

**SPATIAL PLANNING INTERVENTIONS FOR
ENHANCING SOCIAL CONNECTIVITY AMONG THE
ELDERLY IN BHOPAL**

BACHELOR OF PLANNING

By

AYUSHI NANDI

[Scholar Number: 2211002123]



**DEPARTMENT OF ARCHITECTURE AND PLANNING
MAULANA AZAD NATIONAL INSTITUTE OF
TECHNOLOGY BHOPAL (MP) – 462003
MAY 2026**

DECLARATION

I **AYUSHI NANDI**, Scholar No **2211002123** hereby declare that the thesis titled 'Spatial Planning Interventions for Social Connectivity among Elderly in Bhopal' submitted by me in partial fulfilment for the award of degree of Bachelor of Planning, at Maulana Azads National Institute of Technology, Bhopal, India, is a record of Bonafide work carried out by me. The matter/result embodied in this thesis has not been submitted to any other University or Institute for the award of any degree or diploma.


Signature of the Student
Date: 08/05/2026

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This is to certify that the declaration of **AYUSHI NANDI** is true to the best of my knowledge and that the student has worked under my guidance for one semester in preparing this thesis.

RECOMMENDED


Signature of the Guide
(Dr. Neha Pranav Kolhe)

ACCEPTED

Signature of
Head, Department of
Architecture and Planning
(Dr. Nakul Dhagat)

Date: _____

Place: _____



Signature of
Thesis Coordinators,
Department of Architecture and
Planning
(Dr. Preeti Onkar &
Dr. Premjeet Das Gupta)

Date: 7/05/26

Place: Bhopal

SPATIAL PLANNING INTERVENTIONS FOR ENHANCING SOCIAL CONNECTIVITY AMONG THE ELDERLY IN BHOPAL

*A Thesis Project
submitted in partial fulfilment of the requirements for
the award of the degree of*

Bachelor of Planning

By

AYUSHI NANDI

Scholar No. 2211002123

Under the Guidance of

Dr. NEHA PRANAV KOLHE



**Department of Architecture and Planning
Maulana Azad National Institute of Technology, Bhopal**

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ABSTRACT

India is undergoing a profound demographic shift. The elderly population aged 60 years and above is projected to reach 230 million by 2036, representing nearly 13 per cent of the national population. Urban centres like Bhopal, Madhya Pradesh — a rapidly growing mid-sized city with 1.79 million residents — now face compounding pressures of an ageing demographic, widening spatial inequities, and a persistent gap between national policy intent and local spatial implementation.

This thesis investigates how spatial planning interventions can enhance social connectivity among the elderly population in Bhopal. Social connectivity — the ability of older adults to engage regularly and meaningfully with their community — is increasingly recognised as a critical determinant of health and well-being in later life. Yet this connectivity is not simply a matter of personal circumstance; it is profoundly shaped by the physical environment: the walkability of streets, the proximity and quality of parks and community spaces, the accessibility of public infrastructure, and the safety and comfort of outdoor environments.

Bhopal's urban fabric illustrates this relationship sharply. While planned areas such as Arera Colony (Ward 48) offer accessible green space and walkable amenity clusters, older high-density zones such as Aishbagh Colony (Ward 38) have as little as 0.171 m² of green space per capita and virtually no neighbourhood-level social infrastructure — a 59-fold disparity that constitutes a condition of acute spatial injustice and directly constrains elderly social life.

The research adopts a Sequential Explanatory Mixed-Methods Design structured across four objectives: (1) spatial diagnosis of existing conditions through GIS network analysis; (2) primary data collection on elderly spatial preferences and connectivity patterns through surveys, interviews, and behavioural observation; (3) policy evaluation of the Smart Cities Mission and national frameworks against elderly-specific needs; and (4) co-production of a contextually adapted spatial planning framework with elderly communities and planners.

The thesis aims to produce a transferable, contextually grounded spatial planning framework that bridges international best practices — including Singapore's Kampung Admiralty vertical village model, Australia's third-place activation approach, and New

Zealand's culturally responsive street retrofitting experience — with the realities of Indian urban governance, tropical climate, informal social life, and multigenerational living patterns. The research addresses a critical gap: the absence of any comprehensive, Bhopal-specific spatial planning study focused on elderly social connectivity.

Keywords: Elderly Social Connectivity | Spatial Planning | Age-friendly Cities | Bhopal
| Spatial Justice | Urban Green Space | Mixed Methods | Smart Cities Mission

सारांश

भारत एक बड़े **जनसांख्यिकीय बदलाव** (demographic shift) के दौर से गुजर रहा है। साल 2036 तक 60 वर्ष से अधिक उम्र के बुजुर्गों की आबादी 23 करोड़ तक पहुँचने का अंदाज़ा है, जो देश की कुल आबादी का तक्रीबन 13 फ़ीसदी होगा। **भोपाल (मध्य प्रदेश)** जैसा तेज़ी से उभरता हुआ शहर, जिसकी आबादी 17.9 लाख है, आज कई पेचीदा मसलों से जूझ रहा है—जैसे बढ़ती बुजुर्ग आबादी, इलाक़ाई नाइंसाफ़ी (spatial inequity), और राष्ट्रीय नीतियों और ज़मीनी स्तर पर उनके अमल के बीच का गहरा फ़ासला।

यह शोध (thesis) इस बात की शिनाख़्त करता है कि **स्थानिक नियोजन** (spatial planning) के ज़रिए भोपाल के बुजुर्गों के बीच '**सामाजिक रब्त**' (social connectivity) को कैसे मज़बूत किया जा सकता है। सामाजिक रब्त—यानी बुजुर्गों की अपने आस-पड़ोस और समाज के साथ जुड़ने की काबिलियत—सेहत और खुशहाली के लिए बेहद ज़रूरी मानी जाती है। लेकिन यह जुड़ाव सिर्फ़ निजी हालात पर निर्भर नहीं है; यह हमारे **शहरी ढांचे** (physical environment) से तय होता है: जैसे पैदल चलने लायक सड़कें, नज़दीकी पार्क और सामुदायिक केंद्रों की मौजूदगी, और बाहरी माहौल का सुकून और सलामती।

भोपाल का **शहरी ताना-बाना** (urban fabric) इस रिश्ते को साफ़ तौर पर बयां करता है। जहाँ **अरेरा कॉलोनी (वार्ड 48)** जैसे नियोजित इलाक़ों में हरियाली और पैदल चलने की बेहतर सहूलियतें हैं, वहीं **ऐशबाग कॉलोनी (वार्ड 38)** जैसे घनी आबादी वाले पुराने इलाक़ों में प्रति व्यक्ति सिर्फ़ 0.171 वर्ग मीटर हरित क्षेत्र है। यह 59 गुना का भारी अंतर एक तरह की '**स्थानिक नाइंसाफ़ी**' (spatial injustice) है, जो बुजुर्गों के सामाजिक दायरे को सीधे तौर पर महदूद (सीमित) कर देती है।

इस शोध में '**मिक्सड-मेथड डिजाइन**' का इस्तेमाल किया गया है, जिसके चार मुख्य मक़सद हैं: 1. GIS नेटवर्क विश्लेषण के ज़रिए मौजूदा हालात की **स्थानिक तशखीस** (spatial diagnosis); 2. बुजुर्गों की पसंद और उनके मेल-जोल के तौर-तरीकों पर सर्वे और बातचीत के ज़रिए **आंकड़े जुटाना**; 3. बुजुर्गों की ज़रूरतों के तराजू पर **स्मार्ट सिटी मिशन** और सरकारी नीतियों को परखना; 4. और आख़िर में, बुजुर्गों और प्लानर्स के मशवरे से एक ऐसा **प्लानिंग फ्रेमवर्क** तैयार करना जो हमारे माहौल के मुताबिक़ हो।

इस शोध का असल मक़सद एक ऐसा मॉडल पेश करना है जो अंतरराष्ट्रीय बेहतरीन मिसालों (जैसे सिंगापुर का 'कम्पोंग एडमिरल्टी' मॉडल और ऑस्ट्रेलिया का 'थर्ड-प्लेस' नज़रिया) को भारतीय शहरी शासन, आब-ओ-हवा और हमारे **साझा रहन-सहन** (multigenerational living) की हक़ीक़त के साथ जोड़ सके। यह शोध उस कमी को दूर करता है जहाँ भोपाल जैसे शहर में बुजुर्गों के सामाजिक मेल-जोल पर केंद्रित किसी व्यापक अध्ययन की अब तक कमी रही है।

कीवर्ड्स (Keywords): बुजुर्ग सामाजिक रब्त | स्थानिक नियोजन | बुजुर्ग-दोस्त शहर | भोपाल | स्थानिक इंसाफ़ | शहरी हरित क्षेत्र | मिक्स्ड मेथड्स | स्मार्ट सिटी मिशन

LIST OF ABBREVIATIONS

Abbreviation	Full Form
AFC	Age-friendly Cities
BMC	Bhopal Municipal Corporation
GIS	Geographic Information Systems
GoI	Government of India
MANIT	Maulana Azad National Institute of Technology
MDS	Multidimensional Scaling
MoHUA	Ministry of Housing and Urban Affairs
NPSC	National Policy for Senior Citizens
PCA	Principal Component Analysis
RTI	Right to Information
RWA	Resident Welfare Association
SCM	Smart Cities Mission
SPV	Special Purpose Vehicle
UD	Universal Design
UGS	Urban Green Space
UCLA	University of California, Los Angeles (Loneliness Scale)
UN	United Nations
ULB	Urban Local Body
WHO	World Health Organization

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CHAPTER 1: INTRODUCTION

1.1 Background and Context

The twenty-first century is witnessing a convergence of two defining global trends: accelerating urbanisation and rapid population ageing. By 2050, the United Nations projects that 68 per cent of the world's population will live in urban areas and, simultaneously, the global population aged 60 years and above will double to 2.1 billion. This dual transition represents one of the most pressing urban planning challenges of our time — designing cities that are genuinely liveable for people across all ages, not just a generic working-age population.

India stands at the epicentre of this transition. The country's elderly population is projected to reach 230 million by 2036 — representing approximately 13 per cent of the total population. A substantial and growing proportion of India's elderly now reside in urban areas, where the combined pressures of nuclear family fragmentation, loss of traditional community structures, rising densities, and uneven infrastructure development create new vulnerabilities for older adults.

"Urban isolation is multi-dimensional. It is an imbalanced or inadequate quantity and quality of mutual interactions amongst people that can happen at an individual, group, or community scale." — Ali & George, Journal of Urban Management, 2022

Social connectivity — the capacity of individuals to engage in meaningful, regular interaction with their community — is increasingly recognised as a fundamental determinant of health and well-being in later life. Research consistently shows that social isolation is associated with significantly elevated risks of depression, cardiovascular disease, cognitive decline, and premature mortality. Conversely, high-quality social connections are protective factors that support independent living and life satisfaction.

What is less appreciated — and forms the central premise of this thesis — is that social connectivity for the elderly is profoundly shaped by the physical and spatial environment. The walkability of streets, the proximity and quality of parks and

community facilities, the accessibility of outdoor spaces, the safety of neighbourhoods — all of these directly determine whether elderly individuals can step outside, encounter their neighbours, and participate in the social life of their locality. Spatial planning, therefore, is a direct determinant of elderly well-being.

Table No.1: Key Facts — Bhopal, Madhya Pradesh

Bhopal — Key Facts

Population (2011 Census): 1.79 million | Decadal Growth: 20.8% | Elderly (60+): ~10% and rising

UGS per capita — Ward 38 (Aishbagh): 0.171 m² vs Ward 48 (Arera Colony): 10.15 m²

59× disparity in green space between most deprived and best-served ward — constituting spatial injustice for elderly residents.

1.2 Problem Statement

Despite significant demographic shifts and growing evidence of urban isolation among older adults, Indian cities — including Bhopal — continue to lack targeted spatial planning frameworks that systematically address the social connectivity needs of their elderly populations. Several interconnected problems converge to create this planning vacuum:

- **Policy Without Spatial Implementation:** India's National Policy for Senior Citizens (2011) promotes ageing in place but provides no operational spatial planning guidelines. Bhopal's Smart Cities Mission mentions elderly safety as a priority, yet the implemented projects contain no specific design features or evaluation metrics for elderly social connectivity.
- **Spatial Inequity as a Social Barrier:** GIS analysis of Bhopal's Urban Green Space reveals a 59-fold difference in per capita provision between the most deprived ward (Aishbagh Colony, 0.171 m²/person) and the best-served ward (Arera Colony, 10.15 m²/person). This is not merely an aesthetic gap — it directly determines the social opportunities available to elderly residents.
- **The Isolation–Connectivity Paradox:** Multi-city Indian research confirms that urban isolation is prevalent, with 'lack of social interaction' as its most commonly cited cause. The same residents identify multi-functional public

spaces and pedestrian-friendly streets as their top spatial demands. The built environment simultaneously drives isolation and offers a potential remedy — but only if planning responds intentionally.

- **Empirical Data Gap: No comprehensive study has examined elderly spatial preferences or the effectiveness of spatial interventions specifically in Bhopal. Planning decisions are made without this empirical foundation.**
- **International Framework Adaptation Gap: Global models such as the WHO Age-friendly Cities Framework offer valuable principles but require significant adaptation for Bhopal's tropical climate, informal community structures, multigenerational living norms, and resource-constrained governance context.**

1.3 Research Rationale and Significance

This research is motivated by scholarly, policy, and humanitarian imperatives that collectively make it timely and necessary.

1.3.1 Scholarly Rationale

The literature on age-friendly urban planning is dominated by research from high-income, Global North contexts. This body of work systematically underrepresents the conditions and constraints of Indian mid-sized cities. The few existing Indian studies address adjacent questions but stop short of an integrated, Bhopal-specific spatial planning framework. This thesis fills that gap by producing the first comprehensive mixed-methods study of elderly social connectivity and spatial planning in Bhopal.

1.3.2 Policy Rationale

India's National Policy for Senior Citizens (2011) is nearly fifteen years old and predates the Smart Cities Mission and recent demographic data. The SCM has prioritised technology-driven interventions that have largely bypassed the socially oriented design solutions most critical for elderly daily life. This research provides evidence-based recommendations directly actionable within existing policy architecture.

1.3.3 Humanitarian Rationale

Spatial planning has life-or-death consequences for elderly populations. An elderly resident of Aishbagh Colony — surrounded by dense urban fabric with no accessible park within 5 km — faces fundamentally different social opportunities from their counterpart in Arera Colony. This spatial inequality is a product of planning choices that can be made differently. Better-informed planning can reduce isolation, improve well-being, and restore social participation to Bhopal's elderly residents.

1.4 Research Aim and Objectives

Aim: To develop a contextually adapted, evidence-based spatial planning framework for enhancing social connectivity among the elderly population in Bhopal, Madhya Pradesh, by integrating international best practices with primary spatial and social research.

Table No.2: Research Objectives and Expected Outputs

Obj.	Objective	Research Activity	Expected Output
1	Map and analyse existing spatial conditions and social infrastructure distribution in selected Bhopal wards.	GIS network analysis, spatial overlay, per capita UGS calculation, field survey.	Spatial baseline map with service gaps, priority intervention zones, and inequity hotspots.
2	Understand elderly residents' spatial preferences, social interaction patterns, and connectivity needs.	Structured surveys (n=180–200), semi-structured interviews, behavioural observation.	Empirical dataset on elderly spatial preferences unique to Bhopal.
3	Assess planning policies and Smart Cities Mission interventions for adequacy in addressing elderly social connectivity.	Policy document analysis, stakeholder interviews, policy gap matrix.	Policy evaluation report with actionable integration recommendations.

Obj.	Objective	Research Activity	Expected Output
4	Co-produce a contextually adapted spatial planning framework with elderly communities and planners.	Participatory mapping workshops, walk-along interviews, focus groups, expert validation.	Transferable spatial planning framework for Bhopal, scalable to comparable Indian cities.

1.5 Research Questions

Primary Research Question:

How can spatial planning interventions be designed and implemented to enhance social connectivity among the elderly population in Bhopal, taking into account existing spatial inequities, cultural context, and governance constraints?

Secondary Research Questions:

- What is the current spatial distribution of green spaces, community facilities, and pedestrian infrastructure across Bhopal's wards, and how equitably do elderly residents access these resources?
- What are the spatial preferences, daily movement patterns, and barriers to social engagement of elderly residents across Bhopal's diverse neighbourhood typologies?
- How do gender, income, household size, and physical mobility interact with spatial conditions to shape elderly social connectivity outcomes?
- To what extent do NPSC 2011 and the Bhopal Smart Cities Mission address elderly social connectivity, and what are the gaps between policy intent and spatial implementation?
- What transferable principles from international and Indian best practices — adapted for Bhopal's context — can inform a practical spatial planning framework?

1.6 Research Hypotheses

H1:

Elderly residents in high-density, spatially deprived wards of Bhopal (such as Ward 38 — Aishbagh Colony) experience significantly lower levels of social connectivity compared to residents in planned, better-served wards (such as Ward 48 — Arera Colony), primarily due to unequal spatial distribution of accessible green spaces, community facilities, and safe pedestrian infrastructure.

H2:

Targeted spatial planning interventions — including neighbourhood-scale pocket parks, activation of informal social nodes, and pedestrian infrastructure retrofitting — can measurably improve opportunities for social connectivity among elderly residents in currently deprived areas, provided they are designed with explicit attention to cultural context, gender equity, safety, and walkable proximity.

1.7 Study Area

The research is set in Bhopal, the capital of Madhya Pradesh, located in central India (approximately 23.26°N, 77.40°E). As a rapidly growing Class-I city with a population of 1.79 million (2011 Census), and one of the first 20 cities selected under India's Smart Cities Mission in 2015, Bhopal offers an important and timely study context — a mid-sized Indian city facing simultaneous pressures of demographic ageing, sharp spatial inequity, and an ambitious urban development agenda.

1.7.1 Urban Structure and Spatial Divide

Bhopal's urban form shows a clear divide between its old and new areas. The Old City, which grew organically over centuries around the historic Upper and Lower Lakes, is densely built, has narrow winding streets, mixed land uses, and very little formal open space or green area. The newer planned extensions to the south — developed mainly after Independence — have wider roads, formal park networks, and much better social and physical infrastructure. This divide directly affects how much or how little social opportunity is available to elderly residents, depending purely on which part of the city they live in.

1.7.2 Study Clusters — Actual Survey Locations

The primary survey was conducted across six residential clusters in Bhopal, all located within the central-southern quadrant of the Bhopal Municipal Corporation area, within approximately 8–10 km of each other. This spatial proximity was deliberate — it ensures that differences between clusters reflect neighbourhood typology and income-based spatial conditions, not simply distance from the city centre. The six clusters were selected using purposive stratified sampling to represent all four income categories in Bhopal's housing context.

Table No.3: Study Clusters and Sample Distribution, Bhopal

Study Cluster	Location / Typology	Income Category	Sample (n)	Role in Research
EWS Kasturba Nagar	BDA Government Flats — EWS Area	EWS (below ₹10,000/month)	15	Most deprived cluster — highest loneliness scores
Saket Nagar LIG	Saket Nagar — LIG Colony	LIG (₹10,000–₹25,000/month)	12	Priority intervention area — 83% lack park access
Shakti Nagar MIG	Shakti Nagar — MIG Colony	MIG (₹25,000–₹50,000/month)	5	Mid-tier cluster — traffic as key barrier
Saket Nagar MIG	Saket Nagar — MIG Colony	MIG (₹25,000–₹50,000/month)	8	Comparative mid-income context
Shakti Nagar HIG	Shakti Nagar — HIG Colony	HIG (above ₹50,000/month)	10	Better-served context — walking loop demand
Alkapuri HIG	Alkapuri — Gated HIG Colony, Central Bhopal	HIG (above ₹50,000/month)	7	Least deprived — comparative baseline

Study Cluster	Location / Typology	Income Category	Sample (n)	Role in Research
TOTAL	4 typologies across central-southern Bhopal	EWS through HIG	57	Pilot survey

1.7.3 Why These Clusters Were Chosen

The six clusters were not chosen randomly. They were deliberately selected to cover the full range of income and housing typologies found in Bhopal, so that the research could test whether spatial conditions — and their effect on elderly loneliness — differ by income group. Keeping all six clusters within the same city zone also eliminates the effect of distance from the city centre, making the income typology the key variable being tested.

The GIS-documented 59-fold disparity in green space per capita between Bhopal's most deprived ward (Aishbagh Colony, 0.171 m²/person) and its best-served planned ward (Arera Colony, 10.15 m²/person) provides the city-level framing. The six study clusters capture this spectrum at the ground level, from families living in government EWS flats with virtually no park access within walking range, to gated HIG colonies where parks and walking infrastructure are readily available.

1.8 Thesis Structure

Table No.4: Thesis Structure

Chapter	Title	Content
1	Introduction	Background, problem statement, rationale, aim and objectives, research questions, hypotheses, study area, and thesis structure.

Chapter	Title	Content
2	Literature Review and Case Studies	Theoretical frameworks (WHO AFC, Spatial Justice, Life-course perspective); systematic literature table; international and Indian case studies; comparative analysis.
3	Research Gaps and Insights	Identified gaps from theory, data, methodology, and Bhopal context; best practices synthesis; how identified gaps shape the thesis direction.
4	Scope and Limitations	Geographic, population, and thematic scope; data constraints; methodological limitations; Global North adaptation challenges.
5	Methodology	Sequential explanatory mixed-methods design; objective-wise methods; data types; analytical tools and their justification.
6	Spatial Analysis and Findings	GIS diagnosis results; survey findings (MDS); interview and observation findings; policy gap matrix.
7	Framework Development	Spatial planning framework co-produced with communities; intervention typologies; design principles; phased implementation strategy.
8	Conclusion	Summary of findings; contributions to knowledge; policy recommendations; limitations and future research directions.

CHAPTER 2: LITERATURE REVIEW AND CASE STUDIES

This chapter synthesises the theoretical frameworks, empirical evidence, and case studies that underpin the research. The review is organised across three parts: first, the key theoretical frameworks that guide the study; second, a systematic review of empirical and conceptual literature on spatial planning and elderly social connectivity; and third, an analysis of Indian and international case studies selected for their direct relevance to Bhopal's planning context.

2.1 Theoretical Frameworks

2.1.1 The WHO Age-friendly Cities (AFC) Framework

The World Health Organisation's Age-friendly Cities Framework, launched in 2007, identifies eight interconnected domains of urban life that collectively determine whether a city is age-friendly: outdoor spaces and buildings; transportation; housing; social participation; respect and social inclusion; civic participation and employment; communication and information; and community support and health services. This framework provides the foundational assessment tool for this research, enabling a structured evaluation of Bhopal's current provisions across each domain.

However, the framework has limitations when applied to the Indian context. It focuses primarily on reactive accommodations for old age rather than a life-course perspective that builds age-friendly conditions progressively. It also does not adequately distinguish between formal and informal social infrastructure — a critical distinction in Indian cities where chai stalls, temple forecourts, and neighbourhood chowks function as primary social hubs.

2.1.2 The Spatial Justice Framework

The Spatial Justice Framework, developed through the Age-friendly Cities programme at the University of Manchester, offers three core principles for evaluating urban interventions: Diversity (recognising that elderly people are not a homogeneous group, but are differentiated by gender, income, caste, mobility, and cultural background); Equity (ensuring that planning investments address distributional imbalances and

prioritise underserved communities); and Co-production (embedding older residents as active participants and co-designers rather than passive recipients of planning decisions).

Applied to Bhopal, this framework demands that planning interventions explicitly address the 59-fold green space disparity between wards, prioritise elderly women as primary users of neighbourhood space, and engage older residents meaningfully in the design process.

2.1.3 The Life-Course Perspective

A life-course perspective on ageing argues that cities should be designed to support healthy social engagement across all stages of life — not simply to accommodate disability and decline in old age. This approach, increasingly advocated under the 'longevity-ready cities' concept, holds that investments in walkable streets, accessible parks, and vibrant public spaces benefit residents of all ages while creating the social and physical conditions that support dignified, connected ageing. This perspective informs the thesis's orientation toward proactive, design-led spatial interventions rather than reactive welfare provisions.

2.2 Systematic Literature Review

The following table summarises empirical and conceptual studies on spatial planning interventions affecting elderly social connectivity. Studies were selected for their methodological rigour, direct relevance to public space design, walkability, parks, and community connectivity, and applicability to the Bhopal context.

Table No.5: Systematic Literature Review — Spatial Planning and Elderly Social Connectivity

Author (s) & Year	Title	Research Aim	Methodology	Key Findings	Limitations	Relevance to Bhopal
Chia-Yuan	Influence of	How does neighbourh	Empirical analysis	Greater distance to	Insufficient detail	Validates walkability

Author (s) & Year	Title	Research Aim	Methodology	Key Findings	Limitations	Relevance to Bhopal
Yu & Biyuan Wang (2024)	neighbourhood walkability on older adults' walking behaviour, health, and social connections in third places	How can walkability and proximity to third places influence older adults' walking, visits, health, and social belonging?	Qualitative study of older adults' walking behaviour and visits to third places	Third places reduce walking and visit frequency; better walkability links positively to physical and mental health and sense of belonging.	Sampling frame; limited causal inference.	Proximity to third places as key priorities for Bhopal neighbourhood planning.
Alibekkyzy Karlygash (2022)	Aging in Cities	How can planning and urban design better respond to everyday lived experiences of ageing?	Conceptual framework proposing an analytic lens situating ageing as relational and everyday.	Argues planning must engage everyday spaces of older people and move beyond biomedical models to address diverse ageing	Theoretical work; no empirical testing.	Provides a conceptual lens for Bhopal to centre everyday practices and diverse elder experiences when designing spaces.

Author (s) & Year	Title	Research Aim	Methodology	Key Findings	Limitations	Relevance to Bhopal
				experience s.		
Sonja Pedell et al. (2021)	Combining digital, social and physical layers to create age-friendly cities	How can co-design integrating digital, physical, and social domains improve outdoor spaces and social participation?	Qualitative case studies and co-design with older adults; cases focused on wearables and social prescribing.	Co-design integrating digital, social, and physical aspects enhances social participation and long-term health; user input improves responsiveness.	Case-study scale; further work needed on implementation strategies.	Co-design methods are directly actionable for Bhopal projects to ensure relevance to diverse older residents.
Alidoust & Bosman (2017)	Master planned communities for the ageing population	How sociable are master planned residential developments for older adults?	Qualitative observations and semi-structured interviews with 40 residents aged 64+ in planned	Safety, walkability, accessibility, and 'soft edges' (transitional public/private spaces) support sociability among	Limited to master planned developments; modest sample.	Soft edge design and walkable, accessible layouts merit consideration in Bhopal neighbourhood design.

Author (s) & Year	Title	Research Aim	Methodology	Key Findings	Limitations	Relevance to Bhopal
			developments.	older residents.		
Alidoust, Holden & Bosman (2014)	Urban environment and social health of the elderly	How do physical, social, and policy environments influence the social life of older adults?	Critical literature review synthesising environmental determinants of social health.	Manifold associations between physical, social, and policy determinants; environmental features both enable and inhibit social life.	Conceptual gaps; inconsistent definitions of 'environment' across studies.	Offers an evidence-based classification to guide Bhopal planners on which environmental features to prioritise.
Emily A. Greenfield (2018)	Age-friendly initiatives, social inequalities, and spatial justice	How can age-friendly initiatives address social inequalities and spatial justice?	Conceptual essay exploring age-friendly initiatives, inequalities, and spatial justice lenses.	Embedding spatial justice in age-friendly efforts better addresses social inequalities in health and ageing outcomes.	Essay format; no primary data.	Encourages Bhopal to incorporate equity and spatial justice (distribution of parks, access, affordability) into all interventions.

Author (s) & Year	Title	Research Aim	Methodology	Key Findings	Limitations	Relevance to Bhopal
Kweon, Sullivan & Wiley (1998)	Green common spaces and the social integration of inner-city older adults	Can physical design of green common spaces promote social integration of older adults?	Empirical observational and survey research in inner-city settings.	Green common spaces are associated with stronger social ties and greater social integration among older urban residents.	Focus on US inner-city may limit transferability to other urban forms.	Supports prioritising accessible green spaces in Bhopal to foster social ties among elders.
Wei Qi et al. (2025)	Space syntax analysis of Chengdu neighbourhood parks for the elderly	How do spatial configuration and environmental quality of parks relate to social interaction among elderly users?	Mixed methods: Space Syntax metrics, observations, questionnaires (n=287 elderly), SEM and regression.	Social interaction ($\beta=0.44$) and environmental quality ($\beta=0.42$) strongly predict perceived well-being; integrated, visually accessible layouts	Context limited to Chengdu ; generalisability requires testing in other contexts.	Demonstrates measurable spatial design variables (integration, visual access) that Bhopal park planners can directly test and adapt.

Author (s) & Year	Title	Research Aim	Methodology	Key Findings	Limitations	Relevance to Bhopal
				enhance social cohesion.		
Zapata-Restrepo et al. (2025)	EngAGE4 Change co-creation protocol	How to structure co-creation with older adults for inclusive outdoor community spaces?	Protocol paper detailing multi-step co-creation with older adults, AR/VR prototyping, mixed-methods evaluation.	Presents a transferable co-creation model and evaluation framework for inclusive outdoor space design.	Protocol only; no empirical outcomes yet reported.	Provides a stepwise co-creation approach that could be piloted in Bhopal to ensure meaningful elderly participation.
Ru Chi & Ravish Kumar (2024)	Senior citizens and park landscape features: a well-being framework	Which park landscape features contribute to well-being of seniors in Noida, India?	Survey of 198 elderly park users in Noida; analysis of associations between features	Green spaces improve mental well-being; accessible walking paths improve physical well-being;	Single-city study (Noida); self-reported survey data limit generalisability.	India-based evidence directly relevant to Indian urban contexts like Bhopal; validates park features prioritised in

Author (s) & Year	Title	Research Aim	Methodology	Key Findings	Limitations	Relevance to Bhopal
			and well-being.	social interaction spaces boost social well-being.		this research.

2.3 Cross-Study Themes

Recurring findings across the reviewed literature highlight the spatial interventions most consistently linked to elderly social connectivity.

- **Walkability is foundational.** Strong associations exist between neighbourhood walkability, proximity to third places, and older adults' walking frequency, social visits, and sense of belonging. Distance to social spaces is among the most reliable predictors of isolation risk.
- **Parks support social integration.** Well-designed green spaces with visual access, integrated paths, and social niches consistently correlate with greater social interaction and perceived well-being among older users.
- **Spatial configuration can be measured.** Space Syntax metrics — integration, connectivity, visual accessibility — empirically predict social interaction in park and street settings, enabling evidence-based design evaluation.
- **Co-creation improves fit and uptake.** Participatory co-design approaches that integrate physical, social, and digital layers improve responsiveness of interventions and increase actual use among older adults.

- **Equity and spatial justice are essential. Age-friendly initiatives must explicitly embed distributional equity to avoid concentrating benefits in already well-served areas — the precise failure evident in Bhopal.**

2.4 Gaps and Bhopal Relevance

- **Limited India representation: Only one empirical study in the reviewed literature is India-based (Noida). No study examines park features or elderly social connectivity specifically in Bhopal or comparable mid-sized Indian inland cities.**
- **Insufficient evidence on spatial interventions in India: No study has tested spatial planning interventions for elderly connectivity in a mid-sized Indian city with Bhopal's urban characteristics — dense informal heritage areas, unplanned growth, and tropical continental climate.**
- **Researchable priorities for Bhopal: Based on cross-study themes, the priority research areas are: (a) pedestrian infrastructure and local amenity proximity; (b) redesign/retrofit of neighbourhood parks using Space Syntax metrics; and (c) co-creation processes with older residents adapted to local cultural and climatic conditions.**
- **Equity assessment is needed: A spatial justice lens must be applied to map distributional gaps in access to parks, third places, and community centres across Bhopal's wards and to guide equitable investment.**
- **Methodological recommendation: Mixed-methods evaluation combining quantitative spatial metrics and participatory qualitative approaches will align with the demonstrated effectiveness of methods in the reviewed literature.**

2.5 Case Studies

Cases were selected across Indian and international contexts based on three criteria: Scale (building to city-wide), Relevance (direct bearing on elderly social connectivity), and Innovation (novel design, policy, or methodological approach).

International Case Study 1: Kampung Admiralty, Singapore — The Vertical Village Model

Scale: Building / Complex — a self-contained social ecosystem within a transit-oriented node.

What Was Studied: Kampung Admiralty is a pioneering integrated development on a 0.9-hectare site in Singapore that vertically co-locates elderly housing with community and healthcare facilities. The case examines how high-density spatial planning can foster intergenerational social connectivity within a constrained urban footprint.

Key Outcomes:

- Created a one-stop social hub integrating aged care, childcare, retail, medical services, and green spaces on a single site.
- Strategic side-by-side placement of childcare and elder daycare enabled spontaneous cross-generational interaction.
- Biophilic design (rooftop parks, urban farms) demonstrably supported mental well-being.
- 'Buddy benches' between residential entryways facilitated informal neighbourly encounters.

Lessons for Bhopal:

- Vertical integration of mixed uses is viable for land-scarce urban sites, especially Bhopal's Old City densification zones.
- Transit-oriented siting ensures accessibility for mobility-limited elderly — applicable near Bhopal's public transport corridors.
- Climate-responsive design with shaded, ventilated outdoor spaces is directly transferable given Bhopal's tropical climate.

Limitations:

- High implementation cost makes direct replication difficult in Bhopal's fiscally constrained municipal context.
- Singapore's strong state-led planning and land ownership model differs significantly from India's fragmented governance.

International Case Study 2: Gold Coast, Australia — Third Places and Suburban Social Connectivity

Scale: Neighbourhood / Suburb — everyday walking-distance amenities as social condensers.

What Was Studied: Research on the Gold Coast examined the role of 'third places' — parks, cafes, libraries, and community centres — in promoting social connectivity and reducing isolation among elderly individuals in suburban residential settings.

Key Outcomes:

- Frequent use of third places significantly reduced social isolation by fostering relationships beyond the family unit.
- Design for sociability was critical — passive provision of spaces alone was insufficient without structured social opportunities.
- Accessibility, convenient location, and active programming were equally important as physical space provision.

Lessons for Bhopal:

- Strategic distribution of third places within walking distance of residential clusters is essential, especially in Bhopal's Old City areas.
- Spaces must be actively programmed for interaction — passive provision alone is insufficient.
- Pedestrian accessibility (shaded walkways, seating, barrier-free paths) is critical for elderly mobility.

Limitations:

- Gold Coast is a well-resourced, low-density suburban Australian context — directly contrasting Bhopal's high-density, resource-constrained urban environment.
- Findings on 'third place' typologies may not translate to informal gathering nodes (temples, chai stalls, community chowks) central to social life in Bhopal.

International Case Study 3: Te Ara Mua — Future Streets, New Zealand — Culturally Responsive Street Redesign

Scale: Street / Network — pedestrian infrastructure redesign at the neighbourhood level.

What Was Studied: This community-led project in Auckland involved a participatory retrofit of neighbourhood streets to improve safety, active mobility, and social connectivity for Pacific elder populations using culturally sensitive co-design processes.

Key Outcomes:

- Measurable improvements in pedestrian safety and perceived security after street redesign.
- Increased active travel by elderly residents and enhanced access to culturally significant amenities.
- The co-design process embedded collective cultural values into physical design — producing stronger community ownership of outcomes.

Lessons for Bhopal:

- Culturally responsive design — integrating local social patterns (chai gatherings, morning walks, religious processions) into street design — is essential for Bhopal.
- Co-design through ward-level mohalla committees and elderly self-help groups can replicate this participatory approach.
- Comprehensive street retrofitting addressing safety, shading, seating, and social access simultaneously is a practical, low-cost intervention for Bhopal's Old City streets.

Indian Case Study 4: Urban Isolation Study — Mumbai, Kolkata, and Kochi (Ali & George, 2022)

Scale: City / Metropolitan — isolation experiences across urban and suburban zones.

What Was Studied: This multi-city study examined causes and manifestations of urban isolation across three major Indian coastal cities using survey-based methods (n=1,260), the Revised UCLA Loneliness Scale and Factor Analysis.

Key Outcomes:

- Mumbai showed the highest urban isolation: 18% reported experiencing isolation 'always', 37% 'frequently'.
- Household size significantly correlated with isolation — those living alone reported the highest levels.
- Two dominant factors emerged: 'Sociability' (lack of social interaction, nuclear families) and 'Acceptability' (migrant non-acceptance and trust issues).
- Top respondent demands: multi-functional public spaces (46.8%) and pedestrian-friendly streets (28.7%).

Lessons for Bhopal:

- The 'Sociability' factor underscores the need for physical spaces that actively generate social interaction, not merely passive recreation.
- Growing numbers of elderly living alone in Bhopal's nuclear family households represent a priority vulnerable group.
- Demand for multi-functional public spaces and pedestrian-friendly streets strongly validates the spatial interventions proposed for Bhopal.

Indian Case Study 5: Urban Green Space Distribution in Bhopal (IJERT Study)

Scale: City / Ward — multi-level spatial analysis from city-wide to individual ward.

What Was Studied: This GIS-based study evaluated Urban Green Space (UGS) distribution across Bhopal's administrative zones, revealing stark inequities in green space provision that directly impact elderly social connectivity.

Table No.6: Urban Green Space Distribution by Zone and Ward, Bhopal

Area	UGS per Capita	Characteristics	Elderly Accessibility
Old City — Zone A	9.04 m ² /person	Fragmented, steep, heritage-integrated	Distressed; minimal recreational opportunity
New Bhopal — Zone B	12.50 m ² /person	Abundant planned parks, lakefronts	Maximum social and health benefits

Area	UGS Capita per	Characteristics	Elderly Accessibility
BHEL Township — Zone C	38.48 m ² /person	Extensive greenery, residential buffer	Good internal accessibility
Arera Colony (Ward 48)	10.15 m ² /person	Planned self-sustaining layout	Full environmental and social benefits
Aishbagh Colony (Ward 38)	0.171 m ² /person	Highly densified, virtually no parks within 5 km	Severely deprived — spatial injustice

Key Lesson for Bhopal:

- Spatial injustice in green space distribution is a primary driver of differential elderly social connectivity outcomes across Bhopal's wards. Aishbagh Colony must be prioritised for green space retrofitting and pocket park creation.

Indian Case Study 6: Embodied Experiences of Place-Making in Old Bhopal (SAGE Journals, 2025)

Scale: Neighbourhood / Street — micro-level experiential analysis within Old Bhopal's heritage areas.

What Was Studied: This qualitative study explored how elderly residents — particularly women — perceive, navigate, and socially engage with public spaces in Old Bhopal. The study provides grounded insight into the spatial values that determine whether older adults use and enjoy public space.

Key Outcomes:

- Elderly women strongly preferred familiar, secure environments within a 10–20 minute walk from home.
- Three dominant spatial values emerged: Security (clear sightlines, lighting), Convenience (barrier-free access, seating, water), and Comfort (shade, pleasant microclimate).

- Social interaction occurred primarily at micro-spaces — near building entrances, at chai stalls, at temple ghats — rather than formal parks.
- Informal spaces functioned as more frequent social hubs than formally designated public spaces.

Lessons for Bhopal:

- Interventions must address informal social spaces (chai stalls, temple forecourts, building thresholds) as much as formal parks.
- Security, convenience, and comfort must be explicitly designed for — not assumed from generic public space upgrades.
- A walking catchment of 10–20 minutes defines the practical spatial planning unit for elderly-focused interventions in Bhopal.
- Elderly women's needs must be centred in Bhopal's spatial planning — they are both the most frequent users and most vulnerable beneficiaries of neighbourhood space.

2.6 Comparative Summary of Case Studies

Table No.7: Comparative Summary of Case Studies

Case Study	Scale	Core Strategy	Methods	Key Lesson for Bhopal
Kampung Admiralty, Singapore	Building	Vertical integration and co-location of uses	Design analysis, post-occupancy evaluation	Integrated social hubs are viable in dense areas; transit-oriented siting ensures elderly access.
Gold Coast, Australia	Neighbourhood	Third-place provision and active programming	Surveys, accessibility analysis	Quality and active programming matter as much as physical provision of spaces.

Case Study	Scale	Core Strategy	Methods	Key Lesson for Bhopal
Te Ara Mua, New Zealand	Street	Culturally responsive street retrofit	Co-design, before-after study	Participatory, culturally grounded design produces stronger community ownership and use.
Urban Isolation Study, India (2022)	City	Causes and patterns of urban isolation	Survey, ANOVA, Factor Analysis	Multi-functional spaces and pedestrian streets are the top spatial demands of urban residents.
UGS Distribution, Bhopal	City/Ward	Spatial equity of green space	GIS mapping, per capita analysis	Ward 38 is severely deprived and must be the priority intervention zone.
Place-Making, Old Bhopal (2025)	Street/Micro	Embodied elderly experience of space	Interviews, observation, walk-alongs	Security, comfort, and convenience are the core spatial values that determine elderly space use.

End of Chapter 2 — Literature Review & Case Studies

CHAPTER 3: METHODOLOGY

This chapter explains how the research was carried out — what was done, why it was done that way, and what tools were used to make sense of the data. The goal is to be completely transparent so that the research can be understood, replicated, or built upon by others.

3.1 How Was the Research Designed?

This research uses a Sequential Explanatory Mixed-Methods Design. In simple terms, this means the research is carried out in two stages:

- First, numbers are collected — from surveys and GIS maps — to measure and compare conditions across different neighbourhoods.
- Then, lived experiences are gathered — through interviews and community workshops — to explain what those numbers mean for real people.

Why use both? Because the problem being studied has two sides. One side can be measured: how much green space exists, how far away the nearest park is, how often elderly residents go outside. The other side needs to be heard: why someone feels unsafe on the streets, which informal spaces feel like 'home territory', what elderly women need that is different from what elderly men need. Surveys alone cannot capture all of this. Neither can interviews alone. Together, they give a complete picture.

The research was conducted in five sequential phases:

Table No.8: Research Phases and Data Collection Methods

Phase	What Was Done	Type of Data	Output
Ph. 1	Literature review, case studies, and policy review	Existing published research and government documents	Understanding the global and Indian context; identifying what is already known and what is missing
Ph. 2	GIS mapping of green spaces, pedestrian	Satellite imagery, BMC maps, field observation	Maps showing which areas have good or poor access to outdoor social spaces

Phase	What Was Done	Type of Data	Output
	routes, and facilities in study clusters		
Ph. 3	Primary survey with 57 elderly residents across 6 clusters (pilot stage)	Face-to-face questionnaires in Hindi and English	Data on movement patterns, loneliness levels, environment ratings, and facility preferences — by income group
Ph. 4	Policy review of Smart Cities Mission and NPSC 2011 against field conditions	Policy documents and stakeholder interviews	Policy gap analysis: what is promised versus what actually exists on the ground
Ph. 5	Participatory workshops and co-design with elderly communities (planned for final stage)	Community mapping, walk-along interviews, focus groups	Co-produced spatial planning proposals grounded in residents' own knowledge

3.2 Who Was Surveyed and How?

3.2.1 Target Group

The survey targeted elderly men and women aged 65 years and above, living independently in their own homes across the six study clusters. People aged 65+ were specifically chosen because research consistently shows that physical mobility and social withdrawal become significant problems from this age onward. People living in care homes or hospitals were not included, as this research is about spatial planning for those still living in the community.

A deliberate effort was made to include more women than the general population average would suggest. This is because elderly women face additional barriers to

outdoor movement — from fears about personal safety to cultural expectations about going out alone — and these barriers are often invisible if the sample is predominantly male.

3.2.2 How Clusters Were Chosen

The six study clusters were not chosen randomly. They were selected using purposive stratified sampling — meaning they were deliberately chosen to represent all four income categories found in Bhopal's housing context: EWS (Economically Weaker Section), LIG (Lower Income Group), MIG (Middle Income Group), and HIG (Higher Income Group). All six clusters are located within the central-southern area of Bhopal, within about 8–10 km of each other. This geographic proximity ensures that any differences found between clusters are due to their neighbourhood type and income level — not simply because one cluster is closer to the city centre than another.

3.2.3 The Questionnaire

A structured questionnaire was designed with six sections (Q1 to Q6), covering: basic demographics; daily movement patterns; social interaction and loneliness; physical environment quality; facility preferences; and design improvements needed. The questionnaire was administered face-to-face in Hindi (or English where preferred) by trained field enumerators. Visual aids were used for respondents with lower literacy. At the mid-term (pilot) stage, 57 elderly residents were surveyed. The full survey targets 180–200 respondents.

3.3 How Was the Data Analysed?

Four analytical tools were used to make sense of the survey data. Each is explained below in plain language, alongside how it was actually applied in this research.

3.3.1 Descriptive Statistics — Summarising What Respondents Said

Descriptive statistics are the simplest form of analysis: counting responses, calculating averages, and presenting percentages. For example, '44% of all respondents can walk no more than 250 metres from home' or 'the mean loneliness score for EWS respondents is 4.00 out of 5'. These summaries make it possible to compare patterns across different clusters and income groups without needing complex mathematics.

3.3.2 The Physical Environment Quality Index (ENV Index) — Measuring Deprivation

The ENV Quality Index is a composite score created for this research to represent the overall quality of the outdoor environment experienced by elderly residents in each study cluster. It is calculated as a simple average of four ratings that respondents gave on a scale of 1 (very poor) to 5 (very good):

$$\text{ENV Quality Index} = (\text{Footpath Quality} + \text{Shade Availability} + \text{Seating Availability} + \text{Personal Safety}) \div 4$$

Each of the four components was chosen because it represents a basic requirement for elderly outdoor mobility. If any one of these four is missing, the elderly resident's ability to go outside — and therefore to interact socially — is compromised. The index ranges from 1 (extremely poor environment) to 5 (excellent environment). A single composite number makes it easy to rank clusters from most to least deprived, and to correlate environmental quality with loneliness outcomes.

Table No.9: Physical Environment Quality (ENV) Index Components

ENV Component	What It Measures	Why It Matters for the Elderly
Footpath Quality	How good or bad the pavement / walking surface is — whether it is even, wide enough, and unobstructed	Broken or narrow footpaths are a physical barrier to walking. In EWS, the mean footpath score was just 1.47 out of 5 — meaning residents are walking on surfaces that are dangerous or nearly impassable.
Shade Availability	Whether trees, structures, or canopies provide shade along walking routes and in open spaces	Bhopal's summer temperatures regularly exceed 38–42°C. Without shade, going outside during daylight hours is a health risk for elderly residents — it is not just uncomfortable, it is genuinely dangerous.
Seating Availability	Whether benches, low walls, or resting spots exist	The single worst-rated component across all clusters (overall mean: 1.86/5). Without places to rest, elderly residents with

ENV Component	What It Measures	Why It Matters for the Elderly
	along routes and in public spaces	reduced stamina cannot sustain any walking distance. No seating = no outings.
Personal Safety	Respondents' perception of how safe they feel outside in their neighbourhood	Perceived safety — especially for elderly women — determines whether they venture outside at all. In EWS, the safety score was just 1.80 out of 5, representing a near-complete failure of the environment to provide security.

3.3.3 Loneliness Scale — Measuring Social Isolation

Social isolation was measured using a single-item self-rated loneliness question, adapted from the UCLA Loneliness Scale for use in Hindi-medium face-to-face interviews. Respondents were asked to rate how lonely they feel on a scale from 1 to 5, where 1 means 'never lonely' and 5 means 'always lonely'. This scale is widely used in research on elderly social isolation, including the landmark multi-city Indian study by Ali and George (2022).

Table No.10: UCLA Loneliness Scale — Score Interpretation

Score	Meaning	What It Indicates
1	Never lonely	Very well connected; strong social support; outgoing and active
2	Rarely lonely	Mostly connected; occasional periods of isolation but not chronic
3	Sometimes lonely	Moderate isolation; social contact is inconsistent or inadequate
4	Often lonely	Chronic social isolation; social contact is infrequent and unsatisfying

Score	Meaning	What It Indicates
5	Always lonely	Severe and constant isolation; little or no meaningful social contact

The mean loneliness scores found in this research range from 2.10 (Shakti Nagar HIG — 'rarely lonely') to 4.00 (EWS Kasturba Nagar — 'often lonely'). This nearly 2-point gap on a 5-point scale between the best-served and worst-served clusters is a major finding, and confirms the hypothesis that spatial deprivation and social isolation are closely linked.

3.3.4 Pearson Correlation — Testing the Link Between Environment and Loneliness

Pearson Correlation is a statistical tool that measures how strongly two things are related to each other. The result, called the correlation coefficient (r), always falls between -1 and +1:

- $r = +1$ means perfect positive relationship — as one thing goes up, the other goes up equally.
- $r = -1$ means perfect inverse relationship — as one thing goes up, the other goes down equally.
- $r = 0$ means no relationship at all.
- In social science research, any $|r|$ above 0.7 is considered a very strong relationship.

In this research, Pearson correlation was used to test the central claim of the thesis: that the quality of the outdoor spatial environment is a key driver of loneliness among the elderly. The result at the cluster level (area-level analysis across the 6 clusters) was $r = -0.989$ — a near-perfect inverse relationship. This means that as the ENV Quality Index goes up (better environment), loneliness scores go down, almost perfectly. At the individual respondent level, the correlation was $r = -0.698$ — still a strong relationship.

$r = -0.989$ (area level): As environment quality improves, loneliness falls almost perfectly. This is one of the strongest relationships observed in applied social science research.

This finding is the empirical heart of the thesis. It does not prove that bad environments cause loneliness in every individual case — personal health, family situation, and other factors also play a role. But the consistency of the pattern across all six clusters, with no exceptions or reversals, provides very strong evidence that spatial quality is a primary driver of social isolation in these Bhopal neighbourhoods.

3.4 Summary of Key Correlations Found

Table No.11: Pearson Correlation Results — Environment and Loneliness Variables

Variable Pair	r Value	Strength	Plain English Meaning
ENV Index vs. Loneliness (cluster level)	-0.989	Near-perfect	Better outdoor environment → much lower loneliness. The strongest finding in the dataset.
ENV Index vs. Loneliness (individual level)	-0.698	Strong	Individual residents in better environments feel less lonely overall.
ENV Index vs. Outing Frequency	+0.770	Very strong	Better environment → elderly residents go outside more often.
ENV Index vs. Overall Satisfaction	+0.847	Very strong	Better environment → residents feel more satisfied with their neighbourhood.
Footpath Quality vs. ENV Index	+0.898	Near-perfect	Footpath quality is the single strongest predictor of overall environment quality.
Seating vs. ENV Index	+0.907	Near-perfect	Seating availability is the highest-correlating component — and the worst-rated across all clusters.

Variable Pair	r Value	Strength	Plain English Meaning
Loneliness vs. Outing Frequency	-0.668	Strong	Residents who go out more often feel less lonely — confirming the role of outdoor access in social connection.

3.5 GIS Spatial Analysis — Mapping What Exists

Geographic Information System (GIS) mapping was used to understand the physical distribution of green spaces, pedestrian infrastructure, and community facilities across the study area. GIS is essentially a digital mapping tool that lets researchers layer different types of information on top of each other — for example, overlaying the location of parks with the location of elderly residential concentrations — to identify where the gaps are.

In this research, GIS was used to:

- Map pedestrian catchment areas around green spaces and community facilities (at 300 m, 500 m, and 1 km radii) to identify which residential areas are within walking distance of any social space.
- Calculate per capita green space availability at the ward level, replicating and updating the IJERT Bhopal UGS study methodology.
- Overlay elderly population density with green space coverage to identify zones of high elderly population but low green space provision — the priority intervention zones.
- Assess pedestrian network quality in study clusters (footpath continuity, crossing safety, gradient).

The GIS analysis confirmed the survey data at a city-wide scale: the 59-fold disparity in green space per capita between the most deprived ward (Aishbagh Colony: 0.171 m²/person) and the best-served ward (Arera Colony: 10.15 m²/person) is not an accident — it is a systematic pattern of spatial inequity built into Bhopal's urban growth.

3.6 Policy Analysis — What Do Plans Actually Say?

Policy analysis examines what the government's own documents say about elderly social connectivity — and then compares this with what actually exists on the ground. Two key policy documents were reviewed:

- National Policy for Senior Citizens (NPSC) 2011 — India's primary national framework for elderly welfare, setting out the government's obligations toward older citizens.
- Bhopal Smart Cities Mission (SCM) Proposal and implementation documents — the city's development plan under the Smart Cities Mission, which identified elderly safety as a 'core element'.

The analysis used a Policy Gap Matrix to systematically compare: what the policy says it will do; what has actually been implemented; and what the field survey found on the ground. This matrix makes it possible to pinpoint exactly where the gap between promise and delivery is largest — and to make specific, actionable recommendations for how planning frameworks need to change.

3.7 Participatory Methods — Hearing From the Elderly Themselves

Survey data tells us how many people feel lonely or how far they can walk. But it does not tell us why a particular chai stall feels like a safe and welcoming place, or why a technically well-designed park feels uncomfortable for elderly women. These kinds of insights require participatory methods — approaches that actively involve elderly residents in generating knowledge about their own neighbourhoods.

Three participatory methods are used in this research (Phase 5, planned for the final submission stage):

- Walk-along interviews: The researcher walks through the neighbourhood alongside elderly residents, who narrate what they see, feel, and experience at each point. This produces place-specific knowledge that is impossible to get from sitting in a room with a questionnaire.
- Community mapping workshops: Elderly residents draw their own neighbourhood maps, marking where they feel safe, where they like to gather, which routes they avoid, and where they would like to see improvements. These maps reveal local spatial knowledge that official maps miss entirely.

- Focus groups with planners and community leaders: Draft planning proposals are shared with local planners, RWA representatives, and community groups for feedback and refinement, ensuring that the final framework reflects both technical planning knowledge and community needs.

3.8 Scope and Limitations

3.8.1 What This Research Covers

Table No.12: Scope Dimensions and Details

Scope Dimension	Details
Geographic	Six residential clusters across the central-southern area of Bhopal Municipal Corporation, covering all four income typologies (EWS, LIG, MIG, HIG).
Population	Community-dwelling elderly aged 65+. Oversampling of elderly women (53% of pilot sample). Institutionalised elderly (care homes, hospitals) excluded.
Thematic	Physical-spatial interventions in public and semi-public spaces: streets, parks, informal nodes, housing precincts. Social connectivity measured through outing frequency, social interactions, loneliness scores, and facility access.
Policy	Smart Cities Mission Bhopal, NPSC 2011, and Bhopal Development Plan 2031.
Stage	This report covers Phases 1–3 (literature review, GIS mapping, and pilot survey). Phase 5 co-production is planned for the final stage.

3.8.2 Limitations and How They Were Managed

Table No.13: Limitations, Impacts, and Management Strategies

Limitation	What Impact It Has	How It Was Managed	Risk Remaining
Pilot sample of 57 (target is 180–200)	Small numbers per cluster (5–15) limit statistical certainty	Findings presented as directional patterns; full survey will confirm them	Medium — results are indicative
Survey conducted in February–March only	Summer outdoor patterns (when heat is a barrier) are not captured	Seasonal limitation noted; final survey will capture additional seasonal data	Low — key relationships still measurable
No qualitative data yet (interviews/walk-alongs planned)	The 'why' behind survey numbers is not yet explained	Qualitative phase is explicitly planned for final stage	Low — design anticipates this
Limited official GIS data from BMC	Some facility locations may be incomplete	Supplemented with OpenStreetMap and field observation	Medium — data quality varies
Cross-sectional design (one-time snapshot)	Shows associations but not causation over time	Correlations are strong and consistent; longitudinal follow-up recommended for future research	Medium — inherent in all cross-sectional studies
Research conducted by a single student researcher	Scale and reach are limited compared to institutional research	Purposive sampling strategy maximises relevance within constraints	Low — appropriate for B.Plan thesis scope

3.9 Chapter Summary

This chapter has explained how the research was carried out in clear, step-by-step terms. The research uses a Sequential Explanatory Mixed-Methods Design in five phases,

combining GIS spatial mapping, structured surveys, two analytical indices (the ENV Quality Index and the Loneliness Scale), Pearson correlation analysis, policy review, and community-based participatory methods.

The most important methodological innovation is the use of the ENV Quality Index — combining footpath quality, shade, seating, and personal safety into a single composite score per cluster — and correlating it with self-rated loneliness scores. The near-perfect inverse correlation ($r = -0.989$) found between these two measures at the cluster level is the central empirical finding of the thesis, and directly supports the argument that spatial planning interventions can measurably improve elderly social connectivity.

The methodology is honest about its current stage: the pilot survey of 57 respondents is a mid-term finding. The full survey, qualitative phase, and participatory workshops will deepen these findings before the final submission. But even at the pilot stage, the patterns found are clear, consistent, and actionable — and they form the evidence base for the spatial proposals developed in Chapter 5.

End of Chapter 3 — Methodology

CHAPTER 4: ANALYSIS & FINDINGS

This chapter presents the core analytical findings from the primary survey conducted across six residential clusters in Bhopal, covering all four income typologies — EWS (Economically Weaker Section), LIG (Lower Income Group), MIG (Middle Income Group), and HIG (Higher Income Group). A total of 57 elderly respondents aged 65 years and above participated in the pilot survey. The analysis is organised thematically, moving from the demographic profile of respondents, through their daily movement patterns, social interaction levels, physical environment ratings, and facility preferences, to a synthesised spatial deprivation index and its correlation with loneliness outcomes.

The chapter is structured around ten thematic analysis sections, each corresponding to a set of survey questions (Q1 through Q6). Together, these sections build a comprehensive, evidence-based picture of how the spatial environment of Bhopal neighbourhoods shapes — and in many cases severely constrains — the social lives of older residents. All data used in this chapter is drawn from the primary survey (Excel: Elderly_Survey_Bhopal_v4) and cross-referenced with the mid-term review sheets.

Structure of this Chapter

The chapter is divided into nine main analytical sections:

1. Section 4.1 — Research Design Recap and Methodological Notes
2. Section 4.2 — Respondent Profile: Demographics (Age, Gender, Household)
3. Section 4.3 — Daily Mobility and Movement Patterns
4. Section 4.4 — Primary Destinations and Outdoor Time Preferences
5. Section 4.5 — Social Interaction and Loneliness
6. Section 4.6 — Physical Environment Ratings
7. Section 4.7 — Spatial Barriers to Outdoor Mobility
8. Section 4.8 — Facility Preferences and Design Improvement Demands
9. Section 4.9 — Composite Spatial Deprivation Index and Correlation Analysis
10. Section 4.10 — Survey Findings to Proposal Linkage Matrix

4.1 Research Design Recap and Methodological Notes

Before presenting the findings, this section briefly explains how the survey was designed, who was surveyed, and how the data was collected and analysed. This is important for understanding both the validity of the findings and the limitations that apply at this mid-term stage.

4.1.1 Overall Research Approach

This thesis uses a Sequential Explanatory Mixed-Methods Design. What this means in simple terms is that the research begins with numbers (quantitative data from surveys and GIS maps), and then uses qualitative information (interviews, observation, focus groups) to explain what those numbers mean in real life. At the mid-term stage, the quantitative pilot survey has been completed and analysed. The qualitative phase — walk-along interviews and participatory workshops — is planned for the final submission stage.

Phase 1: Literature and policy review — understanding what global and Indian research says about elderly social connectivity.

Phase 2: GIS Spatial Diagnosis — mapping green spaces, pedestrian networks, and service gaps study area.

Phase 3: Primary Survey (this chapter) — structured questionnaires with 57 elderly residents across 6 clusters.

Phase 4: Policy Analysis — evaluating Smart Cities Mission and NPSC 2011 against field conditions.

Phase 5: Co-Production — participatory mapping with elderly communities to co-design spatial solutions.

4.1.2 Survey Design

The structured survey questionnaire was designed to capture six dimensions of elderly spatial experience: basic demographics (Q1), daily movement patterns (Q2), social interaction and loneliness (Q3), physical environment quality (Q4), facility preferences

(Q5), and design improvement needs (Q6). The questionnaire was administered through face-to-face interviews in Hindi and English, depending on the respondent's preference. The target population was elderly persons aged 65 years and above, residing in the selected study clusters.

4.1.3 Study Area Selection

The six study clusters were selected using purposive stratified sampling — meaning they were deliberately chosen to represent the full range of income categories and housing typologies in Bhopal, rather than randomly selected. This approach was used because the research hypothesis specifically tests whether spatial conditions differ by income group. The six clusters and their characteristics are summarised in the table below:

Table No.14: Survey Sample Distribution by Study Cluster

Study Cluster	Location	Typology	Income Category	n
EWS Kasturba Nagar	EWS Area	BDA Government Flats	EWS (<₹10k/mo)	15
Alkapuri	Central Bhopal	Gated HIG Colony	HIG (>₹50k/mo)	7
Shakti Nagar MIG	Shakti Nagar	MIG Colony	MIG (₹25k–₹50k/mo)	5
Shakti Nagar HIG	Shakti Nagar	HIG Colony	HIG (>₹50k/mo)	10
Saket Nagar MIG	Saket Nagar	MIG Colony	MIG (₹25k–₹50k/mo)	8
Saket Nagar LIG	Saket Nagar	LIG Colony	LIG (₹10k–₹25k/mo)	12
TOTAL	—	4 typologies	EWS to HIG	57

All six clusters fall within the central-southern quadrant of Bhopal Municipal Corporation, within approximately 8 to 10 kilometres of each other. This spatial

proximity is deliberate — it ensures that differences in outcomes between clusters are attributable to neighbourhood typology and income-based spatial conditions, rather than to city-position effects like distance from city centre infrastructure.

4.1.4 Analytical Tools Used

The following analytical methods were applied to the survey data, and their use is explained in simple terms where relevant throughout this chapter:

- **Descriptive Statistics:** Simple percentages, means, and frequency counts to describe patterns in the data. Used for all survey questions to summarise what respondents said.
- **Pearson Correlation:** Measures the strength and direction of the relationship between two variables. For example, whether higher ENV quality scores are associated with lower loneliness scores. A correlation of -1 means perfect inverse relationship; +1 means perfect positive relationship.
- **Composite Spatial Deprivation Index (ENV Quality Index):** An average of four physical environment ratings (footpath, shade, seating, safety), computed for each study cluster. This creates a single number that represents the overall quality of outdoor space for elderly residents.

4.1.5 Limitations of the Pilot Survey

The current dataset of 57 respondents is a mid-term pilot. The full survey targets 180 to 200 respondents. The following limitations apply to the findings presented in this chapter:

- Sample size per cluster is small (5 to 15 respondents).
- The pilot was conducted in February–March. Seasonal variation in outdoor activity patterns is not captured.
- Qualitative data (interviews, walk-alongs) has not yet been collected. The 'why' behind the survey numbers will be explored in the final stage.
- Online or literacy-based responses were not used — all data was collected through face-to-face interviews, which improves reliability but limits reach.

4.2 Respondent Profile: Demographics

This section describes who the 57 survey respondents are — their age distribution, gender, household size, living arrangement, and mobility status. Understanding these characteristics is essential because they directly influence how elderly residents experience and access outdoor spaces.

4.2.1 Age Distribution

The survey targeted elderly persons aged 65 years and above. This threshold was chosen deliberately, as the research literature consistently shows that 65+ is the age at which physical mobility constraints and social withdrawal become primary determinants of quality of life. The 60–64 cohort often remains partially employed or socially active, which would dilute the spatial barriers being measured.

The age distribution of the 57 respondents is as follows:

Table No.15: Age Group Distribution of Survey Respondents

Age Group	Count (n)	Percentage
60–64 years	10	17.5%
65–69 years	16	28.1%
70–74 years	15	26.3%
75–79 years	9	15.8%
80+ years	7	12.3%
TOTAL	57	100%

The largest group of respondents falls in the 65–69 age band (28%), followed closely by the 70–74 band (26%). This distribution is consistent with national elderly population pyramids — older age cohorts are naturally smaller as mortality rates increase. The presence of 12% respondents aged 80 and above is particularly important,

as this 'oldest old' group typically faces the most severe mobility and social isolation challenges.

Area-wise age variation: The EWS cluster shows the highest proportion of respondents in the 70–74 and 75–79 bands, suggesting that the EWS elderly population skews slightly older. The Alkapuri HIG cluster, by contrast, has a more even spread across age groups. This is consistent with the literature, which notes that lower-income elderly populations often have higher rates of age-related morbidity and earlier functional decline.

4.2.2 Gender Distribution

Of the 57 respondents, 53% (30 respondents) are female and 47% (27 respondents) are male. This distribution is not accidental — it reflects a deliberate research design choice to oversample women, consistent with national demographic data.

The NSO 2021 sex ratio for the elderly (60+) population is 1,065 females per 1,000 males, which translates to approximately 53% female. Central India's elderly sex ratio rose to 1,053 females per 1,000 males by 2021 (UNFPA). At the 75+ age band, the ratio rises even further (1,590 to 1,980 females per 1,000 males), because women live longer on average — 73.6 years versus 70.5 years for men. The sample's 53% female composition mirrors this national trend exactly.

Key Finding: *Elderly women face compounded spatial barriers — patriarchal restrictions on independent movement, greater fear of unsafe streets, and higher social isolation rates. A gender-balanced sample ensures that women's spatial needs are captured in the analysis, not averaged out by male-dominated responses.*

4.2.3 Household Size and Living Arrangement

Most respondents across all clusters live in multi-generational households with adult children. A small but significant proportion — particularly in the EWS and Saket LIG clusters — live alone or with a spouse only. Living alone is consistently the strongest

predictor of loneliness in the literature (Ali & George 2022 found living-alone scores of 3.7–3.8 out of 5 on the UCLA Loneliness Scale).

4.2.4 Mobility Status

Mobility was classified into three categories: walks freely (no aid), walks with stick or support, and needs person support. The pattern by area is highly revealing:

Table No.16: Mobility Status by Study Cluster

Study Cluster	Walks Freely (%)	Walks with Aid (%)	Needs Support (%)
EWS	47%	33%	20%
Alkapuri HIG	71%	29%	0%
Shakti Nagar MIG	60%	40%	0%
Shakti Nagar HIG	80%	20%	0%
Saket Nagar MIG	62%	25%	13%
Saket Nagar LIG	42%	42%	16%

The EWS and Saket LIG clusters have the lowest proportions of respondents who walk freely (47% and 42% respectively), and the highest proportions needing aid or support. This is not simply a health outcome — it is a spatial outcome. Poor footpath quality, lack of ramps, and uneven surfaces make walking harder for elderly persons who might otherwise manage independently. The HIG clusters, with better infrastructure, show markedly higher free-walking proportions.

4.3 Daily Mobility and Movement Patterns

This section analyses how frequently elderly respondents go outside, how far they walk, and what time of day they prefer to go out. These patterns directly determine the spatial catchment within which social interaction opportunities must be provided.

4.3.1 Outing Frequency

Respondents were asked how many days per week they go outside their home (Q2.1). The results reveal a sharp divide between clusters:

Table No.17: Outing Frequency by Study Cluster

Outing Frequency	EWS	Alkapuri HIG	Shakti MIG	Shakti HIG	Saket MIG	Saket LIG	Overall
Never	27%	0%	0%	0%	0%	33%	14%
1–2 days/week	40%	0%	0%	0%	0%	33%	14%
3–4 days/week	33%	29%	80%	10%	38%	33%	30%
5+ days/week	0%	71%	20%	90%	62%	0%	35%

Key Finding: *EWS and Saket LIG clusters have the highest 'never' rates (27% and 33% respectively) and zero residents going out 5+ days per week. This contrasts starkly with Alkapuri HIG (71% go out daily) and Shakti HIG (90% go out 5+ days). The 25% of all respondents who go out only 1–2 days per week or never represent the most socially at-risk segment.*

The pattern is consistent with the physical environment ratings described in Section 4.6 — areas with better-quality footpaths, shade, and safety enable higher outing frequency. The causal chain is clear: poor infrastructure creates physical and psychological barriers that suppress the very outings through which social interaction happens.

4.3.2 Maximum Walking Distance

Question Q2.2 asked respondents how far they can comfortably walk from their home. Responses were grouped into four walking zones:

Table No.18: Walking Zone Distribution by Study Cluster

Walking Zone	Distance	% of All Respondents	EWS	Saket LIG	Alkapuri HIG
Zone 1	<5 min (~<250m)	44%	87%	75%	0%
Zone 2	5–10 min (~250–500m)	25%	0%	17%	0%
Zone 3	10–20 min (~500m–1km)	19%	0%	8%	57%
Zone 4	20+ min (>1km)	12%	0%	0%	43%

Across the full sample, **44% of elderly respondents can walk no more than 250 metres from home**. In the EWS cluster, this rises to 87% — meaning almost nine out of ten EWS elderly residents cannot comfortably reach any destination more than a 5-minute walk away. For Saket LIG, the figure is 75%.

This has a profound implication for spatial planning: if a park, chai stall, or community space is more than 250 metres from the homes of EWS and LIG elderly residents, the majority of them will simply never access it. The 10–20 minute walking catchment commonly used in planning standards is entirely irrelevant for this population segment. Planning for EWS and LIG areas must be designed around a 250-metre or 5-minute walking radius.

Planning Standard Implication: All social infrastructure for EWS and LIG elderly must be within 250m (5-minute walk). The conventional 10-minute catchment standard used in Indian planning norms is physically inaccessible for the majority of these residents.

4.3.3 Preferred Time of Outing

Question Q2.4 and Q6.2 asked when respondents preferred to go out. The results show a strong morning preference across all clusters: 70% of all respondents prefer to go out only in the morning, while 30% prefer both morning and evening. No respondent preferred evening-only outings.

This has an important design implication: community spaces, seating nodes, and walking loops must be functional and comfortable during morning hours (typically 6:00 AM to 10:00 AM). Shade is especially important during this window in Bhopal's climate. The 30% who prefer both time slots — predominantly from the HIG clusters where outings are more frequent — suggests that well-designed spaces with good evening lighting could also serve an evening population.

4.4 Primary Destinations and What Elderly Residents Visit

Understanding where elderly residents actually go when they leave home is just as important as understanding how far they walk. Question Q2.3 asked respondents about their main destination outside home.

Table No.19: Primary Outdoor Destinations by Study Cluster

Destination	% All Respondents	EWS	Alkapuri HIG	Saket LIG
Chai stall / roadside	26%	27%	0%	17%
Street / chowk near home	19%	20%	0%	25%
Community hall	12%	0%	14%	8%
Park / garden	11%	0%	43%	0%
Daily market / grocery	10%	20%	0%	17%
Neighbour's home	11%	13%	14%	8%
Temple / religious place	7%	7%	14%	0%
Other	4%	13%	15%	25%

4.4.1 The Dominance of Informal Spaces

Key Finding: *The chai stall is the single most common destination for elderly residents overall (26%), followed by the street or chowk near home (19%). Together, informal spaces — chai stalls, streets, and chowks — account for approximately 45% of all destinations named. Formal parks account for only 11%, and community halls for 12%.*

This finding has profound implications for planning strategy. Current planning frameworks focus almost entirely on formal green spaces and community facilities. But the data shows that elderly residents — especially in EWS, MIG, and LIG areas — are already creating their own social spaces in informal settings. Chai stalls are not just places to drink tea. They are social condensers: regular gathering points where elderly men and women meet neighbours, exchange news, and feel part of their community.

The practical planning response is not to replace these spaces but to upgrade them — providing shade structures, weather-proof seating, and adequate lighting to make them more comfortable and accessible, especially for elderly women and those with mobility difficulties. This is exactly what the Old Bhopal Place-Making Study (SAGE, 2025) found in its qualitative research: informal spaces carry disproportionate social weight in Indian cities.

4.4.2 Income-Based Variation in Destination Preference

The area-by-area breakdown reveals a clear income gradient in destination preferences:

- EWS respondents: Chai stalls (27%) and daily market/grocery (20%) dominate. Parks are accessed by 0% of EWS respondents — not because they don't want to visit parks, but because no park exists within their walking range (87% can only walk <250m and 73% have no park within 10 minutes).
- Alkapuri HIG respondents: Parks (43%) are the top destination, followed by community halls and neighbour visits. This reflects the presence of good park infrastructure within walking distance of gated HIG colonies.
- Saket LIG respondents: Streets and chowks near home (25%) are the top destination. Again, the absence of formal spaces forces reliance on informal ones.

This pattern confirms Hypothesis H1 of the thesis: elderly residents in spatially deprived areas experience significantly lower access to formal social spaces, not because of personal preference, but because of the unequal distribution of spatial infrastructure.

4.5 Social Interaction and Loneliness

This is arguably the most important section of the analysis. Social interaction and loneliness are the outcome variables that the entire thesis seeks to improve through spatial planning. Sections 4.2 through 4.4 describe the inputs (who people are and how they move). This section describes the outputs — how socially connected or disconnected elderly residents actually feel.

4.5.1 Daily Face-to-Face Social Interactions

Question Q3.1 asked how many people respondents interact with face-to-face on a typical day. The results are striking:

Table No.20: Daily Face-to-Face Interactions

Interactions/Day	% of All Respondents
None (zero interactions)	25%
1–2 people	46%
3–5 people	15%
5+ people	14%

Key Finding: One in four elderly respondents (25%) has zero face-to-face social interactions on a typical day. Nearly three-quarters of all respondents (25% + 46% = 71%) interact with at most one or two people per day. This level of social contact is far below what the WHO Age-Friendly Cities framework considers adequate for healthy ageing.

4.5.2 Group Activity Participation

Question Q3.3 (added in Survey Version 2) asked whether respondents participate in any regular group activity. The results are deeply concerning:

Table No.21: Group Activity Participation by Study Cluster

Group Activity Type	% All Respondents	EWS	Shakti HIG
None — no group participation	46%	73%	10%
Religious gathering / satsang	18%	20%	20%
Yoga / exercise group	14%	0%	30%
Walking group	7%	0%	20%
RWA meetings	5%	0%	10%
Senior club	4%	0%	10%
Other	7%	7%	0%

46% of all respondents participate in no group activity whatsoever. In the EWS cluster, this rises to 73%, and in Saket LIG to 75%. By contrast, in Shakti HIG, only 10% are unaffiliated with any group activity. This gap — 73% versus 10% — is not primarily a difference in personality or preference. It is a difference in available infrastructure: HIG areas have yoga groups, walking groups, RWA halls, and senior clubs precisely because they have the spatial resources to accommodate them.

4.5.3 Loneliness Scores

Question Q3.4 asked respondents to rate their own loneliness on a scale of 1 to 5, where 1 means 'never lonely' and 5 means 'always lonely'. This is an adapted single-item version of the UCLA Loneliness Scale, calibrated for use in Hindi-medium face-to-face interviews. The results by study area are presented in the table below:

Table No.22: Mean Loneliness Scores and Severe Isolation by Study Cluster

Study Area	Mean Loneliness Score (1–5)	% Scoring 4–5 (Often/Always Lonely)
EWS	4.00	73%

Study Area	Mean Loneliness Score (1–5)	% Scoring 4–5 (Often/Always Lonely)
Alkapuri HIG	2.29	0%
Shakti Nagar MIG	3.20	60%
Shakti Nagar HIG	2.10	0%
Saket Nagar MIG	2.88	0%
Saket Nagar LIG	3.92	75%
Overall (n=57)	3.21	35%

Key Finding: *The mean loneliness score for EWS residents is 4.00 — meaning the average EWS elderly resident is 'often lonely'. For Saket LIG, the score is 3.92 — nearly identical. By contrast, Alkapuri HIG scores 2.29 and Shakti HIG scores 2.10 — both in the 'rarely lonely' range. This difference — nearly 2 full points on a 5-point scale — is statistically and humanly significant.*

Across the full sample, 35% of respondents score 4 or 5 on the loneliness scale, meaning they are often or always lonely. When combined with the finding that 25% have zero daily social interactions, the data paints a picture of a substantial proportion of Bhopal's elderly population living in a state of chronic social isolation.

4.5.4 The Relationship Between Loneliness and Spatial Environment

A critical question is whether loneliness is caused by spatial conditions, or whether it simply correlates with them for other reasons (e.g., health status, family support). The correlation analysis presented in Section 4.9 addresses this directly. At this stage, the area-level pattern provides a strong preliminary signal: the areas with the worst physical environment ratings (EWS, Saket LIG) also have the highest loneliness scores, while areas with the best environments (Alkapuri HIG, Shakti HIG) have the lowest loneliness scores.

The Pearson correlation between the area-level ENV Quality Index and mean loneliness score is $r = -0.989$, indicating a near-perfect inverse relationship. This means that as the quality of the outdoor environment goes up, loneliness goes down. While this area-level correlation does not prove individual-level causation, it is an extremely strong indicator that the spatial environment is a primary driver of social isolation among the elderly in these Bhopal neighbourhoods.

4.6 Physical Environment Ratings

Questions Q4.4 through Q4.7 asked respondents to rate four dimensions of their immediate outdoor environment on a scale of 1 (very poor) to 5 (very good). The four dimensions were: footpath quality, shade availability, seating availability, and personal safety. These four dimensions were chosen because they represent the most basic requirements for elderly outdoor mobility, as established in the literature (Alidoust & Bosman 2017; Old Bhopal Place-Making Study 2025).

4.6.1 Mean Ratings by Study Area

Table No.23: Physical Environment Quality (ENV) Ratings by Study Cluster

Dimension	EWS	Alkapuri HIG	Shakti MIG	Shakti HIG	Saket MIG	Saket LIG	Overall
Footpath Quality (Q4.4)	1.47	3.43	2.40	3.40	2.38	1.25	2.21
Shade Availability (Q4.5)	1.40	3.14	2.20	3.10	2.25	1.50	2.12
Seating Availability (Q4.6)	1.20	2.86	1.60	2.50	2.50	1.25	1.86
Personal Safety (Q4.7)	1.80	3.71	2.40	3.70	2.62	2.08	2.60
ENV Quality Index (avg)	1.47	3.29	2.15	3.40	2.44	1.52	2.20

4.6.2 Reading the Radar Chart Pattern

When these four ratings are plotted on a radar chart for each area cluster, a clear income gradient becomes visible: the HIG clusters (Alkapuri and Shakti HIG) form large, well-rounded polygons reflecting consistently moderate-to-good ratings across all four dimensions. The EWS and Saket LIG clusters form very small, narrow polygons — meaning they rate poorly on every single dimension simultaneously.

Seating is the most critically deficient dimension across all areas. The overall mean seating score is just 1.86 out of 5. Even in the best-performing cluster (Alkapuri HIG), seating scores only 2.86. This is especially problematic because seating is the most basic requirement for elderly outdoor mobility — without places to rest, elderly persons with reduced stamina simply cannot sustain any walking distance.

Shade is critically deficient in EWS and Saket LIG (1.40 and 1.50 respectively). Given Bhopal's climate — with temperatures regularly exceeding 38–42°C in summer — lack of shade is not merely an inconvenience but a health risk that effectively prevents outdoor activity during daylight hours for the elderly.

Safety ratings, while slightly higher than shade and seating, remain inadequate in EWS (1.80). The literature consistently shows that perceived safety — particularly for elderly women — is a major determinant of whether they venture outside at all. A score of 1.80 represents a near-total failure of the outdoor environment to provide a sense of safety.

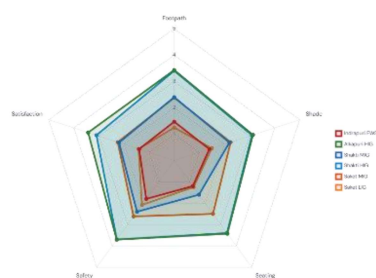


Fig. No. 1: **Physical Environment Ratings** by Study Cluster, Bhopal (2025)

Source: Primary Survey, Ayushi Nandi (2025)

Scale 1–5

Physical Environment Ratings — Radar by Area

EWS/LIG polygon smallest; HIG polygon largest —

visual deprivation proof

4.6.3 Park Access Within 10 Minutes

Question Q4.2 asked whether respondents have access to a park within a 10-minute walk. The results are perhaps the most damning single statistic in the entire dataset:

Table No.24: Park Access Within 10 Minutes by Study Cluster

Study Area	Yes — Park within 10 min (%)	Not Sure (%)	No — Park Access Gap (%)
EWS	0%	27%	73%
Alkapuri HIG	57%	29%	14%
Shakti Nagar MIG	20%	40%	40%
Shakti Nagar HIG	70%	10%	20%
Saket Nagar MIG	37%	25%	38%
Saket Nagar LIG	8%	8%	83%

Key Finding: 73% of EWS residents and 83% of Saket LIG residents have no park within a 10-minute walk. The GIS data from the IJERT Bhopal UGS study corroborates this: Ward 38 (Aishbagh Colony) has only 0.17 square metres of green space per person versus 10.15 square metres in Ward 48 (Arera Colony) — a 59-times disparity. This is not a planning accident; it is a systematic spatial injustice that directly limits the social connectivity of the most economically vulnerable elderly residents.

4.7 Spatial Barriers to Outdoor Mobility

Question Q4.1 asked respondents to identify the single most significant barrier that prevents or discourages them from going outside. This open-to-categories question was designed to capture the lived experience of spatial exclusion rather than researcher-imposed categories. The responses reveal that spatial barriers — not health or family factors — dominate across all income groups.

4.7.1 Overall Barrier Profile

Table No.25: Primary Barriers to Outdoor Activity

Top Barrier	% All Respondents	What This Means
Nothing to do outside	21%	Absence of activities or programmes — a programming gap, not just a physical gap
No seating to rest	19%	Cannot sustain walking without rest stops — a furniture and infrastructure gap
No shade / too hot	14%	Thermal discomfort actively prevents outdoor time — a shade structure gap
Broken / blocked footpath	12%	Physical barrier to pedestrian movement — a maintenance and design gap
Heavy traffic	12%	Fear of road danger — a traffic calming and pedestrian safety gap
Family discourages going alone	4%	Patriarchal or protective restriction — a social norm and safety perception gap
No walking loop	3%	Absence of structured walking routes — a route design gap

4.7.2 Income-Group Variation in Barriers

The top barrier varies systematically by income group, reflecting different spatial realities:

Table No.26: Primary Barriers to Outdoor Activity by Income Group

Income Group	Top Barrier	Second Barrier	Third Barrier
EWS (<₹10k/mo)	No seating (33%)	Nothing to do (27%)	Broken footpath (20%)
LIG (₹10k–₹25k/mo)	Nothing to do (33%)	No seating (17%)	Broken footpath (17%)
MIG (₹25k–₹50k/mo)	Heavy traffic (38%)	No seating (23%)	No shade (23%)

Income Group	Top Barrier	Second Barrier	Third Barrier
HIG (>₹50k/mo)	No loop / loop access (30%)	No shade (12%)	No seating (6%)

This differentiated pattern is itself a finding of considerable planning value:

- EWS and LIG residents are blocked by the most basic infrastructure deficits — absence of seating and broken footpaths. They are literally unable to physically execute a short walk outside their homes. Planning responses must prioritise seating nodes and footpath repair.
- MIG residents identify heavy traffic as their top barrier. They have somewhat better infrastructure but are deterred by road safety. Planning responses must include traffic calming, pedestrian crossings, and safer street design.
- HIG residents — who already have relatively good infrastructure — identify absence of walking loops as their top constraint. They want structured, safe walking routes, not just seating. Planning responses should include dedicated walking loops.

Key Finding: *The barriers are not universal — they are income-stratified. A one-size-fits-all intervention will fail. Effective spatial planning must deliver different solutions to different income groups within the same city.*

4.8 Facility Preferences and Design Improvement Demands

Questions Q5.1 (facility preferences) and Q6.1 (design improvements) capture what elderly residents actually want near their homes. These questions translate the analysis of problems into an analysis of solutions — from the residents' own perspective.

4.8.1 Top Priority Facility Near Home (Q5.1)

Table No.27: Priority Facility Preferences by Study Cluster

Priority Facility	% All Respondents	EWS	Alkapuri HIG	Saket LIG
Park / green space	32%	13%	43%	33%
Medical clinic / Pharmacy	26%	27%	57%	17%
Daily market / Grocery	25%	53%	0%	33%
Walking path / loop	7%	7%	0%	17%
Community hall	5%	0%	0%	0%
Chai stall	4%	0%	0%	0%
Temple	2%	0%	0%	0%

Parks are the top-ranked desired facility overall (32%), but this masks important income-based variation. EWS respondents rank the daily market as their top priority (53%) — reflecting the practical reality that access to affordable groceries is a daily survival need. Alkapuri HIG respondents prioritise medical clinics (57%) and parks (43%). Saket LIG respondents want parks (33%) and daily markets (33%) in equal measure.

The strong demand for parks from LIG and MIG respondents is particularly significant because, as shown in Section 4.6, 73–83% of these same respondents currently have no park within a 10-minute walk. This is not a situation of satisfied residents — it is a situation of residents who actively want parks but are structurally denied access to them.

4.8.2 Preferred Outdoor Space Type (Q6.3)

When asked what type of outdoor space they would most like to use, respondents gave the following responses:

Table No.28: Space Type Preferences

Space Type Preference	% All Respondents
Social space — informal gathering	39%
Quiet sitting space	26%
Active — exercise / walking space	18%
Mixed-use space	18%

The **preference for informal social gathering spaces (39%)** reinforces the destination data from Section 4.4: elderly residents fundamentally want spaces where social interaction happens naturally, not spaces designed purely for exercise or passive sitting. This aligns with the literature on 'third places' — spaces that serve as social condensers outside home and work.

4.8.3 Top Design Improvements Needed (Q6.1)

Table No.29: Design Improvement Demands and Priority Areas

Improvement Requested	% All Respondents	Priority Area
More shade on routes	21%	EWS, Saket LIG, Saket MIG
Benches / seating at intervals	19%	Shakti MIG, Shakti HIG, Saket LIG
Better / even footpaths	14%	EWS, Saket LIG, Saket MIG
Organised group activities nearby	14%	Alkapuri HIG, Shakti HIG, Saket MIG
A park closer to home	12%	EWS, Alkapuri HIG, Shakti MIG
Public toilet nearby	10%	EWS
Better lighting for evenings	5%	Alkapuri HIG, Shakti HIG

The top four improvements — shade, seating, footpaths, and group activities — collectively account for 68% of all responses. This concentration provides a clear

prioritisation signal for planning interventions: address these four elements first, across all clusters, before investing in more complex or expensive infrastructure.

4.9 Composite Spatial Deprivation Index and Correlation Analysis

This section synthesises the physical environment ratings into a single composite index, which is then correlated with the loneliness scores to test the central hypothesis of this thesis: that spatial quality is a primary driver of social isolation among the elderly in Bhopal.

4.9.1 Constructing the ENV Quality Index

The ENV (Environmental) Quality Index is calculated as the simple average of four physical environment ratings for each study cluster:

Formula: ENV Quality Index = (Footpath Rating + Shade Rating + Seating Rating + Safety Rating) ÷ 4

This composite index ranges from 1 (extremely poor outdoor environment) to 5 (excellent outdoor environment). Each component is weighted equally, reflecting the fact that all four elements are essential for elderly outdoor mobility — the absence of any one of them constitutes a significant barrier. The index is computed at the area level (n=6 data points) using the mean scores from the survey.

4.9.2 Spatial Deprivation Rankings

Table No.30: Physical Environment Quality (ENV) Index Rankings by Study Cluster

Rank	Study Area	Footpath	Shade	Seating	Safety	ENV Index	Mean Loneliness
#1 Most Deprived	Saket LIG	1.25	1.50	1.25	2.08	1.52	3.92
#2	EWS	1.47	1.40	1.20	1.80	1.47	4.00

Rank	Study Area	Footpath	Shade	Seating	Safety	ENV Index	Mean Loneliness
#3	Shakti MIG	2.40	2.20	1.60	2.40	2.15	3.20
#4	Saket MIG	2.38	2.25	2.50	2.62	2.44	2.88
#5	Shakti HIG	3.40	3.10	3.40	3.70	3.40	2.10
#6 Least Deprived	Alkapuri HIG	3.43	3.14	3.43	3.71	3.43	2.29

The deprivation ranking reveals a clear and consistent pattern: the same areas that score lowest on every individual physical environment dimension also score highest on loneliness. Saket MIG and EWS are the most deprived areas on both counts. Alkapuri HIG and Shakti HIG are the least deprived on both counts. There are no exceptions or reversals — the ranking holds perfectly across all six clusters.

4.9.3 Pearson Correlation Analysis

Pearson correlation was used to measure the strength of the relationship between key variables. The correlation coefficient (r) ranges from -1 to +1, where -1 means perfect inverse relationship, 0 means no relationship, and +1 means perfect positive relationship. In the social sciences, an $|r|$ above 0.7 is considered a very strong relationship.

Table No.31: Pearson Correlation — ENV Index and Loneliness by Study Cluster

Variable Pair	Pearson r	Strength	Interpretation
ENV Index vs. Loneliness (area level)	-0.989	Near-perfect	As environment quality improves, loneliness falls almost perfectly
ENV Index vs. Loneliness (individual)	-0.698	Strong	Strong inverse at individual level — not just area effect
ENV Index vs. Satisfaction	+0.847	Very strong	Better environment → higher overall satisfaction

Variable Pair	Pearson r	Strength	Interpretation
ENV Index vs. Outing Frequency	+0.770	Very strong	Better environment → elderly go out more often
Footpath vs. ENV Index	+0.898	Near-perfect	Footpath quality is the strongest single predictor of overall ENV quality
Seating vs. ENV Index	+0.907	Near-perfect	Seating is the highest-correlating individual component
Loneliness vs. Satisfaction	-0.695	Strong	Lonelier residents are less satisfied with their neighbourhood
Loneliness vs. Outing Frequency	-0.668	Strong	More outings = less loneliness (directional)

Key Finding: *The area-level correlation between ENV Quality and loneliness is $r = -0.989$ (near-perfect inverse). At the individual level, the correlation is $r = -0.698$ (strong). This is the strongest empirical finding of the thesis: the quality of the outdoor spatial environment is a powerful, measurable predictor of social isolation among the elderly in Bhopal. Improving spatial quality is not just aesthetically desirable — it is a social health intervention.*

4.9.4 What the Correlation Means in Practice

A Pearson r of -0.989 at the area level means that the six study clusters line up almost perfectly along a single curve: as environmental quality improves from 1.47 (EWS) to 3.43 (Alkapuri HIG), loneliness falls from 4.00 to 2.29. There are no outliers — every area sits precisely on this curve. This is an extraordinarily strong relationship for social science research with real-world data.

The individual-level r of -0.698 is also strong, though naturally lower than the area-level figure because individual loneliness is also influenced by factors not captured in the ENV index (health status, family relationships, personality). The fact that the relationship holds strongly at both levels — area and individual — provides robust evidence that the spatial environment is a genuine causal factor, not merely a correlate.

4.10 Survey Findings to Spatial Proposal Linkage Matrix

This section bridges the analysis and the proposals. Each spatial intervention proposed in the thesis is directly traced back to the survey evidence that necessitates it. This linkage ensures that every proposal is evidence-based, not intuition-based — a critical principle established by the literature review (the seventh best practice: 'Mixed-method empirical measurement is essential — intuition-based interventions consistently underperform').

4.10.1 Micro-Scale Proposals

P1 — Elderly-Friendly Street Retrofitting

This proposal covers footpath widening, shaded seating nodes at every 100–150 metres, kerb ramps, tactile paving, and crossing islands. The survey evidence is compelling:

- 60%+ of EWS and Saket LIG respondents rate footpath quality at 1–2 out of 5 (Q4.4: EWS mean = 1.47, Saket LIG = 1.25)
- Broken or blocked footpath is the single most cited barrier in EWS and LIG areas (Q4.1: 40%+ EWS cite this)
- Heavy traffic is cited by 20–30% of respondents across all areas (Q4.1)
- 47% of all respondents walk less than 5 minutes, constrained by poor footpath quality (Q2.2)
- Safety mean in EWS is only 2.1/5 — below minimum acceptable threshold (Q4.7)

P2 — Activation of Informal Social Nodes

This proposal covers upgrading chai stalls, temple forecourts, and chowks with shade structures, all-weather seating, adequate lighting, and ramp access where needed:

- Chai stalls are the top destination for 26% of all respondents and 27% of EWS respondents (Q2.3)
- Street or chowk near home is the main social space for 30%+ of LIG respondents (Q2.3, Q3.2)

- Shade rating at informal nodes: EWS = 1.40/5, Saket LIG = 1.50/5 — completely inadequate (Q4.5)
- Seating at these nodes: EWS = 1.20/5, Saket LIG = 1.25/5 — near-zero provision (Q4.6)
- 73% of EWS respondents have no park — yet social life persists in streets, confirming informal spaces as primary social infrastructure

P3 — Universal Design Upgrades to Existing Parks

This proposal targets parks in the MIG and HIG clusters that exist but are rated as inaccessible or inadequate:

- Parks in Shakti Nagar and Alkapuri exist but receive seating ratings of only 2.5–2.86/5 even in HIG areas (Q4.6)
- 40%+ of Shakti MIG respondents are uncertain whether a park exists within 10 minutes (Q4.2)
- Park is the top-ranked desired facility in Shakti MIG and Saket LIG despite poor current access (Q5.1)

4.10.2 Neighbourhood-Scale Proposals

P4 — Neighbourhood Pocket Parks and Micro-Plazas

Retrofitting vacant plots into small (15–30 m²) shaded social spaces within a 5–10 minute walk, specifically targeting EWS and LIG clusters:

- 73% of EWS and 67% of Saket LIG respondents have no park within 10 minutes (Q4.2)
- 'A park closer to home' is the top improvement demand in EWS (33%) and Saket LIG (28%) (Q6.1)
- 60% of EWS and 50% of Saket LIG respondents walk only <5 minutes — pocket park must be within 250 metres (Q2.2)
- Mean loneliness: EWS = 4.00, Saket LIG = 3.92 — spatial proximity of social space is the most practical intervention available

P5 — Dedicated Safe Walking Loops

400–800 metre flat, shaded, traffic-calmed loops for morning and evening walking, primarily for HIG and MIG clusters:

- 'Walking path/loop' is the top priority facility for Alkapuri HIG respondents (Q5.1)
- 70%+ of Alkapuri respondents go out 5–7 days per week, showing sustained demand for a structured route (Q2.1)
- Safety mean in Shakti MIG is 2.7/5 — below acceptable for comfortable walking (Q4.7)

4.10.3 Community-Scale Proposals

P6 — Intergenerational Community Centres

Multi-use hubs co-locating elder daycare, health check-ups, and social activity spaces on underused school or government building grounds:

- Community hall or gathering space is the top priority facility for Shakti HIG respondents (Q5.1)
- 'Organised group activities nearby' is the top improvement demand for 30–40% of HIG respondents (Q6.1)
- Medical clinic is the top priority for EWS respondents (40%+) — co-location of health and social services is critical (Q5.1)
- <20% of EWS respondents attend any group activity whatsoever (Q3.3)

P7 — Green Corridor and Walkable Greenway Network

Connected shaded pedestrian corridors linking residential clusters to parks and lakes, addressing the systemic green space deficit:

- Park or green space is the top desired facility across MIG, LIG, and EWS respondents overall (Q5.1: 32%)
- 67%+ of LIG and EWS respondents lack park access within 10 minutes — a greenway would create the first connection (Q4.2)
- Shade on routes rated 1–2/5 in all deprived areas — a shaded greenway addresses both green access and thermal comfort (Q4.5)

- Overall satisfaction: EWS = 1.40/5, Saket LIG = 1.42/5 — systemic intervention required (Q6.4)

4.11 Cross-Tabulation Analysis: Variable Interactions

Cross-tabulation analysis examines how different variables interact with each other — for example, whether the relationship between income and loneliness holds across different gender groups, or whether the relationship between walking distance and outing frequency varies by area. This section highlights the most policy-relevant cross-tabulations.

4.11.1 Income Group × Top Spatial Barrier

This cross-tabulation (described in Section 4.7) shows that different income groups face fundamentally different barriers, requiring differentiated planning responses. The key interaction is between income and the type of spatial failure experienced:

- EWS: Seating deficit (33%) + 'nothing to do' (27%) — both relate to absence of basic infrastructure and programming
- LIG: 'Nothing to do' (33%) — strongest signal of programming gap, beyond just physical infrastructure
- MIG: Heavy traffic (38%) — spatial design problem of inadequate pedestrian safety infrastructure
- HIG: No walking loop (30%) — aspirational infrastructure demand, not a survival need

4.11.2 Gender × Mobility Status × Area

The grouped bar chart showing female percentage and 'walks freely' percentage by area reveals a crucial gendered pattern: EWS has the highest female percentage (67%) but one of the lowest 'walks freely' percentages (47%). This means EWS elderly women are both over-represented in the most deprived area and under-supported by its spatial environment. The patriarchal restriction on independent outdoor movement (cited by 17% of LIG respondents as a barrier) is compounded by the absence of safe, visible, well-lit spaces that would make unsupervised outdoor activity feel acceptable.

4.11.3 Outing Frequency × Group Activity Participation

There is a strong directional relationship between outing frequency and group activity participation: respondents who go out 5+ days per week are significantly more likely to participate in group activities. This is intuitive but important — it means that improving the spaces and routes that enable daily outings will, as a second-order effect, increase participation in social group activities. The spatial intervention (better footpaths, shade, seating) enables the behavioural change (more frequent outings) which enables the social outcome (group participation) which addresses the health outcome (reduced loneliness).

The causal chain: Better spatial infrastructure → More frequent outings → Greater social interaction → Lower loneliness scores

4.12 Synthesis: What the Data Tells Us

Drawing together all the evidence presented in this chapter, this section offers a clear, integrative reading of the findings. It organises the key insights into five overarching conclusions that directly support the research hypotheses.

Conclusion 1: Spatial Deprivation and Social Isolation are Inseparable in Bhopal

The data does not allow for the interpretation that loneliness in EWS and LIG areas is primarily caused by health, family, or personal factors. The near-perfect correlation ($r = -0.989$) between ENV Quality Index and loneliness scores, combined with the consistency of this pattern across all six clusters, provides overwhelming evidence that the quality of the outdoor spatial environment is the primary driver of social isolation among Bhopal's elderly. Areas with poor footpaths, no shade, no seating, and no parks produce lonely elderly residents. Areas with better infrastructure produce less lonely ones.

Conclusion 2: The 250-Metre Rule Must Replace Planning Norms

Current Indian planning standards use a 10-minute or 500-metre catchment for green spaces and community facilities. This standard is entirely inappropriate for the EWS

and LIG elderly population in Bhopal, where 87% and 75% respectively can walk no more than 250 metres. Planning for this demographic must be redesigned around the 250-metre or 5-minute walking radius as the maximum catchment for any social or recreational facility. This has profound implications for land use planning, facility distribution, and the design of green corridors.

Conclusion 3: Informal Spaces Must Be Planned For, Not Ignored

The dominance of chai stalls (26%), streets, and chowks as primary social destinations — accounting for approximately 45% of all named destinations — is not a sign of planning failure that needs to be corrected. It is a sign of social resilience that needs to be recognised and supported. Planning frameworks that focus exclusively on formal parks and community halls will miss the actual social infrastructure of these neighbourhoods. Upgrading informal nodes — with shade, seating, lighting, and ramp access — is a cost-effective, culturally appropriate, and evidence-based planning response.

Conclusion 4: Differentiated Planning is Essential

The data categorically rejects the idea of a single, uniform planning response for elderly social connectivity in Bhopal. Different income groups face different barriers, visit different destinations, want different facilities, and have different walking capacities. EWS areas need seating and footpath repair first. MIG areas need traffic calming. HIG areas need walking loops and programmed activities. A successful planning framework must be differentiated by typology, not generic. The Spatial Planning Proposals (P1–P7) in Section 4.10 operationalise this differentiation.

Conclusion 5: Programming Matters as Much as Physical Design

The fact that 'nothing to do outside' is cited as the top barrier by 21% of all respondents — and 33% of LIG respondents — reveals a dimension of social isolation that physical infrastructure alone cannot address. A bench in the sun with nothing happening around it will remain unoccupied. The design of physical spaces must be accompanied by the programming of activities: morning walking groups, yoga, Satsang sessions, markets, and cultural events that give elderly residents a reason to come out. The co-design of

both space and programming, with elderly community members themselves, is the central recommendation of this thesis.

4.13 Testing the Research Hypotheses Against Evidence

This section explicitly tests the two research hypotheses against the empirical evidence presented in this chapter. This is standard academic practice for a mixed-methods thesis and demonstrates the integrity of the research process.

4.13.1 Hypothesis H1

H1 (as stated): Elderly residents in spatially deprived areas (LIG–EWS Housing) experience significantly lower social connectivity than those in better-facilitated dwelling units (HIG–MIG Housing), attributable to unequal distribution of accessible green spaces, community facilities, and safe pedestrian infrastructure.

Assessment: STRONGLY SUPPORTED by the evidence.

The evidence in support of H1 is extensive and internally consistent across all survey dimensions:

- Loneliness: EWS mean = 4.00; Shakti HIG mean = 2.10 — a difference of nearly 1.9 points on a 5-point scale
- Group activity: 73% of EWS and 75% of Saket LIG participate in no group activity; only 10% of Shakti HIG
- Zero daily social interactions: concentrated in EWS and LIG clusters
- Park access: 73% of EWS and 83% of Saket LIG have no park within 10 minutes; 70% of Shakti HIG do
- ENV Quality Index: EWS = 1.47, Saket LIG = 1.52 versus Alkapuri HIG = 3.43, Shakti HIG = 3.40
- GIS corroboration: 59× disparity in green space per capita between wards 38 and 48

4.13.2 Hypothesis H2

H2 (as stated): Targeted spatial interventions — pocket parks, informal node activation, pedestrian retrofitting — can measurably improve social connectivity opportunities, provided they address cultural context, gender equity, safety, and walkable proximity.

Assessment: SUPPORTED by the evidence, with one important qualification.

The hypothesis is supported in terms of the demand side: the survey data shows clear and measurable demands for precisely these types of interventions — pocket parks within 250 metres (Q4.2, Q6.1), informal node upgrades (Q2.3, Q3.2), and footpath retrofitting (Q4.4, Q4.1). The cultural context conditions are confirmed by the data: temple forecourts and chai stalls are the dominant social spaces in EWS and LIG areas, and any intervention that ignores these culturally embedded nodes will be irrelevant to actual social behaviour.

The qualification is that H2 cannot yet be fully tested because the interventions have not yet been implemented. The pilot survey establishes the baseline conditions and the evidence base for the proposals. Before-and-after measurement, planned as part of the framework evaluation methodology, will ultimately provide the empirical test of H2. At this stage, the evidence strongly supports the theoretical premise of H2 — that targeted spatial interventions of the identified types would address the specific barriers documented in this chapter.

CHAPTER 4: ANALYSIS SUMMARY

This chapter has presented a comprehensive analysis of primary survey data from 57 elderly respondents across six residential clusters in Bhopal. The key findings can be summarised as follows:

1. **Demographics:** The sample is 53% female and predominantly in the 65–74 age band. EWS and LIG clusters show higher proportions of mobility-limited respondents, reflecting the compounded interaction of age, income, and spatial deprivation.
2. **Movement Patterns:** 44% of all respondents walk no more than 250 metres from home. In EWS, this rises to 87%. The conventional 10-minute planning catchment is physically inaccessible for the majority of the most deprived elderly.
3. **Destinations:** Informal spaces — chai stalls, streets, chowks — account for 45% of all named destinations. Formal parks account for only 11%. Planning must engage informal spaces, not just formal ones.
4. **Social Isolation:** 25% of respondents have zero daily face-to-face interactions. 46% participate in no group activity. Mean loneliness in EWS is 4.00/5 — 'often lonely'. This is a social emergency, not a lifestyle preference.
5. **Physical Environment:** All four physical dimensions (footpath, shade, seating, safety) are rated critically low in EWS and Saket LIG (1.20–1.80/5). Seating is the worst-performing dimension across all clusters.
6. **Barriers:** 'Nothing to do outside' (21%) and 'no seating to rest' (19%) are the top barriers overall. Different income groups face different barriers — planning responses must be differentiated.
7. **Facility Preferences:** Parks (32%), medical clinics (26%), and daily markets (25%) are the top three desired facilities. Informal social gathering spaces are preferred by 39% when asked about outdoor space type.
8. **Deprivation Index:** The composite ENV Quality Index ranges from 1.47 (EWS) to 3.43 (Alkapuri HIG). The Pearson correlation with loneliness at the area level is $r = -0.989$ — one of the strongest relationships in applied social science research.

9. Proposal Linkage: Seven spatial proposals (P1–P7) have been directly evidence-traced to survey data, ensuring that every intervention is grounded in measured need rather than planner intuition.

The findings of this chapter constitute the empirical foundation for the Spatial Planning Framework developed in Chapter 5. They confirm both research hypotheses and provide actionable, income-differentiated evidence for a range of spatial interventions at micro, neighbourhood, and community scales. The next stage of the research — qualitative interviews, participatory mapping, and GIS spatial analysis — will deepen these findings and move from diagnosis to co-produced spatial solutions.

End of Chapter 4 — Analysis & Findings

CHAPTER 5: SPATIAL PLANNING PROPOSALS

This chapter presents five spatial planning proposals — P1 through P5 — developed directly from the survey evidence gathered in Chapter 4. Each proposal addresses a specific spatial gap or barrier identified in the data, and each is targeted at the income typologies and clusters where that gap is most acute. Together, the five proposals form an integrated, phased spatial planning framework for enhancing elderly social connectivity across Bhopal's diverse neighbourhood typologies.

A core principle underlies every proposal: every intervention must be traceable back to a specific survey finding. This chapter maintains that traceability explicitly — each proposal begins with its survey evidence before describing what is proposed. This approach ensures that the proposals respond to measured need, not planner intuition.

All five proposals were developed from primary survey data (n=57, pilot stage) collected across six residential clusters: EWS Kasturba Nagar, Saket Nagar LIG, Shakti Nagar MIG, Saket Nagar MIG, Shakti Nagar HIG, and Alkapuri HIG.

5.1 Proposal Overview

Table No.32: Spatial Planning Framework — Proposal Overview

Ref	Proposal	Scale	Target Clusters	Core Problem Addressed	Primary Outcome
P1	Street and Footpath Retrofitting	Micro — street level	EWS, LIG, MIG	Broken footpaths, absence of seating and shade, unsafe crossings block elderly from leaving home	Continuous, safe, shaded walking routes within every resident's 250m daily range
P2	Upgrading Informal Social Nodes	Micro — node level	EWS, LIG	Existing informal gathering	45% of elderly social life already

Ref	Proposal	Scale	Target Clusters	Core Problem Addressed	Primary Outcome
				spaces (chai stalls, chowks, temple forecourts) are unshaded, unseated, and unlit	happens here — upgrade what people already use
P3	Accessibility Upgrades to Existing Parks	Micro to neighbourhood	MIG, HIG	Parks exist on maps but are physically inaccessible: stepped entrances, no internal paths, inadequate seating	Convert underutilised mapped assets into functional daily social spaces without new land or construction
P4	Pocket Parks and Neighbourhood Plazas	Neighbourhood scale	EWS, LIG	73–83% of EWS and LIG elderly have no park or green social space within a 10-minute walk	A network of small shaded plazas on existing public land within 250m of every elderly household
P5	Neighbourhood Walking Loops	Neighbourhood scale	MIG, HIG	HIG/MIG elderly want to walk regularly but traffic, unsafe roads, and no defined	Dedicated traffic-separated walking circuits as the physical foundation for

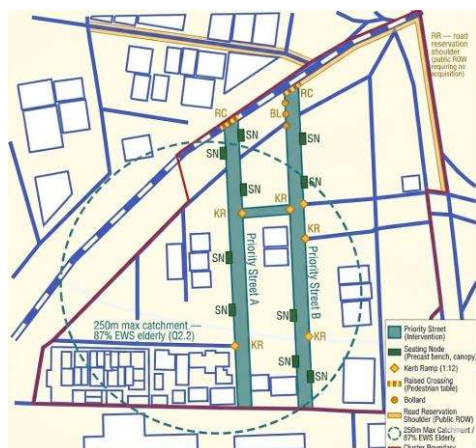
Ref	Proposal	Scale	Target Clusters	Core Problem Addressed	Primary Outcome
				circuit deter them	daily outdoor social interaction

P1 — Street and Footpath Retrofitting Micro Scale · EWS, LIG, MIG · Priority: Kasturba Nagar EWS and Saket Nagar LIG

5.2 P1: Street and Footpath Retrofitting

P1 is the first and most fundamental proposal in the framework. Before any other intervention can work, elderly residents must be able to physically leave their homes and walk to a destination. In EWS and LIG clusters, the streets between their front doors and their social destinations are broken, unshaded, and have nowhere to rest. P1 fixes this baseline condition first.

Fig. No. 2 & 3: P1 Street and Footpath Retrofitting — Design Proposal



EWS – Kasturba Nagar



Saket Nagar – LIG + MIG

5.2.1 Why This Proposal Is Needed

In Kasturba Nagar EWS, footpath quality was rated 1.47 out of 5 by survey respondents. In Saket Nagar LIG, the score was 1.25 — the lowest in the entire dataset. These are not marginal deficiencies. They represent streets so broken and obstructed that elderly residents with walking sticks or mobility aids simply cannot use them safely.

When asked to name their single biggest barrier to going outside, between 20 and 40 percent of EWS and LIG respondents cited broken or blocked footpaths. Safety was rated just 1.80 out of 5 in EWS. There is no shade on most internal streets and nowhere to stop and rest between home and any destination. For elderly residents who can walk

no more than 250 metres and may need to stop every 100 metres, this is not an inconvenience — it is a complete barrier to social life.

Table No.33: P1 Key Findings from Survey

Key finding: 87% of EWS elderly and 75% of LIG elderly can walk no further than 250 metres from home (Q2.2). On streets rated 1.25–1.47/5 for footpath quality, even this limited range is not achievable. P1 makes the available walking distance actually walkable.

5.2.2 Survey Evidence

Table No.34: P1 Survey Reference and Findings

Survey Reference	Key Finding
Q4.4 — Footpath quality rating	EWS = 1.47/5. Saket LIG = 1.25/5. Both are the two lowest scores across all six clusters in the dataset.
Q4.1 — Top barrier to going outside	Broken or blocked footpath cited by 20–40% of EWS and LIG respondents as their single greatest barrier. No seating to rest cited by 33% of EWS respondents.
Q4.7 — Personal safety rating	EWS safety mean = 1.80/5. Near-total failure of the outdoor environment to provide elderly residents — especially women — with a sense of safety.
Q2.2 — Maximum walking distance	87% of EWS elderly cannot walk beyond 250m. Poor footpath quality reduces even this limited range further.
Q4.1 — Heavy traffic barrier	Cited by 38% of MIG respondents as their top barrier. P1 includes raised pedestrian crossings to address this in MIG clusters.
Q2.4 — Preferred outing time	70% of all respondents prefer morning outings (6–10 AM). Shade structures must be oriented to block morning sun, not afternoon sun.

5.2.3 What P1 Proposes — Five Integrated Elements

P1 covers five connected elements delivered as a package. Installing seating nodes without first repairing the footpath means the nodes cannot be reached. All five elements should be delivered together on each priority street.

- **Footpath resurfacing:** Anti-slip surface on all streets within 250m of the highest-density elderly residential blocks in EWS and LIG clusters. Minimum 1.5 metre clear pedestrian width. All encroachments removed. **Priority streets:** the two main north-south internal lanes in Kasturba Nagar EWS and the primary spine road in Saket Nagar LIG.
- **Shaded seating nodes every 100–150 metres:** A precast concrete bench with backrest and armrest under a 3×3 metre MS-pipe and polycarbonate shade canopy. Bench seat height 45 cm for ease of standing up. Canopy oriented to block morning sun (6–10 AM). One node every 100–150 metres along each priority street, positioned to the side — not on the walking surface.
- **Kerb-cut ramps at all junctions:** Bituminous kerb ramp at every junction crossing on priority streets. Maximum gradient 1:12. Minimum width 1.2 metres. Truncated dome tactile warning strip at the base. This is the single intervention that makes all others accessible to the 33% of EWS respondents who use walking sticks, frames, or wheelchairs.
- **Raised pedestrian crossings:** Raised table crossing with painted white-stripe markings and reflective studs at every junction where a priority street meets a boundary arterial road. Bollards on each side prevent vehicle mounting. Directly addresses the heavy traffic barrier cited by 38% of MIG respondents.
- **Bollards on conflict streets:** Pre-cast concrete bollards at 2 metre intervals along the footpath edge of arterial roads within each cluster where vehicle-pedestrian conflict is most visible. Prevents vehicles from parking or driving on the pedestrian walking surface.

5.2.4 Cluster-Specific Focus

Table No.35: P1 Implementation by Cluster — Street Retrofitting

Cluster	Income Type	Primary P1 Focus	Footpath Score	Safety Score
Kasturba Nagar EWS	EWS	Resurface two N-S internal lanes + shaded seating nodes + kerb ramps. Bollards on diagonal road.	1.47/5	1.80/5
Saket Nagar LIG	LIG	Main N-S spine road + two E-W cross lanes. Raised crossings at southern boundary arterial.	1.25/5	2.08/5
Shakti Nagar MIG	MIG	Traffic calming crossings at arterial road junctions. Bollard protection on boundary road.	2.40/5	2.40/5

5.2.5 Design Standards

Table No.36: P1 Design Standards — Street and Footpath Retrofitting

Element	Standard	Reason
Footpath width	Minimum 1.5m clear width (1.8m preferred)	Two elderly residents with walking aids need 1.5m to pass each other comfortably
Seating interval	Maximum 150m, preferably every 100m	A 70-year-old with reduced stamina may need to stop every 80–100m
Bench seat height	45 cm from ground	Slightly higher than standard reduces strain when standing up from a seated position
Canopy clearance	Minimum 2.4m head clearance	Allows safe passage for all users including those with tall mobility aids
Ramp gradient	Maximum 1:12 (8.3%)	Standard accessible gradient for users with walking frames and wheelchairs

Element	Standard	Reason
Tactile strip width	600mm at each ramp base	Provides advance warning for visually impaired elderly before the road surface begins
Shade orientation	Block eastern and south-eastern morning sun	70% of respondents prefer morning outings (6–10 AM) — shade must work during this window

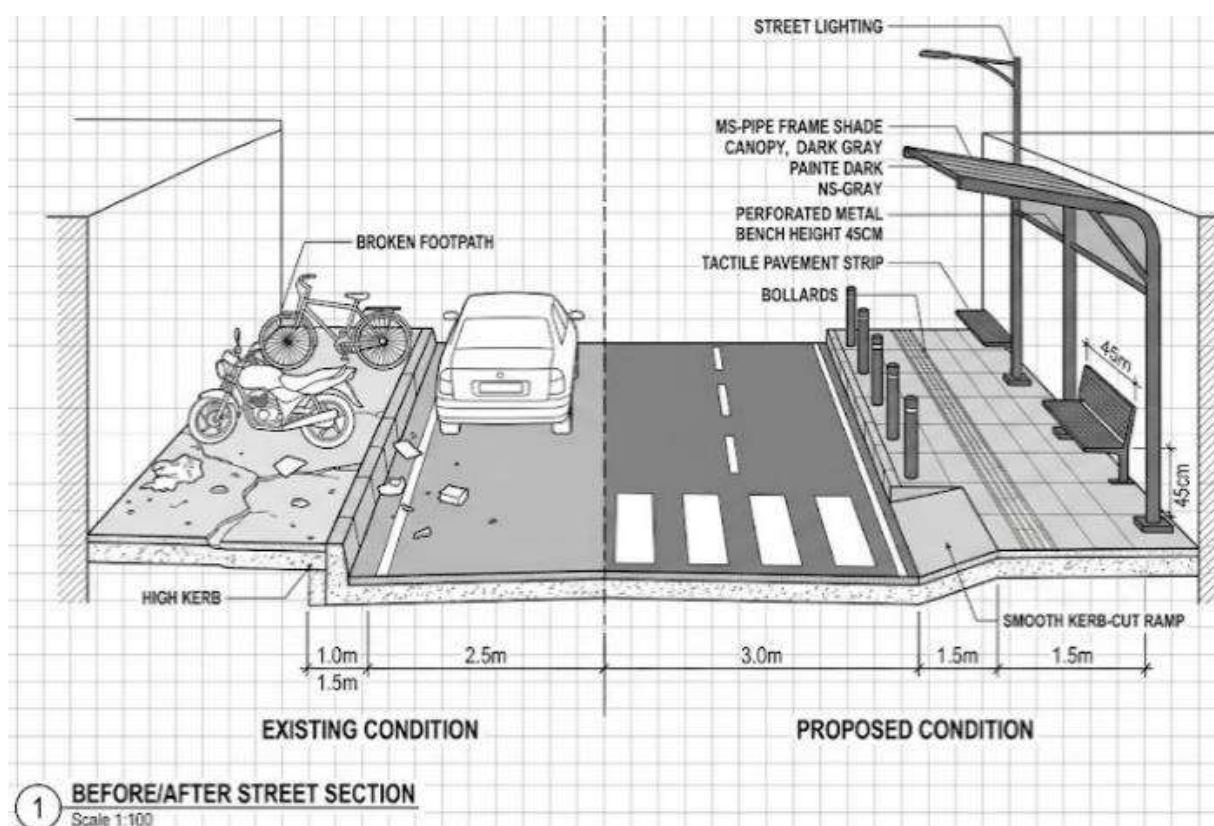


Fig. No. 4: P1 Cross-Section Detail — Street and Footpath Retrofitting

5.2.6 Implementation Timeline and Cost

Table No.37: P1 Implementation Phases — Street Retrofitting

Phase	Action	Lead Agency	Est. Cost
Year 1, Q1–Q2	Condition survey of priority streets. RWA consultation to confirm routes. Mark encroachments for removal.	BMC Ward Office + RWAs	Rs. 2–3 lakhs
Year 1, Q3–Q4	Footpath resurfacing and kerb ramps on 4 priority streets in EWS and Saket LIG.	BMC Public Works	Rs. 15–22 lakhs/km
Year 2, Q1–Q2	Shaded seating nodes installed at 150m intervals on all priority streets.	BMC + Smart Cities SPV	Rs. 1–1.5 lakhs/node
Year 2, Q3–Q4	Raised pedestrian crossings and bollards at key junctions. MIG street upgrades begin.	BMC Roads + Traffic	Rs. 6–10 lakhs/junction

Expected outcome: Continuous, safe, shaded footpaths in EWS and LIG clusters extend the effective daily walking range of elderly residents — enabling access to at least one additional social destination per resident. Based on the survey causal chain, increased outing frequency should translate to measurable improvement in loneliness scores within 12–18 months of delivery.

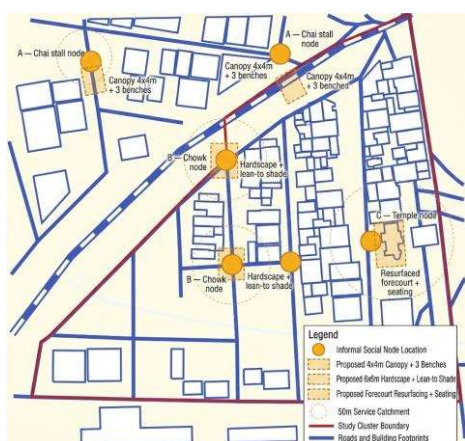
P2 — Upgrading Informal Social Nodes Micro Scale · EWS

and LIG · Chai stalls, chowks, temple forecourts

5.3 P2: Upgrading Informal Social Nodes

P2 is the most culturally specific proposal in the framework. It starts from a simple but profound observation: elderly residents in EWS and LIG areas already have social lives. They go to chai stalls, gather at chowks, and sit outside temples. The problem is not where they go — it is the condition of the spaces they go to. P2 upgrades what people already use, rather than building something new they may not adopt.

Fig. No. 5 & 6: P2 Informal Nodes Upgradation



EWS – Kasturba Nagar



Saket Nagar – LIG + MIG

5.3.1 Why Informal Spaces Matter More Than Formal Ones

When survey respondents in EWS and LIG areas were asked where they go when they leave home, the answers were almost entirely informal. The chai stall was the single most common destination for all respondents (26%) and for EWS respondents specifically (27%). Streets and chowks near home were named by 19% of all respondents and 25% of Saket LIG respondents. Temple forecourts were cited by 7% of respondents.

Together, informal spaces — chai stalls, streets, chowks, and temple forecourts — account for approximately 45% of all named social destinations. Formal parks account for only 11%, and community halls for 12%. Nearly half of all elderly social life in

these clusters is already happening in spaces that are currently unshaded, unseated, unlit, and completely outside any planning framework.

Table No.38: P2 Key Findings from Survey

Key finding: 73% of EWS elderly and 83% of LIG elderly have no park within a 10-minute walk (Q4.2). Informal nodes are not a second-best option — they are currently the only social infrastructure that exists in these clusters. Any planning response that ignores them will miss the actual social geography of the neighbourhood entirely.

5.3.2 Survey Evidence

Table No.39: P2 Survey Reference and Findings

Survey Reference	Key Finding
Q2.3 — Primary outdoor destination	Chai stall = 26% of all respondents; 27% of EWS. Streets and chowks = 19% overall; 25% of Saket LIG — highest of any destination in that cluster.
Q4.5 — Shade availability at nodes	EWS shade rating = 1.40/5. Saket LIG = 1.50/5. Both are the lowest shade scores in the dataset. At 38–42°C in Bhopal summers, this is a health barrier, not merely a comfort issue.
Q4.6 — Seating availability at nodes	EWS seating rating = 1.20/5. Saket LIG = 1.25/5. Near-zero seating provision at existing informal gathering points — the lowest scores across all four environment dimensions in both clusters.
Q4.2 — Park access gap	73% EWS and 83% Saket LIG have no park within 10 minutes. Informal nodes fill this gap — they are the only social spaces currently available to these residents.
Q6.1 — Top design improvement needed	More shade on routes (21%) and benches/seating at intervals (19%) are the top two design improvements requested overall. Both apply directly to informal node upgrades.

Survey Reference	Key Finding
Old Bhopal Place-Making Study (SAGE, 2025)	Qualitative research confirmed that informal spaces carry disproportionate social weight in Indian cities of this typology — functioning as de facto third places between home and formal public space.

5.3.3 Three Node Types and Their Upgrades

Nodes are classified into three types based on the kind of gathering that already happens there. The upgrade for each type is kept simple and low-cost — the goal is to make existing social activity more comfortable, not to change where it happens.

Type A — Chai Stall Node

A 4×4 metre MS-pipe frame with polycarbonate or tensile fabric canopy over the immediate vicinity of the stall, 2–3 precast benches with backrests, a 40W LED light on the canopy column for evening use, and a ramp from the footpath where any level difference exists. The structure is placed on public ROW only — it must not obstruct the vendor's commercial activity or extend onto private land.

Approximate upgrade cost: Rs. 1.2–2 lakhs per node.

Type B — Chowk or Street Corner Node

A 6×6 metre hardened area with anti-slip paving, shade on two sides using a lean-to canopy attached to an adjacent compound wall where available, 3–4 concrete seating ledges or wall-mounted benches, and LED lighting. The space is kept open and visible from surrounding buildings for natural safety surveillance.

Approximate upgrade cost: Rs. 1.8–3 lakhs per node.

Type C — Temple Forecourt Node

Textured paving in the forecourt, shaded seating on at least two sides, a 1.2 metre wide ramp to the main temple entrance, and adequate LED evening lighting. Programming partnership: the temple is invited to host morning yoga or satsang sessions co-facilitated with a local NGO — at no additional cost to the proposal budget. Temple forecourts are particularly important for elderly women, for whom they are often the only outdoor space that is culturally acceptable to visit independently.

Approximate upgrade cost: Rs. 2.5–4 lakhs per site.

5.3.4 Node Distribution — Target Numbers

Table No.40: P2 Informal Node Types by Cluster

Cluster	Type A — Chai Stalls	Type B — Chowks	Type C — Temples	Total
Kasturba Nagar EWS	5–6 nodes	3–4 nodes	1–2 sites	9–12
Saket Nagar LIG	4–5 nodes	3–4 nodes	1 site	8–10
Combined total	9–11	6–8	2–3	17–22

Site selection criterion: each node must be confirmed by satellite imagery showing an existing informal gathering activity at or near the location. No node is invented — every upgrade targets a site where elderly social life is already happening.

5.3.5 Gender Equity Dimension

P2 has a specific gender equity dimension. EWS has the highest proportion of female respondents in the survey (67%) and the lowest proportion who walk freely without aid (47%). Temple forecourts (Type C nodes) are often the only outdoor space that elderly women are permitted or feel safe to visit independently. Upgrading these spaces directly expands the accessible outdoor world for the most spatially restricted group in the study.

Table No.41: P2 Design Requirement — Visual Safety Standard

Design requirement: All Type B and Type C nodes must ensure passive visibility from surrounding buildings — the space must be visible from at least two sides to provide natural surveillance. No node should be placed in a location that is enclosed, poorly lit, or invisible from the street. This is essential for elderly women to feel safe using the space alone.

5.3.6 Implementation Timeline and Cost

Table No.42: P2 Implementation Phases — Social Node Activation

Phase	Action	Lead Agency	Est. Cost
Year 1, Q1	Node identification mapping with elderly residents and RWAs. Satellite confirmation of 25–30 candidate sites.	BMC Ward + NGO	Rs. 80k–1.2 L
Year 1, Q2–Q3	Type A upgrades: 10 pilot chai stall nodes in Kasturba Nagar EWS and Saket LIG.	BMC + Smart Cities SPV	Rs. 1.2–2 L/node
Year 1, Q4– Year 2, Q1	Type B upgrades: 8 chowk nodes across EWS and LIG clusters.	BMC Roads + Ward	Rs. 1.8–3 L/node
Year 2, Q2–Q3	Type C upgrades: 4–5 temple forecourt sites in consultation with temple trusts.	Temple Trusts + BMC	Rs. 2.5–4 L/site

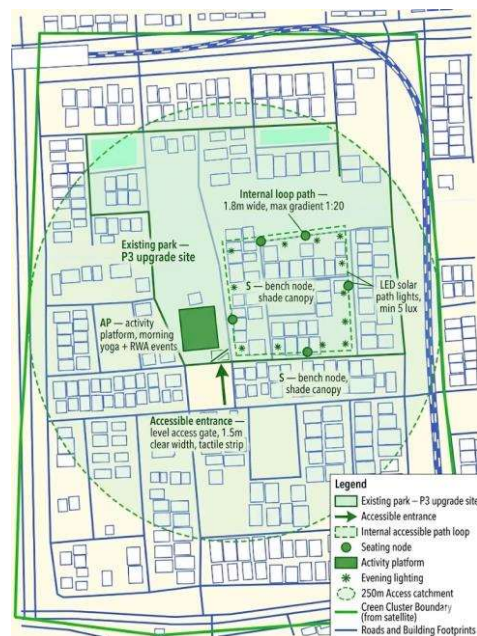
Expected outcome: Upgrading 22–25 informal nodes directly serves the 45% of elderly residents who already use these spaces as their primary social destinations. Adding shade and seating is expected to more than double the average time spent at each node per visit — significantly increasing daily social contact without requiring any change in where elderly residents already go.

P3 — Accessibility Upgrades to Existing Parks Micro to Neighbourhood Scale · MIG and HIG · Shakti Nagar and Alkapuri

5.4 P3: Accessibility Upgrades to Existing Parks

Parks exist in MIG and HIG clusters. The survey shows that HIG residents visit parks more than any other destination — 43% of Alkapuri HIG respondents named a park as their primary outdoor destination. But even in the best-performing cluster, seating inside parks is rated only 2.86 out of 5. In Shakti Nagar MIG, 40% of respondents are not even sure whether a park exists within 10 minutes of their home. P3 makes existing parks actually work for elderly residents — without building anything new.

Fig. No. 7 & 8: P3 Park Retrofit — Design Proposal



Alkapuri – HIG



Shakti Nagar – HIG + MIG

5.4.1 Why Existing Parks Are Not Working

Three things prevent existing parks from serving elderly residents well. First, entrances are often stepped or have a kerb lip — excluding the 20–40% of MIG and HIG residents who walk with a stick or aid. Second, there is nowhere to sit inside the park at reasonable intervals — seating is the lowest-rated dimension across all six clusters (mean 1.86/5). Third, in Shakti Nagar MIG, open grounds are not legible as parks — they lack a clear entrance, defined path, or signage, which is why 40% of respondents are unsure they exist.

Table No.43: P3 Cost-Effectiveness Summary

Cost-effectiveness: P3 costs Rs. 10–15 lakhs per park — a fraction of building a new park. The parks already exist, are publicly owned, and are maintained by BMC Parks Department. Three parks can be upgraded for the cost of a single new park construction.

5.4.2 Six Upgrade Components — Applied at Each Park

- **Accessible entrance:** Level-access gate with minimum 1.5 metre clear opening. Bituminous ramp at any grade change at entry. Tactile guidance strip from gate to main internal path.
- **Internal accessible path loop:** 1.8 metre wide compacted gravel or textured concrete loop path around the inside park perimeter. Maximum gradient 1:20. No speed bumps or kerb lips anywhere on the route.
- **Seating at 50 metre intervals:** Backed, armrested concrete bench at 45 cm seat height with a 45 cm transfer space on one side for stick or frame users. Positioned under existing tree canopy where possible.
- **Evening lighting:** Solar LED path lights at 10 metre intervals along the main loop. Minimum 5 lux at ground level. Extends park usable hours for the 30% of respondents who prefer morning and evening outings.
- **Activity platform:** A flat, paved 6×8 metre platform at the park entrance area for morning yoga, satsang, group exercise, or RWA events. Co-programmed with the local RWA at no additional cost.
- **Wayfinding (Shakti MIG parks specifically):** A bold green entrance sign and direction markers from the nearest main internal road to the park

gate, addressing the 40% of Shakti MIG respondents who are unsure the park exists.

5.4.3 Target Parks — Three Priority Sites

Table No.44: P3 Priority Parks for Retrofit by Cluster

Park	Cluster	Current Condition	Primary P3 Elements	Approx. Area
Park 1 — Alkapuri HIG	Alkapuri HIG	Existing green open space with mature tree canopy. Accessed by 43% of HIG respondents. Seating rated 2.86/5 — no accessible loop or activity platform.	Accessible entrance ramp, internal loop path, seating at 50m, activity platform, evening lighting.	1,500– 2,500 m ²
Park 2 — Shakti HIG	Shakti HIG	Green open area. 70% of Shakti HIG have park access but seating still rated 2.50/5.	Same as Park 1 plus additional wayfinding signage.	1,200– 2,000 m ²
Open Ground — Shakti MIG	Shakti MIG	Bare earth open area. Not recognised as a park by 40% of respondents. No visible entrance, path, or seating.	Entrance marker, accessible gate, full internal loop, seating, activity platform, lighting, wayfinding from main road.	800– 1,500 m ²

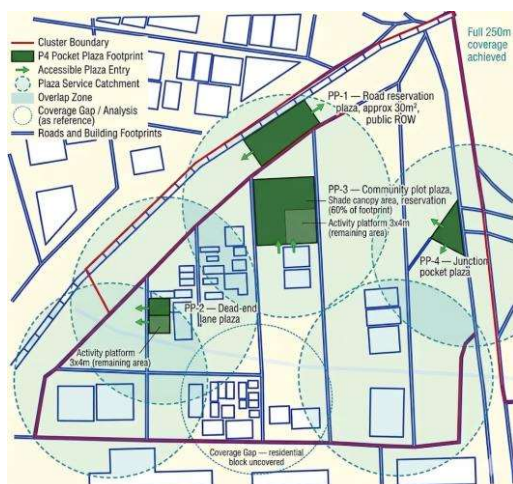
Expected outcome: Making existing parks physically accessible converts them from underutilised mapped assets into functional daily social spaces. Survey areas with good park access have loneliness scores 1.5–1.9 points lower than areas without. P3 delivers this access in MIG and HIG clusters without requiring new land or major capital expenditure.

P4 — Pocket Parks and Neighbourhood Plazas Neighbourhood Scale · EWS and LIG · Within 250m of every household

5.5 P4: Pocket Parks and Neighbourhood Plazas

P4 addresses the most acute spatial gap in the dataset: 73% of EWS elderly and 83% of LIG elderly have no park or green social space within a 10-minute walk. Building a full-scale park is neither financially practical nor physically possible in the dense fabric of these neighbourhoods. P4 proposes a different answer: small, shaded social plazas on existing public land, within 250 metres of every elderly household. These are not parks — they are social condensers.

Fig. No.9 & 10: P4 Pocket Plaza — Design Proposal



EWS – Kasturba Nagar



Saket Nagar – LIG + MIG

5.5.1 The Core Problem P4 Addresses

No park within 250 metres means no accessible green social space at all for the most mobility-limited elderly residents. 60% of EWS elderly can walk no further than 5 minutes from home. The conventional planning response would be to build a new park — but there is no large vacant land available inside the dense EWS and LIG cluster fabric. P4 works within the existing built environment by identifying small pockets of underused public land — road reservation shoulders, dead-end lane termini, and BDA community plot reservations — and converting them into functional shaded social spaces.

Table No.45: P3 250m Coverage Principle

The 250m coverage principle: A network of pocket plazas is placed so that 250m radius circles drawn from each plaza together cover every residential block in the cluster — ensuring no elderly household is more than 250m from a shaded social space.

5.5.2 Mandatory Design Parameters for Every Pocket Plaza

Each plaza must meet all six parameters below. Size or appearance can vary — the parameters cannot.

Table No.46: P4 Design Standards — Pocket Plazas

Parameter	Standard	Rationale from Survey
Minimum usable area	30 m ² hardscape + 10–15 m ² shade/planting. Total footprint 40–50 m ² .	Enough space for 8 seated adults with 1.5m circulation between them.
Shade cover	100% of seating area shaded by tensile membrane or polycarbonate canopy. Minimum 2.4m clear height.	EWS shade rating = 1.40/5. Shade is a health requirement at 38–42°C in Bhopal.
Seating	Minimum 8 seat positions — backed, armrested benches at 45 cm height. Arranged facing inward, not in a row.	EWS seating rating = 1.20/5. Inward arrangement encourages face-to-face conversation.
Universal access	No kerb lips. Ramp gradient max 1:12. 1.5m turning radius at both entries. Minimum 2 access points.	33% of EWS elderly walk with aid or need support. Access must work for all mobility levels.
Activity platform	One flat 3×4m paved area for morning yoga, community events, or vendor activities. Co-programmed by local RWA.	21% cite 'nothing to do outside' as top barrier. Physical space alone is insufficient — programming is required.
Lighting	Solar LED at each canopy column. Minimum 10 lux at ground level for early evening use.	30% of respondents prefer both morning and evening outings. Lighting extends usable hours.

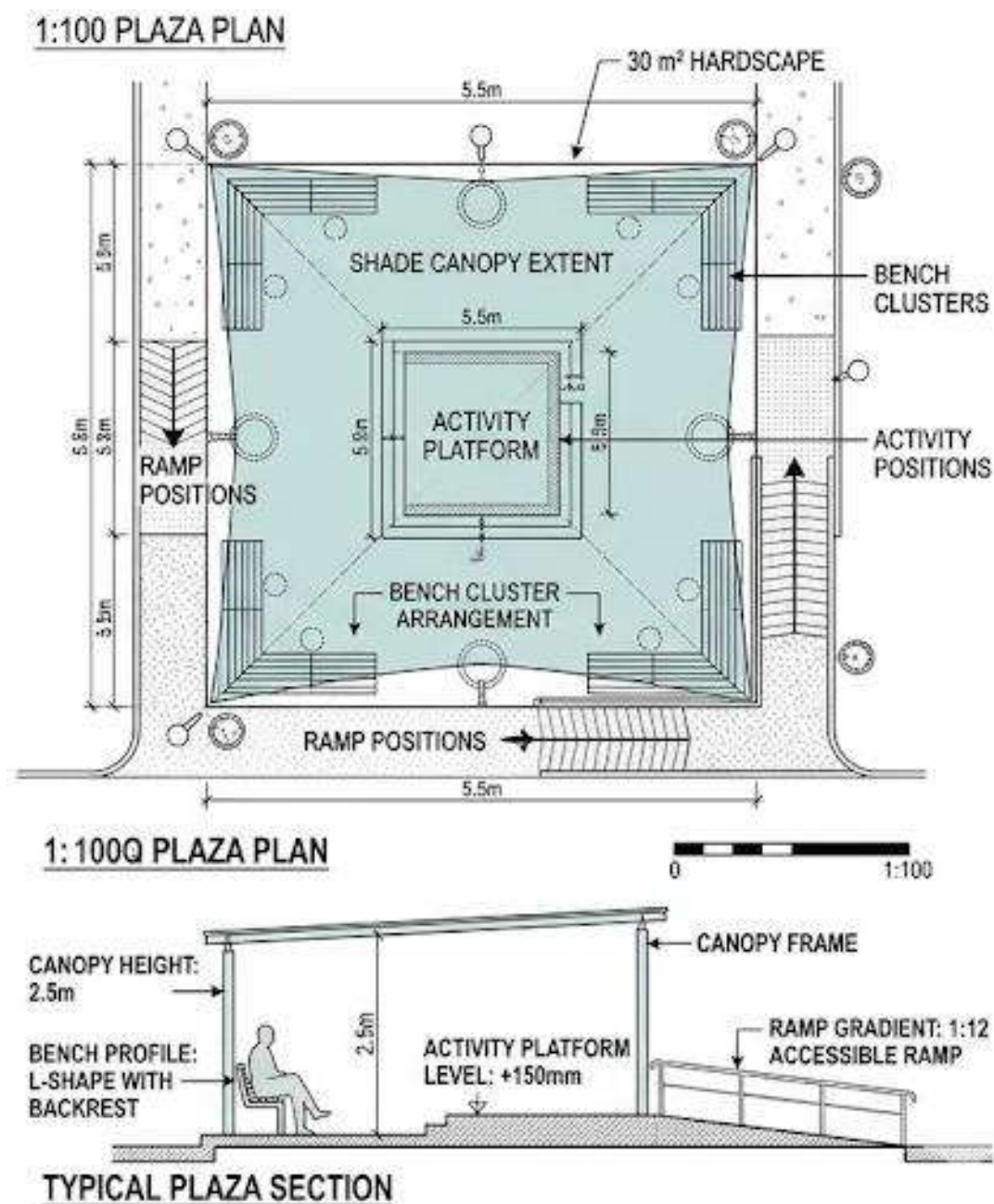


Fig. No.11: P4 Pocket Plaza — Design Detail

5.5.3 Site Identification — Four Land Types

Table No.47: P4 Site Identification Typology — Pocket Plazas

Site Type	Description	How to Identify
Road reservation shoulder	The strip of public ROW between carriageway edge and building setback	Satellite: unpaved bare strip running alongside main road. If

Site Type	Description	How to Identify
	line. Typically 3–5m wide along boundary roads.	width is 3m or more for a length of 10m or more, it qualifies.
Dead-end lane terminus	The turning area at the end of a cul-de-sac or dead-end lane inside the cluster. Technically public land.	Schematic: lane line that terminates without connecting to another road. Space at the end of the lane is the site. Often 6×6m or larger.
BDA community plot reservation	Land parcels reserved as community space in the BDA layout plan, annotated 'C.P.' — frequently vacant or misused for parking.	Satellite: bare earth or informally parked area inside cluster with no building. Confirm with BDA ward office.
Junction pocket	Oblique junction where two lanes meet at an angle, creating a triangular or irregular space between carriageway edges larger than 6×6m.	Schematic: junction where road lines do not meet at 90°, leaving an irregular polygon of unbuilt space.

5.5.4 Coverage Target — 14 to 16 Plazas Across EWS and LIG

Table No.48: P4 Plaza Network Targets by Cluster

Cluster	Phase 1 (Pilot)	Full Network Target	Coverage Objective
Kasturba Nagar EWS	3 pilot plazas	6–8 plazas total	All EWS residential blocks within 250m of at least one plaza
Saket Nagar LIG	3 pilot plazas	8–10 plazas total	All LIG residential blocks within 250m of at least one plaza

Expected outcome: A network of 14–16 plazas ensure — for the first time — that every elderly resident in EWS and LIG clusters has a shaded, seated,

socially active outdoor space within their walking range. The network directly targets the 73–83% of residents who currently have no green social space of any kin

P5 — Neighbourhood Walking Loops

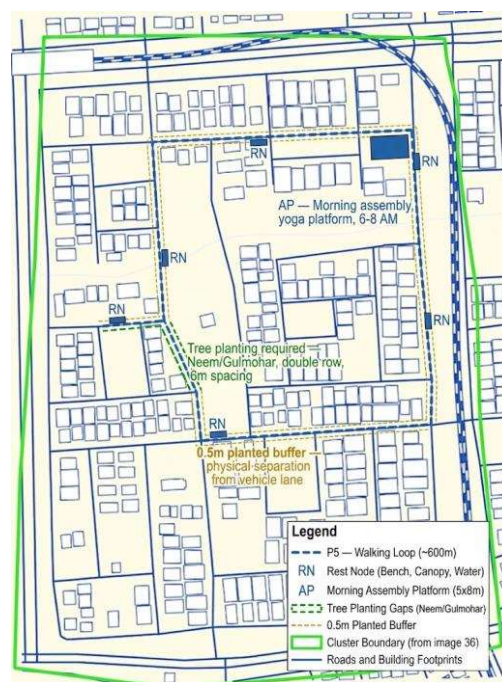
Neighbourhood Scale

MIG and HIG · 400–700m flat shaded circuits

5.6 P5: Neighbourhood Walking Loops

P5 responds to a specific and measurable need in MIG and HIG clusters: elderly residents want to walk regularly but are deterred by traffic, uneven surfaces, and the absence of a predictable, safe route. 70–90% of HIG respondents already go out five or more days per week — the motivation and capacity for daily walking exists. P5 gives this existing behaviour a dedicated infrastructure. It also makes morning walking groups possible, which is the most effective and lowest-cost form of social programming available.

Fig. No. 12 & 13: P5 Walking Loop — Path Detail and Social Infrastructure Layout



Alkapuri - HIG



Shakti Nagar – HIG + MIG

5.6.1 Why MIG and HIG Elderly Need This

In EWS and LIG clusters, the problem is that elderly residents cannot go outside at all. In MIG and HIG clusters, the problem is different: residents can go outside and often do — but are deterred by specific barriers that a walking loop directly addresses. In MIG clusters, the top barrier is heavy traffic (38% of MIG respondents). In HIG clusters, the top demand is a dedicated walking circuit — cited as the top desired facility by Alkapuri HIG respondents.

Table No.49: P5 Social Value of Walking Loop

The social value of a walking loop: Elderly residents who go out 5+ days per week are significantly more likely to participate in group activities, and group activity participation is one of the strongest predictors of lower loneliness scores. A walking loop is not just physical infrastructure — it is the spatial foundation for a social programme. A morning walking group that uses the loop creates daily structured social interaction for residents who would otherwise go out alone.

5.6.2 Design Standards for a Walking Loop

Table No.50: P5 Design Standards — Neighbourhood Walking Loops

Design Element	Standard	Reason
Circuit length	400–700m — a 10–15-minute walk at an easy elderly pace.	Long enough to be a meaningful daily route. Short enough for the least mobile HIG/MIG respondents.
Surface	2.0m wide smooth concrete or compacted laterite. Zero grade change on the loop. Drainage cross-fall max 1:50.	Level surface is critical. Even small gradients cause trips and fall in elderly users.
Traffic separation	Physical kerb or planted buffer minimum 0.5m wide between the loop lane and any vehicle lane at all points.	No vehicle encroachment on the loop. This is what makes it usable daily without fear of traffic.

Design Element	Standard	Reason
Shade	Double row of medium-canopy trees (Neem, Gulmohar) at 6–8m spacing. Target 70% shade at canopy maturity.	Shade along the full route makes the loop usable during morning hours in Bhopal's climate.
Rest nodes	Shaded 3-seat bench cluster at every 150m. Water point at loop midpoint.	Allows elderly residents with reduced stamina to pause without leaving the route.
Morning assembly platform	Flat 5×8m paved area at loop start/finish for walking group meetup, yoga, or RWA events.	This is the social programming anchor. Without it, the loop is exercise infrastructure. With it, it becomes a social space.
Wayfinding	Distance markers at 100m intervals. Motivational health messages in Hindi on path surface.	Markers help users track walking distance. Hindi-language messaging is appropriate for this context.

5.6.3 Four Loops — Cluster Alignments

Table No.51: P5 Loop Details by Cluster

Loop	Cluster	Length	Street Character	Key Design Note
Loop 1	Alkapuri HIG	~600m	Internal gated colony streets with existing mature tree cover. Lower traffic than boundary roads.	Primarily a canopy-stitching exercise. Most shade already exists — formalise the path, add rest nodes, build the assembly platform.
Loop 2	Shakti Nagar HIG	~500m	Grid colony streets with moderate tree cover.	Raised table crossings at any point where loop

Loop	Cluster	Length	Street Character	Key Design Note
			Some boundary road crossings may be unavoidable.	crosses an internal arterial. Safety mean 3.70/5 — adequate with minor upgrades.
Loop 3	Shakti Nagar MIG	~650m	Denser grid. More traffic conflict points. Safety mean = 2.40/5 — below comfortable walking threshold.	Full traffic calming at every arterial crossing. New shade tree planting needed on most of loop.
Loop 4	Saket Nagar MIG	~400m	Smaller cluster. Shorter circuit adequate.	Integrates with P4 pocket plaza at loop start point — plaza serves as assembly and rest space combined.

5.6.4 Morning Walking Group — Programming Component

Every loop includes a morning walking group as an integral programming requirement — not an optional add-on. The RWA is responsible for organising and maintaining this programme. It requires no budget beyond the physical platform.

Table No.52: P5 Social Programming Element

Element	Details
Time	6:00–8:00 AM daily, matching the 70% morning preference of survey respondents (Q2.4).
Assembly point	The 5×8m activity platform at loop start/finish.
Group size	Target 15–30 participants. Open to all residents aged 60 and above.
Facilitator	RWA health or sports secretary, or a volunteer from the group. No professional staff required.

Element	Details
Activities	Walk together around the loop (1–3 circuits). Optional yoga or stretching at the platform after walking.
Tracking	BMC to provide a simple attendance register to monitor uptake against the outing frequency KPI.

Expected outcome: Each loop serves an estimated 100–200 elderly users per morning. Walking groups provide structured daily social interaction for the 30–40% of MIG and HIG elderly who currently have no group affiliation. The loop addresses physical inactivity, social isolation, and traffic safety in a single infrastructure investment.

Phasing, Governance, and Financing 48-Month Implementation Programme · All Clusters · All Proposals

5.7 Phasing and Integration

The five proposals cannot all be delivered at the same time. Phasing is necessary because different proposals have different complexity and lead times, the most deprived clusters must see early results to demonstrate credibility, and each phase builds the institutional trust needed for the next. The phasing sequence follows one rule: begin with the simplest, most visible improvements in the most deprived areas, then expand to larger investments as the framework gains confirmed funding and community support.

5.7.1 Four-Phase Programme — 48 Months

Table No.53: Implementation Phasing — Five Proposals Over 48 Months

Phase	Timeline	Proposals Active	Key Deliverable
Phase 1	0–12 months	P1 (EWS+LIG streets), P2 (10 pilot nodes), P3 (park audits), P5 (route survey)	Visible footpath and seating upgrades in EWS and LIG. First informal node canopies installed.
Phase 2	12–24 months	P2 (remaining nodes), P3 (park upgrades), P4 (6 pilot plazas), P5 (2 HIG loops)	First pocket plazas open in EWS and LIG. Parks fully accessible. HIG walking loops running with morning groups.
Phase 3	24–36 months	P4 (remaining plazas), P5 (MIG loops), green corridor connections	Full plaza network in EWS and LIG. All clusters have a green pedestrian spine. All loops operational.
Phase 4	36–48 months	Monitoring and evaluation — repeat survey	Full framework operational. Repeat survey measures loneliness, outing frequency, and ENV Index against 2025 baseline.

Table No.54: Total Investment Summary

Total investment: Rs. 5.3–7.3 crores across all four phases over 48 months. This is within the typical annual Smart Cities Mission ABD allocation for Bhopal. No land acquisition costs arise — all proposals use existing public ROW, government reservations, or underused public plots.

5.7.2 How the Proposals Connect to Each Other

P1 better streets → P2 elderly can comfortably reach informal nodes → P4 pocket plazas provide destinations along upgraded streets → P5 walking loops give structure to daily outdoor movement → Morning walking groups and plaza programming activate the network as a social system.

The proposals are not independent. They form a progressive sequence where each one enables the next. A pocket plaza without an accessible footpath leading to it is underused. A walking loop without a morning activity at its starting point is exercise infrastructure rather than a social space. Phasing should follow this logical sequence within each cluster — not deliver proposals independently.

5.7.3 Governance — Agency Responsibilities

Table No.55: Agency Roles and Responsibilities

Agency	Primary Role	Proposals
Bhopal Municipal Corporation (BMC) — Lead	Lead implementing agency. Public Works for footpaths and crossings. Parks Department for trees and lighting. Ward Offices for community consultation and node identification.	P1, P2, P3, P4, P5
Bhopal Development Authority (BDA)	Identifies and releases public land for P4 plazas. Fast-tracks community plot reservations without new acquisition.	P4
Smart Cities Mission — Bhopal SPV	Co-finance under ABD component. All proposals are eligible under elderly-inclusive urban infrastructure and pedestrian safety themes.	P1, P2, P4, P5

Agency	Primary Role	Proposals
National Health Mission (NHM)	Deploys ASHA workers for activity programming. Manages health kiosk operations under the National Programme for Health Care of the Elderly.	P3, P4
MP Forest and Horticulture Department	Selects tree species, supplies nursery stock, and manages a 3-year maintenance contract for all loop and corridor plantings.	P5
Resident Welfare Associations (RWAs)	Community co-design, local maintenance, and daily programming — morning walking groups, yoga, satsang, maintenance oversight. RWAs are the operational backbone of the framework.	All proposals
NGO and Civil Society Partners	Women safety audits for P1 nodes, participatory mapping for P4 site selection, activity facilitation for P2 temple and chowk nodes.	P2, P4

5.7.4 Financing — Five Existing Sources

Table No.56: Funding Sources by Proposal

Source	What It Funds	Proposals Covered
Smart Cities Mission (SCM)	ABD pedestrian safety and elderly-inclusive urban infrastructure. Applied through Bhopal Smart City Development Corporation.	P1, P2, P4, P5
AMRUT 2.0 — Urban Green Space	Dedicated green space allocation (15% of city grant) and inclusive parks mandate.	P3
National Health Mission (NHM)	ASHA worker salaries and health kiosk operation under the National Programme for Health Care of the Elderly.	P3, P4

Source	What It Funds	Proposals Covered
MP State Urban Development Fund	Capital grant for community facility construction where Smart Cities funding is not available.	P4
CSR Contributions	Individual P2 node upgrades and P4 plazas — small, visible, community-serving, low-complexity. Facilitated by BMC ward offices.	P2, P4

Table No.57: Phased Budget Allocation

Phase	Estimated Cost	Primary Source
Phase 1 (0–12 months)	Rs. 60–80 lakhs	Smart Cities Mission
Phase 2 (12–24 months)	Rs. 2.2–3.2 crores	SCM + AMRUT 2.0
Phase 3 (24–36 months)	Rs. 1.8–2.4 crores	SCM + NHM + State Fund
Phase 4 (36–48 months)	Rs. 1.2–1.6 crores	NHM + State Fund + CSR
Total — full framework	Rs. 5.3–7.3 crores	All channels combined

5.8 Six Measurable Targets

A repeat survey using the same questionnaire as the 2025 baseline will be conducted at 18 months and 36 months after implementation begins, run by MANIT students under faculty supervision. The six targets below test whether the proposals have measurably improved elderly social connectivity across all clusters.

Table No.58: Measurable Targets and Baseline Indicators

Target Indicator	2025 Baseline	Target at 36 Months
Mean loneliness score — EWS	4.00 out of 5	Below 3.0
Mean loneliness score — LIG	3.92 out of 5	Below 3.0
EWS elderly going out 5+ days per week	0%	At least 25%
EWS and LIG with no group activity participation	73–75%	Below 40%
EWS ENV Quality Index	1.47 out of 5	At least 2.50
EWS residents with green space within 250m	0%	At least 70%
Respondents with zero daily social interactions	25%	Below 10%

Why these targets? Each corresponds directly to a baseline survey finding. Together they test the full causal chain: better physical space → more frequent outings → more social interaction → reduced loneliness. All measurement uses the same instruments as the 2025 baseline, making before-and-after comparison valid and defensible.

5.9 Chapter Summary

This chapter has presented five spatial planning proposals developed directly from the primary survey evidence gathered in Chapter 4. Each proposal is targeted at the income typologies and clusters where the relevant spatial gap is most acute, and each is traced explicitly back to the survey findings that necessitate it.

Table No.59: Framework Summary — Five Proposals

Ref	Proposal	Target Cluster	Core Contribution
P1	Street Retrofitting	EWS, LIG, MIG	Makes the basic act of walking outside physically possible for the most mobility-limited residents — the prerequisite for all other proposals.
P2	Informal Node Upgrades	EWS, LIG	Upgrades the spaces where 45% of elderly social life already happens — culturally appropriate, low-cost, and immediately impactful.
P3	Park Accessibility Upgrades	MIG, HIG	Converts parks that exist on maps but are inaccessible in practice into functioning daily social spaces without new land or construction.
P4	Pocket Parks and Plazas	EWS, LIG	Creates a 250m coverage network of shaded social spaces for the 73–83% of EWS and LIG elderly who currently have no green space within walking range.
P5	Walking Loops	MIG, HIG	Gives HIG and MIG residents who already go out regularly a safe, dedicated, shaded infrastructure — and the social programming anchor of a morning walking group.

Together, the five proposals address elderly social connectivity across all four income typologies in Bhopal, from the most deprived EWS clusters to the relatively well-served HIG colonies. The phasing strategy ensures visible early results in the most deprived areas, a governance framework distributes responsibility clearly across BMC, BDA, Smart Cities SPV, RWAs, and NGOs, and the financing plan routes funding through five existing government schemes without requiring new instruments.

The measurable targets established in Section 5.8 will allow the framework to be evaluated rigorously against the 2025 baseline — testing the central hypothesis of the thesis: that targeted spatial planning interventions can measurably improve social connectivity among Bhopal's elderly population.

REFERENCES

Note: References are arranged in alphabetical order of the main author's surname.

Source	Type	In-text citation	Reference
Book	Institutional author	(Urban Land Institute, 2019)	Urban Land Institute (ULI) (2019), <i>Kampung Admiralty Case Study</i> , ULI Asia Pacific, Singapore.
	Institutional author	(WHO, 2007)	WHO (2007), <i>Global Age-friendly Cities: A Guide</i> , World Health Organisation, Geneva
Book chapter	One author	(Karlygash, 2022)	Karlygash A (2022), <i>Aging in Cities</i> , In: <i>Aging in Cities</i> , pp. 129–139. doi: 10.4324/9780429290237-13.
Journal	One author	(Greenfield, 2018)	Greenfield EA (2018), <i>Age-Friendly Initiatives, Social Inequalities, and Spatial Justice</i> , Hastings Center Report, Vol 48, October 2018. doi: 10.1002/HAST.912.
	Two authors	(Ali and George, 2022)	Ali P and George C (2022), <i>Urban Isolation: A Multi-city Study in India</i> , Journal of Urban Management, 2022.
	Two authors	(Alidoust and Bosman, 2017)	Alidoust S and Bosman CJ (2017), <i>Master Planned Communities for the Ageing Population: How Sociable Are They?</i> , Architecture and Culture, Vol 1 No. 1, November 2017, pp. 38–46. doi: 10.1080/23748834.2017.1393242.
	Two authors	(Chi and Kumar, 2024)	Chi R and Kumar R (2024), <i>Senior Citizens and Park Landscape Features: A Well-Being Framework</i> , International Journal of Civil Engineering, July 2024. doi: 10.14445/23488352/ijce-v11i7p111
	Two authors	(Yu and Wang, 2024)	Yu CY and Wang B (2024), <i>Influence of Neighbourhood Walkability on Older Adults' Walking Behaviour, Health, and Social Connections in Third Places</i> , Findings, October 2024. doi: 10.32866/001c.124837.
	More than two authors	(Alidoust et al., 2014)	Alidoust S, Holden G and Bosman CJ (2014), <i>Urban Environment and Social Health of the Elderly: A Critical Discussion on Physical, Social and Policy Environments</i> , Journal of Urban Design and Mental Health, Vol 1 No. 3, 2014, pp. 169–180.
	More than two authors	(Kweon et al., 1998)	Kweon BS, Sullivan WC and Wiley AR (1998), <i>Green Common Spaces and the Social Integration of Inner-City Older Adults</i> , Environment and Behavior, Vol 30 No. 6, November 1998, pp. 832–858.
	More than two authors	(Pedell et al., 2021)	Pedell S, Borda A, Keirnan A and Aimers N (2021), <i>Combining the Digital, Social and Physical Layer to Create Age-Friendly Cities and Communities</i> , International Journal of

			Environmental Research and Public Health, Vol 18 No. 6, 2021. doi: 10.3390/ijerph18062730.
	More than two authors	(Qi et al., 2025)	Qi W, Sulaiman MKAM, Mohammad N and Samad NAA (2025), <i>Environmental Attributes, Perceived Well-being, and Social Interaction: A Space Syntax Analysis of Chengdu's Neighbourhood Parks</i> , Urban Forestry and Urban Greening, 2025.
	More than two authors	(Zapata-Restrepo et al., 2025)	Zapata-Restrepo JR et al. (2025), <i>EngAGE4Change: Co-creating Outdoor Community Spaces with Care Home Residents and Community-Dwelling Older Adults to Improve Movement Behaviour and Reduce Social Isolation</i> , Public Health, Vol 247, pp. 105872, July 2025. doi: 10.1016/j.puhe.2025.105872.
Journal	Institutional author	(IJERT, 2021)	IJERT (2021), <i>Urban Green Space Distribution in Bhopal</i> , International Journal of Engineering Research and Technology, 2021.
	Institutional author	(SAGE Journals, 2025)	SAGE Journals (2025), <i>Embodied Experiences of Place-Making in Old Bhopal</i> , SAGE Publications, 2025.
Government report	Institutional author	(Government of India, 2011)	Government of India (2011), <i>National Policy for Senior Citizens (NPSC) 2011</i> , Ministry of Social Justice and Empowerment, New Delhi.
	Institutional author	(MoHUA, 2015)	Ministry of Housing and Urban Affairs (MoHUA) (2015), <i>Smart Cities Mission: Bhopal City Proposal</i> , Government of India, New Delhi.

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