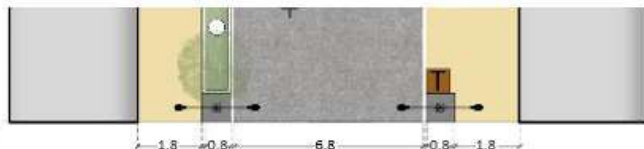
Template 2 for 10M ROW, G1 Typology



ZONING PLAN



SECTION



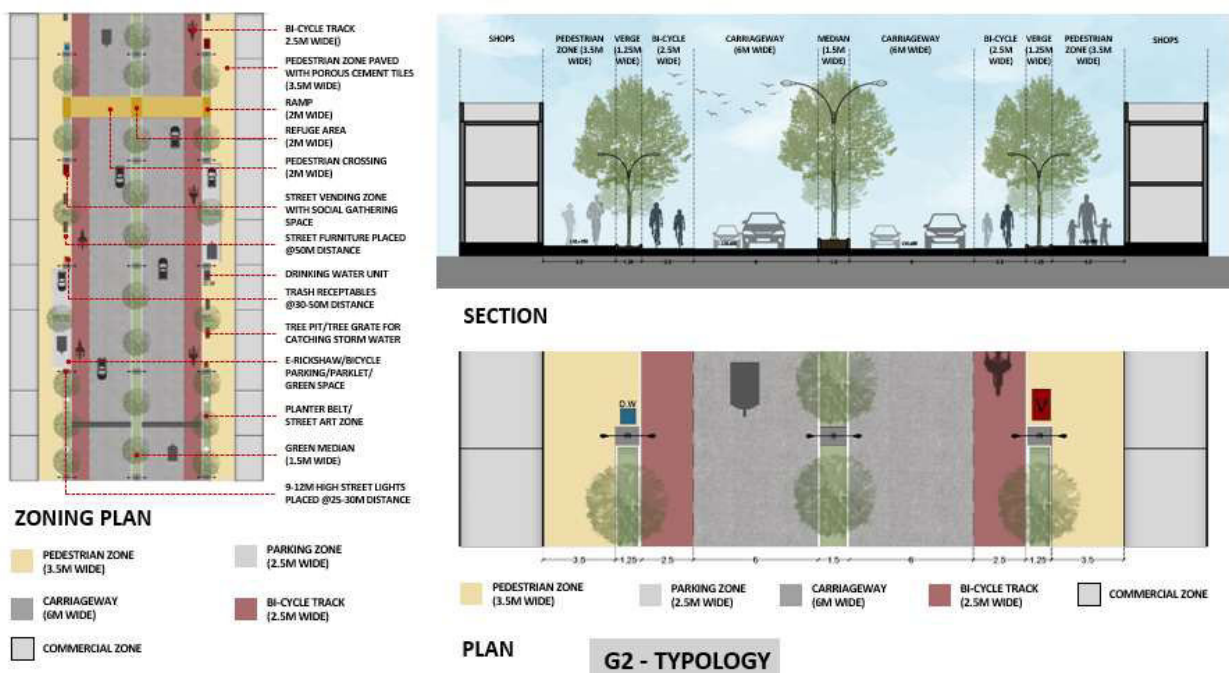
PLAN

G1 – TYPOLOGY (ROW 12M)

Template 3 for 12M ROW, G1 Typology

Under G1 typology, if ROW is 10m or less, then market stretch has been treated as a non-motorized zone with only E Rickshaw and Bicycles allowed in the premises. Dedicated parking spots for E rickshaw/bicycles have been created which can also act as street art/green spaces. A street vending zone has also been recommended, which must include street furniture like benches, trash receptible and street lights at optimum distances, which helps in creating vibrant social gathering spaces. Based on the width of the road, 4.5 – 6m high street lights at optimum distances of 12m is recommended. Apart from this, landscape elements like tree grates/bio-swales, retention pits etc. have been proposed, for storm water management. Material like porous cements tiles and asphalt road are recommended, which are non-reflective and help mitigate the heat. An elevated planter belt helps in segregating the pedestrians from bicycle and e rickshaw traffic. This also helps in providing the much-needed shade for the comfortable journey. To prevent any obstruction in the pedestrian flow, façade control measure can be implemented, which will restrict the shops from encroaching the sidelines of pedestrian zone, beyond their limit.

G2 Typology: - Template 4 is depicting recommendations for G2 markets



Template 4 for G2 Typology

The market stretch has been segregated to accommodate pedestrian flow, bicycle flow and vehicular flow. A 6m wide carriage way along with a 2.5m wide bi cycle track is recommended

for this typology of market space. The existing median can be upgraded to accommodate storm water retention techniques like bio swales, retention pits etc. Dedicated parking zones can be created to prevent haphazard parking in the existing scenario. A street vending zone has also been recommended, which includes street furniture like benches, trash receptible, drinking water units etc. at 30-50m, to promote vibrant social gathering spaces. Based on the width of the road, 9-12m high street lights at optimum distances of 25-30m, is recommended. Table top pedestrian crossing along with ramps is recommended to reduce the speed of traffic and help preventing accidents. This also includes a 2m wide refuge area at the median. Apart from this, landscape elements like tree grates/bio-swales, retention pits etc. have been proposed, for storm water management. An elevated planter belt helps in segregating the pedestrians from bicycle and e- rickshaw traffic and provides the much-needed shade. Material like porous cements tiles and asphalt road are recommended, which are non-reflective and help mitigate the heat.

G3 Typology: - Template 5 is depicting recommendations for G3 markets



Template 5 for G3 Typology

In this typology of the market, it is recommended to only have pedestrian flow in front of the shops and restricting any vehicular traffic in the area. The parking zone can have pockets of green spaces in order to reduce the urban heat island effect. Material like porous cements tiles and asphalt road are recommended, which are non-reflective and help mitigate the heat. The

pedestrian zone can be divided into a 3m wide building zone, which can house shop canopies/signage hoarding, and the remaining 8m can be used by pedestrians and can have parking plazas or parklet. Such zones can either promote the market & the city, using art and sculptures by the local artisan of the area, which in turn adds to the aesthetic value of the overall market space. A street vending zone which includes street furniture like benches, trash receptible, drinking water units etc. at 30-50m, is recommended, which helps in creating vibrant social gathering spaces. For such typology of the market, 9– 12m high street lights at optimum distances of 25-30m, is recommended. Apart from this, landscape elements like tree grates/bio-swales, retention pits etc. have been proposed, for storm water management. An elevated planter belt helps in segregating the parking zone from the pedestrian zone.

Undoubtedly, to overcome problems and constrains while implementation of the proposed template, it is suggested to have separate development controls for each typology. It would help to promote planned development and enhance pedestrian user experience in B&M retail markets.

5.4 FUTURE RESEARCH

- Comparative examinations could be directed in other Indian urban areas to regulate pedestrian oriented designing techniques in the B&M retail markets.
- Exclusive research on specific policies, to enhance user experience in B&M retail markets, could be done.
- Currently, pedestrian oriented planning in B&M retail market has been generally stayed hypothetical in majority of Indian cities. The time has come to move towards execution so that continuous advantages determined out of the upgraded sustainable and economical techniques to upgrade tangible and intangible parameters of B&M retail markets must be considered with real spirit. Problems regarding implementation of guidelines and policies in B&M retail markets should be identified through research.
- Further, detailed study on environmental/economic impact of increased vehicles in B&M retail markets could help in suggesting measures to reduce vehicles and promote pedestrian in these markets.

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Annexure-I Items for content validity for user satisfaction

I am conducting study on user perception on Intangible Urban Planning aspects in B&M Retail Markets, for which already two parameters i.e., convenience-attractiveness and safety-security; comprising 10 statements, as listed below, are already considered by taking reference from GWI.

1. Availability of pedestrian amenities like water, public toilets, ATM etc. at walkable distance is essential.
2. Availability of streetscape elements like street furniture, garbage bins etc. at regular interval is essential.
3. Dedicated parking area at multiple location should be provided for ease of connectivity.
4. Traffic volume and speed should be controlled in retail markets by various traffic claiming devices.
5. Width of Pathway should be greater than 1.8m for unobstructed walking.
6. Safety measures like CCTV, security guard etc. are essential.
7. For safety in odd hours market layout should emphasize eye on street concept.
8. Provision of non-motorized public transport mode is preferred.
9. Pedestrian crossing should be provided at appropriate distance.
10. Fire safety measures should be provided as per code.

But keeping users in Indian retail market, further other statements are framed, you are requesting to validate the same for content validity. Rating is to be done in 3 Categories: -1-Essential; 2- Useful but not essential; 3- Not necessary. The suggestion provided by you in this questionnaire is quite essential to proceed with field survey study.

1 2 3

1. Semi covered or shaded walkways are more comfortable for walking.
2. Pedestrian zones must be free from stray animals.
3. Green spaces, fountains and trees are important to regulate temperature of retail market.
4. Material used in pathway is important to regulate temperature of retail market.
5. Walking obstruction like electrical poles, parked vehicles, hoardings etc. should be avoided.
6. Pedestrian oriented street lighting should be designed.
7. Medical facilities for emergencies to be provided at approachable distance.
8. Street vendors should be avoided.
9. Pathway connectivity from one stretch to other stretch is important.
10. Signage in street nodes and on front façade of shops could enhance ambience of retail market.
11. Along with Universal Accessibility, controlled zones for different age groups could enhance spatial quality.
12. Depiction of socio-cultural expression through art pieces or articulation with respect to city is important.
13. Music, Aroma (Fragrance) & Special Lighting effects can enhance enthusiasm in user while shopping.
14. Active engagement through activities can enhance enthusiasm in user while shopping.
15. Pet friendly zones to be provided.

Annexure-II: Questionnaire for Structure Equation Modelling

To understand user perception, in Physical (B&M) retail markets, statements are framed keeping pedestrian user satisfaction in mind and the participants are requested to indicate their degree of agreement using a five-point Likert scale 1Strongly Disagree, 2Disagree, 3Neutral, 4Agree, 5Strongly Agree					
A Convenience & Attractiveness (C&A)	1	2	3	4	5
A1 Availability of pedestrian amenities like water, public toilets, ATM etc. at walkable distance is essential.					
A2 Availability of streetscape elements like street furniture, garbage bins etc. at regular interval is essential.					
A3 Dedicated parking area at multiple location should be provided for ease of connectivity.					
A4 Traffic volume and speed should be controlled in retail markets by various traffic claiming devices.					
A5 Width of Pathway should be greater than 1.8m for unobstructed walking.					
B Safety & Security (SS)	1	2	3	4	5
B1 Safety measures like CCTV, security guard etc. are essential.					
B2 For safety in odd hours market layout should emphasize eye on street concept.					
B3 Provision of non-motorized public transport mode is preferred.					
B4 Pedestrian crossing should be provided at appropriate distance.					
B5 Fire safety measures should be provided as per code.					
C Comfort (C)	1	2	3	4	5
C1 Semi covered or shaded walkways are more comfortable for walking.					
C2 Green spaces, fountains and trees are important to regulate temperature of retail market.					
C3 Material used in pathway is important to regulate temperature of retail market.					
C4 Walking obstruction like electrical poles, parked vehicles, hoardings etc. should be avoided.					
C5 Pedestrian oriented street lighting should be designed.					

D Convivial Environment (CE): - Spatial Quality & Socio Active Environment (SQ & SAE)	1	2	3	4	5
D1 Signage in street nodes and on front façade of shops could enhance ambience of retail market.					
D2 Along with Universal Accessibility, controlled zones for different age groups could enhance spatial quality.					
D3 Depiction of socio-cultural expression through art pieces or articulation with respect to city is important.					
D4 Music, Aroma (Fragrance) & Special Lighting effects can enhance enthusiasm in user while shopping.					
E User Satisfaction (US)	1	2	3	4	5
E1 Improvement in Convenience & Attractiveness would increase footfall in B&M retail markets					
E2 Improvement in Safety and Security would increase footfall in B&M retail markets					
E3 Improvement in Comfort would increase footfall in B&M retail markets					

Annexure-III: Questionnaire for Objective and Subjective Field Study

To analyse existing state in Physical (B&M) retail markets, identified factors were evaluated using a five-point Likert scale 1 is Very Bad to 5 is Very Good rating by keeping pedestrian user satisfaction in mind					
A. Convenience & Attractiveness (C&A)	1	2	3	4	5
A1 Availability of pedestrian amenities like water, public toilets, ATM etc. at walkable distance.					
A2 Availability of streetscape elements like street furniture, garbage bins etc. at regular interval.					
A3 Dedicated parking area at multiple location for ease of connectivity.					
A4 Control of traffic volume and speed by various traffic claiming devices.					
A5 Width of Pathway should be greater than 1.8m for unobstructed walking.					
B. Safety & Security (SS)	1	2	3	4	5
B1 Safety measures like CCTV, security guard etc.					
B2 Layout emphasizing eye on street concept.					
B3 Provision of non-motorized public transport mode.					
B4 Pedestrian crossing should be provided at appropriate distance.					
B5 Fire safety measures should be provided as per code.					
C. Comfort (C)	1	2	3	4	5
C1 Semi covered or shaded walkways.					
C2 Green spaces, fountains and trees to regulate temperature.					
C3 Material used in pathway to regulate temperature.					
C4 Avoiding walking obstruction like electrical poles, parked vehicles, hoardings etc.					
C5 Pedestrian oriented street lighting.					
D. Convivial Environment (CE): - Spatial Quality & Socio Active Environment (SQ & SAE)	1	2	3	4	5
D1 Spatial quality through natural/artificial sights, signage etc.					
D2 Spatial quality through universal accessibility, controlled zones for different age groups etc.					

D3 Depiction of socio-cultural expression through art pieces or articulation with respect to city context.					
D4 Enthusiasm through music, aroma (fragrance) & special lighting effects.					
E. User Satisfaction (US)*	1	2	3	4	5
E1 Rating of Convenience & Attractiveness in existing B&M retail market					
E2 Rating of Safety & Security in existing B&M retail market					
E3 Rating of Comfort & Convivial Environment in existing B&M retail market					
* Rating will be taken from Q2,3 and 4 under Pedestrian Perception in Annexure-V: Questionnaire for Pedestrian Perception and Preference Survey					

Annexure IV: - Codes and Score Assigned to the Attributes

Codes	Parameters and Attributes	Maximum Scores
A	Convenience & Attractiveness (C&A)	25
A1	Availability of pedestrian amenities	5
A2	Availability of streetscape elements	5
A3	Dedicated parking area at multiple location	5
A4	Traffic volume and speed	5
A5	Width of Pathway	5
B	Safety & Security (SS)	25
B1	Safety measures	5
B2	Layout emphasizing eye on street concept	5
B3	Provision of non-motorized public transport mode	5
B4	Pedestrian zones free from stray animals	5
B5	Medical facilities at approachable distance	5
C	Comfort (C)	25
C1	Semi covered or shaded walkways	5
C2	Green spaces, fountains and trees to regulate temperature	5
C3	Material used in pathway to regulate temperature	5
C4	Avoiding walking obstruction	5
C5	Pedestrian oriented street lighting	5
D	Convivial Environment (CE): - Spatial Quality & Socio Active Environment (SQ & SAE)	20
D1	Natural/artificial sights, signage	5
D2	Universal accessibility, controlled zones for different age groups	5
D3	Art pieces or articulation with respect to city context	5
D4	Enthusiasm through music, aroma & special lighting effects	5
E	User Satisfaction (US)	15
E1	Rating of Convenience & Attractiveness	5
E1	Rating of Safety & Security	5
E1	Rating of Comfort & Convivial Environment	5

Annexure-V: Questionnaire for Pedestrian Perception and Preference Survey

Socio-economic Profile

1 Gender

Male	Female
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2 Age (in years)

0-20	20-35	35-50	>50
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3 Occupation

Homemakers	Employee	Business man	Students/Other
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4 Monthly Household Income (in rupees)

<20000	20000-50000	50000-2 Lakhs	>2 Lakhs
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5 Vehicle ownership

No Vehicle	Bicycles	2-Wheelers	Car/ Jeep etc.
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Pedestrian Preference

1 How often do you prefer walking over driving in B&M markets?

Never	Very few times	Sometimes	Frequently	Almost every time
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2 How do you rate Convenience & Attractiveness in existing B&M retail market?

Very Bad	Bad	Average	Good	Very Good
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3 How do you rate Safety & Security in existing B&M retail market?

Very Bad	Bad	Average	Good	Very Good
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4 How do you rate Comfort & Convivial Environment in existing B&M retail market?

Very Bad	Bad	Average	Good	Very Good
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5 If walkability conditions are enhanced, would you like to prefer walking?

May be	Very few times	Sometimes	Frequently	Almost every time
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6 What improvements would you like to have in B&M retail market to enhance walkability
(Rank ALL as per your preference order)

DI 1	Convenience & Attractiveness (Availability of pedestrian amenities, streetscape elements etc.)	
DI 2	Safety & Security (Safety measures like CCTV, security guard etc.)	
DI 3	Comfort (Enhancing quality of facilities like surface conditions, street lighting etc.)	
DI 4	Spatial Quality (Enhancing by natural sights, articulation in building design etc.)	
DI 5	Socio Active Environment (enthusiasm by Music, accessible to people with disabilities etc.)	

List of Publication & Conference Presentation

SNO.	TITLE OF PAPER WITH AUTHOR NAMES	NAME OF JOURNAL / CONFERENCE	PUBLISHED DATE	ISSN NO/ VOL NO, ISSUE NO
1.	Enhancing Walkability in Brick & Mortar Retail Markets: Case Study of Chaura Bazar, Ludhiana. Raminder Kaur and Mahendra Joshi	Civil Engineering and Architecture	17-01-2022	2332-1121 /Vol. 10 and Issue 2
2.	Factors Affecting Pedestrian User Satisfaction in B&M Retail Market: An Indian Perspective. Raminder Kaur and Mahendra Joshi	Iranian Journal of Science and Technology, Transactions of Civil Engineering	Manuscript Submitted, Current Status: -Editor Assigned	--
3.	Review of Intangible Urban Planning Aspects for Sustainable Brick & Mortar Retail Markets. Raminder Kaur and Mahendra Joshi	Global Emerging Innovation Summit (GEIS-2021)	Paper presented on 9-10 April 2021 and published in 2021	978-1-68108-901-0 Scopus index conference
4.	Circular Economy: - Measures to Reduce & Reuse Waste in Brick & Mortar Retail Markets. Raminder Kaur and Mahendra Joshi	International Conference on Materials for Emerging Technologies (ICMET-21)	Paper presented on 18-19 Feb 2022 and Yet to Publish	----- Scopus index conference