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Integration of Mobility, Heritage and Landscape: Towards a Local Area Mobility Plan for Pune, India

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Abstract

Urbanisation in India has seen a rapid increase in recent years, which has resulted in increased stress on transportation and mobility options. In an attempt to cope with it, the Government of India has launched several policies such as the Comprehensive Mobility Plan 2008, the Smart City Mission in 2015, the National Policy on Transit Oriented Development 2017, the Metro Rail Policy 2017, etc. This thesis focuses on the case study of the city of Pune, where all these national government-sponsored schemes are being implemented. According to nationwide schemes, Pune's urban development has focused on transport planning and infrastructural development. But historical landscape, which is the identity of the city, is not considered as a part of this development. This has led to significant changes in the urban landscape of the city, neglecting important tangible and intangible heritage features. Given the scenario, this thesis analyses the recent developments and policy regulations in Pune and investigates how such policies favour infrastructure-oriented development over the social and cultural heritage of the city.

This thesis intends to propose a need to integrate mobility, heritage, and landscape into a local area mobility plan (LAMP) for the city centre of Pune, India. LAMPs are derived from the concept of a Local area plan (LAP) – which is a land use plan that sets out detailed planning policies at the neighbourhood level and creates a framework for contextual development. According to the National Policy on Transit Oriented Development 2017, 3 pilot local area plans are proposed in Pune to encourage compact living and transit-oriented development around the metro stations in the city. So, this research makes an argument for the need for an additional similar framework in the form of a Local area mobility plan to preserve, sustain and enhance the cultural landscapes in the city centre of Pune.

The focus of this research starts with analysing the governance structure that regulates mobility planning and heritage conservation from the national to the local level in Pune, India. Based on the findings, this research advocates for the preparation of a Local area mobility plan with strong coordination among mobility and heritage decision-makers. For the assessment of the mobility scenario in the predefined case study area, mobility generation factors, recorded footfall, available infrastructure and behavioural patterns of its users are analysed. Similarly, for the same case study area, the tangible heritage structures and intangible heritage practices are enlisted with their challenges related to excessive mobility and heritage blind planning. Based on the findings this research proposes a combined framework of Local Area Mobility Plan.

Keywords – Mobility, Heritage, Landscape, Governance, Historical urban landscape, Local area mobility plan, India.

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Contents

List of Figures

List of Table

List of Abbreviations

AMASR – The Ancient Monuments and Archaeological Sites and Remains (Act)

AMRUT – Atal Mission for Rejuvenation and Urban Transformation

ASI – Archaeological Survey of India

BRTS – Bus Rapid Transit System

CMP – Comprehensive Mobility Plan

CSO – Civil Society Organization

CTTS – Comprehensive Traffic and Transportation Study

DP 2007-2027 – Development Plan 2007-2027

HCC – Heritage Conservation Committee

HRIDAY – Heritage City Development and Augmentation Yojana

HUL – Historic Urban Landscape

IAS – Indian Administrative Service

INTACH – Indian National Trust for Art and Cultural Heritage

ITDP – Institute for Transportation and Development Policy

JNNURM – Jawaharlal Nehru National Urban Renewal Mission

LAMP – Local Area Mobility Plan

LAP – Local Area Plan

MPCB – Maharashtra Pollution Control Board

MR&TP – Maharashtra Regional & Town Planning (Act)

MSRDC – Maharashtra State Road Development Corporation

MSRTC – Maharashtra State Road Transport Corporation

NMA – National Monuments Authority

NMT – Non-Motorized Transport

NGO – Non-Governmental Organisation

NUTP – National Urban Transport Policy

PCMC – Pimpri Chinchwad Municipal Corporation

PMC – Pune Municipal Corporation

PMR – Pune Metropolitan Region

PMRDA – Pune Metropolitan Region Development Authority

PMPML – Pune Mahanagar Parivahan Mahamandal Limited

PSCDCL – Pune Smart City Development Corporation Limited

RTO – Regional Transport Office

SDG – Sustainable Development Goals

TOD – Transit-Oriented Development

UDD – Urban Development Department

1. Introduction

The city of Pune has been known by many names in the past, such as the Oxford of the East, Queen of the Deccan, and cultural capital of Maharashtra (Diddee & Gupta, 2000) (Mundhe & Jaybhaye, 2017). It is the birthplace of Chhatrapati Shivaji Maharaj, a revered king of the Maratha empire from the 17th century. He laid the foundation of his kingdom in the city, making Pune a sacred site for many. Later in the 18th century, the Peshwas, the prime minister of the Maratha Empire, transformed Pune into a significant city by virtually establishing it as the capital of the Maratha empire (Gokhale B. G., 1985). In the same period, the "Wada" housing typology flourished in the city, from residential to administrative buildings and created a unique urban landscape (Nagapurkar et al., 2020). During British rule, the town retained its "Wada" style landscape and gained significance in terms of education, military and administration (Krishnamurthy et al., 2016). At the same time, Pune was one of the first cities where the freedom movement against British rule took place in India (Bari, 2022). Festivals such as "Ganesh Utsav" and "Shiv Jayanti" were initiated in the city for cultural revival and to support the freedom struggle (Kalambe, 2020). These historical associations are evident in Pune's tangible heritage and intangible practices, which continue to shape its identity and perception today. Therefore, Pune's very essence is deeply rooted in its historical landscapes.

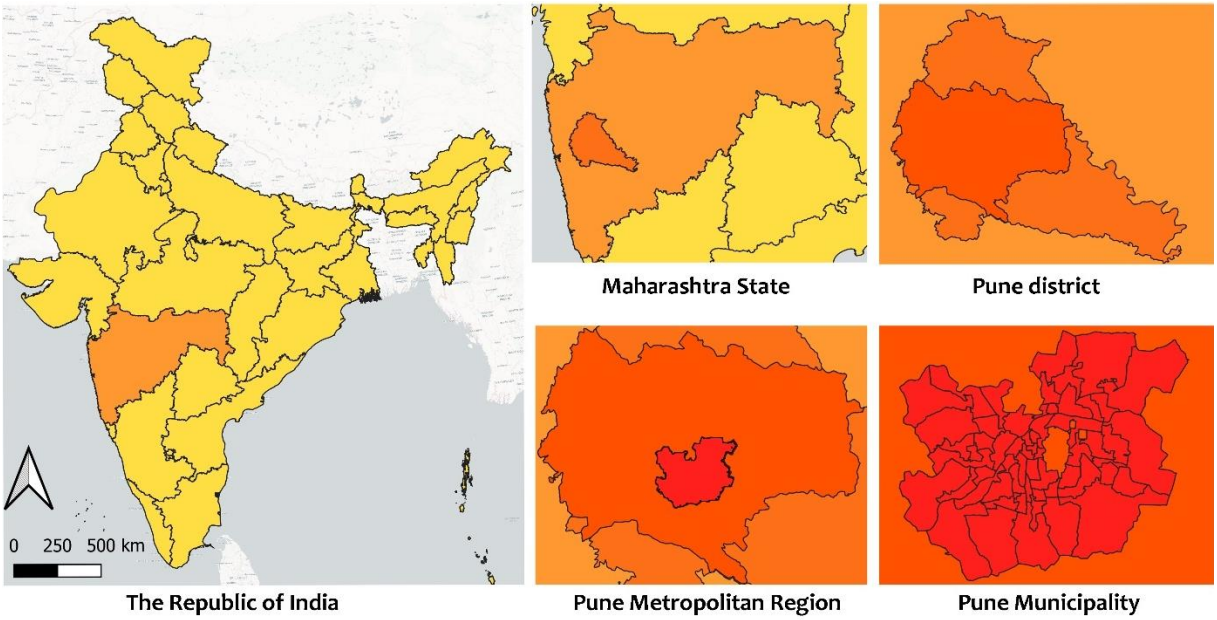


Figure 1 - The geographic location of Pune Municipality (Source – Author)

The new-age urbanisation, however, is simultaneously another story. It has introduced a different perception of Pune. According to Butsch et al. (2017), The city attracted a large-scale migration

from other parts of Maharashtra and neighbouring states, particularly since 1991, when the economy of India was liberalised. It led to the emergence of information technology and biotechnology parks, making Pune a cosmopolitan city.

As per Kantakumar et al. (2016), between 1992 to 2013, Pune grew about 82.5 km^2 in built-up areas, and the population density rose to 27488 people per sq. km in 2011 (Musmade, 2018). According to Indo-Asian News (2018), the number of private vehicles has overtaken the city's population. These developments have added many new layers to Pune's historical landscape.

From its historical and cultural significance to a rapidly urbanising city, Pune is a complex example of India's evolving urban landscape. This evolution has led to the emergence of significant challenges. Among others, one of the most concerning statistics, according to Tomtom traffic index (2024) Pune has become the fourth most congested city in the world in terms of traffic. Events such as these pose a grave threat to the city's tangible and intangible historical landscapes.

This overall scenario raises several critical enquiries for research.

- Do the governance structures consider the impact of evolving traffic congestion and excessive mobility on heritage and its historical urban landscapes?
- Is there a coordination between heritage conservation and mobility planning authorities to address these challenges?
- Are there similar challenges that exist globally?

This necessitates a more profound, nuanced understanding of historic urban landscapes, urbanisation, governance, mobility planning and the evolving landscapes of a city in a rapidly changing circumstance.

India is developing unprecedentedly, and techno-infrastructural development is being created daily in mobility planning through the Smart City initiative and Transit-Oriented Development (TOD) scheme (Gandhi et al., 2021). Pune is a major city that is no exception to this transformation. The city is witnessing the construction of a new metro line and a proposal for compact development along these metro corridors through local area plans. The local area plans (LAP) are the development plans for a 500-meter area around some key metro stations where compact development will be incentivised through a high floor space index (FSI) to increase the dependency on Metros for travel. (Raj, 2024). But during this surge of urbanisation and modernisation, the conservation of social, cultural and historical considerations seems to have been left out of Pune's agenda (Gandhi et al., 2021). This neglect raises concerns about the future of the city's cultural identity and the preservation of its historical Landscape.

One significant positive sign is that despite these changes and emerging challenges, Pune's residents regard their historical identity with the same grace and pride. This thesis seeks to build upon that identity to advocate that tangible and intangible characteristics of heritage should be critical (Ziyaee, 2018) for mobility-related urban developments. There should be an integrative approach to mobility, heritage and landscape for the city centre of Pune. This thesis mainly focuses on the defined case study area in the historical city centre of Pune, where new urbanisation is evident in the form of a mix of authorised-unauthorised urban structures (Butsch et al., 2017), mixed-use commercial activities in those structures and the resulting traffic agglomeration.

This thesis is organised as follows: after introducing the intent of integrating Mobility, Heritage and Landscape, the three pillars of this thesis, section 2 explores how they should and could be dealt with in an integrated manner. Section 3 presents the aims and method of the thesis while laying out the methodological framework. Section 4 presents the current context of the city of Pune, along with its short introduction to mobility and heritage scenarios. This section also determines the case study area for further analysis. Section 5 investigates the governance and policies related to mobility planning and heritage conservation. Then, highlighting the gaps and the neglect of heritage integration in planning by authorities, it further advocates for a Local Area Mobility Plan (LAMP) to specifically address that gap for the case study area. Sections 6 and 7 conduct the methodological assessments of the case study area's historical landscape and mobility. It assesses its tangible and intangible heritage characteristics and it assesses mobility in terms of generation points, footfall on the ground, available infrastructure and user behaviour. Based on the findings, section 8 concludes with the recommendations and guidelines for the local area mobility plan framework for the city centre of Pune.

2. How do Mobility, Heritage and Landscape integrate?

Mobility, Heritage, and Landscape are the three primary pillars of this thesis. Still, their definitions change from place to place, so for the purpose of this thesis, this section solidifies the basic definitions of mobility, heritage and landscape with their planning practices. Also, while these three domains are equally important aspects of the urban fabric, the instances of integrating all of them are scarce. Therefore, this section seeks practices and research on integrating heritage, landscape, and mobility into the planning framework. In the Indian context, urban heritage protection is in a primary stage, and most of the historic landscapes are dilapidated (Abdurahiman & Kasthurba, 2022). Therefore, this study will analyse the globally available material about such integration practices.

According to Loulanski (2006), the definition of "Heritage" has evolved and expanded its meaning in recent history. Even the "landscape" was included in the heritage domain due to the semantic expansion of heritage in the 20th century (Choay, 2001). The meaning of the word "Mobility" also changes from place to place. Therefore, the definitions of mobility, heritage, and landscape, along with their respective planning practices, must be solidified before starting the study.

Heritage or Cultural heritage according to UNESCO (2009), "Cultural heritage includes artefacts, monuments, a group of buildings and sites, museums that have a diversity of values including symbolic, historic, artistic, aesthetic, ethnological or anthropological, scientific and social significance. It includes tangible heritage (movable, immobile and underwater), intangible cultural heritage (ICH) embedded into cultural, and natural heritage artefacts, sites or monuments." Heritage planning applies the conservation of this heritage in the context of community planning (Kalman, 2014).

Mobility signifies the ability to move or be moved freely (Oxford). Mobility planning, according to the European Commission (2013) is "a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life."

"The landscape is part of the land, as perceived by local people or visitors, which evolves through time as a result of being acted upon by natural forces and human beings." (COE,2000) and Landscape planning is "The aspect of the land use planning process that deals with physical, biological, aesthetic, cultural, and historical values and with the relationships and planning between these values, land uses, and the environment" (European Environment Agency, n.d.). These definitions will serve as a foundation for reviewing the practices involved in integrating Mobility, Heritage and Landscape.

This study intends to review context-specific global practices where heritage, landscape and mobility are integrated in planning. The intention is also to find the research gaps for this specific topic. As mentioned earlier, the literature on such convergence is scarce. However, during the review, some themes briefly overlapped; they are as follows –

- Heritage-led approach
- Mobility-led approach
- Cultural landscape approach
- Integrated landscape approach
- Historical urban landscape approach

Heritage led approach

On brief occasions, the convergences between mobility and heritage are found for different objectives. In an example explained by Wang & Wong (2020) , Singapore, the city-state known for its urban development, used its urban heritage as a catalyst to promote active mobility in heritage-sensitive areas. Banking on the fact that urban heritage is a form of nostalgic connection to the past and it is an essential part of the cityscape. Through government efforts, they promoted walking as an experience, capitalising on the sense of identity among people with its urban heritage. The idea was to combine the physical and perceptual aspects of urban heritage, that is, the sense of identity, into the practical application, in this case, active mobility. This example showcases a heritage-led approach to mobility planning.

Mobility-led approach

Example by Gargiulo & Sgambati (2022), in the city of Naples, the exact opposite experiment was conducted. In this case, through the promotion of active mobility, a district of the historic city centre called "Pizzofalcone" was regenerated. Despite its centrality, historic architecture, and cultural heritage, the district was deserted and grappled with socio-economic problems. So, the city used walkability as a key attraction, and the district was promoted for a better quality of life. They advertised the historic place for well-being and a safe atmosphere through active mobility infrastructure. This regeneration example shows the use of a mobility-led approach for heritage conservation. There are other such examples [(TAJADDINI et al., 2023), (Ila Maltese, 2017)] where active mobility/slow mobility is promoted within the heritage areas.

The key takeaway from the above approaches is that mobility and heritage profoundly impact each other. Active mobility is promoted around heritage-sensitive areas, and by integrating the two, even tertiary objectives can be achieved, as explained in the examples. While these studies show

promising efforts in integrating the two pillars of this thesis that is heritage and mobility, they do not encompass the ecosystem as it can be encompassed with Landscape integration into the equation.

Cultural landscape approach

The integration of landscape and heritage is a widely discussed and studied topic. In 1964, the idea of embracing historic monuments not just by architecture but also by their urban setting (Charter, 1964) marked a milestone in (Gargiulo & Sgambati, 2022) evolution of heritage in terms of its landscape. Later, concepts related to Landscape flourished throughout the 20th century to acknowledge the cultural values of the cities (Sánchez et al., 2020). In 1992, "Cultural Landscape" was officially recognised as a category of protection on the UNESCO World Heritage List (Rössler, 2006). In the European Landscape Convention (COE, 2000), landscapes were regarded for their cultural, ecological, environmental and social dimensions, and the formation of local cultures with improved quality of life.

During the review, some key approaches were found that were particularly related to the study of this thesis. The first one was cultural landscapes. They are defined as an interwoven net of nature and culture, tangible and intangible heritage, embodying the essence of culture and people's identity (Rössler, 2006). This approach first integrates the landscape with heritage and eradicates the strict distinctions between historic environment and new development, nature and culture, and built heritage and context (Punekar, 2006). In urban heritage conservation practices, this approach explains the significance of intangible practices associated with tangible heritage and considers both as cultural artifacts (Taylor, 2015). Though this approach does not necessarily add mobility planning into the process, it does open an avenue by its eradication of strict distinction of components of the landscape.

Integrated landscape approach

The second approach is an integrated or holistic Landscape approach, which arose from the interdisciplinary use of the word landscape in a wide spectrum of practices. The characteristics of this approach are "multifunctionality" in terms of achieving multiple objectives, "transdisciplinary" in terms of linking different disciplines together, "participation" as in the exchange of information and engagement among stakeholders, "complexity" as in heterogeneity of the landscape and "sustainability" in terms of continuation of social-ecological systems (Freeman et al., 2015) (Sayer et al., 2013). On the overview, this approach is about creating a platform for negotiations among the multiple stakeholders, which may include political, economic, cultural, social, environmental,

etc. and making balanced policy decisions (Foli et al., 2018). This approach goes well beyond sectoral thinking and involves multiple stakeholders (Waeber et al., 2023).

According to Wu et al. (2017), in Sweden, at the time of the construction of the NS6 road, which passed through the "Tanum World Heritage Site" known for Bronze Age rock carvings, they implemented a holistic landscape approach to resolve the situation. This instance includes the considerations of heritage and landscape for mobility. The alternative route was proposed through an environmentally sensitive zone. Under the holistic landscape approach umbrella, the experts, authorities and public representation were summoned. Heritage concerns from public representation were filtered through experts and with negotiations among authorities; the road was built at the expense of an environmentally sensitive zone. This example exhibits the challenge of implementing the holistic landscape approach. This approach remains highly in the political or expert domain, and the role of its public is limited (Wu et al., 2017) . Specifically, in the context of this thesis, this approach is too vast without a specific established framework.

Historical urban landscape (HUL) approach

The third approach is Historical urban landscapes (HUL). By its structure, it is another inter-multi-transdisciplinary approach (Angrisano et al., 2016). The difference is that it introduced a change in the practice of heritage conservation as a "value in itself" to conservation as a "tool" to harmonise the ongoing changes to fit with the cultural heritage (Gravagnuolo & Fusco Girard, 2017). Under this approach, the urban area is considered as a historical layering of cultural and natural values and attributes. It also extends its approach beyond the historical centre to a broader context (UNESCO, 2011). Unlike the integrated landscape approach, HUL considers the urban landscapes in terms of historical layering, whereas integrated landscape considers landscapes and their components in terms of distinct ecosystems. Another important distinction is that integrated landscape aims to create a sustainable landscape by balancing and negotiating different ecosystems, whereas HUL empowers the local community through engagement, financial tools participatory planning to turn conflicts of interest into sustainable collaboration (Angrisano et al., 2016).

The HUL approach has the potential to become a catalyst for socio-economic development (UNESCO, 2011). According to Taylor (2023), the HUL approach helps planners, designers, locals, and governments visualise the layered cultural experiences and their influence on the urban landscape. With the HUL approach, it is possible first to conceptualise the urban landscape in terms of layers and then address all of them so that the new development does not overpower the tangible and intangible urban heritage.

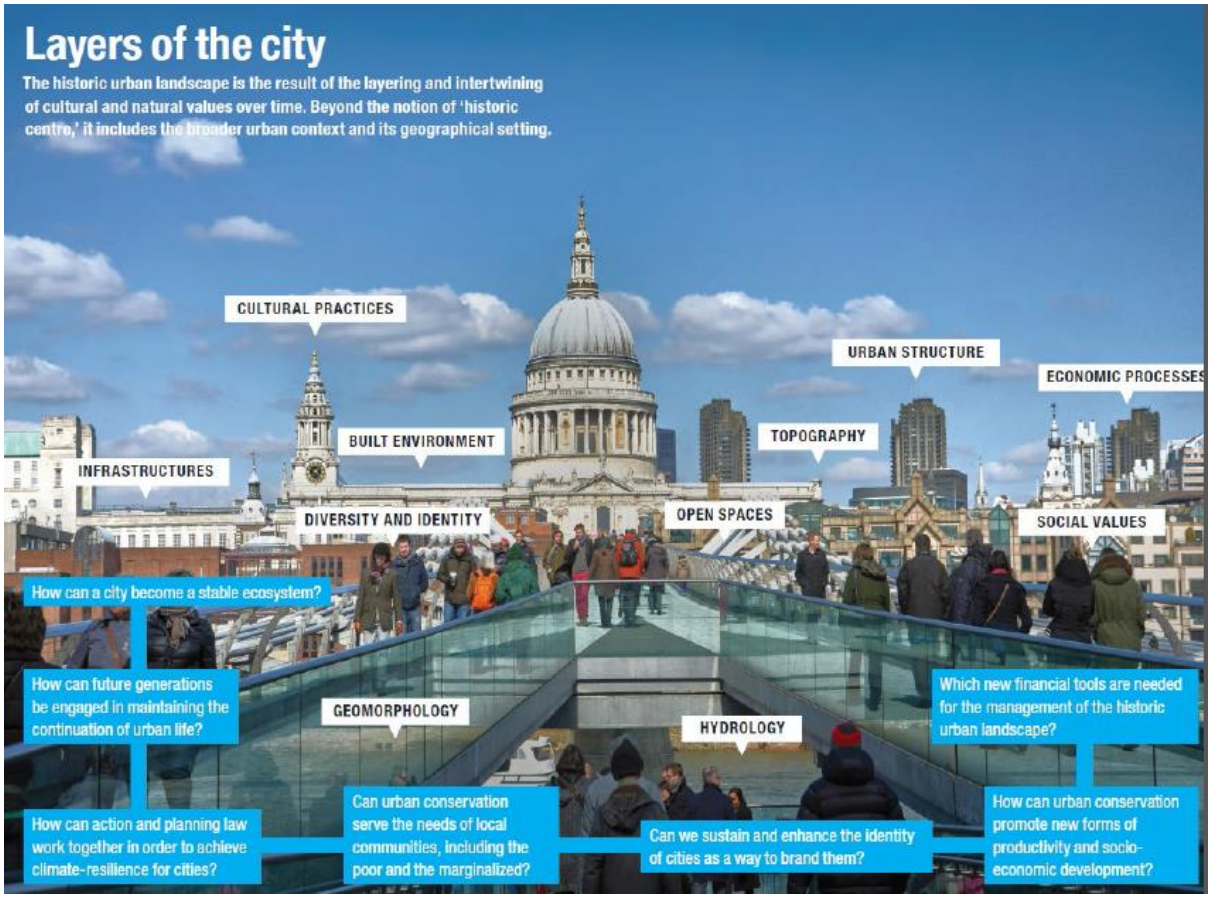


Figure 2 - Layers of the city (Source - UNESCO, 2011)

The HUL approach is also accompanied by its action plan and toolkit.

The action plan of HUL is as follows:

1. "Undertake a full assessment of the city's natural, cultural and human resources
2. Use participatory planning and stakeholder consultations to decide on conservation aims and actions
3. Assess the vulnerability of urban heritage to socio-economic pressures and impacts of climate change
4. Integrate urban heritage values and their vulnerability status into a wider framework of city development
5. Prioritize policies and actions for conservation and development, including good stewardship;
6. Establish the appropriate (public-private) partnerships and local management frameworks;
7. Develop mechanisms for the coordination of the various activities between different actors" (UNESCO, 2011).

There is not much explicitly mobility-related material available in the context of practices in HUL, but many researchers who have assessed case studies around the world using the HUL framework

strongly believe that the HUL approach is the most suitable for sustainable development, including mobility planning (Pino, 2018) (Wahurwagh & Dongre, 2015) (Wang et al., 2019) (Yin et al., 2019). UNESCO state of conservation reports (UNESCO, 2014) has published a list of major threats to the historical cities in the world, and transportation infrastructure is one of the major threats, but Gravagnuolo & Girard (2017) explain that exploiting the full potential of HUL can overcome these threats and create opportunities for sustainable cities.

Gaps and opportunities

This study aimed to find practices or approaches that integrate mobility, heritage, and landscape in a planning framework. After reviewing the available material, it was found that there was no specific data on this subject. The convergences of mobility and heritage were found to be used for tertiary purposes in terms of regeneration or pedestrianisation or even to attract tourists. These approaches (mobility-led and heritage-led) were implemented for a specific purpose and indirectly had an impact on the overall landscape. On the other hand, landscape-based approaches, where mobility and heritage are part of the landscape, have a bigger context, purpose, and holistic approach. Cultural landscape paved the way for the consideration of multiple faculties, including intangible heritage, as a part of the landscape. Still, it lacked a trade-off among the multiple disciplines within the landscape. The Integrated landscape approach filled that gap with its multidisciplinary and multifunctionality, but it lacks democratisation and localisation compared to HUL.

Even though no specific practices are recorded in the academic literature specifically related to a complex issue, such as this thesis, the HUL approach seems promising enough to help in decision-making. The approach gives a clear action plan and a toolkit for its implementation. It is specific to the urban context, and it considers the landscape components as layers, unlike other approaches where they consider different ecosystems. The HUL approach advocates for assessing the vulnerabilities of heritage in the modern context and fits conservation values in the city's development framework. This approach not only conserves the heritage but also develops the sustainable city approach. These salient features make HUL stand out among other features. The table below shows the comparative analysis of all the approaches that were found in this study.

	Heritage-led approach	Mobility-led approach	Cultural landscapes	Integrated landscapes	Historical urban landscapes
Scope	City or Neighbourhood specific approach	City or Neighbourhood specific approach	Urban or rural landscapes shaped by human and nature interactions over time.	Urban, rural, natural any kind of ecosystem	Primarily urban. Peri urban landscape of historical evolution
Goal	Leverage the heritage to establish a sense of identity for another objective	Leverage mobility to establish a sense of safety and quality of life to regenerate heritage city	To conserve the landscapes that reflect cultural traditions, histories, and identities.	To create a Multifunctional, transdisciplinary, Participatory, negotiation platform for a complex landscape for sustainable policy making.	To integrate urban heritage conservation practices as a tool into contemporary planning to help socioeconomic and sustainable development, by allowing multidisciplinary trade-off.
Key features	Sense of identity, promotion of walkability	Urban regeneration, quality of life	No barriers among tangible-intangible, human-nature, historical-new etc.	Holistic landscape approach, multidisciplinary system, trade-off among different sectors, and sustainability of ecosystems within the landscape.	Layered analysis of urban form, Vulnerability assessment of heritage, Governance, policies, participatory planning, and financial tools for the sustainable landscape development

Table 1 - Comparative analysis of different approaches in the integration of Mobility, heritage and landscape (Source - Author)

Every approach has some important key features that will help this thesis, but it will mainly follow the HUL approach for assessing Pune and the proposed framework of LAMP. As convincingly proposed by Taylor (2023) that HUL can become a platform for city planners, local communities and government (national to local) to put collaborative effort by addressing the layers of the urban morphology and avoid harm to tangible, intangible cultural values of the landscape by overwhelming new urban development.

3. Aim and Methods

This chapter defines the problem statement, which sets the focus of the thesis and provides a glimpse of the research discussed throughout the subsequent chapters. The aim, research objectives, and questions further enunciate this research's focus. The methodological framework explains the steps to achieve the aim, fulfil the objectives and answer the research questions.

3.1 Problem statement –

Today, Pune stands at a pivotal moment where its historical-cultural heritage and identity are challenged by overwhelming urbanisation, resulting in traffic congestion and excessive mobility. The heritage, including a distinctly local religious culture (Preston, 2002) that has developed since the time of the Marathas and evolved through British rule, the freedom struggle is overshadowed by specifically recurring traffic congestion and unregulated parking, among other factors. The lack of integrated effort among the concerned heritage and mobility authorities in planning further multiplies the issue. A rapid mobility infrastructure development envisaged by the national government throughout the city can be seen through the example of the construction of Metro lines (Deshpande A. , 2024) where the elevated columns have already altered the city's landscape, to avoid further decay of the city's historical landscape, a more integrated, participatory, and localised effort is required.

Pune's tangible and intangible heritage makes its identity as the cultural capital of the Maharashtra state. These heritage monuments and intangible practices, such as festivals, craftsmanship, etc., are concentrated in Pune's city centre, in a small part of the city yet the most significant. These areas including historical markets, religious places, craftsmen's allies, etc., are along the historical roads, which are incompatible with the traffic that has evolved through recent years. This area also encompasses many locally important heritage sites (Preston, 2002) which may not be considered important at the National, State, or even overall city level, but these places and their religious-cultural practices shape the city's historic urban landscape. In complex situations such as this, expanding more infrastructure or even maintaining an infrastructure-oriented approach could further threaten the city's identity.

The local area mobility plan is the micro-level planning where the smallest contextual factors that are affected by the mobility of that particular area are considered, which may not be important at the city level (Martínez et al., 2005). This kind of planning is better suited for complex areas such as the city centre of Pune, which is a melting pot of numerous Historical, cultural and economic

activities. It is important to explore the possibility of a tool like a local area mobility plan to integrate mobility, heritage and urban landscape at the local level.

3.2 The Aim, Research Objectives and Research Questions

This thesis aims to analyse governance tools/policies related to mobility planning and heritage conservation to identify their approach towards possible integration and gaps. It also seeks to examine a defined case study area in the city centre of Pune for its current state of mobility with its landscape of heritage sites and intangible cultural practices. Then, this thesis aims to propose an integrated framework of Mobility, Heritage and Landscape as a local area mobility plan along with the necessary recommendations and guidelines.

Research Objectives

To achieve the aim of this thesis, the objectives are formulated to create the path for a systematic research framework. These objectives are -

- To analyse the governance structure and tools/policies in place related to mobility planning and heritage protection for the city centre of Pune to prove the gaps in their approach.
- To propose the necessity of addressing mobility and heritage conservation in an integrated approach by analysing the current mobility and heritage scenario of a case study area in the city centre of Pune.
- To propose a local area mobility framework with recommendations and guidelines that integrates its mobility, heritage and historical urban landscapes for a case study area in the city centre of Pune.

Research Question

In the next step toward framing the structure of this thesis, research questions are formulated whose answers will help fulfil the objectives and achieve the aim of this thesis.

- What priorities have been set by the urban mobility and heritage conservation authorities at various levels of governance through their tools, and how has it impacted the historical landscapes of the city centre of Pune?
- How do mobility planning and tangible/intangible heritage influence each other?
- How can the Local area mobility plan for the case study area of Pune's city centre integrate heritage and landscape conservation considerations into mobility planning?

3.3 Methodological Framework

To answer the research questions, fulfil the objectives and achieve the aim of this thesis, a four-phased methodological framework is designed, as shown in Figure 3.

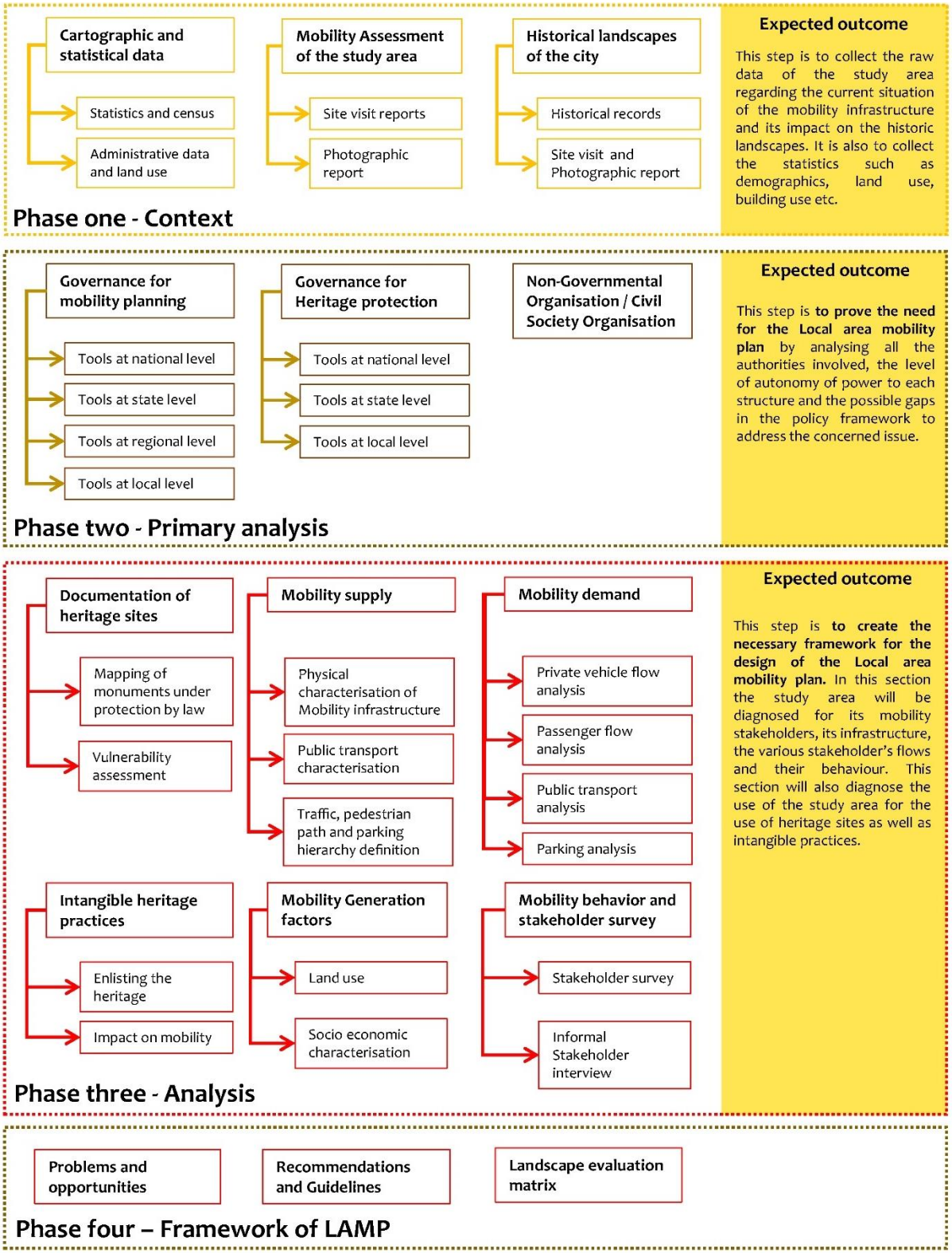


Figure 3 - Methodological framework of the thesis (Source – Martínez et al. (2005) modified by Author)

These phases will systematically conduct an in-depth assessment of the governance structure of mobility planning and heritage conservation, along with an assessment of the ground reality in the city centre of Pune. Initially, it was realised that the city centre area of Pune was a vast area for the argument of this thesis, so, in the first phase, the case study area is defined based on the concentration of heritage sites, both tangible and intangible. The cartographic data about the historical expansion of the city was used to support the decision-making. The statistical data from the municipality was used to understand further the general scenario in terms of land use, socio-economics, condition of the buildings, etc. Fieldwork, including a site visit and photographic documentation, was also conducted to support the assessment of the case study area

In the second phase, the overall governance system related to mobility planning and heritage management is analysed from the national level to local level authorities. It enlists the hierarchy and the power of autonomy for decision-making at each level of governance. It also enlists every tool, instrument, and policy each level of authority has that impacts mobility planning and heritage management. It also analyses all the possible gaps at each level that affect the effective governance and integration of mobility in heritage-sensitive areas. It also includes the role of the CSO/NGOs working in the field of mobility improvement and heritage preservation. Then, this phase, by proving all the gaps, concludes by making the case for Local area mobility planning.

The third phase includes the analysis of the mobility scenario on the ground and the documentation of tangible and intangible heritage practices. The results of this phase will be used to build the framework for the local area mobility plan. This phase is structured in six points -

- First, the assessment of the local heritage sites, a tangible aspect of the historic urban landscape, is conducted through photographic documentation. These sites are documented according to National, State, Municipal, and local NGO sources. Photographic documentation presents the effect of excessive mobility on the heritage sites. At the same time, the specific laws associated with those are enlisted to represent the heritage conservation efforts by different authorities.
- The second point deals with the documentation of cultural practices, rituals, and craftsmanship, which contribute to the intangible aspects of the historical urban landscapes of the case study area. This documentation consists of enlisting intangible practices throughout the year and categorising them. It also includes mapping those practices with their spatial settings, spatial relationships and their influence on mobility in the case study area. This information is gathered through observation, photographs, and informal stakeholder interviews.

- The third point starts the analysis of the mobility scenario onwards. First, the study of mobility generation factors is conducted where the land use map by the Pune municipality is used as a base, and the mobility generation in each use is cross-checked through an observational study. This analysis of possible differences between designated land uses defined by the municipality and the practices observed on the ground, along with the key attractions for mobility generation factors, offer the pattern of mobility in the case study area. A photographic report is used for each land use type to showcase the results.
- The following point documents existing mobility demand regarding footfall and traffic count through all transport modes, including private, walking, and public transport. This data is essential in understanding the magnitude of people using the mobility infrastructure, yet it is impossible for this thesis to conduct it independently. This data is collected from PMR's Comprehensive Mobility Plan 2018, where the traffic count is published at various key locations in the case study area. This analysis will also help understand users of the mobility infrastructure at the hotspots in the case study area.
- The fifth point is documenting existing mobility supply in terms of available infrastructure such as vehicular roads, pedestrian infrastructure, bicycle infrastructure, public transport infrastructure, etc. Also, the direction regulations for the traffic, such as one-way streets and the widths of the roads, are mapped for the case study area. There is insufficient material available through official records, so the combination of satellite maps, field observations, and government records is used for this section. This study will help to compare the supply in terms of infrastructure with the earlier demand in terms of footfall.
- The sixth and final point focuses on understanding mobility behaviour patterns through a survey of stakeholders. This section includes two types of data collection: structured surveys and informal interviews to understand stakeholders' issues and expectations better.

The final phase consolidates the problems identified in earlier analyses, focusing on mobility, heritage, and historical landscapes. This phase summarises the key challenges affecting the case study area. It presents the strategic opportunities through the framework of a Local area mobility plan that can help combine the two disciplines that are currently working in silos. Through recommendations and guidelines, it proposes a comprehensive framework of LAMP that integrates mobility, heritage, and landscape. This section also enlists the limitations of the thesis due to the lack of resources and research available. This section ends with the possibility of different research avenues that can be sketched out through this thesis.

4. Case study contextualisation

The city centre of Pune or, as referred by PMC (2013), congested area or core area of Pune is also commonly called the "Peth areas". A "Peth" historically was known as the commercial area (Datar, 2013) but currently, it is referred to as the sub-district within the city centre area. There are several such "Peths", for example, "Kasba Peth", "Shaniwar Peth", "Budhwar Peth", etc. But the overall city centre or combined Peth areas is a vast scope for this thesis. Therefore, a defined case study area must be selected to move further. Since this thesis focuses on the historical landscapes of the city centre of Pune, the case study area is extracted from the map of the city's historical expansion.

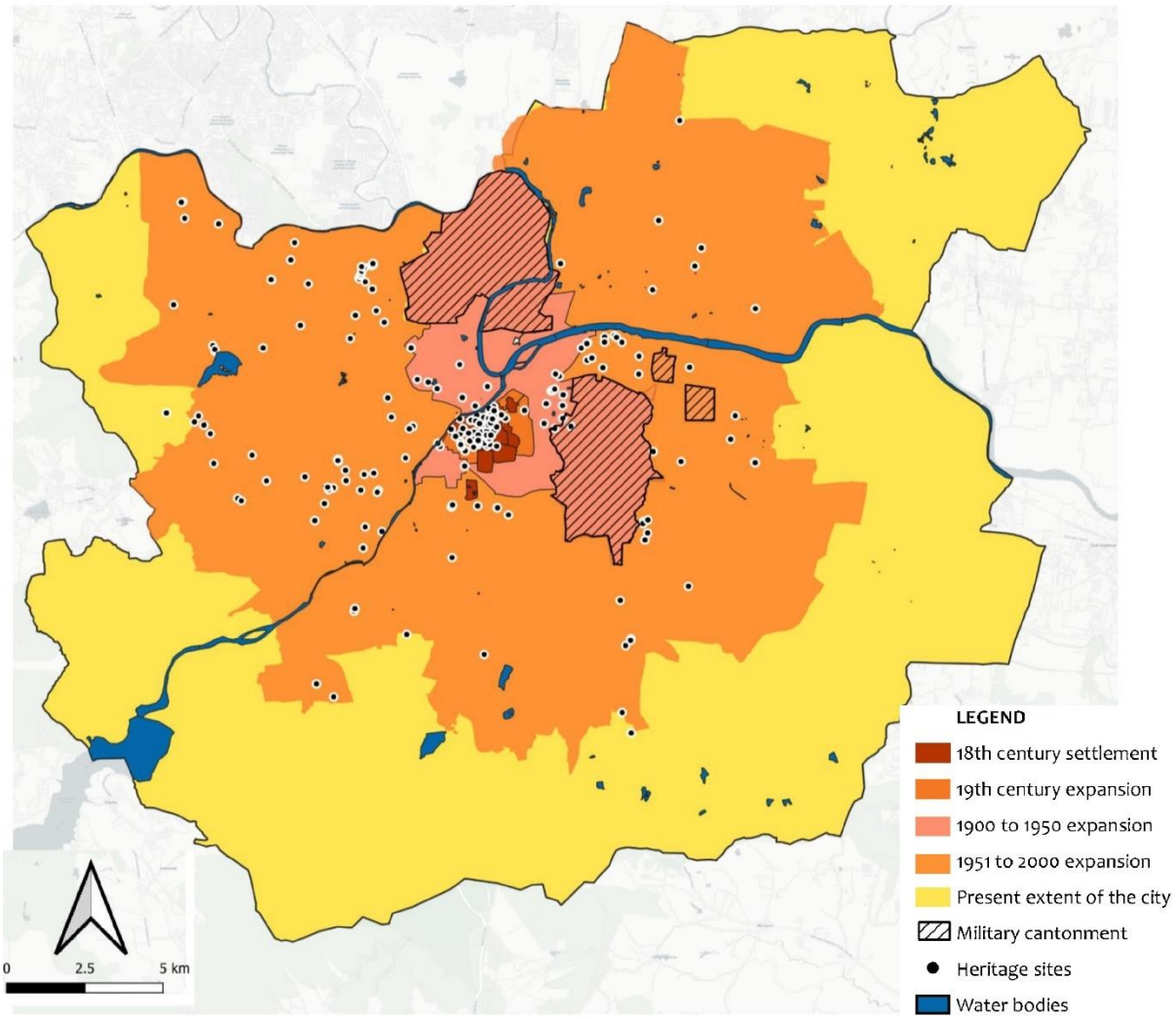


Figure 4 - Historical expansion and the heritage sites of the city. (Source – data from Datar (2013) & Compbell (1885–1901) illustrated in map by Author)

Figure 4 shows the historical expansion of the city of Pune. From the small settlements in the 17th–18th centuries, it has now, according to PMC (2013), grown into a municipality spanning 340.45 sq. km. but more recently, according to Jadhav (2021), 516.18 sq. km. Figure 4 also shows the

concentration of heritage sites clustered in the city centre. Due to various factors, most of the city's expansion occurred during the 20th and 21st centuries. This rapid development has left a dense concentration of heritage sites isolated in the historic city centre.

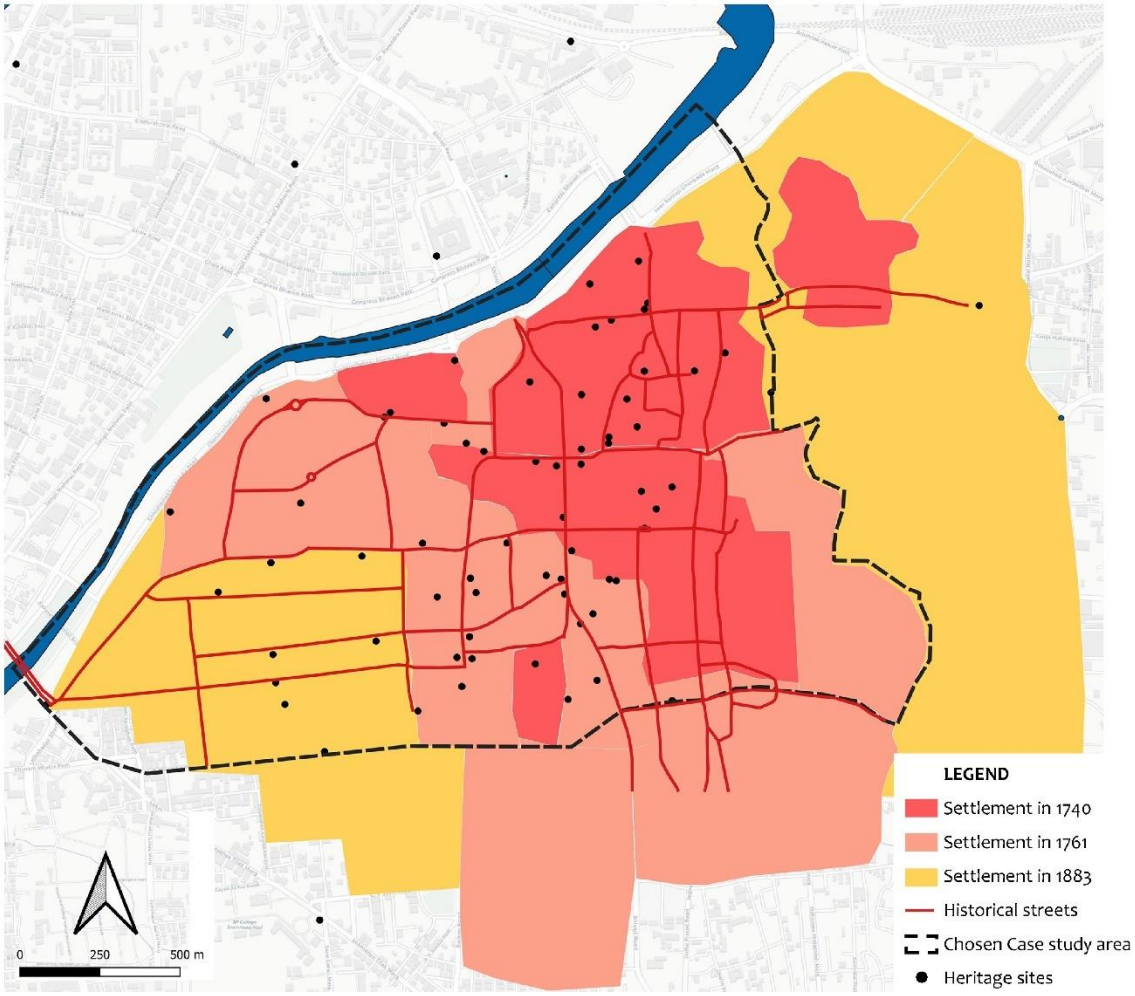


Figure 5 - A chosen case study for the thesis in accordance with the historical settlement and heritage site clusters. (Source – data from Datar (2013) & Compbell (1885–1901) illustrated in map and modified by Author)

Therefore, for the sake of the focus of this thesis, the case study area must be in the city's historic core. Figure 5 shows the most historic settlements and heritage sites recognised by (PMC, 2018) and the road network that continues to shape the city's urban form. These streets were designed primarily in the 18th and 19th centuries and are still used today.

Considering these historically significant factors and focusing more on the cluster of heritage sites, Figure 5 also shows the chosen case study area for this thesis. As can be seen, several historical and cultural landmarks that represent the city's identity are present in the case study area, which will help analyse the effect of excessive mobility. On its northern side, the case study area is bordered by banks of the Mutha River, which will act as a natural edge to this culturally and historically dense urban landscape. This case study area spans an area of 2.185 square kilometres.

4.1 Cartographic and statistical data

The case study area is well within the "Peth areas" of Pune, though the municipality does not officially recognise its boundaries for governance purposes. On the contrary, the case study area is governed and represented by different authorities at different levels of governance. As mentioned before, for this thesis, the chosen case study area is based on the concentration of the heritage sites, so it is governed by multiple authorities. Figure 6 shows the involved authorities.

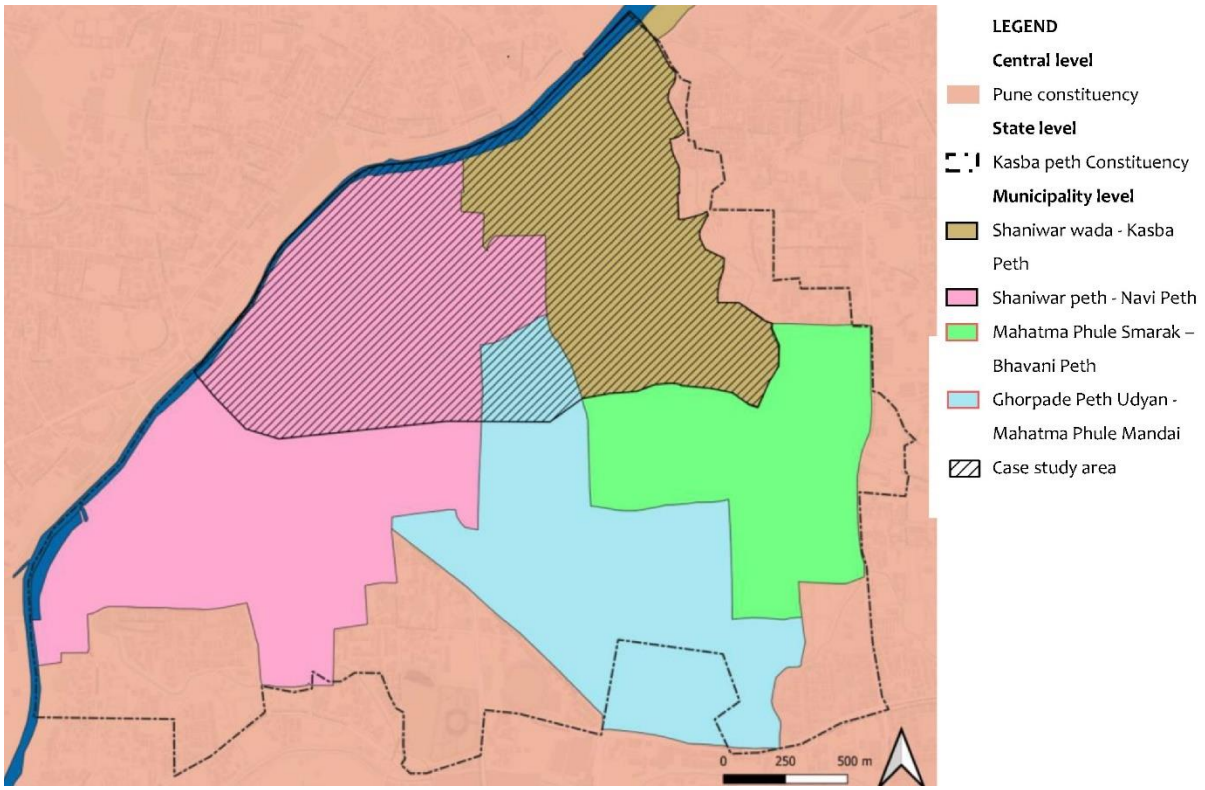


Figure 6 - Administrative boundaries in the study area (Source – PMC (2022) modified by Author)

Also, since the boundary of the case study area is not defined by any authority, the census is divided within the municipality wards. According to PMC (2022) the population of each of these wards is as follows –

1. Shaniwarwada - Kasba Peth ward – 67,701
2. Shaniwar peth - Navi Peth - 67,951
3. Mahatma Phule Smarak –Bhavani Peth ward – 67,592

As can be seen in Figure 6, the Shaniwar wada – Kasba Peth ward is incorporated into the case study area. The rationale behind it is that Kasba Peth is known to be the first-ever settlement of the city (Mundhe & Jaybhaye, 2017). Shaniwar Peth – Navi Peth ward and Mahatma Phule Smarak –Bhavani Peth ward are partially included in the chosen case study because those parts of the city include some important historical sites.

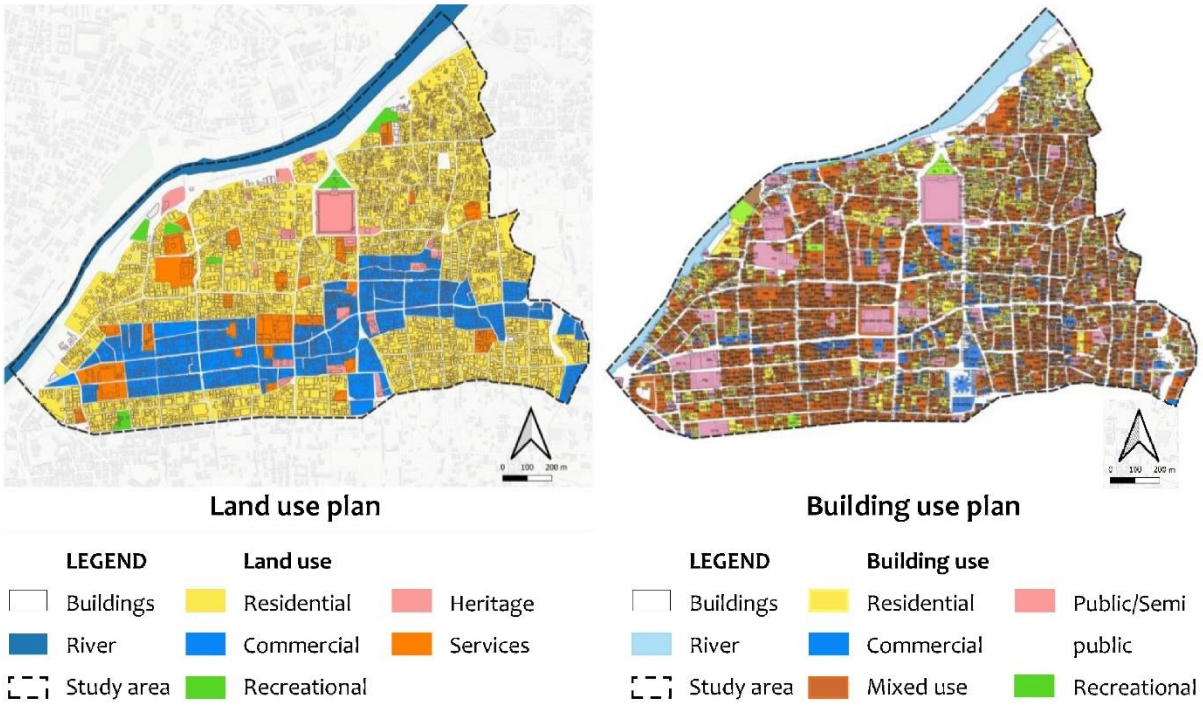


Figure 7 - Land use map and Building use map for the case study area. (Source –PMC (2013) cropped for the case study area by author)

The case study area is observed to be high-density, compact, and significantly congested in terms of population. It has developed organically since the 18th century (Nagapurkar & Narkhede, 2019). The area reflects the combination of regulated and unregulated development patterns (PMC, 2013), which shows the absence of systematic planning efforts before rapid urbanisation. In the first picture of Figure 7, the land use map shows designated specific zones for residential, commercial, and other purposes. But when cross-referenced with the second picture of Figure 7, the actual building usage within the area is predominantly mixed, regardless of the land-use designation.

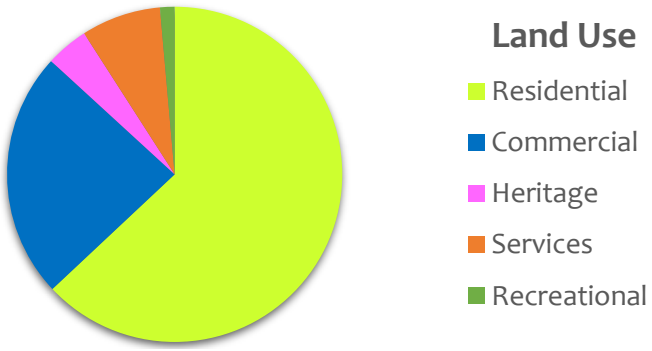


Figure 8 - The pie chart representation of land use considered by the PMC (Source – PMC (2013) represented in the pie chart by author)

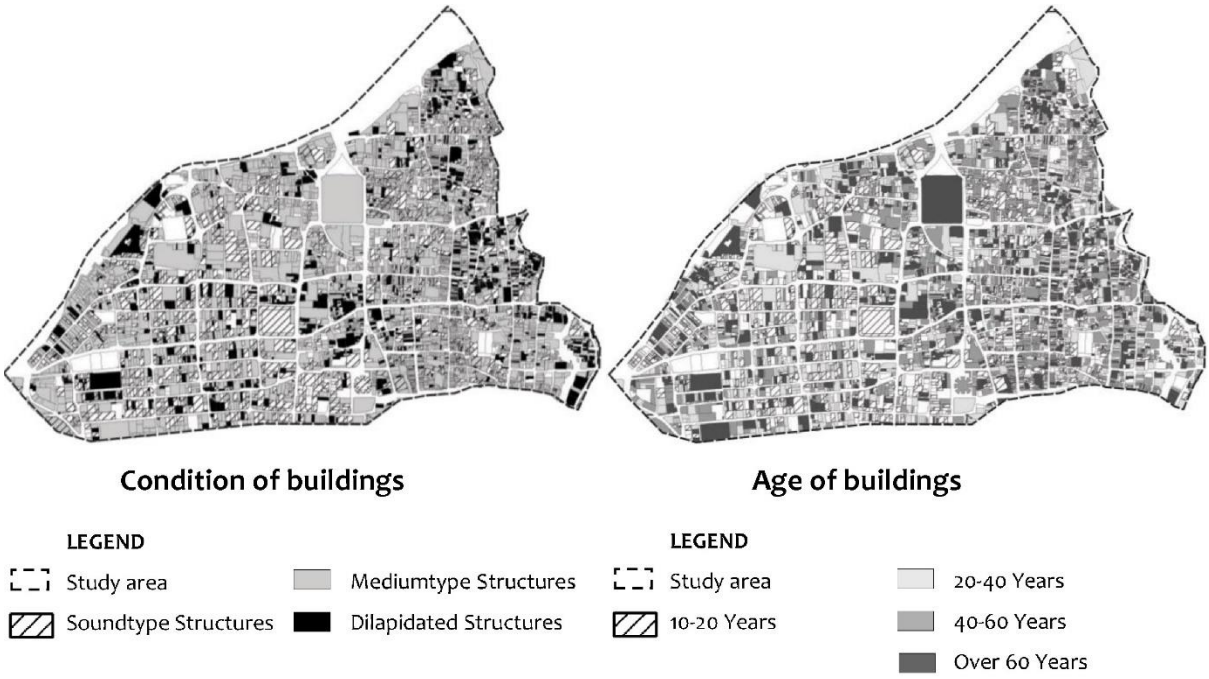


Figure 9 - The condition and the age of the built structures in the case study area. (Source – PMC (2013) cropped for the case study area by the author)

Other interesting maps of the case study area are shown in Figure 9, where the condition of the built structures can be seen to be dilapidated in great numbers. These structures are known to have historically given identity to the landscapes of Pune, but during the recent urbanisation process around these structures, they are observed to be sidelined. Among many other reasons, one is that these houses are habited with economically weak sections (PMC, 2013) who may not afford to reconstruct the structures. Figure 9 also shows the age of the built structures in the case study area, encompassing many historical structures.

Although built structures and their conditions are outside the scope of this thesis, they have a major impact on the city's landscapes and mobility. The age and condition of structures can be used to make informed decisions about where to limit or adapt mobility infrastructure projects. For example, the LAMP could include detailed buffer zones around critical heritage buildings where motorised infrastructure could be limited, which might create a conducive environment for heritage protection.

4.2 Mobility Profile

This section introduces the mobility scenario of the case study area through observational and photographic reports. As shown in Figure 10, the case study area can be characterised by its complex nature in terms of dense urban fabric, heritage sites, and a mix of commercial, residential, and cultural activities. So overall, it also creates a complex scenario for the mobility system. Different stakeholders are involved in motorised mobility options, as shown in Figure 10, it can be observed that it is a unique mix of public transportation, intermediate public transport or paratransit options, and private vehicles on relatively narrow streets. Figure 10 shows the scenes from the Bajirao and Shivaji Roads, which are most critical in mobility infrastructure and historical landscape. Usually, vehicles are observed to have no opportunity for any halting point even though these streets accommodate many local businesses, schools, Religious-cultural spaces and heritage structures. Parking is chaos and usually is illegally practised. Also, as can be seen, the streets are not equipped with the NMT or pedestrian infrastructure, which is the story of the entire case study area.

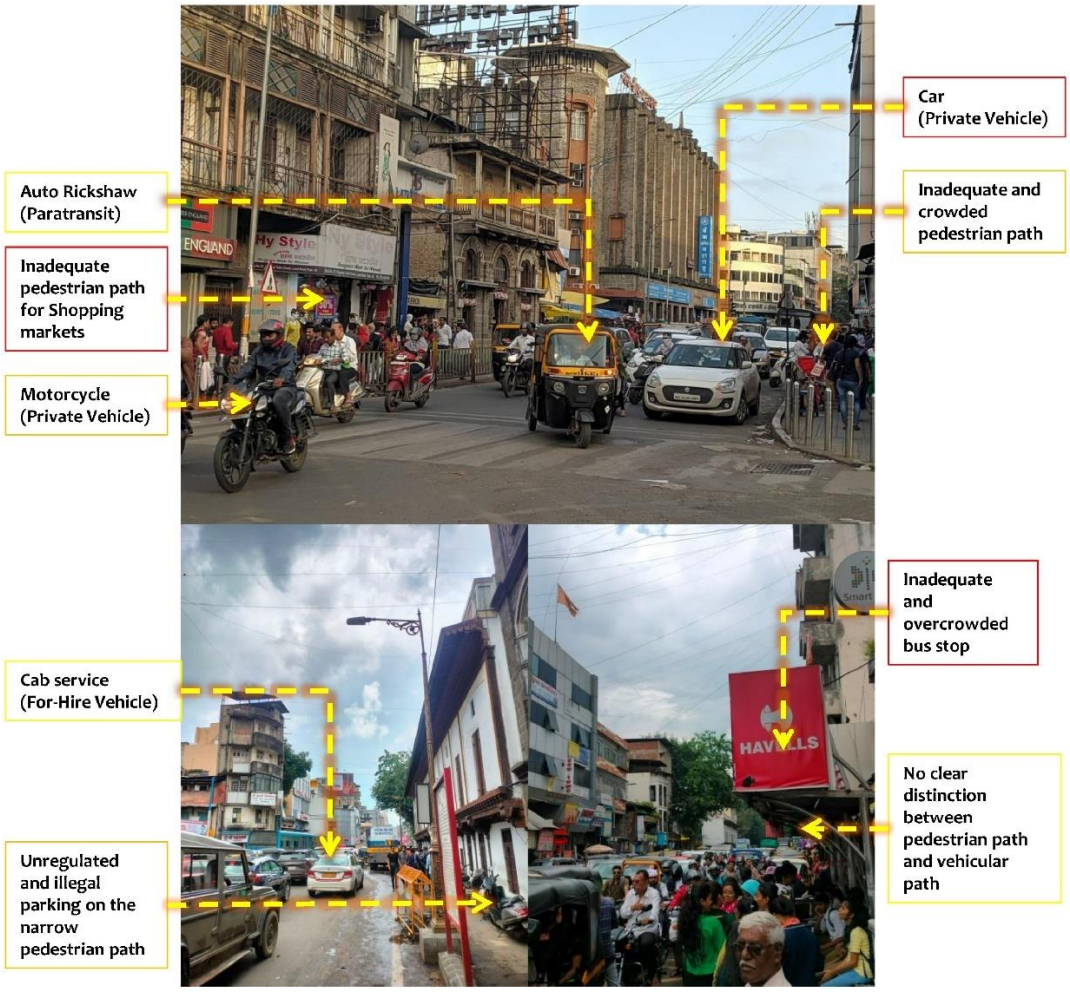


Figure 10 - Photographic documentation of mobility state of art. (Source - Author)

Pune City has experienced a very high surge in vehicle ownership, which is more than the population itself (Indo-Asian News, 2018). This trend is clearly visible on the streets of the case study area. The motorcycle is observed to be the preferred vehicle. This is also observed to lead to overwhelming parking requirements, but since the case study area cannot cater to this requirement, it results in illegal and unregulated parking.

Figure 11 - Photographic representation of mobility state of art. (Source - Author)

Auto rickshaws are a type of paratransit transportation system, which is another preferred mobility option. As can be seen in Figure 11, they play a dominating role on the streets. This option gets last-mile connectivity at relatively economical prices, and it is also smaller than a car, which helps to travel through heavy traffic areas. There are approx. 103,000 auto-rickshaws in the city (Tigga, 2024), and it is observed that they do not necessarily stop at designated parking spots, taking up a substantial amount of space on already very busy streets. As can be seen in Figure 11, there is a bare minimum walking infrastructure on some roads. Still, local businesses or informal economies, such as hawkers or street vendors, often encroach on these walking pathways.

4.3 Historical landscapes of the city

This section introduces the historical landscapes of the case study area with a brief history. These landscapes of the case study area, however dilapidated to the present day, are a testimony of the architectural and cultural heritage of Maharashtra state. According to Mahajan (2000) this heritage is chronologically developed in four distinct periods, and each has made a significant contribution to the development of this landscape.

- Pre - Maratha Period up to 1600
- Maratha Period (1600-1817)
    A. Bhosale Dynasty (1600-1680)
    B. Period of Peshwas (1713-1817)
- The British Period (1818-1947)
- Post-Independence Period

A small settlement that has evolved from the time of Chhatrapati Shivaji Maharaj of the Bhosale dynasty in the Maratha period to today's rapidly urbanising city makes a complex historical urban landscape for the case study area, with numerous layers that have evolved through centuries.

Figure 12 - Historical landscapes of the case study area with its distinct "Wada" architecture (Source – Standage (2021), Discover Maharashtra (n.d.) & Author)

Owing to the initial stability maintained during the period of Peshwas, a regional architectural style was developed called "Wada." (Nagapurkar et al., 2020). These Wadas remained a standard practice during the British era in Pune. Interestingly, few European architectural elements were added to it. One such example can be observed in "The Nagarkar Wada" in the case study area. This particular structure has Maratha, Venetian, and Gothic architectural elements. In the post-independence period till the 1990s, these structures defined the city's landscapes.

According to Deshpande & Narkhede (2021), the case study area is also a peculiar example of the Maratha town planning style with its connectivity to the resources and road design. The streets were designed in tree branch patterns because of the problematic topography in the Western Maharashtra region. The width of the road was designed to carry a bullock or horse cart. The hierarchy of these roads was as follows: Primary roads, Internal roads, and subordinate roads. The primary and internal roads were designed parallel, while subordinate roads were curved or zigzagged. The general road width of the primary road varied between 7.5 to 10 meters, while for the Internal Road, it was nearly 3.15 to 4.5 meters. Subordinate lanes, on the other hand, were the narrowest ranging between 1.8 to 2.5 meters.

The current chaotic urban scenes can be better understood considering these case study areas' historical and traditional planning patterns. The area was designed in an era where mobility needs were limited to pedestrians and animal-drawn carriages; in the current scenario, these neighbourhoods cannot accommodate modern traffic demands.

The case study area is also known for its festivals, historic settlements of craftsmen, religious and cultural rituals, etc., adding an intangible value to the historical landscape. These practices are discussed in detail in further chapters. Most importantly, these equally important practices with historical structures are in danger because of the emerging excessive mobility. Therefore, its consideration in mobility planning is paramount to sustaining the city's identity.

5. Governance and Planning

This section addresses the mobility and heritage governance systems and analyses their current state. This section starts with the key concepts of transportation and mobility and their usage in the Indian governance system. It enlists the departments at every level of the governance system. It also enlists the tools, instruments, and policies they use to understand the priorities of the authorities in their respective fields. The analysis also aims to identify existing gaps that obstruct comprehensive development.

The primary intention of this study is to prove that, in India, mobility and heritage governance work separately in a top-down manner, where the national government envisages the planning of its cities. The city's lack of contextual planning and horizontal coordination among various departments, such as mobility and heritage, damages the historical Urban Landscape. This section analyses Mobility planning and heritage conservation governance separately because that is how they are practised on the ground.

Mobility Vs Transport

It took the 21st century for India to make dedicated efforts from Central (National) and state (provincial) governments to institutionalise ‘urban transportation planning’ (Gijre & Gupta, 2020). The terminology here is crucial, as there is a fundamental distinction between "transportation" and "mobility". Transportation refers to the act of moving people or goods, whereas mobility is about the ability to move freely or be moved. From the start, the governance related to transportation lacked a sustainable vision, and policies related to private vehicular transport were prioritised (Dawda, 2024) as opposed to providing multiple mobility options.

The word mobility itself was introduced in the 'Comprehensive Mobility Plan' (CMP) 2005, which marked a significant shift by emphasising the mobility of people rather than just the transportation of vehicles. This policy was introduced as a part of the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) 2005 and National Urban Transport Policy (NUTP), 2006, which aimed to optimise the “mobility patterns of people and goods” over merely accommodating vehicles, Promotion of NMT, etc. (CMP Preparation Toolkit, 2008). But by the time this initiative was legislated in the Indian Parliament in 2008, the country already had over 90 million active registered vehicles on the ground and a population of 1.207 billion (Census of India, 2011).

5.1 Governance Structure for Transportation - mobility planning

In the Indian context, different ministries, departments, and agencies across the central, state, and municipality levels are involved in other urban transport planning and implementation tasks. As described by Vaidyanathan et al. (2013), It is very nascent, primarily top-down, and constantly evolving. Figure 13 shows the governance structure for transportation planning in a top-down fashion from the central government to the municipality of Pune.

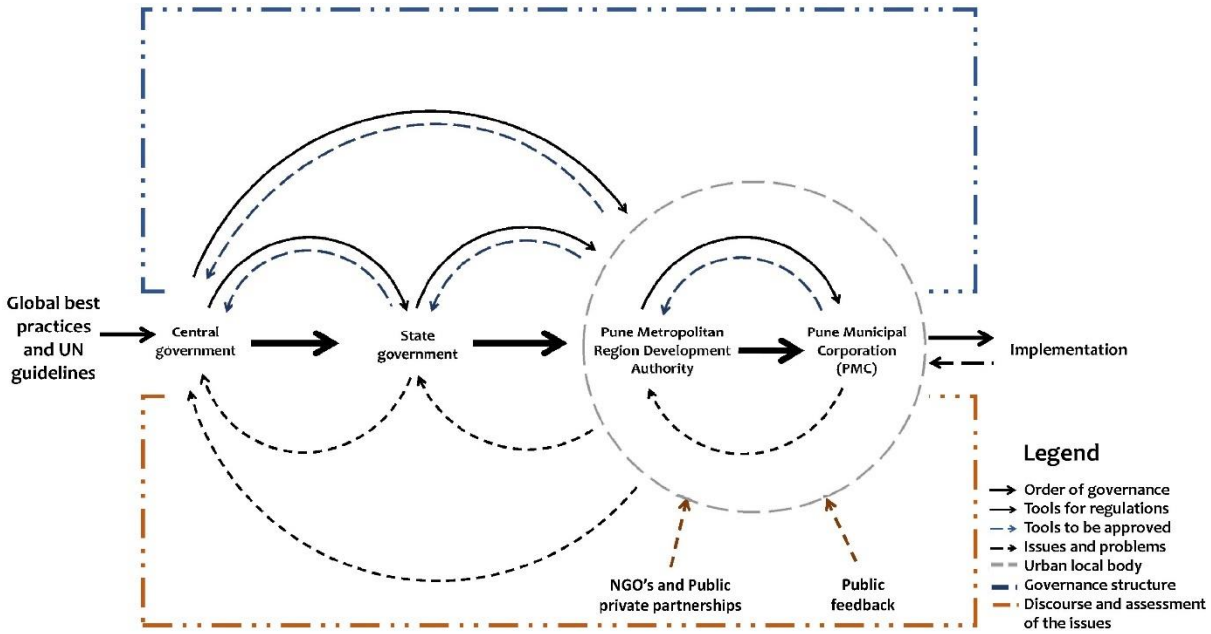


Figure 13 - Governance structure for Transport-Mobility planning. (Source – Author)

According to the Indian Constitution, urban transport is the responsibility of the state governments, but the national government designs the policies, vision and recommendations (Gijre & Gupta, 2020). In other words, although the state governments are responsible for urban transport initiatives, the central government is responsible for shaping the strategy and nationwide standards. This shows the power concentration at the central AKA at the national level to shape any policy design.

At the Central Government level, The Ministry of Road Transport and Highways used to serve as an apex body responsible for formulating, administering, and consulting on road transport policies, but since 2017, The Ministry of Housing and Urban Affairs has been responsible for urban transport planning (Gijre & Gupta, 2020). It formulates policies, sponsors programs, and monitors various urban development initiatives nationwide. In addition to these, NITI Aayog is another institution responsible for monitoring the Sustainable Development Goals (SDGs) while promoting competitive and cooperative federalism among States and Union Territories (Niti Ayog, n.d.).

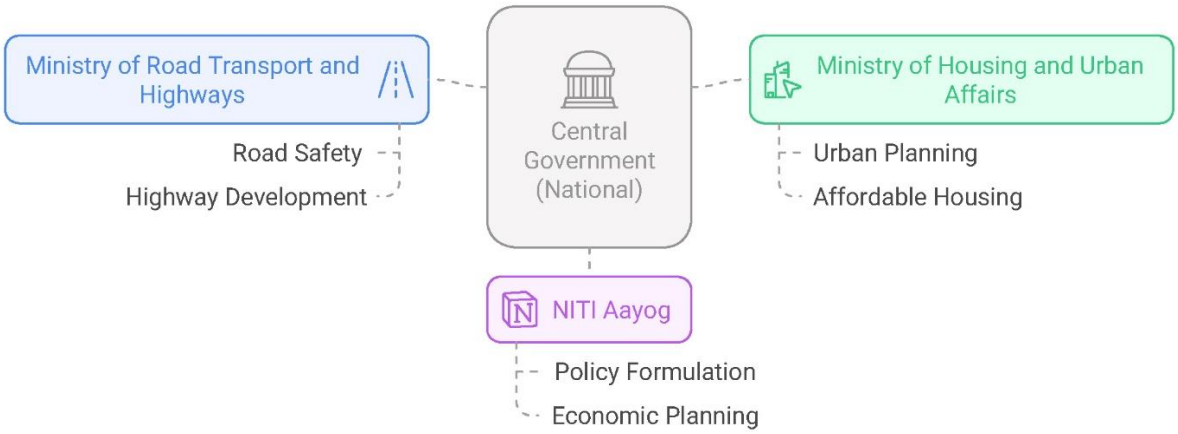


Figure 14 -Ministries for transport-mobility planning at national level (Source – Author)

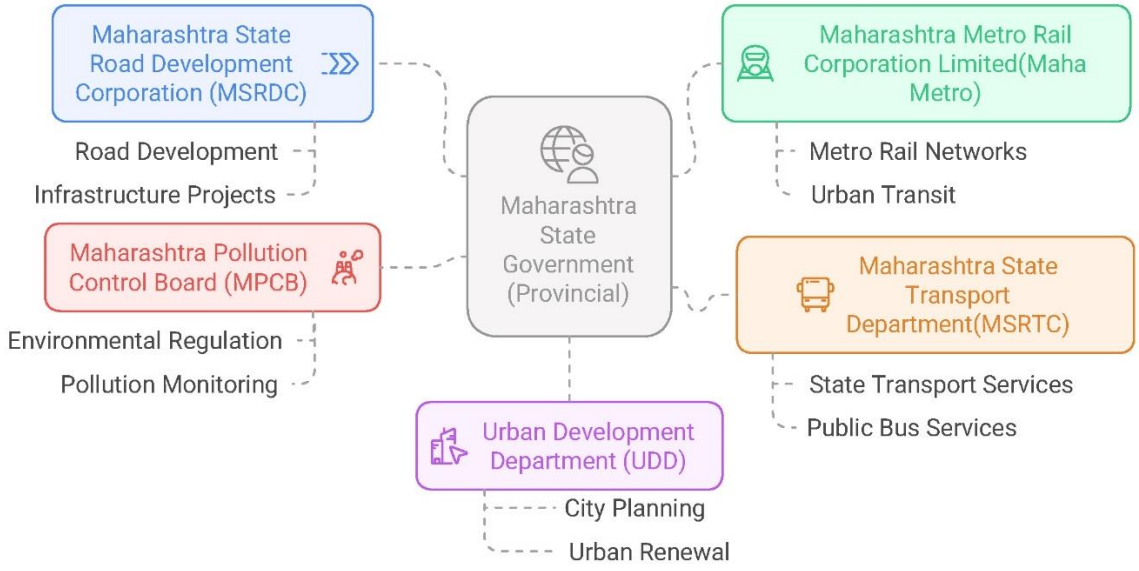


Figure 15 – Ministries for transport-mobility planning at the state level (Source – Author)

Figure 16 – Departments for transport-mobility planning at regional level (Source – Author)

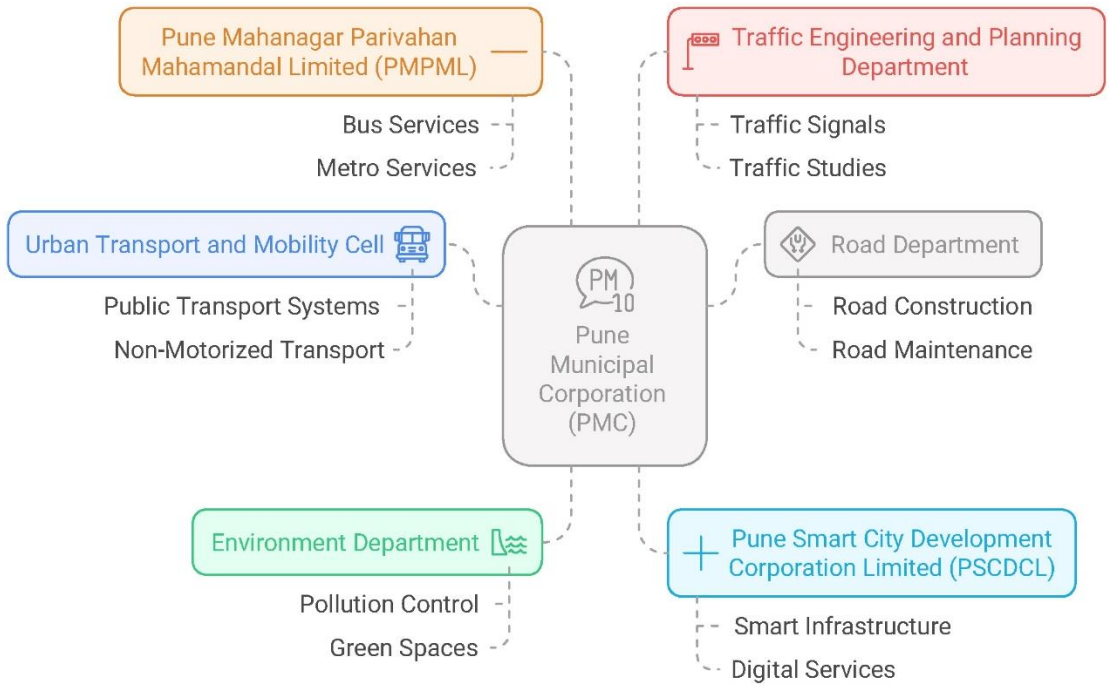


Figure 17 - Departments for transport-mobility planning at municipality level (Source – Author)

At the state government level, specifically in Maharashtra, where Pune is situated, another set of departments oversees regional transport and infrastructure projects. The Maharashtra State Road Development Corporation (MSRDC) is responsible for land and road projects, including all infrastructure projects (MSRDC) . Maharashtra Metro Rail Corporation Limited (Maha Metro) is a joint entity between the Government of India and the Government of Maharashtra that manages metro projects in the state (Maha Metro, n.d.). The Maharashtra State Transport Department (MSRTC) provides a state-run bus network connecting towns and cities within Maharashtra and neighbouring states. The Urban Development Department (UDD) is an urban affairs ministry at the state level, and it guides and coordinates transport-related policies. The Maharashtra Pollution Control Board (MPCB) is another stakeholder in the state-level governance, which enforces environmental laws on transport-related development in the city.

At the regional level, the Pune Metropolitan Region Development Authority (PMRDA) was founded in 2015 to plan transit infrastructure in the Pune Metropolitan Region, among other tasks. Its goal is to strategically organise and control urban development in the wider Pune metropolitan area.

At the local level, governance is handled by Pune Municipal Corporation (PMC). This is an urban local body. There are again several departments dedicated to urban and transport development. The Urban Transport and Mobility Cell addresses urban mobility challenges. The Road Department focuses on maintaining and developing the city's road infrastructure. The Pune Smart City

Development Corporation Limited (PSCDCL) implements smart city projects to enhance urban living through technology. The Pune Mahanagar Parivahan Mahamandal Limited (PMPML) manages Pune's public bus transport services. The traffic engineering and planning department works on improving traffic flow, road safety, and reducing congestion.

Tools at the National level

This section analyses the evolution and currently active transport-related tools at the disposal of the central government in terms of policies, acts and laws. Table 2 enlists these tools and their strategic objectives in terms of their focus. This table of policies provides an understanding of evolving priorities and the strategies that have been considered over the years. With the help of (Census of India, 2011) and other available resources; the table also shows India's population at the time of policy formulation and the number of vehicles operating on the streets. Such cross-referencing allows for a critical analysis of these policies. The table also shows the policy's current status to understand its impact on the current mobility scenario.

Tools	**Objectives**			**Population**	**Then operating vehicles**	**Current status as of January 2025**
	Urban development	**Motorised mobility infrastructure**	**Non-Motorised mobility infrastructure**			
Metro Railways (Construction of Works), 1978 Act and Amendment Act in 1982	NA	To construct the metro railways in the metropolitan cities of India.	NA	666.3 million	5.4 million	This legislation remains foundational and functional for metro rail projects across various Indian cities.
The Motor Vehicles Act, 1988	NA	To provide driver licenses, vehicle registration, traffic regulations and permits to control motor vehicles.	NA	833.7 million	21.4 million	The Motor Vehicles Act 1988 has been significantly updated by the Motor Vehicles (Amendment) Act 2019.
Integrated Transport Policy, 2001	NA	To Improve transport infrastructure and encourage private sector participation	NA	1.079 billion	55 million	As of now, it is not actively enforced in its original form.

Jawaharlal Nehru National Urban Renewal Mission (JNNURM), 2005	JNNURM mandated cities to prepare Comprehensive Development Plans (CDPs) to integrate land use into transport planning.	To create sustainable transportation, improve public transportation.	To Improve safety and security for pedestrians, NMT.	1.155 billion	81.5 million	JNNURM was withdrawn in 2014.
National Urban Transport Policy (NUTP), 2006	To establish the Unified Metropolitan Transport Authority (UMTA) in cities with over a million inhabitants.	To encourage public transport.	To improve walking infrastructure	1.172 billion	89.6 million	Amended in 2014
National Road Safety Policy, 2010	NA	To enhance the licensing procedure and improve vehicle safety from the design.	To provide safe and convenient facilities for pedestrians and cyclists.	1.241 billion	127.7 million	It is active, but its implementation has faced challenges, particularly regarding enforcing safety laws and road infrastructure improvements.
Street Vendors (Protection Of Livelihood And Regulation Of Street Vending) Act, 2014	To provide an area, place, or location designate d by the local authority for street vending, including footpaths, sidewalks, pavement, etc.	NA	NA	NA	NA	It is active and working, but National Policy on Urban Street Vendors recognising street vending positively creates a big challenge to include street vendors in urban mobility planning
India Transport Report: Moving India to 2032 (2014)	To plan a long-term timeline as of 2032, India should be ready to adopt multimodal transportation facilities.	To put control on private vehicles plans for freight movement, Expansion of road network,	To promote NMT, universal accessibility, etc.	1.307 billion	190.7 million	NA
Smart Cities Mission, 2015	To develop essential infrastructure,	To enhance the efficiency of motorised	NA	1.323 billion	210 million	Active

	using 'Smart' solutions, public transport and last-mile para-transport connectivity	transport through better traffic management systems and intelligent transport networks.				
Green Urban Mobility Scheme, 2017	To promote Sustainable urban mobility	To enhance the Bus Rapid Transit System (BRTS) and Intelligent Transport System (ITS).	To promote the non-motorized transportation system by developing the walking and cycling infrastructure.	1.354 billion	253.31 million	Active and in the latest updates, the Green Urban Mobility Initiatives have been integrated into projects like the "PM-eBus Sewa" scheme.
National Policy on Transit-Oriented Development, 2017	To integrate land use with mass transit systems.	To develop metro lines as an anchor.	To provide NMT infrastructure and a bicycle-sharing system	1.354 billion	253.31 million	Active and development is under process.
Metro Rail Policy 2017	NA	To build metro infrastructure	NA	1.354 billion	253.31 million	Active and development is under process.
Motor Vehicles Act (Amendment Bill, 2019)	NA	To put higher penalties for violations compared to the previous Act.	NA	1.383 billion	295.77million	Active.

Table 2 – Tools for transport-mobility planning at the national level (Source – Ahmad & Chang (2020), Verma et al. (2021), modified and expanded by the Author)

Gaps

The main gaps in the governance structure for transportation and mobility planning at the national level can be summarised as follows:

- The policy formulation and its evolution have been very slow compared to the population growth and the increase in the number of operating vehicles. The big gap in the formulation of policies till the early 2000s was already too late to rectify the situation without drastic measures.

- The central government is creating laws about fundamental aspects of transportation policy. For example, policies such as The Motor Vehicles Act (1988) and its amendment in 2019 focus on traffic regulations and penalties at the central government level. Local authorities should formulate these policies according to the context of their jurisdiction. The lack of decentralisation of responsibilities is evident (Singh S. K., 2005).
- The importance of NMT was neglected (Verma et al., 2021) until 2005, when the population and vehicles were already overwhelming.
- The focus of evolving policies seems to be very motorised-centric and infrastructure-oriented. In contrast, the promotion of NMTs seems to appear in the document, but no actual strategy is dedicated to it.
- The policies lack a shared vision (Goswami, 2010) and fail to recognise the need for contextual planning. The policies fail to consider the cities' characters and prescribe infrastructure development to solve every transport-related issue.
- The policies neglect heritage-related concerns in transport planning, and no such policies are formulated for historic cities.

Tools at the state level

The Maharashtra state government implements national initiatives and makes state-specific solutions. While states adhere to central regulations, they are not bound to them because urban transport is a state-subject (Singh S. K., 2005). States have the autonomy to create policies tailored to the unique needs of their urban and rural population. Maharashtra state has more departments than central related to urban transport, where they enforce stricter traffic regulations and manage the Maharashtra State Road Transport Corporation (MSRTC).

Table 3 shows the tools available to state authorities and their primary objectives for transport planning in Maharashtra. Because of the lack of resources, this table does not include cross-referenced demographic and status data like Table 3. All the tools explained in Table 3 are active as of January 2025.

Tools/Acts	Objective
Maharashtra Regional and Town Planning Act, 1966	To provide the legal framework for planning, developing, and controlling urban and regional spaces, including transportation systems To commission regional planning authorities, like PMRDA (Pune Metropolitan Region Development Authority),
Maharashtra Motor Vehicles Act (MVA), 1989 (State Amendment)	To provide a state-specific adaptation of the Central Motor Vehicles Act to regulate road safety, vehicle registration, driver licenses, and rules for using motor vehicles on public roads.
Maharashtra State Road Development Corporation (MSRDC) Act, 1996	To plan, design, and implement significant road projects and highways.
Maharashtra Urban Transport Policy, 2016	To create sustainable, efficient, and equitable urban transport systems in all cities.
Maharashtra Road Safety Act,2017	To improve road safety by setting traffic regulations, imposing penalties, and improving road infrastructure.
Pune Metropolitan Region Development Authority (PMRDA) Act, 2015	To plan and implement transportation infrastructure and urban mobility solutions in Pune and surrounding areas authorised under MRTP 1966

Table 3 – Tools for transport-mobility planning at the state level (Source – Author)

Gaps

The main gaps in the governance structure for transportation and mobility planning at the state level can be summarised as follows:

- Given the autonomy of urban development, including urban transport to the state, no significant policy effort is visible through the policies.
- The state is the second in command in a top-down approach with a free hand in the planning process, but the level of cooperation differs among centre, state and city authorities according to different political parties at various levels of governance (Pethe et al., 2012). There is no effort from state governance to create a steady urban transport policy.
- Maharashtra Regional & Town Planning (MR&TP) Act, 1966, is a foundational legislative framework. It has not seen remarkable amendments in urban transport planning.
- The potential of autonomy at the disposal of the states is largely untapped. There is no context-specific effort in transport planning for the cities.
- There is no special consideration of heritage-sensitive cities in urban transportation. The policies seem to be mass infrastructure-oriented.

Tools at the Regional Level

The Pune Metropolitan Region Development Authority (PMRDA) is a Spatial Planning Authority (SPA) under the Maharashtra Regional and Town Planning (MR&TP) Act, 1966. This act came into action in 2015 to plan the region with a population of 6.7 million people and 3.2 million private vehicles (Rathore, 2023). In 2024, the population stands at over 7.2 million (Census of India, 2011), with the same or more number of private vehicles (Indo-Asian News, 2018). The PMRDA drafts regional-level plans for transportation and its infrastructure. PMC retains authority over local urban planning and administration within its boundaries

PMRDA has two tools at its disposal to control development: the Comprehensive Mobility Plan (CMP) and the Development Plan (Regional Plan). The CMP was the municipality's responsibility earlier, but it has been PMRDA's since its formulation in 2015. PMRDA conducts comprehensive traffic and transportation Surveys (CTTS) for the entire PMR. These surveys form the foundation for the proposed traffic and transportation strategies in the CMP and the Development Plan (Regional Plan).

Regional development plan (2021–2041)

The Regional Plan is PMRDA's primary planning tool. Earlier, these plans were made at the state level. The Pune Metropolitan Region Development Authority (PMRDA) has not yet fully implemented its Regional Development Plan. The draft plan, originally proposed in 2017, underwent significant revisions and public feedback processing in 2022 and early 2023. As of January 2025, the state government still has not approved it.

Objective	Actions
Develop Regional Linkages	**Action 1**: Expansion and up-gradation of highways
	Action 2: Development of Ring Roads
	Action 3: Development of secondary road network
Develop Transport Hubs	**Action 4**: Development of multi-modal hubs
	Action 5: Promote development along transit corridors along with last-mile connectivity
	Action 6: Development of truck terminals
Promote Public Transport and Increase Its Modal Share	**Action 7:** Connect employment nodes by mass transit
	Action 8: Development of Metro, linking Growth Centres to PMC and PCMC
	Action 9: Development of suburban railway, crescent railway, and high-speed rail
	Action 10: Promote mass transit system/feeder systems within the secondary road network

Table 4 - Action plan proposed in the regional development plan (Source – Regional plan, 2021-2041)

Table 4 shows the objectives and actions proposed specifically regarding transportation planning in the draft. Unlike state or central government, this table makes its action plan clear for its objectives. As observed, the transportation strategy focuses on expanding and upgrading highways, constructing ring roads, and developing secondary road networks to improve regional linkages. It also intends to create multi-modal hubs and truck terminals and encourage development along transit corridors for efficient last-mile connectivity.

In short, the objectives of the regional plan focus on developing a massive mobility infrastructure within the PMR, which also includes heritage-sensitive areas such as the case study area of this thesis. Further, this plan also shares the provisions for the strategies to be followed to achieve the objectives of the regional plan.

Key Strategies	**Key provisions proposed in the DP**
Interconnectivity	Interconnectivity with the regional network, municipal corporations and councils, industrial areas, TP schemes and integrated townships is considered
Continuity	Connectivity between adjoining urban growth centres as well as between urban and rural planning areas is considered for effective traffic dispersal.
Pragmatic approach	Proposed roads took cognisance of contours, forests, water bodies, defence lands, railway buffers, approved building plans, and major existing structures.
Dense urban grid and hierarchy	An urban grid of 500m x 500m is considered for the road network. Hierarchy in the road network is proposed categorising roads into primary, secondary, collector and local level roads.
Multimodal corridors	PMRDA Ring Road will act as multimodal corridor
Public transport	7 Metro corridors identified in the CMP form the key projects.
Non-Motorised Transport	Non-Motorised Transport (NMT) width is considered in road widths for last-mile connectivity from neighbourhoods to arterial roads.
Accessibility	Accessibility to major development zones, all proposed amenities and major transit points such as Metro, bus terminals, railway stations is provided.
Intermodal Integration	Intermodal integration at intersecting locations between Rail and Roads is proposed to encourage modal shift to rail-based public transport and public transport terminals in urban growth centres.
Logistics planning	Logistic hubs/Truck terminals are proposed along the Ring Roads and highways at strategic locations.
Optimised road widths	Optimised road widths considering the current and projected population and traffic forecast.

Table 5 - Strategies proposed in the regional development plan (Source – Regional plan, 2021-2041)

Table 5 clearly shows the priorities of the regional plan through its strategy and provisions. This plan is focused on managing mobility by building new infrastructure. It plans to increase the connectivity of new urban growth hotspots to the overall city. This plan intends to improve public transportation infrastructure and develop NMT infrastructure.

In summary, this plan, which is developed by a third-ranking authority in top-down governance but next to the municipality from the bottom up, envisages transport planning purely in terms of infrastructure development.

Comprehensive Mobility Plan 2008 and 2018

According to the National Urban Transport Policy (NUTP, 2006), the Mobility Plan is a city's long-term blueprint for improving accessibility and mobility. The aim of the mobility plan is to develop "an adequate, safe, environmentally friendly, affordable, equitable, comfortable, and efficient integrated transport system within the framework of a progressive and competitive market economy" (NUTP, 2006). It advocates planning for the mobility of people rather than vehicles by just transport planning.

The first CMP was prepared in 2008 for PMC and PCMC separately because PMRDA didn't exist at that time. From 2015, as per (MoHUA), fresh CMP needs to be prepared every 5 years for 2172 sq.km of area of PMRDA (30% of PMRDA region). The 2008 CMP, which was developed exclusively by PMC, laid out primary strategies for improving urban mobility, including developing a metro system, BRT corridors, pedestrian infrastructure, non-motorized transport, etc. Its implementation saw mixed results. The BRT system was partially developed but faced challenges related to land acquisition, funding, and public acceptance (More, 2019). The Pune Metro project, which was the key part of the plan, began its first Phase of construction with major delays.

The current Comprehensive Mobility Plan (CMP) 2018 is partially in effect, with some components being approved but others still undergoing refinement. As of January 2025, the Pune Metro is actively working in two phases. They are also on a traffic survey to expand metro lines and introduce new modes of transportation. The improvements in this plan will have to go through state approval, which usually delays the process.

CMP 2008 and 2018 exclusively mention decongesting the historical city centre of Pune, promoting NMT, and pedestrianising the core area. It partially aligns with the objectives of this thesis, but it does not envision the integration of heritage and landscape but purely in infrastructure orientation. It does not create a framework for the coordination among the mobility and heritage authorities.

Apart from the new provisions, actions taken through CMPs undergo thorough surveying. These surveys are helpful for this thesis and will later be used to analyse the case study area.

Gaps

The main gaps in the governance structure for transportation and mobility planning at the regional level can be summarised as follows:

- PMRDA's long-term planning document, the Regional Plan (2021–2041), is a primary tool used by the PMRDA for developments in the PMR. Still, it exclusively speaks in terms of infrastructure favouring motorised transport.
- There is a major gap in the approval hierarchy and an absence of autonomy for PMRDA to implement the policies swiftly. The delays in approvals and implementation do not match the speed of urbanisation.
- The priorities of the regional and comprehensive mobility plan focus on motorised mobility and infrastructure development throughout the city. While the documents mention non-motorised transport, they do not discuss its incentives or strategies.
- The document timelines for a regional plan that is 2021 to 204 and for CMP (five years on paper but 10 years in reality) are not efficient for the level of growth happening in the city.
- PMR is a vast region and thus does not include heritage-sensitive local areas in its considerations. Therefore, heritage-sensitive mobility planning is missing.

Tools at the Municipality level

As an urban local body, Pune Municipal Corporation (PMC) is the lowest tier of governance in Pune and the case study area of this thesis. This governance system is directly responsible for the on-ground execution and administration of urban transportation-mobility initiatives. These projects often originate from higher levels of government, i.e. the central or state authorities. PMC has the autonomy to create localised regulations and schemes to address city-specific challenges like traffic congestion, road safety, etc. The planning department coordinates with other authorities, like the Pune Traffic Police and Pune Smart City Development Corporation Limited (PSCDCL).

Development plan (2007 -2027)

This is the primary tool Pune municipal corporation has to control, regulate, and propose development. According to section 38 of MR&TP Act 1966 (Maharashtra Regional and Town Planning Act), "at least once in twenty years from the date a development Plan has come into operation, the Planning Authority shall revise the Development Plan" (MR&TP act, 1966).

According to this, the current development plan for 2007-2027 is ongoing and one of the most essential tools PMC has to implement planning strategies.

Summary of Sustainable Transportation Goals, Objectives and Performance Indicators		
Sustainability Goals	**Objectives**	**Performance Indicators**
Economical		
Economic productivity	Transport system, efficiency, Transport system, integration. Maximize, accessibility. Efficient, pricing and incentives.	Per capita GDP, Portion of budgets devoted to transport, Per capita congestion delay. Efficient pricing (road, parking, insurance, fuel, etc). Efficient prioritization of facilities
Economic development Energy efficiency	Economic and business development Minimize energy costs, Particularly petroleum imports.	Access to education and employment opportunities. Support for local industries. Per capita transport energy consumption Per capita use of imported fuels.
Affordability	All residents can afford access to basic (essential) services and activities.	Availability and quality of affordable modes (walking, cycling, ridesharing and public transport). Portion of lowincome households that spend more than 20% of budgets on transport.
Efficient transport operations	Efficient operations and Asset management maximizes cost efficiency.	Performance audit results. Service delivery unit costs compared with peers. Service quality.
Social		
Equity / fairness	Transport system accommodates all users, including those with disabilities, low incomes, and other constraints.	Transport system diversity. Portion of destinations accessible by people with disabilities and low incomes.
Safety, security and health	Minimize risk of crashes and assaults, and support physical fitness.	Per capita traffic casualty (injury and death) rates. Traveller assault (crime) rates. Human exposure to harmful pollutants. Portion of travel by walking and cycling.
Community development	Help create inclusive and attractive communities. Support Community cohesion.	Land use mix. Walkability and bikability Quality of road and street environments.

Cultural heritage preservation	Respect and protect cultural heritage. Support cultural activities.	Preservation of cultural resources and traditions. Responsiveness to traditional communities.
Environmental		
Climate stability	Reduce global warming Emissions Mitigate climate change impacts	Per capita emissions of global air pollutants (CO_2, CFCs, CH_4, etc.).
Prevent air pollution	Reduce air pollution emissions Reduce exposure to harmful pollutants.	Per capita emissions of local air pollutants (PM, VOCs, NOx, CO, etc.). Air quality standards and management plans.
Protect water quality and minimize Hydrological damages.	Minimize water pollution. Minimize impervious surface area.	Per capita fuel consumption. Management of used oil, leaks and stormwater. Per capita impervious surface area.
Open space and biodiversity protection	Minimize transport facility land use. Encourage more compact development. Preserve high quality habitat.	Per capita land devoted to transport facilities. Support for smart growth development. Policies to protect high value farmlands and habitat.

Table 6 - Goals proposed in the development plan (Source – PMC , 2013)

Table 6 shows the vision and the priorities of PMC regarding transport planning. This document is made with the active involvement of regional authorities, i.e., PMRDA and its regulations in the regional plan. It also includes CMP 2008 principles because this is the execution tool for CMP proposals. This draft PMC (2013) prioritises -

1. Urban Roads

2. Traffic improvements

3. Non-Motorised Transport (NMT) management

4. Road Safety

5. Mass transport system

6. Intermediate Public transport (IPT)

7. Urban Transport Planning & Operation Data

8. Terminals

Apart from these PMC (2013) states, "Encourage and Designate Pedestrianization in Core Area". It acknowledges that the case study or core area is well suited for pedestrianisation. Further, the document also proposes that Laxmi Road be planned as a pedestrian road. It suggests a hypothetical scenario where vehicles may be banned on Laxmi Road and adjoining streets (within 50m to 200m) from 8 am to 8 pm, effectively turning an area of approximately about 0.5~1.0 square kilometres into a vehicle-free zone to ease the air pollution and traffic jams that plague the old city.

This document addresses some local issues which were not considered at the higher level of governance because it is the most contextual authority. But it also entails that they have very little power. City authorities have little control in deciding what kind of urban transportation infrastructure they want (Vaidyanathan et al., 2013).

Another fact about the development plan is that it was supposed to start in 2007, but it was drafted in 2013 and sanctioned by the State government in 2017. The last Development plan before that came into action in 1987, and that's why the current one is called 2007-2027 because the development plan is supposed to be revised every 20 years. Initially drafted for the 2007-2027 period, this plan has faced modifications and implementation challenges over the years, but it is currently partially effective. The remaining part, which has yet to be approved, is not concerned with the case study area, but this pattern proves the delays in the planning procedure.

PMC's existing tools and projects		
No.	Name	Objective
1	Town Vending Scheme, 2014	To control street vending practices on the roads with dignity to street vendors.
2	Urban Street Design Guidelines 2016	To establish the street system to accommodate growth, transportation choices and liveable spaces
3	Parking Management and Policy, 2016	To transform at least 10% of on-street parking spaces to public open spaces or NMT infrastructure. Also, to help achieve 80% of motorised trips by public transit by 2031
4	"Walk Smart"— Policy for Pedestrian Safety & Comfort (2016)	To make Pune a pedestrian-friendly city with dignity for pedestrians and care for their safety and well-being.
5	Guidelines for Trenching Activity	To provide citizens with the highest level of infrastructure facilities.
6	Transit-oriented Development	To adopt a sustainable urban development approach to creating more liveable cities.
7	Integrated Transport Management System	To enable real-time tracking of all the 2,000 buses fitted with GPS and seamless payment across modes of transport.
8	Multi-modal transport integration	To facilitate efficient mobility
9	Pune cycle plan	To increase cycling in Pune to 25% of mode share by 2031

10	"Rainbow Bus" rapid transit	To develop 6808 km of BRT corridor
11	Fleet Augmentation	To improve the ability of the public transport system to meet transit demand.
12	Electric rickshaws	To deploy 4,000 electric rickshaws
13	High-Capacity Mass Transit Route (HCMTR)	To de-congest the existing situation and increase the speed of vehicular traffic.
14	Maha Metro	To reduce traffic congestion and provide connectivity to commuters; to support an estimated daily ridership of 6 lakh in 2021

Table 7 - The ongoing and proposed tools and projects by PMC (Source – RMI, 2018)

Table 7 presents all the tools at PMC's disposal for transport planning. All these are parallel to the provisions of DP 2007-2027. One critical aspect and not part of any higher-level tools is the Town Vending Scheme, 2014. It is for regulating street vending, which is part of the unregulated informal economy and is generally criminalised by city officials. Yet the number of registered street vendors in Pune is 28000 (Panse & Raval, 2020), and they are an essential part of street culture. However, managing the vendors and creating space for pedestrians is a tricky issue. This policy attempts to solve the problem. This scheme is stalled due to delays in forming the Street Vendor Committee, as the state government has yet to issue the necessary notifications for its operation.

Other essential tools include Parking management and policy (2016). The policy contains provisions for traffic safety by addressing issues such as illegal parking and encroachments, which often contribute to road congestion and accidents. It incorporates enforcement mechanisms, such as fines and penalties, to ensure compliance with regulations and promote orderly parking behaviour among citizens.

The parking management strategy proposes vehicle-free zones in high-footfall areas like shopping streets within the case study area of this thesis. It also suggests the possibility of a better connection to public transport; parking for private vehicles would be restricted and subject to higher charges. Despite the policy being approved in 2018, it is still unimplemented because of the lack of clarity in enforcement mechanisms and resistance from sections of the public and local businesses. (Parekh, 2019).

Figure 18 - Thematic proposal in parking management plan (Source – PMC ,2016)

The Urban Street Design Guidelines 2016 is another important tool that directs professionals in planning, designing, constructing, and maintaining streets within PMC's operational scope. These guidelines standardise street elements to align with broader urban development goals. It invites Community organisations, NGOs, activist groups, and stakeholders working on traffic and transportation issues for its practical implementation through collaboration with municipal bodies. This tool also is facing challenges in its implementation. However, some success stories have been introduced of improving the city's walkability and encouraging people to switch to more sustainable transport options by dedicated lanes for bicycles and wider footpaths.

Figure 19 – The graphical representation of vision in USDG 2016 (Source – PMC ,2016)

Pune Walk Smart, 2016 makes the case for high-quality pedestrian infrastructure with equitable allocation of road space. It also calls for aesthetic efforts such as Any beautification of roads, junctions, footpaths, etc., by providing fountains, landscaping, flowerbeds, murals, sculptures, etc., but not at the cost of walking space or causing any hindrance to smooth pedestrian movement on footpaths, road crossings, traffic islands and pedestrian refuges. Despite all these provisions, this policy is short on budget allocation and sanctions from higher authorities. This

campaign has a success story with some good examples of roads, which are comparatively wider and not part of the case study area.

Gaps

The main gaps in the governance structure for transportation and mobility planning at the municipality level can be summarised as follows:

- PMC is the lowest tier of governance yet the most contextual to the city-level issues. But it clearly lacks the needed autonomy and resources, further proving that decentralization is needed (Savage & Dasgupta, 2006).
- There is no fixed time framework or deadline for Producing, approving, and implementing the development plan strategies. This leads to delays in the process, which cannot match the arising needs of the growing urbanisation.
- Twenty years to change the DP is too long period considering the policy reforms and changes of proprieties at the higher level.
- Proposals for pedestrianising the city core and strict parking policies to decongest the cities have been made, yet they have not been implemented.
- There is no mention of heritage-sensitive planning, even at the city level.

5.2 Governance structure for Heritage protection

India has no national-level or otherwise authority dedicated to managing and preserving historical landscapes. However, protecting historical monuments falls under the purview of multiple institutions at multiple governance levels. It is primarily based on recognition by either national, state, or municipal authorities, and accordingly, the regulations will be followed. The preservation of historic landscapes, including urban precincts with historical significance, is indirectly addressed through existing heritage, environmental, and urban planning frameworks. Before independence, the heritage was conserved according to British rules, but after independence, the Constitution of India continued the same provisions (Pal, 2024,). Later on, with the 74th Amendment to the Constitution, Municipal Corporations were also made responsible for the heritage conservation (Pal, 2024,). Figure 20 shows the governance approach, which is again top-down like transport planning, where the central level is the primary custodian of heritage preservation. National authorities, particularly the Archaeological Survey of India (ASI), set broad policies for overall conservation practices. They also oversee the conservation of monuments and sites of national importance.

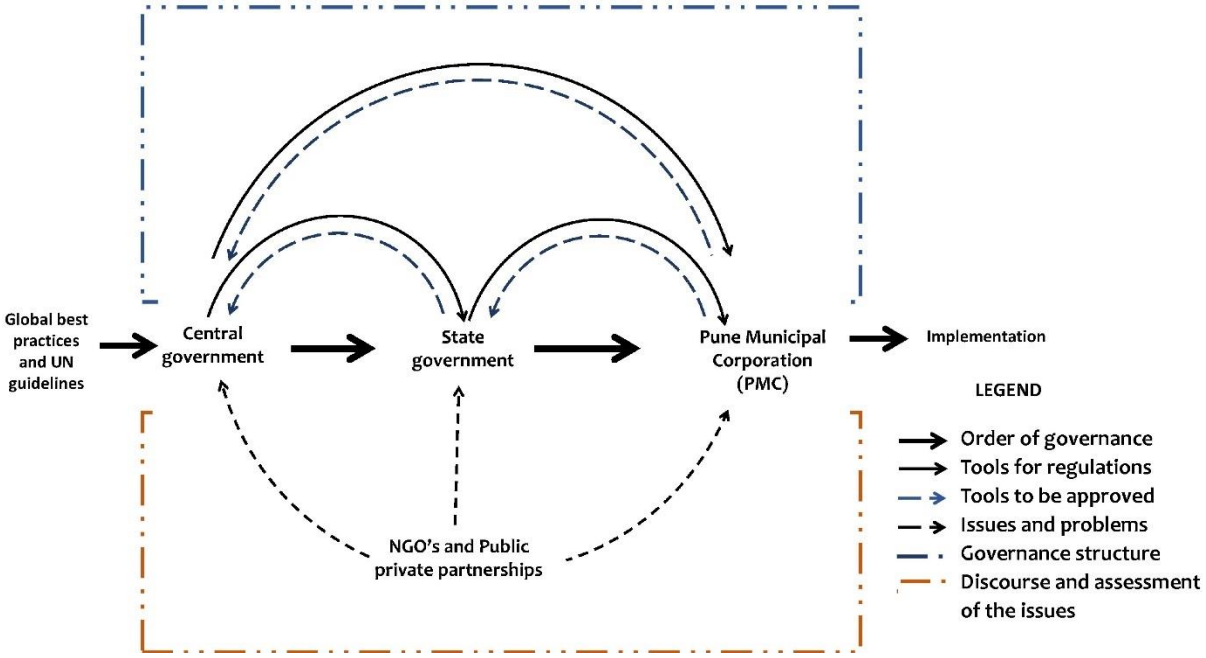


Figure 20 - Schematic representation of governance structure for heritage protection (Source – Author)

ASI also publishes state-protected monuments where the conservation responsibility falls on the state government according to ASI standards. State government bodies integrate heritage management into urban development plans separately. At the municipality level, heritage sites are recognised by the cities in Grades 1,2 and 3. Apart from monuments of national importance and state-protected monuments, other heritage sites are the municipality's responsibility.

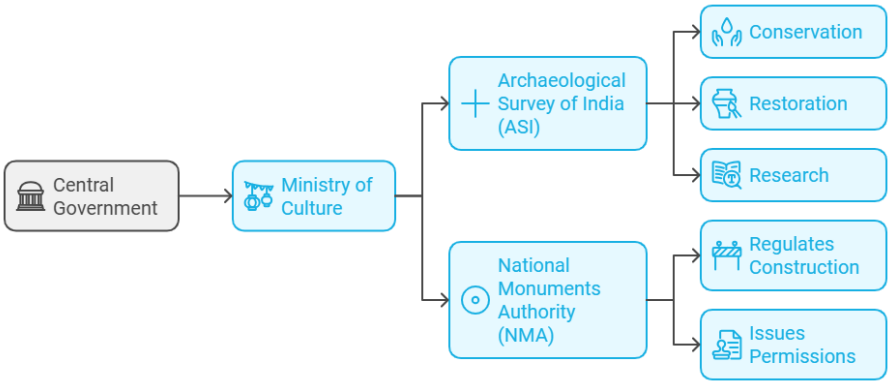


Figure 21 - Ministries at the national level for heritage protection (Source – Author)

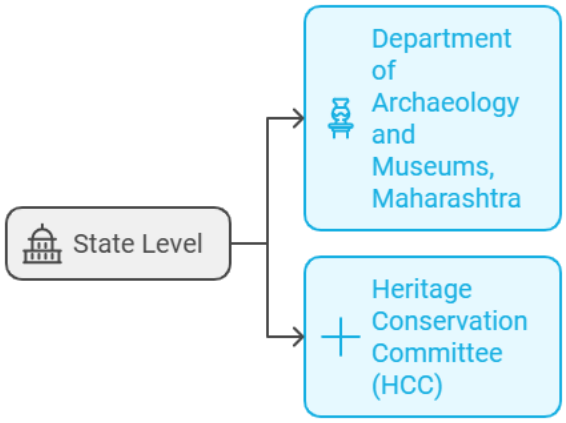


Figure 22 - Departments at the state level for heritage protection (Source – Author)

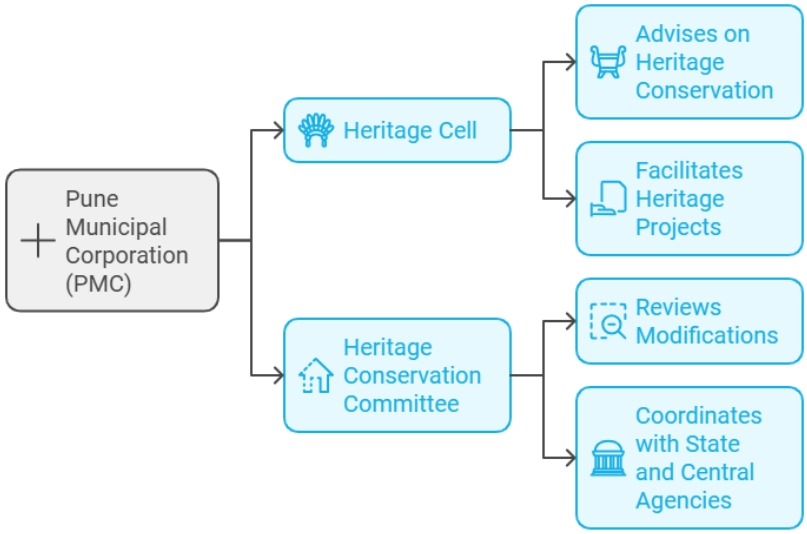


Figure 23 - Departments at municipality level for heritage protection (Source – Author)

The Ministry of Culture is responsible for conserving and preserving heritage monuments, archaeological sites, art, and traditions at the national level. Two central departments come under this: the Archaeological Survey of India (ASI) and the National Monuments Authority (NMA). ASI is

considered responsible for conserving and maintaining monuments of national importance. It is also responsible for conducting archaeological research and excavations. The National Monuments Authority (NMA) regulates the development and construction activities around centrally protected monuments. It enforces heritage laws, especially regarding the zones surrounding such monuments. As mentioned earlier, no other authority exists to manage heritage protection at the highest level of governance. The Ancient Monuments and Archaeological Sites and Remains Act, 1958 (AMASR Act), is the primary tool at the disposal of national governance, specifically protecting monuments of national importance (Pal, 2024,). There are some rules, such as the prohibition on construction or modification within a 100-meter radius of protected monuments (regulated further up to 300 meters), that indirectly address historical landscape protection.

This act is very monument-specific in its nature, which is proven through the definitions provided in the act. It establishes its priorities through some of its important definitions as follows -

1) "Ancient monument" means any structure, erection or monument, or any tumulus or place of interment, or any cave, rock sculpture, inscription or monolith, which is of historical, archaeological or artistic interest and which has been in existence for no less than one hundred years, and includes—
    a. the remains of an ancient monument,
    b. the site of an ancient monument,
    c. such portion of land adjoining the site of an ancient monument as may be required for fencing or covering in or otherwise preserving such monument, and
    d. the means of access to, and convenient inspection of, an ancient monument" (AMASR, 1958, p. 4).
2) "Construction" means any erection of a structure or a building, including any addition or extension thereto either vertically or horizontally, but does not include any re-construction, repair and renovation of an existing structure or building, or construction, maintenance and cleansing of drains and drainage works and of public latrines, urinals and similar conveniences, or, the construction and maintenance of works meant for providing supply of water for public, or, the construction or maintenance, extension, management for supply and distribution of electricity to the public or provision for similar facilities for public" (AMASR, 1958, p. 5).

In 2015 the government launched the National Heritage City Development and Augmentation Yojana (HRIDAY), which focuses on the development of heritage cities, aligning cultural preservation with sustainable infrastructure and economic growth (HRIDAY, 2015). But it is

primarily focused on only 12 cities all over India, and Pune is not one of them. There are also some provisions in the Smart Cities Mission (2015) that include protecting heritage and integrating it into urban development without any actual implementation strategy. AMRUT (Atal Mission for Rejuvenation and Urban Transformation 2015) is another tool that is supposed to indirectly contribute to preserving natural heritage and urban sustainability, but again, without an actual implementation plan.

At the state level, the Department of Archaeology and Museums is responsible for managing the heritage sites at the state level. It incorporates National guidelines and monitors its progress. It also gives state protection to certain monuments recognised by ASI. There is also the Heritage Conservation Committee (HCC) under the MRTP 1966 Act, which approves modifications, redevelopment, or repairs to heritage buildings and precincts. The Maharashtra Ancient Monuments and Archaeological Sites and Remains Act, 1960, is the primary instrument for the state government and a state-specific law to protect monuments not covered under the AMASR at the national level.

At the municipal level, Pune Municipal Corporation (PMC) is responsible for enforcing heritage-related provisions in the city's Development Plan. It has been tasked with maintaining the list of heritage sites and precincts under the Heritage Conservation Committee (HCC). This list is produced in coordination with local NGOs and public participation. There is also a Heritage Cell dedicated to advising on heritage conservation and facilitating heritage-related projects. The Heritage Conservation Committee reviews and approves modifications to local heritage structures. It also works in coordination with state and central agencies for larger projects.

Gaps

The main gaps in the governance structure for heritage conservation can be summarised as follows:

- The heritage conservation through all tiers of governance is very monument-specific, and the priorities are only to preserve, conserve and secure the monuments. Historical landscapes or even precincts around the monuments, except for monuments of National importance, are protected.
- While national authorities have an iron fist over the development of monuments of national importance, other authorities have no resources. There is no unified body to manage heritage sites holistically.

- Responsibilities are divided among national, state and municipal authorities. This means the monuments in Pune, according to their recognition status from national, state or PMC, the laws and resources to protect them will differ.
- There is no concept of intangible heritage recognised by any government bodies. The idea of intangible heritage conservations severely lacks in the tools of multiple governance structures.
- Apart from some guidelines set up by ASI, such as prohibiting any sort of development process within 100 M of the heritage site of national importance, no other tool considers the historical landscapes.
- Heritage protection is working in silos and not integrated into comprehensive urban development. This leads to encroachments or inappropriate urbanisation around heritage sites and landscapes.

5.3 NGOs working in Pune

Apart from the above-listed government bodies, some CSOs/NGOs have been recognised and included in the mobility planning process and heritage conservation by all the governance levels. This section explores the initiatives and the role of their work in their respective field. The information was gathered from published articles on their websites and other sources to understand their work and efforts.

INTACH, Pune chapter

The Indian National Trust for Art and Cultural Heritage (INTACH) was founded in 1984, and it advises central, state and local governments (Pal, 2024,). It is based on the principle of people's participation in heritage conservation while working parallel with the Archaeological Survey of India (ASI). It is a volunteer-based organisation. This NGO has a major role in the heritage conservation practices in India, where it is branched through its "Chapters." In Pune also, INTACH has a local chapter called "Pune Chapter". The primary objective of this chapter is to document, protect, and promote Pune's architectural, cultural, and natural legacy (INTACH, n.d.). One of the significant objectives of INTACH is to advocate for undocumented heritage.

The Pune chapter is famous for activities like heritage walks and awareness workshops in Pune. It plays a significant role in mapping intangible heritage, like traditional crafts, food walks, bamboo workshops, mask-making, etc. They focus awareness campaigns on the most critical impact of the loss of intangible practices and livelihoods of some artists and craftsmen (INTACH, n.d.).

INTACH is also a member of the Pune Heritage Committee in PMC. Along with them, it is composed of Indian Administrative Service (IAS) officers, historians, conservation architects, and engineers. This committee evaluates infrastructure projects that may impact heritage, and according to that evaluation, further proceedings are done. As a part of this committee, INTACH also conducts an impact assessment for any development project within the radius of nationally protected monuments.

INTACH has its charter, where it has established its own principles, guidelines and objectives. The key highlights of INTACH charter –

- Indian heritage is a multicultural activity. It cannot be considered a single system as it varies in every region of the country. The tangible and intangible heritage cannot only be judged and followed through colonial lenses or bodies such as UNESCO and ICOMOS but also the different sets of criteria which existed before these charters in India.
- The conservation is practised to maintain the significance of tangible and intangible heritage.

- The living heritage should be defined, and its cultural landscape should be preserved.
- The core of heritage is not only in its physical form but also in the intangible practices around it.
- Any protected or unprotected heritage is inseparable from its context and belongs to locals to nurture it.
- In rapidly homogenising cities, the image of the historical context should be preserved as significantly as the protected monument.
- The objective of INTACH is to promote the neighbourhood's character to be followed in the new construction of the buildings.
- Conservation of architectural elements should also be incorporated with the socio-economic aspirations of the context.
- Heritage areas should be marked as special areas, and town planning should be integrated into heritage conservation efforts.

It can be seen that this charter reflects a comprehensive effort toward sustainable heritage conservation. It also calls for the need for sensitive planning in heritage-sensitive zones across various disciplines, which includes mobility planning. It also calls for the integration of heritage into the urban planning domain.

Parisar

Parisar is another CSO working in the field of Urban heritage and urban transport, along with other concerns such as environmental awareness, carbon footprint, etc. It is primarily an advocacy group that asses the developments in the city through technical and policy-driven approaches. This CSO has been working with and also critically analysing the policies of PMC since 1980.

Their primary objective is to advocate for a systematic and sustainable approach to mobility and engage with stakeholders to understand public sentiment. They aim is to engage in generating political will to implement an effective mobility plan in the core city. There are several reports published on their website where they conduct various studies on the ground, for example, Laxmi Road: Redevelopment and Rejuvenation of Pune's Core Area (PARISAR, 2022) where they argue for a pedestrianisation of the street. They also have run programs with the help of PMC, where they celebrate Pedestrian Day on the 11th of December by making a street no-vehicle zone for a day (Shah, 2024).

According to PARISAR (2022), There are some commercial interests involved in the mobility improvement of the core city area in Pune, where the influential traders in the area oppose the

efforts that are planned to decongest the core city. PARISAR plays an important role in uncovering issues like these and runs public awareness campaigns.

The Institute for Transportation and Development Policy (ITDP)

ITDP is another NGO actively working with the PMC. The main area of their work is to scrutinise the allocation of funds for sustainable mobility, advocate walking and cycling infrastructure, and provide overall assistance to PMC via research and data collection. They review and assess the before and after effects of all the policies designed by PMC. They also publish their reports for public awareness.

ITDP plays an important role in the design and policy formulation strategies, especially for the urban mobility of Pune. They provided technical assistance for the execution of the Bus Rapid Transit System (BRTS) in Pune, along with future reforms in the system. ITDP is also actively working with PMC to develop NMT infrastructure such as pedestrianisation and laying cycle tracks.

ITDP has also played an important role in developing Urban Street Design Guidelines, 2016 for the city. They also conduct public awareness workshops and cocreation activities.

5.4The Need for Local Area Mobility Plan

As discussed in the previous sections, PMC often faces restrictions despite taking initiatives for urban mobility planning due to approvals required from state-level entities. In some cases, it even needs approval from the central government. Even though municipalities in India received a statutory status in the year 1992 and their scope of work expanded (Gokhale & Kapshe, 2016) the top-down governance system continues to limit their autonomy and effectiveness. At the PMC and PMRDA levels, the solutions are more contextual and localised, yet a substantial portion of urban mobility project funding is controlled by the central and state governments. This dependency often translates in the form of delays or aligning of their priorities with higher authorities' funding priorities. These instances deviate the priorities from the actual needs of the local population. This makes municipalities serve merely as implementation bodies or extensions of state and central governance systems, lacking true decision-making power.

Apart from this vertical hierarchy, the horizontal coordination within national, state or PMC related to mobility planning and heritage conservation is non-existent, and the departments often work in silos. So, these vertical dependencies and horizontal coordination gaps in governance are particularly problematic in sensitive zones like Pune's historical city centre. The inefficiencies, along with current traffic congestion, virtually non-existent pedestrian infrastructure and uncoordinated heritage preservation efforts, are destroying the landscape of the case study area.

It can also be observed that there are policies at various levels of governance only in terms of infrastructural development because that is the broader idea of central and state government, but the authority which is most connected to the ground has no space to take the decisions on their own. Unlike Indian cities, most of the megacities around the world enjoy the autonomy of infrastructural development decisions (Gijre & Gupta, 2020), There are accounts of the discussion on decentralisation of powers in NUTP and empowering urban local bodies, but it failed to execute on the ground (Vaidyanathan et al., 2013).

This situation presents the need for more localised efforts for efficiency of development to address the issues at stake in Pune city. At the same time, this scenario presents the need to address the issues that are being neglected in the broader theme. That is why there is a need for tools like LAMP. As discussed extensively throughout the governance chapter, the one-size-fits-all will not help in the planning of cities like Pune. So, to preserve the importance of the heritage and landscape of the case study region of Pune, there is a dire need for LAMP, which will integrate mobility, heritage and landscape.

6. Historical landscape assessment

From this section onwards, the thesis will delve into the assessment of the case study area to support the framework for the LAMP. The first step towards it starts with the historical landscape assessment. As discussed in earlier chapters, this will include tangible and intangible heritage documentation in the case study area. The tangible heritage sites will be assessed in terms of the monuments of national importance, state-protected monuments, and PMC-recognised heritage sites. This section will first map all the sites within the case study area and then document their present scenario, their vulnerabilities due to mobility patterns and the laws that exist to protect them at various levels of governance. For intangible heritage, this section will enlist all the festivals, rituals and practices, their spatial setting in the case study area, and their impact on mobility patterns.

Just to understand the landscape in terms of the HUL approach, meaning in terms of the historical layering of cultural and natural values and their attributes (UNESCO, 2011), figure 24 shows the different layers of its urban morphology. The purpose of this image is just to inform the reader about the complex landscape structure of the case study area.

Figure 24 - Layers of the city on a broader scale (source - Author)

Fig. 24, shows the urban landscape layers at a broad scale where significant players in the compact case study area are dominating the landscape. Although it is a small part of the city, the case study

area is a complex landscape where historical structures interact with nature and are either surrounded or dwarfed by mobility infrastructure while authorities are overlooking from one side.

Figure 25 - Layers of the city on street level (Source - Author)

In contrast, as can be seen in Fig. 25, when the landscape is expressed on a smaller scale, people's interactions and relationships with the space create another set of diverse layers dominated by social, cultural and economic activities. Here, the urban landscape is shaped by activities such as informal trade, cultural-religious practices, and traditions coexisting within the evolving urban elements. This dual perspective underscores the need for a nuanced approach to address the issues at stake. On a broader scale, expansion of mobility infrastructure might seem to be a better approach to solving the urbanising problems, but it has a devastating effect on smaller dynamic urban landscapes.

6.1 Tangible heritage

This section is an assessment of heritage sites within the case study area, with their concerned heritage conservation norms, their impact on the mobility pattern of the area and vice versa, the impact of mobility practice on the heritage sites. This section intends to first document all the heritage sites within the case study area, map them, and assess their vulnerability to evolving mobility patterns.

To start the documentation, it is important to note that in the case study area, the heritage sites are looked after by different authorities of different governance levels. According to the norms present for the heritage sites within the case study area, they are categorized into:

1) Monuments of National Importance

These sites are managed under the jurisdiction of the Archaeological Survey of India (ASI), meaning they are looked after by central government norms. They are recognised for their historical and cultural significance at the national level.

2) State-Protected Monuments

These sites are governed by the State Department of Archaeology, meaning they are looked after by the state government. They are acknowledged for their importance to the state's identity.

3) **Heritage Sites Recognized by the PMC (Pune Municipal Corporation)**

These sites are locally significant and identified under the jurisdiction of the PMC. These sites are further graded into three categories based on their historical, architectural, and cultural value.

As indicated by their names, it is evident that these classifications are exclusively monument-specific or monument-oriented. They are focused on individual structures rather than their broader urban or cultural contexts. Figure 26 shows the spatial distribution of these recognised heritage sites within the case study area.

In the case study area, there is one monument of national importance, one state-protected monument, and multiple PMC-recognized heritage sites. This distribution showcases a layered management system; each has its own framework for preservation and regulation. This influences the approach of this thesis to integrate mobility and heritage conservation in the region. Within this management system, as can be seen in figure 26, PMC has further divided the heritage sites into 3 grades based on their historical significance. The nationally protected and state-protected monuments are also Grade 1 heritage.

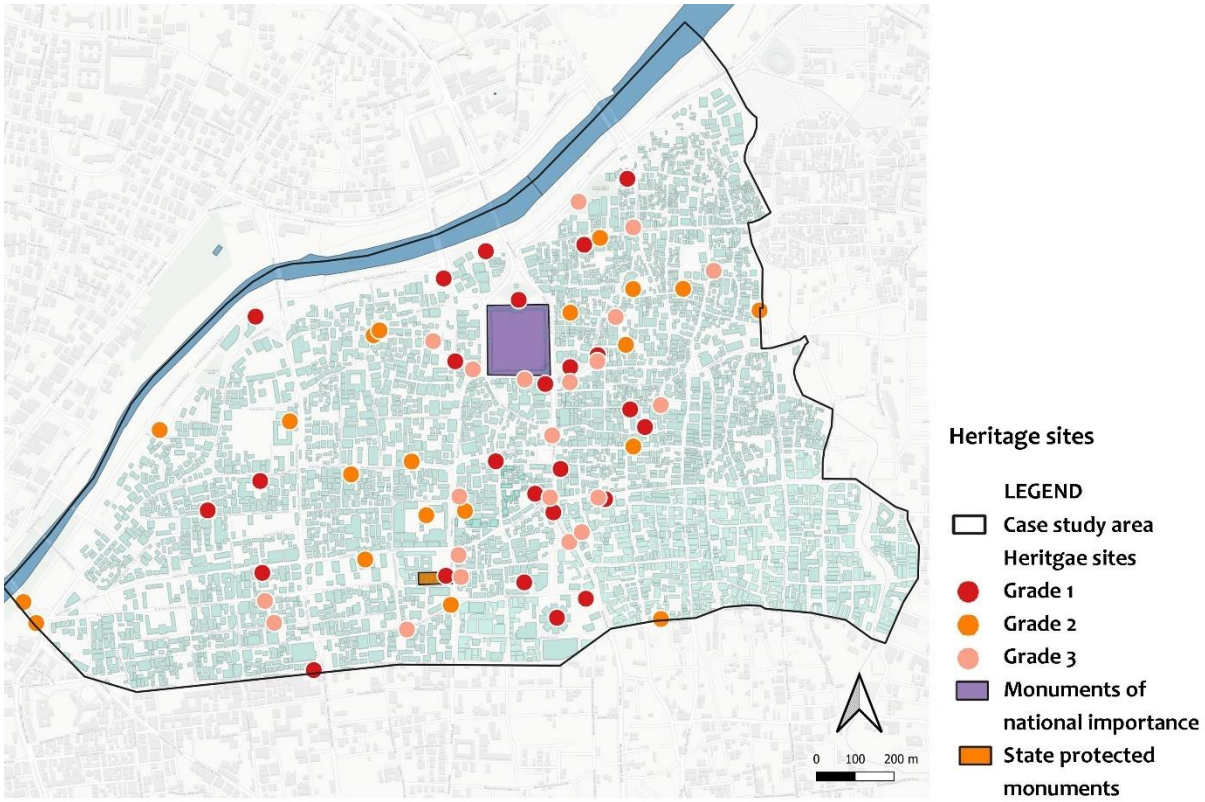


Figure 26 - The recognised heritage sites of the case study area (Source – PMC (2018) data mapped by author)

Before starting the assessment of vulnerability of each heritage type, an observational study was conducted at each site within the case study area to gain a holistic understanding of the overall impact of these heritage sites on mobility. During this process, it was found that not all sites are public property, but some are also under private ownership. Certain sites are in a dilapidated condition, which has minimal to no impact on mobility within the area.

In this assessment, along with the observational study, the authorities, owners or caretakers were enquired about the number of people visiting the place. If they bring a vehicle? And if yes, then where do they park it? The intention was just to understand the impact of these sites on the mobility of the case study area. The findings are visually represented in the form of a map in Figure 27.

As can be seen, there is a drastic difference between Figure 26 and Figure 27. This shows that since not all heritage sites are publicly accessible or open to everyone, the impact of heritage sites on mobility differs. The heritage sites that are frequently visited significantly impact overall mobility. Due to their importance and the number of people they attract, these sites have a notable effect on traffic flow, pedestrian movement, and overall urban mobility. However, the reasons for the high levels of visitation and the mobility challenges associated with these sites are varied and

influenced by different factors. For example, historical sites may attract tourists and heritage enthusiasts, while religious sites may see significant traffic during festivals or prayer times.

Figure 27 - The impact of heritage sites on mobility. (Source - Author)

The most visited site, and the one with the greatest influence on the area's mobility, is the monument of national importance. Its historical significance makes it a major attraction, drawing a large volume of visitors which results in impacting traffic and pedestrian movement around the site. The second most influential sites include a historically important site and a fresh vegetable and fruit market, both of which generate significant but distinct types of mobility. While the historically important site attracts tourists and heritage enthusiasts, the market primarily draws local residents, vendors, and buyers. These two locations show contrasting mobility patterns, with the former characterised by intermittent flows of visitors and the latter by regular, high-intensity movement involving pedestrians and vehicles, particularly during peak shopping hours.

The monument of national importance

Figure 28 - Shaniwar Wada - a monument of national importance (Source - Author)

In the list of monuments of national importance, there is only one monument in the case study area that makes the list. It is called "Shaniwar Wada". It is a fort-like structure from the 18th century that stands as the identity of Pune. It was built during the Maratha period. It is known to blend the Mughal and Maratha styles of architecture (Narkhede & Nagapurkar, 2022). This monument is a major tourist destination. It is also a recreational area for the residents of the city. There are no direct records available, but according to Hindocha (2021), the average daily visitors to the place are around 2,000.

Apart from tourists, the grand open space in front of Shaniwar Wada is frequently used by residents for recreational activities, such as gatherings, leisure, and informal events. As a result, the actual number of people interacting with the site within the monument and its surrounding areas is likely to be significantly greater than the reported figures.

The heritage laws for monuments of national importance, covered by the Ancient Monuments and Archaeological Sites and Remains Act (AMASR), 1958, are statutory and monument-specific, focusing primarily on protecting individual structures, in this case - Shaniwar Wada. It does consider the historical landscape setting in terms of explicitly prohibiting any public works, large-scale infrastructural interventions, new construction of buildings, or repair works in the immediate vicinity of protected monuments. –

1) "Every area, beginning at the limit of the protected area or the protected monument, as the case may be, and extending to a distance of one hundred metres in all directions shall be the prohibited area to carrying out public work or other works in respect of such protected area or protected monument" (AMASR, 1958, p. 11).
2) "Every area, beginning at the limit of prohibited area in respect of every ancient monument and archaeological site and remains, declared as of national importance under sections 3 and 4 and extending to a distance of three hundred metres in all directions shall be the regulated area in respect of every ancient monument and archaeological site and remains" (AMASR, 1958, p. 12)

This heritage law has directly influenced mobility planning, as evidenced by the realignment of the underground metro line construction near Shaniwar Wada. The original proposed alignment of the metro line fell within the 100-meter prohibited zone of the monument, as defined by the heritage protection laws. Consequently, the metro line had to be realigned to comply with the regulations, demonstrating the impact of heritage laws on infrastructure and mobility projects. Unfortunately, this is an isolated instance of coordination between two departments.

The vulnerabilities of the Shaniwar Wada

Shaniwar Wada is the city's nucleus and is in a highly congested area. This often overshadows the monument's importance, distracting from the visitor experience and the site's role as a heritage. As shown in Figure 29, there is a clear pattern of unregulated parking, which significantly affects the visual setting of the historical landscape surrounding Shaniwar Wada. In the first and third pictures, illegal, unregulated and unorganised parking can be observed along the periphery and on the adjacent roads. The second picture shows the allowed legal open parking in the campus structure, which also upset the campus's historical landscape.

Unregulated outside the walls of Shaniwar wada | **Motorcycle parking in the campus of Shaniwar wada** | **Unregulated parking outside Shaniwar wada**

Figure 29 -The parking problem around Shaniwar wada. (Source - Author)

In addition to the issue of uncontrolled parking, another significant factor affecting the visual setting of the heritage site and its mobility dynamics is the presence of hawkers, street vendors, and the overall informal economy, as illustrated in Figure 30. These activities are not controlled under the AMASR act, but they directly impact not only the visual setting but also the accessibility of pedestrians by obstructing walkways.

Street vendors outside the walls of Shaniwar wada | Car parking and narrow sidewalks | Hawkers and narrow sidewalks

Figure 30 - Obstacles to pedestrians around the periphery of the Shaniwar Wada (Source - Author)

These informal economic activities also have a direct impact on mobility, as they often become temporary pausing points where people park their vehicles, sometimes illegally, to purchase goods from vendors. This worsens traffic congestion and further detracts from the visual and cultural integrity of the heritage site.

Having observed the above scenario for the assessment of heritage sites, it is important to note that street vendors make a big part of a historic urban landscape because they provide authentic cultural experiences around the heritage sites. Sustainable development, as discussed in the HUL approach, also signifies the inclusion of these local economies in the landscape approach. Street vending is not only a mean of the informal economy but also a part of the cultural experience (WEIGO, 2018). Street vendors, unlike excessive mobility, are not abusive to the visual setting of the historic landscape but the addition of local flavour to it (Panse & Raval, 2020).

The vulnerabilities related to monuments of national importance are complex and unique, yet because of the attention from the national heritage conservation bodies, it has tools and means to protect the integrity of the structure.

State-Protected Monuments

State-protected monuments are heritage sites maintained by individual state governments. However, these sites are also designated by ASI, a national heritage conservation agency. These monuments hold cultural, historical, or architectural significance at the state level.

In the case study area, there is only one state-protected monument that is Vishrambaug Wada. It is also a structure built during the Maratha period by the Peshwas. Currently, Vishrambaug Wada is used by PMC for a few offices and also it features a small museum displaying Maratha artefacts (Narkhede & Nagapurkar, 2022).

Figure 31 - State-protected monument - Vishrambaug wada (Source - TravelSetu, n.d.)

State-protected monuments do not enjoy the same laws as monuments of national importance. The states are responsible for maintaining the physical structure and structural integrity of the monuments, and there is no provision for visual setting around these monuments. So, this section will not go into the details of the laws under state-protected monuments.

The vulnerabilities of the Vishrambaug Wada

Vishrambaug Wada is located at the junction of two of Pune's busiest and historically significant streets—Kumthekar Road and Bajirao Road. Kumthekar Road is one of the main roads in the commercial district in Pune's city centre, famous for its markets of clothing, accessories and gold jewellery shops. This commercial activity attracts a high volume of shoppers, resulting in constant traffic congestion and parking challenges along the street.

In contrast, Bajirao Road is one of the primary roads in the case study area, which carries heavy traffic of commuters and vehicles passing through the city. The intersection of these two streets near Vishrambaug Wada often faces major mobility challenges, as the area experiences continuous vehicular and pedestrian activity due to its commercial and historical significance.

Figure 32 - Traffic around Vishrambaug Wada (Source - The Indian Express, 2019)

Figure 32 shows the vehicular flow surrounding Vishrambaug Wada, which dominates the visual setting historical urban landscape. Similar to Shaniwar Wada, this area also hosts informal economies, but unlike Shaniwar Wada, the nature of the hawkers here is predominantly focused on selling clothing and accessories rather than food items. This commercial activity, combined with the high vehicular flow, not only contributes to the mobility challenges but also overshadows the monument's historical and architectural significance.

Heritage Sites Recognised by the PMC (Pune Municipal Corporation)

PMC, through the heritage committee and in collaboration with INTACH, publishes a list of buildings, artefacts, areas, and precincts deemed to have historical and/or cultural importance (PMC, 2018) (INTACH, n.d.). This list includes natural, cultural and historical heritage sites within the municipality area of PMC. These heritage sites are graded into three categories, and the restoration and renovation norms vary according to their assigned grade. This grading system provides a framework for prioritising conservation efforts and tailoring interventions to the significance and condition of each site.

PMC is not authorised or enjoys the same rules and regulations for its heritage site protection as state or central agencies. They are responsible for the physical and structural integrity of the site and ensure that the restoration work does not change the character of the site.

The vulnerabilities of the heritage sites recognised by the PMC

The heritage sites are graded into grade 1, grade 2 and grade 3 for the case study area. The grade 1 heritage sites also include Shaniwar Wada and Vishrambaug Wada, which are already monuments of national importance and state-protected monuments. Other heritage sites recognised by PMC are not necessarily public places; they include private spaces, offices, and other uses.

Figure 33 shows examples of Grade 1 heritage sites that vary greatly in typology and experience diverse impacts from traffic and congestion. The first picture showcases the Tulshibaug Temple Complex, located in the heart of the historical Tulshibaug market. This site presents a dual character—on one side, it faces the historical market, which is predominantly pedestrianised, creating a unique cultural and economic character. On the other side, it is surrounded by highly congested streets, impacted by vehicular traffic and the presence of street vendors, adding to the mobility challenges.

The second picture depicts Mandai, another grade 1 structure that is a colonial-era heritage site known for Pune's largest fresh vegetable and fruit market. The area is consistently congested with traffic, particularly due to the constant flow of vehicles bringing in goods and buyers navigating the market's busy streets.

Tulshibaug temple complex Mandai Kasba Ganapati Temple

Figure 33 - Grade 1 heritage structures. (Source – Author)

The third picture shows the Kasba Ganpati Temple, a historically significant religious site that is not situated within a commercial district. However, the temple becomes extremely busy during festivals, attracting many visitors and creating temporary congestion around the area.

NMV high school and Junior college Pasodya Vitthal temple Veer Maruti temple

Figure 34 - Grade 2 heritage sites (Source - Author)

Grade 2 heritage sites also encompass a diverse range of typologies, including school buildings, private structures, religious places, and cultural gathering spaces. For example, the first picture in Figure 34 shows the NMV School, which directly faces the heavy traffic on Bajirao Road. This creates a hazardous environment for students and visitors, posing safety risks and reducing accessibility to the institution. The second and third pictures feature historical temples, which, due to their fixed locations and cultural significance, cannot be relocated. However, the surrounding

traffic congestion creates significant challenges and difficulty for devotees and visitors to access these sacred spaces.

Grade 3 heritage sites primarily consist of old structures, including banks, hotels, residences, and temples. These sites are recognised for their historical or architectural significance, but their impact on and interaction with the mobility system is generally similar to common buildings in their surrounding neighbourhoods. Because these sites are not typically associated with exclusive or specialised uses, the mobility-related challenges they face—such as traffic congestion, parking issues, and pedestrian accessibility—largely reflect the broader issues affecting the building typologies in their vicinity.

6.2 Intangible heritage

This section focuses on the intangible practices recognised and practised by the locals of the case study area. The intention is to explore these practices, their spatial setting within the case study area and their importance to the social fabric and cultural identity. This section also intends to assess their impact on the mobility of the case study area or vice versa, the impact of mobility on these practices.

Understanding Intangible Cultural Heritage (ICH) in the Indian context is inherently complex and challenging due to its deeply rooted cultural diversity and historical layers. Intangibility is the essence of the cultural landscape of India, and it is difficult to bind in UNESCO's framework (Singh et al., 2020) . The intangible heritage includes the languages, performing arts, rituals, festivals, craftsmanship, etc. (ICH, 2003). But in the case study area, numerous such local practices and many other aspects shape its cultural and social fabric, which also influences mobility patterns.

Given this complexity, the thesis avoids delving deeply into the conceptual intricacies of intangibility in India, as it falls outside its scope. Instead, this study simplifies the analysis by categorising intangible practices based on those observations within the case study area. The categories of ICH for the case study area:

1) Frequent practices/rituals
2) Once a year festival
3) Prolonged once a year festival
4) Traditional craftsmanship

These categories have been developed based on patterns observed throughout the year. Rituals and festivals are a frequent and integral part of Indian culture, essential to various faiths and traditions. However, the modes of celebration differ significantly. In Pune's case study area, certain festivals are particularly well-known and closely associated with the region's identity. Alongside these festivals, the mass rituals occur on specific days of the week, such as visits to temples or other religious gatherings.

An important aspect of festival celebrations in the case study area is the involvement of "Mandals", which are groups or organisations that play a central role in organising these events. The term "Mandal" literally translates to group or association, and these entities are responsible for collecting donations from the community to fund the festival arrangements.

The Mandals often build temporary structures, known as "Mandaps," and organise various cultural and religious activities, including processions, music, and decorations. These temporary setups

frequently occupy public spaces, such as streets and open areas, influencing mobility patterns and creating traffic bottlenecks during the festival season.

Spatial distribution and pattern of intangible practices

No.	Intangible Practice	Typology	Date/time	Spatial setting	Relationship with Spatial Setting
Frequent practices/rituals					
1.	Chaturthi/Sankashti Chaturthi	Hindu practice	Twice a month according to Hindu calendar	Many devotees gather in the temple of lord Ganesh to seek the blessings.	There are many important temples such as Dagadusheth, Kasba Ganapati temple in the case study area.
2.	Thursday ritual – Dattatreya puja	Hindu practice	Every Thursday	Devotees gather in the temple of lord Dattatreya.	The Dagdusheth datta temple on the Shivaji road.
3.	Saturday ritual – Shani/Hanuman Puja	Hindu practice	Every Saturday	Devotees gather in the temple of lord Shani and Hanuman.	There are many important temples such as shanipar, Navagraha temple etc.
4.	Jumma namaz	Muslim practice	Every Friday	Followers gather in the mosque to pray.	There are many important Mosques and dargahs such as Badi Dargah Tamboli masjid etc.
Once a year festival					
3.	Republic day	National celebration	26th January	The flags are hosted in the squares by different Mandals.	There are many Mandals present in the case study area
4.	Ganesh Jayanti	Hindu practice	Approx Jan-Feb (According to the	Ganesh temples and mandals perform rituals in front of the temples.	There are many temples and mandals in the case study area which perform

			Hindu calendar)		these rituals on the streets.
5.	ShivJayanti	Birthday celebration of a renowned king	19th of February	Processions are conducted in celebration of King Shivaji's birthday by Different mandals.	There are many Mandals present in the case study area
6.	Dr. Babasaheb Ambedkar jayanti	Birthday celebration of a renowned public figure	14th of April	Processions are conducted in celebration of Dr. Babasaheb Ambedkar by Mandals	There are many Mandals present in the case study area
7.	Ashadhi Ekadashi Dindi procession	Pilgrimage in celebration of Lord Vitthal	Approx June-July (According to the Hindu calendar)	Procession of pilgrims stay in Pune for 1 day	The stay of pilgrims is near the case study area
8.	Muharrum	Muslim festival	Approx June-July-august (According to the Islamic calendar)	Processions are conducted on the streets	The streets are in the case study area
9.	Independence Day	National celebration	15th January	The flags are hosted in the squares by the Mandals.	There are many Mandals present in the case study area
10.	Dahi Handi	Hindu practice	Approx August-September (According to the Hindu calendar)	It is celebrated by tying a pot filled with dairy products at a height and many groups try to break it with a human pyramid	There are many Mandals present in the case study area which arrange this festival.
Prolonged once-a-year festival					
11.	Ganeshotsav	Hindu festival	Approx August-September-	It is celebrated by building temporary	There are many Mandals present in the

			October 11-day festival (According to the Hindu calendar)	structures and processions on the streets on the first and last day	case study area which arrange this festival.
12.	Navaratri	Hindu festival	Approx August-September-October 9-day festival (According to the Hindu calendar)	It is celebrated by building temporary structures on the streets.	There are some Mandals present in the case study area which arrange this festival.
Traditional craftsmanship					
13	Tambat aali (Coppersmith Alley)	Craftsmanship		These craftsmen's families live in the same neighbourhood, practising their craft on the side of the road.	There is a small neighbourhood and there is a workshop in Kasba Peth.
14	Kumbharwada (Pot makers neighbourhood)	Craftsmanship		These craftsmen's families live in the same neighbourhood, practising their craft on the side of the road.	There is a neighbourhood and a workshop in Kasba Peth. They also have their shops in that neighbourhood.

Table 8 - The list of intangible practices observed in the case study area and their spatial distribution (Source - Deshpande & Gangopadhyay (2024) modified by Author)

Frequent practices/rituals

In the Hindu faith, each day of the week is associated with a particular deity, and devotees often visit temples dedicated to that deity to perform their rituals. Similarly, according to the Hindu calendar, some deities have significance on a monthly basis. Even according to the Muslim faith, followers perform the prayers five times daily and have special significance on Friday. These days also attract beggars around these religious places because these days are also considered sacred for making donations. Even though these practices may not be considered intangible practices

according to international standards on the local scale of the case study area, these visits occur regularly and create unique traffic patterns, particularly on the days considered sacred to certain deities. This recurring practice contributes to local congestion and impacts both pedestrian and vehicular movement.

Saturn deity temple on Saturday | Lord hanuman temple on Saturday | Lord Ganesh temple on 4th day of the month

Figure 35 - Frequent rituals/practices observed in the case study area (Source – Author).

These temple/mosque visits are typically short in duration, often leading to visitors neglecting traffic rules. Many park their vehicles illegally or haphazardly, without regard for designated parking zones or regulations, as shown in Figure 35.

The data for this analysis was gathered through field observations. While the initial intention was also to document the parking patterns of devotees near these places, it was observed that the parking behaviour was often random and sometimes located far from the site. Due to the complexity and variability of these patterns, the focus of the map is limited to the gathering of devotees and their spatial impact on the area rather than parking.

Figure 36 shows the impact radius of various locations within the case study area based on the crowds and gatherings observed around them. On significant days, lines or groups of people can often be seen waiting to enter these places, creating a noticeable impact on the surrounding area. behaviour.

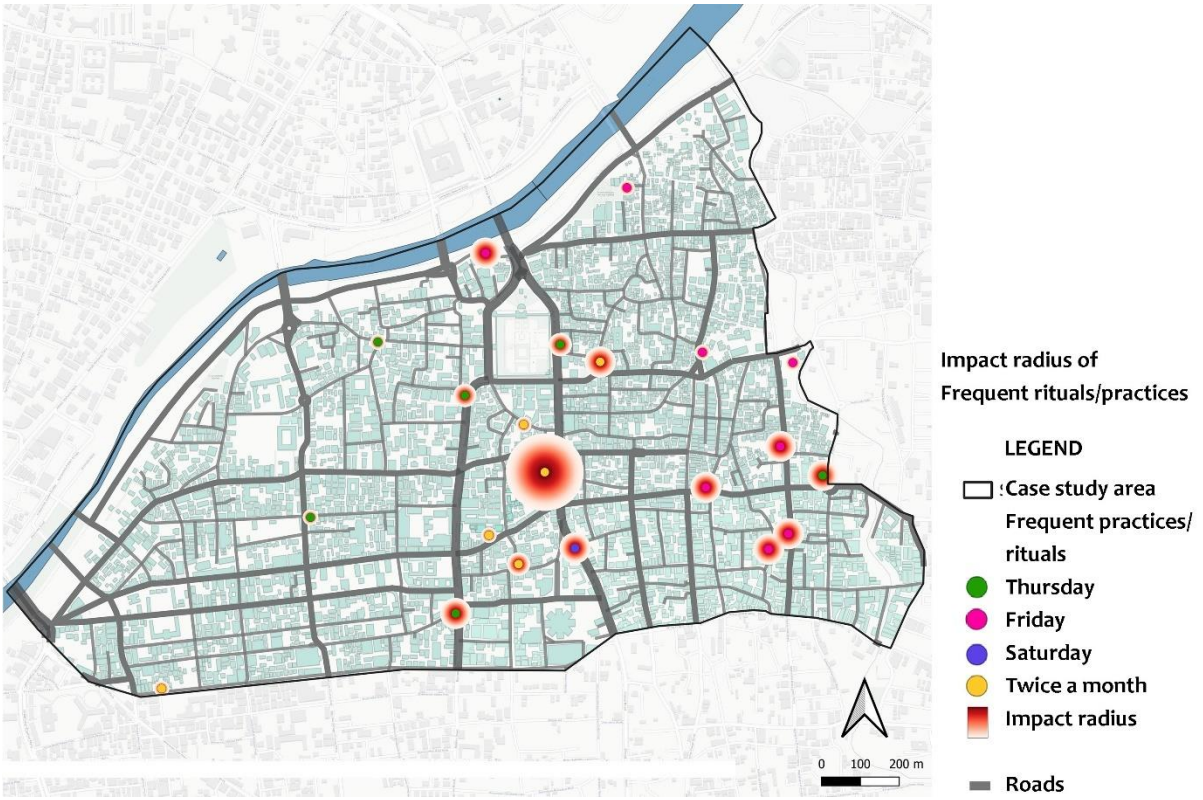


Figure 36 - Impact radius of intangible practices (Source - Author)

Among the significant weekly rituals, it was observed that Thursday, Friday, and Saturday witness noticeably high devotee gatherings in the case study area, each contributing to distinct mobility challenges:

- Thursday: According to Hindu beliefs, this day is dedicated to Lord Datta. The Dagdusheth Datta Temple, located on Shivaji Road, is a major site of worship and is situated right on the edge of the road. As a large number of devotees gather on Thursdays, it is heavily impacted by traffic congestion.
- Friday: For Muslim residents, Friday prayers (Jumma) hold special significance. Mosques and dargahs in the area become central points of gathering, with large crowds assembling for prayers, which influences pedestrian and vehicular movement in their vicinity.
- Saturday: Devotees of Lord Shani (Saturn) and Lord Hanuman visit temples dedicated to these deities. The area has numerous small temples, many of which are historical and recognised as Grade 2 or Grade 3 heritage sites by the PMC. These temples draw significant crowds, creating mobility challenges. According to Hindu tradition, donating food or feeding the poor on Saturdays is considered auspicious, leading to many beggars gathering on the streets, further complicating traffic flow.
- Twice a Month Ritual (Chaturthi): According to the Hindu lunar calendar, every fourth day (Chaturthi) of the two fortnightly cycles is dedicated to Lord Ganesh. As Lord Ganesh is

considered the Gramadaivat (deity of the city) of Pune, many devotees visit temples on these days. The Shrimant Dagdusheth Halwai Ganesh Temple is the most prominent among them, attracting the highest number of visitors, significantly impacting the mobility patterns of the surrounding area.

Once a year festival

The second intangible practice category includes cultural and religious practices. It also includes national events and commemorations of individuals of significant historical and cultural importance. Unlike daily or weekly rituals, these occasions are marked by once-a-year festivals that attract residents of the wider city and tourists from across the country and even the world.

These festivals are celebratory in nature, going beyond mere rituals to include activities such as processions, music performances, theatrical plays, dances, and other cultural expressions. On such occasions, the municipality recognises the significance of the day and implements specific traffic regulations to manage the increased activity. Certain roads are closed, traffic is diverted, and traffic police become more active to ensure compliance with the rules. These measures facilitate the smooth execution of processions, celebrations, and other events, minimizing disruptions while ensuring safety and order.

Ganesh Jayanti, Republic Day, and Independence Day are celebrated by various Mandals. These Mandals are prominently known for organising the grand festival of Ganeshotsav but also play an active role in hosting these events as part of community-building efforts. These Mandals are composed of local residents, and there are many such mandals in the case study area, as shown in Figure 37.

Ganesh Jayanti, a celebration of Lord Ganesh's birth, involves more elaborate rituals. A major event organized by the mandals is the "Yagya", a Hindu ritual that requires a complete block of traffic in the vicinity. This creates significant mobility challenges, as roads are temporarily closed to accommodate the ritual, affecting the overall traffic flow and accessibility in the case study area.

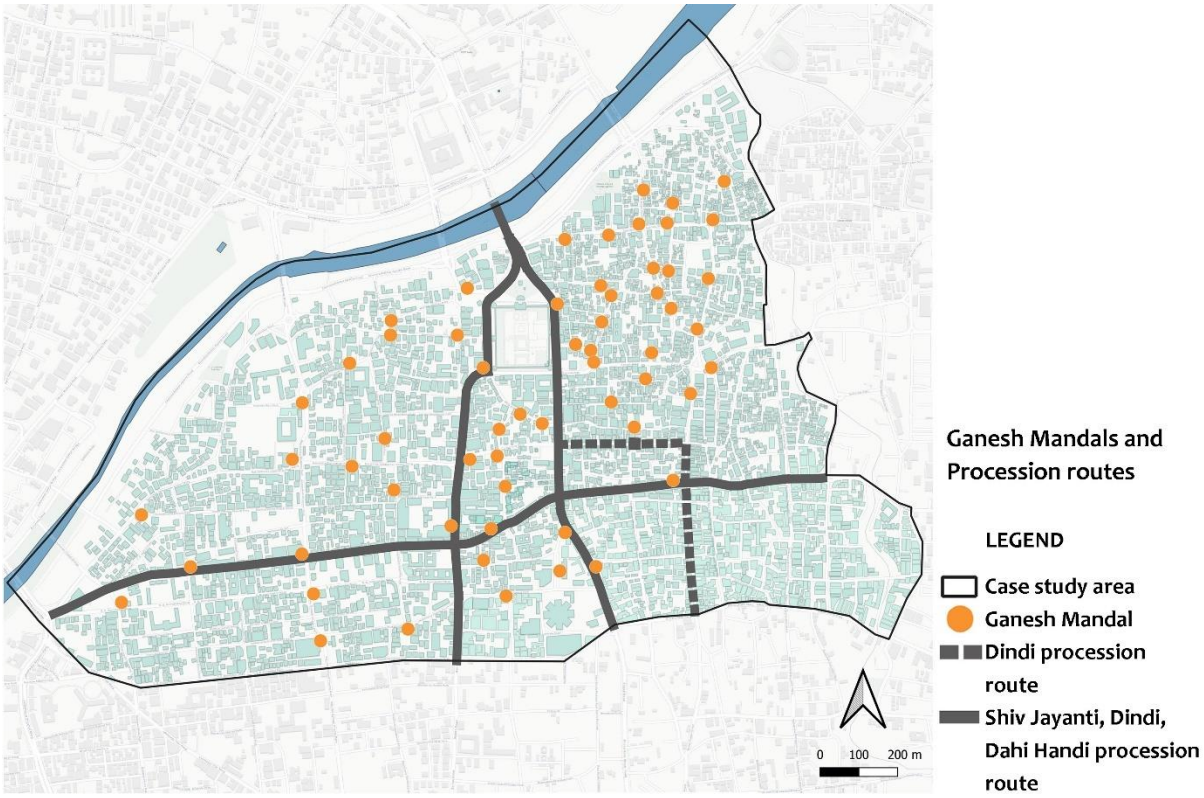


Figure 37 - Once a year festival (Source - Author)

The celebrations for national holidays such as Republic Day and Independence Day are relatively simple, with flag-hoisting ceremonies conducted by the Mandals in their respective areas. These events cause only minor disruptions, such as slight alterations in parking patterns, but generally do not have a significant impact on traffic.

Shiv Jayanti, Ambedkar Jayanti, Muharram, and Ashadhi Ekadashi Dindi are all procession-based practices that significantly impact the roads in the case study area. Each of these events has its unique history and social background, yet they share a common feature regarding their influence on mobility in the region.

Shiv Jayanti celebrates the birthday of the revered Maratha king, Chhatrapati Shivaji Maharaj. The processions, which have been held since the time of freedom fighter Lokmanya Tilak, aim to unite the community and honour his legacy. This tradition has evolved into a significant cultural event in Pune, with processions held throughout the city.

Ambedkar Jayanti honours Dr B.R. Ambedkar, the architect of the Indian Constitution and a prominent advocate for the removal of the caste system. While the processions marking his birth anniversary do not pass directly through the case study area, diverted traffic substantially impacts the area, affecting its mobility.

Muharram is an important Muslim practice, with processions commemorating the martyrdom of Imam Hussain. Similar to Ambedkar Jayanti, the procession routes do not directly pass through the case study area, but traffic diversions due to this event influence the region's roads and mobility.

Dahi Handi

Dindi procession

Figure 38 - Once a year festival (Source - Author)

Ashadhi Ekadashi Dindi is a pilgrimage procession dedicated to Lord Vitthal. Thousands of devotees travel to the city of Pandharpur. The procession passes through Pune and stays overnight in the case study area, which restricts mobility within the case study area.

Prolonged once-a-year festival

This type includes festivals are Ganeshotsav and Navratri, with Ganeshotsav being a core identity of the case study area. Historically, Bal Gangadhar Tilak, a freedom fighter in India’s independence movement known as Lokmanya Tilak, initiated this 10-day social celebration of Lord Ganesh in the case study area in the 1890s. Tilak used the festival as a platform to gather people and spread ideas of freedom and unity during the struggle for independence. Today, Ganeshotsav has become one of India's biggest festivals, attracting massive participation from residents, visitors, and tourists alike. This festival has the biggest impact on mobility patterns during its 10 days of celebration. Heavy traffic is usually restricted to the case study area.

While Navratri is not as grand as Ganeshotsav, there are certain places in the case study area where the style of celebration is similar. These celebrations often involve the construction of temporary structures called “Mandap” and gathering a significant number of devotees for daily rituals, cultural events, and worship. This 9-day festival also has a noticeable impact on mobility, leading to increased pedestrian and vehicular movement, particularly around temples and “Mandap”.

Figure 39 - Prolonged once-a-year festival (Source - Shreemant Dagdusheth Halwai Ganpati Trust and Author)

Traditional craftsmanship

Along with festivals, cultural practices and rituals, the case study area is also known for its unique craftsmanship heritage. There are two main craftsmen allies are known as "Tambat Aali" and "Kumbhar Wada".

Figure 40 - Traditional craftsmanship areas of Kasba Peth (Source - Standage, 2022 & Sahapedia, n.d.)

Tambat Ali is a 300-year-old community of coppersmiths living in the case study area. They still continue to practice their traditional craft of creating handmade copper vessels. They have acquired this skill passed down through generations (Nargolkar, 2022). Similarly, Kumbhar Wada is

home to artisans who specialise in producing handmade pots. This is also a traditional and historical settlement in the case study area, which is still known for practising its art.

However, these areas are shrinking and facing challenges because of urbanisation, changing market demands, and a lack of institutional support. The reasons are not necessarily related to excessive mobility, but this thesis considered this form of intangible heritage for the vulnerability assessment of the case study area.

7. Mobility Assessment

From this chapter onwards the mobility scenario in the case study area will be assessed in terms of generation points, footfall on the ground, available infrastructure, and user behaviour. The intention is to comprehensively understand the mobility scenario within the case study area.

7.1 Mobility generation factors

This section discusses the intricate factors that contribute to the generation of mobility prospects with respect to the different modes of transport. The intent here is to focus on the relationship between land use patterns and their influence on traffic flows, pedestrian movements, and the overall mobility pattern in the study area. This assessment uses the Land Use Plan from the 2013 Development Plan as a basis, supported by photographic documentation and field observations to provide a holistic view of mobility dynamics. By correlating land use with mobility patterns, this section highlights how certain planning practices and regulations affect mobility patterns and traffic generation on a neighbourhood level.

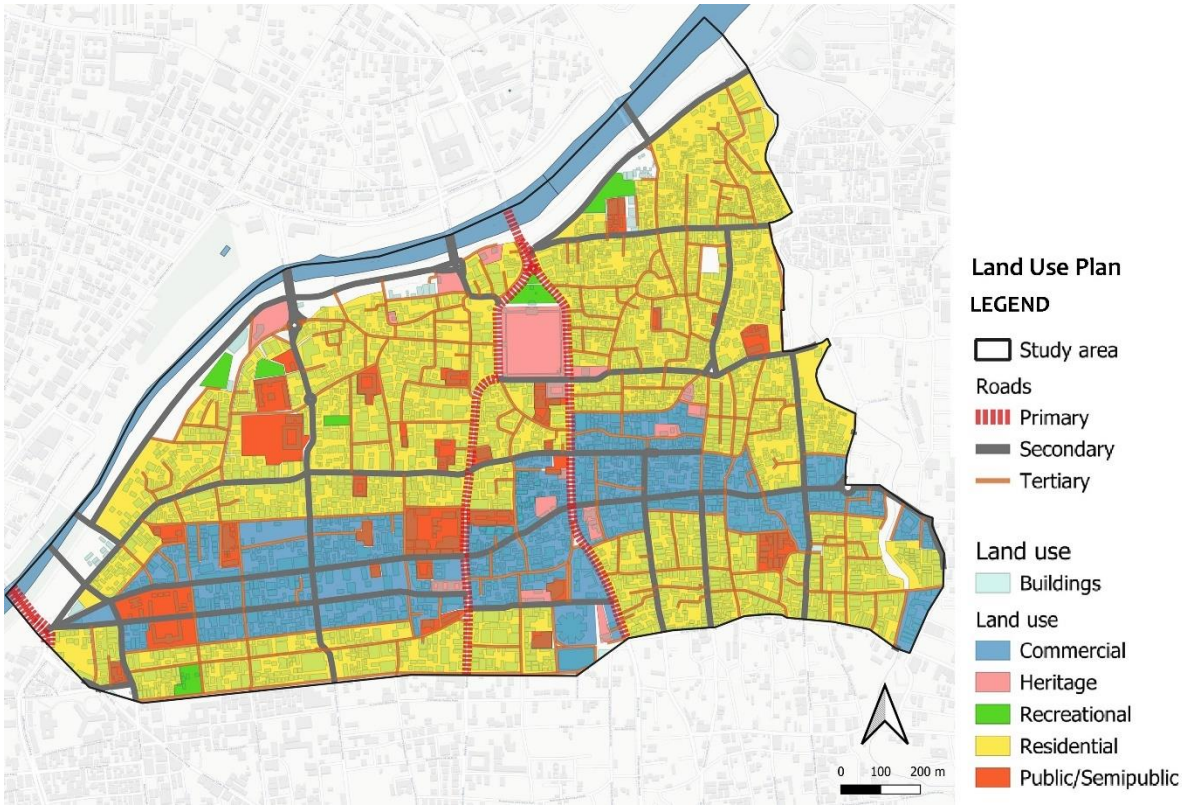


Figure 41 - The Land Use Plan from the Development Plan 2013 (Source – PMC, 2013, modified by author)

In the above Figure 41, The land use plan can be seen encompassing overarchingly residential and commercial uses as well as public – semi-public uses in some parts. To understand the impact of

zoning regulations on the mobility structure, existing road networks were superimposed on the map for a comprehensive analysis. At the same time, observations from the fieldwork were analysed to support the mapping analysis. The commercial district of city centre (signified in blue) is composed of local, historical, retail and wholesale markets of the city. During the observational field study, a lot of spillover commercial activities in other land use types were also noticed

Designated commercial land use

The commercial land use as defined in the 2013 Development Plan reveals significant variations when on-the-ground nuances are compared to its identified allocation. Field observations reveal that the mobility load varies in different market settings, with each one revealing its distinct needs of transportation. It was also observed that many buildings in the commercial area are not purely commercial but mostly mixed-use buildings, combining commercial spaces with residential units. This character creates an additional layer of mobility pressure, as the area must cater not only to the needs of commercial activities but also to the mobility demands of residents living within the same buildings. The Development Plan, while completely overlooking the composite building character of the study area, fails to cater to the dynamic mobility demands pertinent this land use.

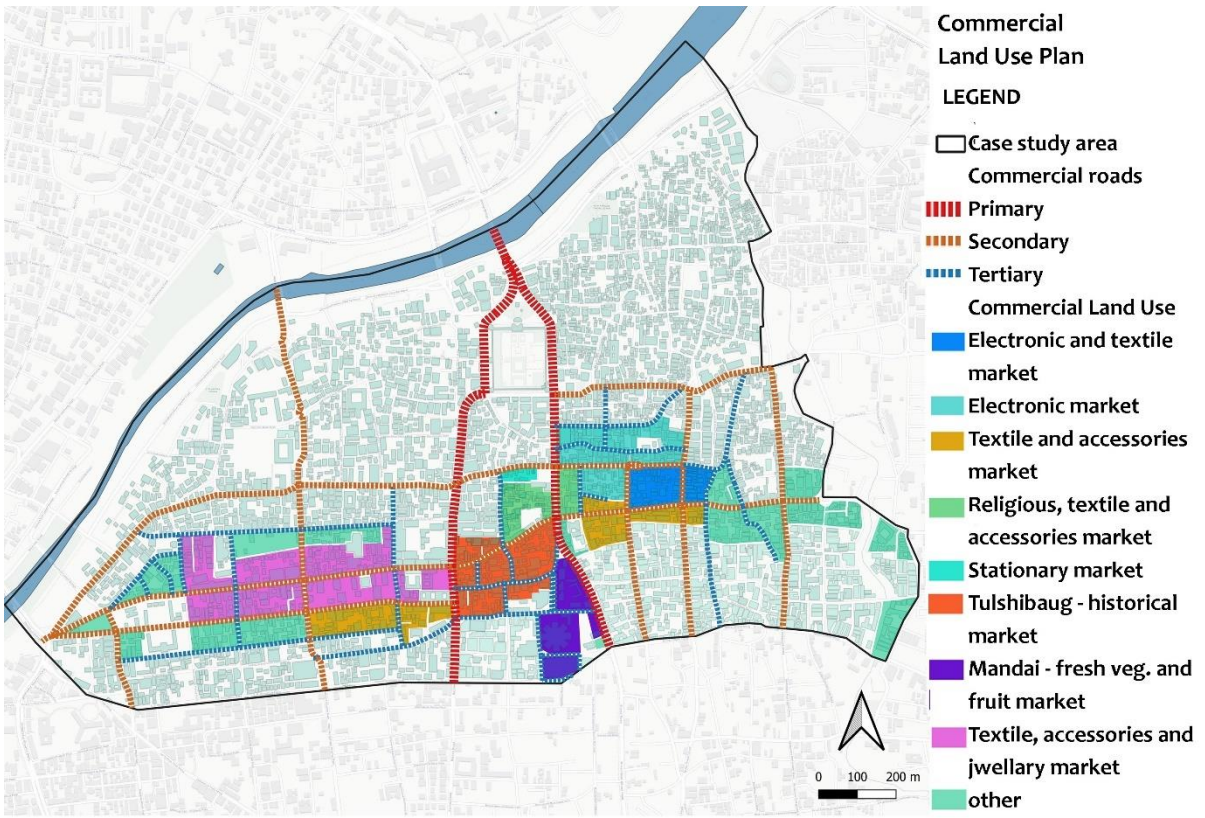


Figure 42 - Classification of commercial activities on designated commercial land (Source – Author)

The central core of the commercial district, as shown in Figure 42, encompasses historically significant markets such as *Tulshibaug* and *Mandai*. These markets have largely contributed in

shaping the historical urban landscape of the city centre. The eastern markets, on the other hand, are involved in modern-day textile, electronic, and wholesale activities. While the Development Plan 2013 indicates these markets being located on secondary roads, fieldwork observations reveal a denser network of market clusters with numerous tertiary roads interwoven around them. The western side of the district is more retail-focused, featuring shops that sell clothes, accessories, and jewellery. These activities are predominantly concentrated along *Laxmi Road*, a well-known and shopping destination in the city.

Electronic market in Tapkir Galli | **Electronic and textile market near Pasodya Vitthal temple** | **Textile and accessories market on Laxmi road**

Figure 43 - Eastern Electronic, textile and accessories markets (Source - Author)

The eastern section of the study area is characterised by electronics, retail markets, that are spread across narrow alleys where wholesale operations dominate. These alleys, as seen in the first picture of Figure 43, accommodate the logistical movement of cargo vehicles required for transporting on a daily basis. The lack of formal parking infrastructure and designated parking spaces results in an open, free parking scenario - with illegally parked vehicles that exacerbate congestion in these narrow alleys. This area, similar to the rest of the case study is also mixed-use in nature resulting in congestion caused by conflicts between daily market visits and the routinely commute of the residents.

The street from second picture in Figure 43, features electronics and textile market, which further leads to a larger wholesale market - which is not categorized as commercial land use in the Development Plan 2013 by the Pune Municipal Corporation (PMC). This street lines several historical structures located in the case study area. It becomes notably busier than the usual days during festival seasons as the electronics and textile markets get busier. A historical temple,

Pasodya Vitthal, is located in the middle of the street. However, the presence of heavy vehicles and illegal parking on both sides of the street causes regular congestion reduces its socio-cultural significance in this urban setting. The traffic situation is further compounded by narrow branch alleys connected to this street, which are also occupied with illegal parking.

The third picture in Figure 43 the eastern end of Laxmi Road, is a well-known shopping street that consistently experiences severe traffic pressure. Despite being a one-way street, the street remains packed with parked two-wheelers, while four-wheelers are rarely parked here. This section of the street is comparatively less visited than the western section, yet it still faces significant mobility challenges. The presence of traffic police helps in controlling illegal parking to some extent, yet the street struggles with high through-traffic volumes. As a secondary road, it bears the additional burden of traffic exiting from narrow alleys, further aggravating congestion.

Historical Tulshibaug market | **Mandai – Fresh vegetable and fruit market** | **Textile, accessories and Jewellery market on Laxmi road**

Figure 44 - The historical market of Tulshibaug, vegetable and fruit market of Mandai and Laxmi road market (Source - Author)

The first picture in Figure 44 shows *Tulshibaug*, one of Pune's most famous historical marketplaces, renowned across the city. Despite being located in narrow streets that are inaccessible for cars or larger vehicles, the market attracts tourists and customers from all over the city. This street is also home to a historical temple, making it a destination for both shoppers and devotees. Although the market is typically crowded with pedestrians, instances of illegal motorcycle entry can occasionally be observed, further adding to the challenges of mobility management in this area.

The second picture in Figure 44 shows *Mandai*, an established local vegetable and fruit market, which is one of the largest in Pune. Set inside a historical building from the colonial era, it draws

significant traffic, with people traveling from across the city. Observations reveal that many shoppers prefer to enter the market with their vehicles to transport heavy bags, with auto-rickshaws being the most favoured mode of transport. These paratransit public vehicles offer on-demand services and are a more practical option as compared to cars, which are used less often due to the area's traffic congestion. Peak activity at *Mandai* is typically observed in the morning and evening hours exceeding further mobility challenges on surrounding streets during these times.

As discussed previously, the third picture in Figure 44 focuses on the most visited part *of Laxmi Road*, a major attraction for tourists and shoppers. Observations on this street indicate that the road is consistently filled with parked two-wheelers. While the road includes minimal sidewalks, these are often encroached upon by hawkers and parked vehicles, leaving limited space for walking. This street also serves as a key passage to adjoining narrow alleys, including the streets in *Tulshibaug*, that further add to its status as one of the busiest roads in the area.

Designated residential land use

The second observation was conducted in the designated residential areas of the case study. However, it became abundantly clear that there is no exclusive residential area that exists on the ground. Most of the observed areas consist of mixed-use buildings. On the tertiary roads in these dense neighbourhoods, a significant presence of local retail and wholesale shops and their associated warehouses was observed. In some parts of the study area, the dominance of commercial activity was so overwhelming that areas such as *Bohri ali – Raviwar Peth* market appeared to function more as commercial zones rather than purely residential ones.

Observational field study revealed several aspects that were both unique and contradictory to the designated residential land use on the Plan. Even though classified as purely residential, the streets and neighbourhoods across the area were overwhelmingly congested with traffic and disturbed by unregulated parking. This was observed across all types of roads including narrow tertiary streets within dense neighbourhoods.

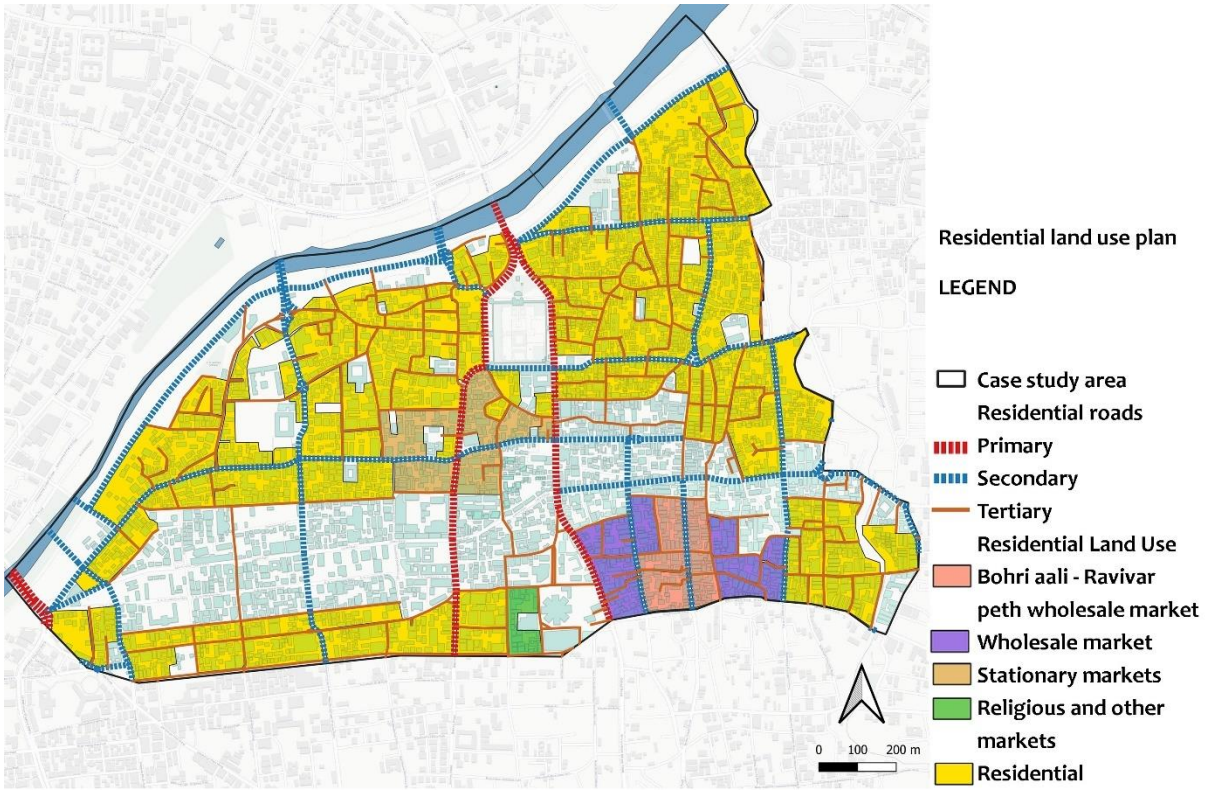


Figure 45 - Observed activities on designated residential land (Source - Author)

In the case study area, this thesis identifies two primary roads, *Shivaji Road* and *Bajirao Road*, as they are major connectors to the rest of the city. It divides the study area into two parts. Both roads are designated as one-way streets, functioning in opposite directions and providing critical mobility links for the area. According to the Development Plan PMC (2013), both roads are also connected to specific residential land use, making them key corridors for local and through traffic.

Figure 46 - Observed activities on different types of roads in designated residential land (Source - Author)

In the first picture of Figure 46, these streets can be observed to be heavily congested, with vehicles parked on one side of the road. This unregulated parking reduces the effective width of the carriageway, giving rise to further contestation of street space.

The secondary roads in the case study area have higher concentration of commercial activities compared as to the primary roads, with retail shops being operated even in designated residential land use areas. The road width varies significantly in different sections of a single road, reflecting its historical organic development patterns. These roads also serve as important locations for auto-rickshaw stands, which cater to short-distance, on-demand transportation. Intensive business activity, the presence of rickshaw stands, and unregulated on-street parking collectively add to the congestion and mobility challenges of the neighbourhood.

The tertiary roads in the case study area were historically designed to provide access to the traditional *Wada-style* housing, characterised by narrow streets suited to the needs of the time. However, as many of these traditional structures have been demolished and replaced with modern concrete buildings today, the roads have remained narrow, making them increasingly unsuitable for vehicular traffic to pass. Despite these constraints, a significant number of residential buildings are still located on these streets, and residents invariably drive vehicles on these narrow streets, resulting in congestion. This mismatch between historical road design and modern mobility demands further increases infrastructure limitations.

Raviwar Peth during festival season | **Wholesale markets of Raviwar Peth** | **Wholesale markets of Raviwar Peth**

Figure 47 - Busy streets of Raviwar peth market in the designated residential area (Source - Gões et al., 2017)

Figure 47 depicts the busy streets of *Bohri Aali – Raviwar Peth* wholesale markets, which are among the historic and significant commercial areas in the city. These streets are very narrow and densely

packed with markets that are particularly well-known for selling seasonal ornaments and decorations during festival seasons. Increased activity during festive seasons in this area creates chaotic conditions due to the sudden surge in visitors and temporary vendors. As a result, these markets act as major mobility generation sources, attracting people and vehicles from across the city.

Despite their evident commercial and historical significance, these streets are officially designated under 'residential zones' in the Development Plan. The ground reality presents a dichotomy between their actual usage and the PMC records, which suggests an unregulated evolution of these areas into commercial hubs.

Kasba Ganapati Temple | Shitole wada Temple

Figure 48 - Religious spaces in designated Residential areas (Photos - Author)

Figure 48 shows the two famous historic temples located within the case study area. Despite being situated within zones officially designated as residential land use, these temples play a significant role in shaping the mobility patterns of the area. The first picture in Figure 48 shows a temple called *Kasba Ganapati*, known as the principal deity of the city. With its historical and cultural significance, it attracts large volumes of visitors and devotees, generating significant mobility demand in its vicinity. The presence of such heritage structures, coupled with their ability to draw crowds, further adds pressure on the surrounding roads and infrastructure.

Figure 49 - Street vendors in designated residential land use (Source - Author)

These areas are also well-known for their street vendors, particularly those selling street food, contributing to informal local economy. These places are observed to be very famous among the locals and create short-term unregulated parking clusters which worsen the overall traffic congestion.

Designated Public/Semi-public land use

This land use type as designated in the Development Plan, has an inherent broader scope, encompassing facilities such as schools, colleges, universities, public offices, and other institutional uses. While this land-use category also includes heritage structures, for the purpose of this thesis and to strengthen the argument, heritage structures have been recognized separately in this chapter. This distinction supports focused analysis of the unique mobility challenges and impacts associated with heritage structures, which differ from those generated by other institutional facilities which will be discussed later.

For Public/Semi-Public zones, which primarily comprise of schools and junior colleges, the mobility patterns are largely defined school traffic. These areas experience peak-hour traffic during school opening and closing times, with a mix of private vehicles, school buses, vans, rickshaws and non-motorized modes such as bicycles and walking. The movement of school-going children, parents and the associated staff with their routinely trips also contribute to mobility generation within the area.

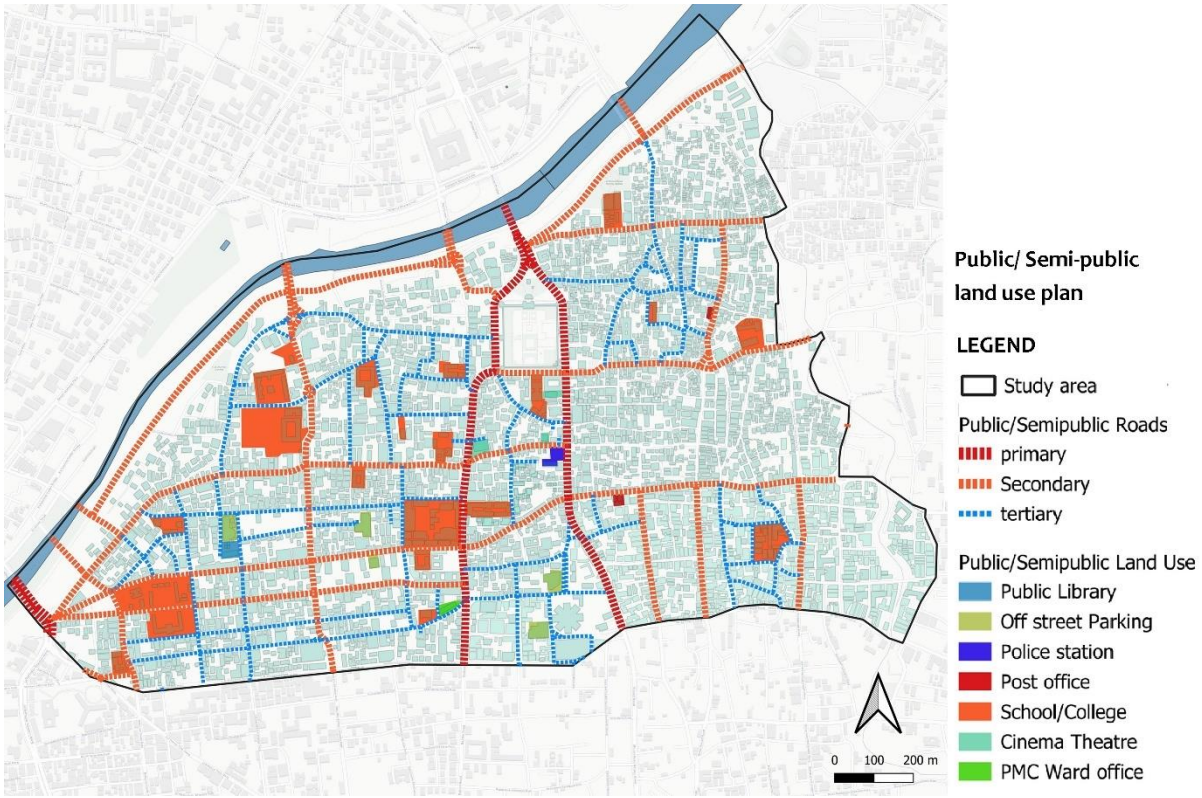


Figure 50 - Designated Public Semi-public land use in DP 2013 (Source – Author)

There are approximately 19 schools and colleges within the case study area, which collectively generate a significant movement on these streets on a daily basis. These institutions contribute to traffic flow, particularly during peak hours, as students and staff commute within these locations. The mobility generated includes a mix of trips by private vehicles, school buses, rickshaws, and pedestrian movement, creating notable pressure on the surrounding road network.

In addition to the educational institutions, the case study area also hosts other public institutions, such as public libraries, a post office, and a police station. However, these facilities do not significantly contribute to the overall mobility generation as compared to schools and colleges, as their footfall and traffic demands are relatively lower and more dispersed throughout the day.

No.	Institute	Type	Mode of transport
1.	Abdul karim husen aatar primary school	Primary school (Age 6 to 10)	On foot, Private vehicle.
2.	Rajmata Jijabai School	Temporarily closed	
3.	Ratanben Chunilal Mehta Gujarati High School	Secondary Education (Ages 11–16)	On foot, cycle, School rickshaw, public transport, Private vehicle.
4.	Maulana Mohammed Ali Johar Urdu Vidyaniketan High School,Pune	Secondary Education) (Ages 11–16)	On foot, cycle, Private vehicle.
5.	Haribhai V. Desai College of Commerce, Arts and Science	Higher Secondary (Junior college), Higher Education (Ages 16 and above)	On foot, cycle, School rickshaw, public transport, Private vehicle.
6.	N V Gadgil School	Skill development centre	On foot, public transport, Private vehicle.
7.	Prin. N. G. Naralkar Institute of Career Development & Research	Skill development centre	On foot, public transport, Private vehicle.
8.	Ideal English School	Secondary Education (Ages 11–16)	On foot, cycle, public transport, Private vehicle.
9.	NMV High School and Junior college	Primary school, Secondary Education, Higher Secondary (Age 6 to 18)	On foot, cycle, School rickshaw, public transport, Private vehicle.
10.	Huzurpaga Girls High School And Jr College	Primary school, Secondary Education, Higher Secondary (Age 6 to 18)	On foot, cycle, School rickshaw, public transport, Private vehicle.
11.	Shrimati Ramabai Ranade Girl School	Secondary Education (Ages 11–16)	On foot, cycle, public transport, Private vehicle.
12.	Zashichi Rani primary school	Temporarily closed	
13.	SNDT Kanyashala	Higher Secondary (Age 16 to 18)	On foot, cycle, public transport, Private vehicle.
14.	Deccan Education Society's Ahilyadevi High School for Girls	Secondary Education (Ages 11–16)	On foot, cycle, School rickshaw, public transport, Private vehicle.
15.	N. Mahadaev Govind Ranade Balak Mandir	Primary school (Age 6 to 10)	On foot, public transport, Private vehicle.
16.	Deccan Education Society's Navin Marathi Shala	Primary school (Age 6 to 10)	On foot, public transport, Private vehicle.
17.	Deccan education society new English school	Secondary Education (Ages 11–16)	On foot, cycle, School rickshaw, public transport, Private vehicle.

18.	Gogate primary school, Pune Municipality	Primary school (Age 6 to 10)	On foot, public transport, Private vehicle.
19.	Jnana Prabodhini Prashala	Secondary Education (Ages 11–16)	On foot, cycle, School rickshaw, public transport, Private vehicle.

Table 9 - List of schools/colleges and the mode of transport used to reach there by students/parents (Source - Author, the data is collected by observation and survey)

Table 9 provides a of the schools and colleges within the case study area, along with the primary modes of transport used by students and parents. The data was compiled by combination of field observations and surveys conducted with the authorities of the respective institutions. This table provides an overview of the mobility demand generated by educational institutions and its impact on the surrounding road network during high-traffic hours.

As can be seen in Figure 51, These auto-rickshaws play a significant role in the mobility patterns of the area, particularly during peak hours when students are being picked up or dropped off. Each vehicle has the capacity to carry 6-8 children to their schools.

Figure 51 - A typical School rickshaw (source - Raj, 2023)

Designated Heritage land use

This specific land use type has been identified and separated distinctively for the purpose of this research. In the Development Plan (DP) 2013, heritage areas are categorised under the broader Public-Semi-Public land use type. However, this categorisation presents a significant contradiction, particularly while considering the heritage sites recognised by the municipality. Many heritage sites within the study have been inaccurately mapped or unidentified in the DP-2013 land use maps. Many historical and culturally significant sites, despite their importance, are categorised under a generic land use category, failing to highlight the unique value of these sites.

Observations revealed that the major heritage sites within the study area predominantly have a religious character, primarily associated with the Hindu faith. These sites were located mainly along primary and secondary roads, which significantly contributes to the traffic pressure on these street types.

All heritage sites do not generate the same level of mobility demand. While a few key sites attract consistent footfall and vehicular traffic every day, others exhibit a more temporal character due to their religious significance, with peaks in activity observed only at specific times—such as particular days of the week, phases of the month, or during annual religious events or festivals.

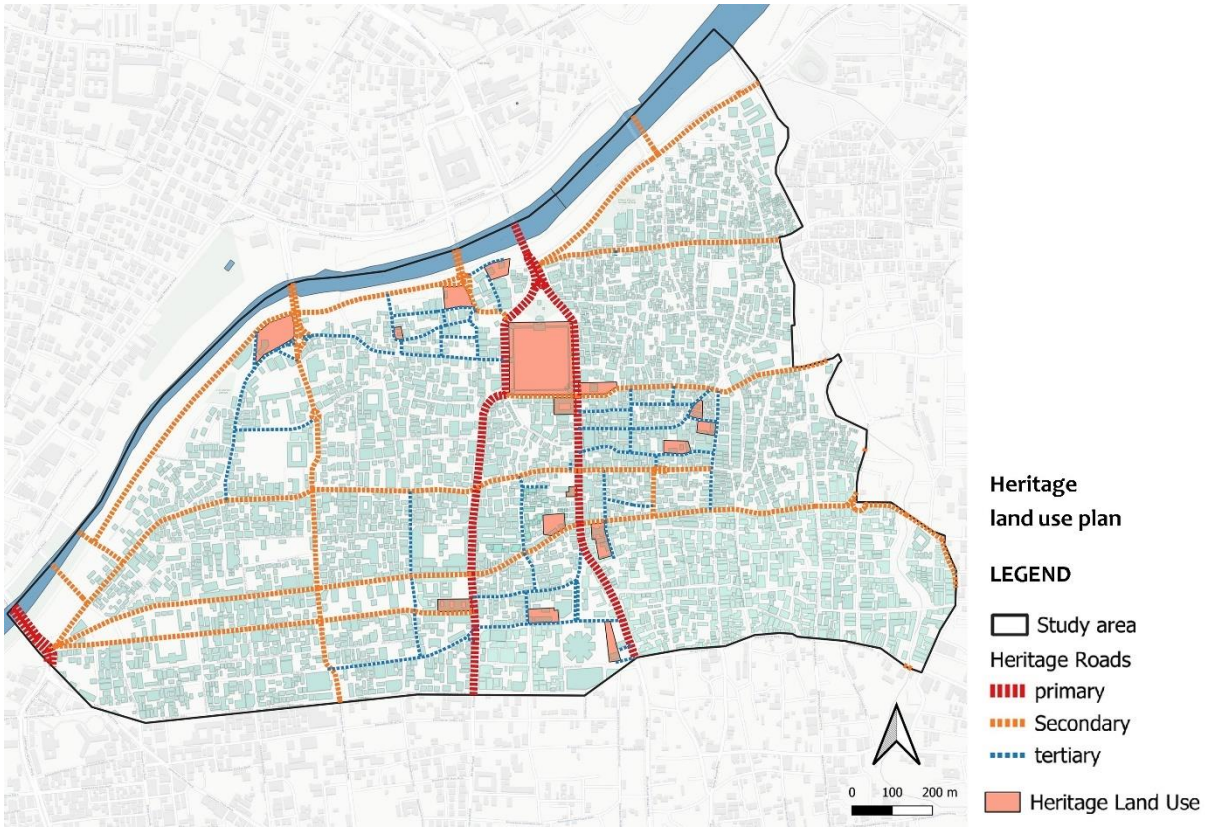


Figure 52 - Designated Heritage land use in DP 2013 (Source – Author)

Due to their location along primary and secondary roads, heritage sites often transform into hubs of activities given their cultural and historical significance. Heavy concentrations of informal economic activities take form when street vendors or small-scale businesses pop up in the main carriageway of the street during certain festivals.

Despite the designation of no-parking zones or the creation of visitor-only parking spaces, it was observed that these regulations are commonly ignored. The lack of enforcement or supervision leads to unauthorized parking, further exacerbating congestion around these busy streets. This dual use of the street marking heritage significance coupled with unregulated visitor activities diminishes the cultural value of these sites and challenges the access to these sites for different users.

As shown in Figure 53, the dominance of parked vehicles around heritage sites is overwhelming, often overshadowing the historical landscape of the designated heritage land use areas. Among

these, *Shaniwar Wada*, a protected monument of significant national importance, draws the most attention and generates the highest mobility due to its historical significance and popularity.

Figure 53 - Different factors affecting the traffic flows around the designated heritage land use. (Source – Author)

Heritage sites other than *Shaniwarwada*, are also overwhelmed with parked vehicles. However, the parking associated to such sites is primarily linked to the informal activities happening in the surrounding areas that to these sites themselves. This misalignment not only diminishes their visibility and cultural value but also adds to the mobility challenges, as unregulated parking further congests the already strained roads.

7.2 Mobility demand

This section lays out the traffic survey of the vehicular inflow and outflow within the case study area. This will provide an understanding of the demand for mobility throughout the day. Given the fact that the case study area encompasses a vast number of people, the data will be used from the Comprehensive Mobility Plan 2018 by PMRDA (CMP, 2018). According to this survey, approximately 2.8 million vehicles enter the case study area daily. This makes it impossible for the author to conduct the surveys for this thesis. So, this thesis relies on the next best option for trusted information, which is CMP 2018.

The original survey covered by the document encompasses not only PMC but also the PCMC area. But for the benefit of this study the survey points within the case study area are compiled in this section. Table 10 shows the summary of all the surveys conducted and the duration of each survey. As per the document, there are three methods used for vehicular movement analysis - Screen-line surveys, Traffic volume count on intermediate roads, and Volume counts at intersections. In addition to this, passenger terminal surveys, pedestrian count surveys and on-street parking surveys were also conducted to understand the overall traffic scenario. There is also a speed and delay survey to depict the pressure on the roads of the case study area.

No.	Type of survey	Duration of the survey
1.	Traffic volume count at the screen line	16 hours
1.	Traffic volume count on intermediate road	16 hours
2.	Turning volume count at busiest intersections	16 hours
3.	Passenger terminal survey	24 hours
4.	Pedestrian count survey	16 hours
5.	On street parking survey	16 hours
6.	Speed delay survey	16 hours

Table 10 - The survey types and its duration (Source - CMP 2018)

In CMP 2018, the surveys are shown in the terms of Passenger Car Unit (PSU) which is a common practice in urban areas when there is a complex interaction of different various kinds of vehicle. Each vehicle type is assigned certain values on their relative interference values. In the report, PSUs are assigned according to Indian Roads Congress (IRC) 106: 1990, which are given in the table 11 –

No.	Vehicle Class	Equivalency Factor	
		Percentage composition of vehicle type in traffic stream	
Fast Vehicles		5%	10%
1.	Two wheelers – motorcycle, scooter etc.	0.5	0.8
2.	Passanger car, Pik up van	1.0	1.0
3.	Auto rickshaw	1.2	2.0
4.	Light commercial vehicle	1.4	2.0
5.	Truck or Bus	2.2	3.7
6	Agricultural tractors	4.0	5.0
Slow Vehicles			
1.	Cycle	0.4	0.5
2.	Cycle rickshaw	1.5	2.0
3.	Tonga (Horse-drawn vehicle)	1.5	2.0
4.	Hand cart	2.0	3.0

Table 11 - PCUs assigned by Indian Roads Congress (IRC) 106: 1990 (Source – IRC, 1990)

It is also important to note that, the equivalency factor changes based on how common the vehicle type is for example If two-wheelers make up only 5% of the traffic, their impact is smaller (factor = 0.5) or If two-wheelers make up 10% or more, their impact grows (factor = 0.8).

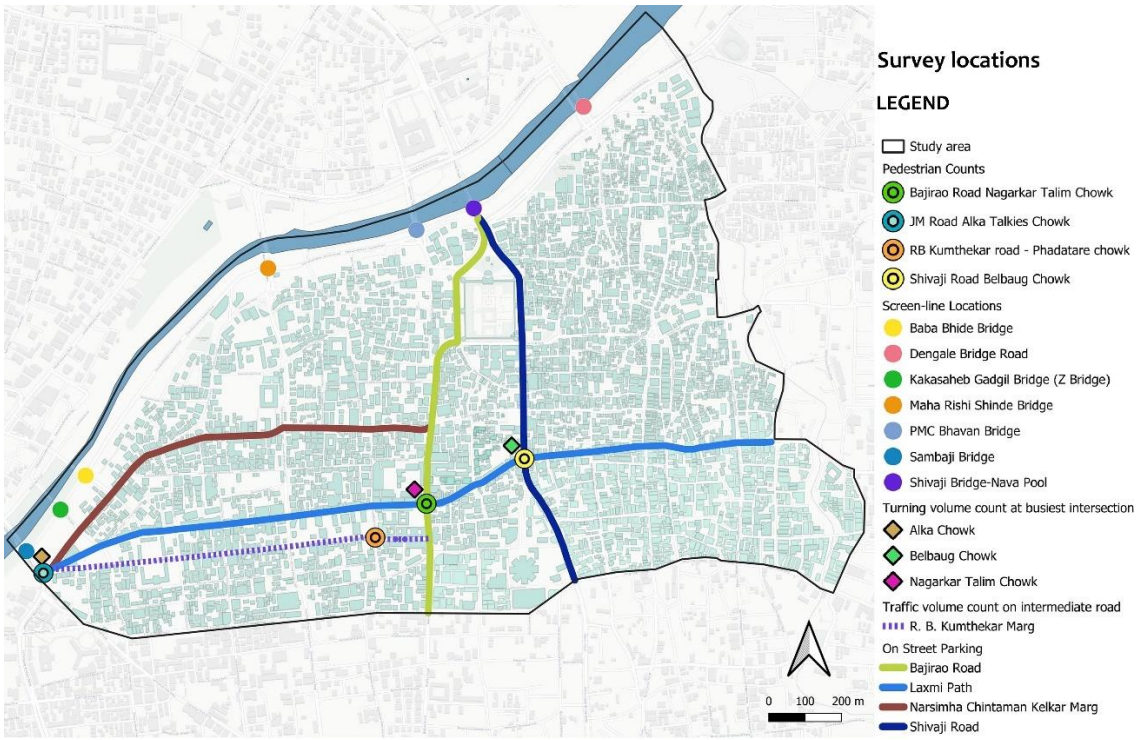


Figure 54 - The survey sites (Source – Plan drafted by the author based on the description in CMP 2018)

Traffic Volume Count at Screen-line Locations

Screen lines are natural or man-made barriers, such as rivers, canals, or railway lines, that divide the study area into distinct zones and provide limited, direct connections between these zones. For case study area the screen line is: the North-South screen line, which includes the Mutha River.

The primary objective of conducting this kind of traffic volume count on screen-line locations is to monitor the movement of vehicles and people across these critical barriers. This helps to understand mobility entering and exiting the case study area. These points are, in a way, pressure points of the case study area because they are its entry and exit points. This approach provided in the CMP 2018 is crucial for understanding mobility dynamics within the study area.

Survey Locations

- Sambhaji Bridge
- Kakasaheb Gadgil Bridge (Z Bridge)
- Baba Bhide Bridge
- Maharishi Shinde Bridge
- PMC Bhavan Bridge
- Shivaji Bridge-Nava Pool
- Dengale Bridge Road

Survey Outcome

The following data represents the 16-hour traffic (06:00 a.m. to 10:00 p.m.) analysis. Based on the overall analysis, which was about 59 points, where a total of about 2.8 million vehicles (2.6 million PCU) cross the North-South screen-line locations every day.

No.	Location	Total number of vehicles	Total number of PCUs	Total Share
1.	Sambhaji Bridge	44,615	61,991	13.64%
2.	Kakasaheb Gadgil Bridge (Z Bridge)	18,942	14,082	5.79%
3.	Baba Bhide Bridge	98,093	76,462	29.99%
4.	Maharishi Shinde Bridge	71,123	64,247	21.74%
5.	PMC Bhavan Bridge	59,044	51,895	18.06%
6.	Shivaji Bridge-Nava Pool	83,941	81,622	25.67%
7.	Dengale Bridge Road	75,078	75,422	22.96%

Table 12 Result of the traffic count at screen line locations. (Source - CMP 2018)

Table 12 shows the important entry points to the case study area based on the total share percentage. These results also help in understanding the role of PCUs where by comparing the number vehicles with number of PCUs gives an idea of what type of vehicles are being noted.

Location	Private modes		Paratransit	Public	Transport	Cycle	Other
	Two wheelers	Car/Jeep	Auto Rickshaw	Bus	Goods vehicle		
Sambhaji Bridge	3,244 (7.3%)	19,876 (44.6%)	15,089 (33.8%)	2913 (6.5%)	2196 (4.9%)	1288 (2.9%)	9 (0.0%)
Kakasaheb Gadgil Bridge (Z Bridge)	18,553 (97.9%)	8 (0.0%)	9 (0.0%)	0(0.0%)	0 (0.0%)	372 (2.0%)	0 (0.0%)
Baba Bhide Bridge	92,344 (94.1%	528 (0.5%)	3,951 (4.0%)	3 (0.0%)	244 (0.2%)	1,023 (1.0%)	0 (0.0%)
Maharishi Shinde Bridge	55,336 (77.8%)	6,001 (8.4%)	7,278 (10.2%)	73 (0.1%)	1,083 (1.5%)	1,346 (1.9%)	6 (0.0%)
PMC Bhavan Bridge	48,455 (82.1%)	3,122 (5.3%)	6,261 (10.6%)	69 (0.1%)	443 (0.8%)	693 (1.2%)	1 (0.0%)
Shivaji Bridge-Nava Pool	58,779 (70.0%)	10,305 (12.3%)	9,346 (11.1%)	2,221 (2.6%)	2,502 (3.0%)	786 (0.9%)	2 (0.0%)
Dengale Bridge Road	49,370 (65.8%)	10,625 (14.2%)	10,520 (14.0%)	1,695 (2.3%)	1,894 (2.5%)	970 (1.3%)	4 (0.0%)

Table 13 - Composition of Traffic at Screen-line Locations. (Source - CMP 2018)

*Others - Tractor, Cycle Rickshaw

As can be observed in table 13, on Kaka Saheb Gadgil Bridge (Z bridge), only two-wheelers and cycles were captured. Other vehicles are restricted from using the Z bridge (few cars and auto rickshaws use the bridge as it seems to be an illegal move). As can be observed on any street in Pune, two-wheelers occupy streets the most. Sambhaji Bridge seems to have the least number of

two-wheelers because their travel is allowed for only specific hours. The numbers related to buses seems to be the most unique and surprising. Since the case study area is at the centre of the city, The frequency of buses going to various parts of the city is quite dense.

Peak Hour Characteristics

The next step involves identifying the time of day when traffic volumes are at their highest, based on observations conducted over a 16-hour period. The peak hour is calculated by examining traffic flow patterns to determine the hour with the maximum movement of vehicles. This metric is crucial in understanding the dynamics of traffic and mobility demand at specific locations. Since it is location-based, the peak hours for each location will vary according to the mobility demand of adjoining areas.

No.	Location	Peak hour	Peak hours PCUs	Total Share
1.	Sambhaji Bridge	11.45-12.45	4,129	6.66%
2.	Kakasaheb Gadgil Bridge (Z Bridge)	18.15-19.15	1,449	10.28%
3.	Baba Bhide Bridge	10.00-11.00	6,701	8.76%
4.	Maharishi Shinde Bridge	10.00-11.00	5,744	8.94%
5.	PMC Bhavan Bridge	17.45-18.45	4,655	8.97%
6.	Shivaji Bridge-Nava Pool	12.45-13.45	6,249	7.6%
7.	Dengale Bridge Road	10.45-11.45	6,469	8.57%

Table 14 - Peak hour characterisation (Source - CMP 2018)

The results from Table 14 reveal some interesting peak hour patterns in the study area. While the data pertains to peak hours, it is noticeable that most peak hour proportions remain in the single-digit percentage range. This suggests that traffic in these locations is relatively constant throughout the day, with no dramatic spikes in volume. In other words, while there are periods of higher activity, the traffic flow does not fluctuate drastically, indicating a balanced or steady flow of vehicles and people across the study area.

In general, the peak hours across most locations fall between the morning and afternoon, further emphasising the influence of the socio-economic characteristics of the adjoining neighbourhoods. An exception to this is observed at Kaka Saheb Gadgil Bridge (Z Bridge) and PMC Bhavan Bridge, where peak hour shares show a more pronounced concentration. These bridges experience a higher volume of traffic during evening times, which may be attributed to their connectivity to key urban areas and transport corridors, creating more concentrated travel patterns.

Passenger Flows across Screen-lines

In CMP 2018, Passenger Flow is also counted on the screen line points. The passenger vehicle occupancy survey helps to estimate the average occupancy of passenger vehicles crossing these lines. The data gathered from this survey is essential for understanding the number of passengers travelling through different areas, as it helps convert vehicular flow into passenger flow. Occupancy factors—essentially the average number of passengers per vehicle—are used in this calculation. Table 15 shows the passenger vehicle occupancy in the case study area. But overall, around 5.3 million passengers are crossing the North-South screen-line in a day.

No.	Location	Motorised	Non-Motorised	Total vehicle	Total Passenger Flow
1.	Sambhaji Bridge	43,327	1,288	44,615	1,53,536
2.	Kakasaheb Gadgil Bridge (Z Bridge)	18,570	372	18,942	27,225
3.	Baba Bhide Bridge	97,070	1,023	98,093	1,45,189
4.	Maharishi Shinde Bridge	69,776	1,347	71,123	1,16,09
5.	PMC Bhavan Bridge	58,351	693	59,044	95,001
6.	Shivaji Bridge-Nava Pool	83,155	786	83,941	1,79,384
7.	Dengale Bridge Road	74,106	972	75,078	1,59,508

Table 15 - Total Passenger Vehicles and Passengers at Screen-lines (Source - CMP 2018)

Table 15 shows the importance of all the screen line points as most of them are used to move across 100,000 people daily. These points act as a doorway to the case study area where overwhelming motorised mobility is observed.

Traffic volume count on intermediate road

This is a second type of traffic volume count that is been counted by the authorities as a part of the Comprehensive Mobility Plan (CMP) 2018. This survey focuses on recording the movement of people within the case study area through various modes of transport on a typical day. Unlike screen-line surveys, which primarily monitor crossings at major barriers such as rivers or railways, intermediate road counts are aimed at capturing the internal mobility patterns of the area.

The primary purpose of this survey is to understand the key mobility trends on an intermediate busy road. This survey shows how urban local roads contribute to the overall transportation network of the case study area, complementing the data from screen-line surveys and providing a more granular view of mobility patterns.

Survey location

RB Kumthekar Road

Traffic volume

Unfortunately, only RB Kumthekar Road from the case study area is considered in CMP 2018 for traffic count in this type of road category. However, the location is in the heart of the case study area with vibrant markets and important for the cultural activities in the area.

Location	Total number of vehicles	Total number of PCUs
RB Kumthekar Road	23,973	24,532

Table 16 - Traffic volume count on intermediate road (Source – CMP, 2018)

Traffic Composition

RB Kumthekar Road lies in the heart of the commercial district of the case study area. It has numerous retail shops which attract the mobility of customers as well as suppliers. This road is a one-way street so it impacts the traffic count. As can be seen in Figure 55, Motorcycles are the most used type, which can also be because of the scarcity of parking areas.

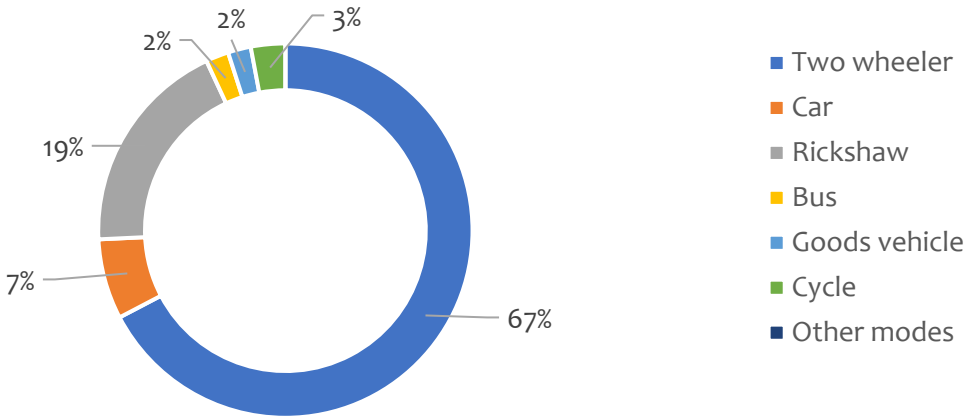


Figure 55 - Traffic composition of KB Kumtherkar road. (Source – CMP, 2018)

Peak Hour Characteristics

Table 17 shows the peak hour traffic volume count. It also shows the peak hour in which traffic is at its maximum, which accounts for 9% of the total.

Location	Peak Hour	Peak Hour PCUs	Peak Hour Share
RB Kumthekar Road	11.45-12.45	2,216	9.0%

Table 17 - Peak hour characteristics of RB kumthekar road. (Source – CMP, 2018)

Turning volume count at busiest intersections

In CMP 2018, the turning volume count is conducted at key intersections to analyse traffic dispersal patterns, which refer to how vehicles move through and distribute at junctions. This survey is intended to calculate the number of vehicles dispersing. The primary objective of this exercise is to gain a deeper understanding of traffic flow dynamics at busy junctions, which are often critical points in the urban transport network. The data collected from turning movement counts is used to validate travel demand models.

Survey Locations

Nagarkar Talim Chowk

Belbaug Chowk

Alka Chowk

Survey Outcomes

Table 18 shows the results published In CMP 2018 which also includes peak hour traffic in the morning and evening in terms of PCUs.

No.	Location	Type	Peak hour traffic (PCUs)		Total PCUs (In 16 hours)
			Morning	Evening	
1.	Nagarkar Talim Chowk	4 legs	8,337	8,055	1,04,157
2.	Belbaug Chowk	4 legs	5,979	6,486	84,971
3.	Alka Chowk	5 legs	7,840	7,864	1,00,463

Table 18 - Turning volume count at busiest intersections (Source - CMP 2018)

Figure 56 shows, the schematic turning patterns of vehicles in Belbaug chowk and Alka chowk.

Figure 56 Schematic representation of turning patterns on Belbaug chowk and Alka chowk (Source – CMP (2018) modified by author)

Pedestrian Counts

Along with the vehicular movement, the pedestrian movement also plays an important role in the case study area. It encompasses historic local markets, religious-cultural spaces, retail shops as well as electronics shops. So, the pedestrian count survey will help understand the intensity of pedestrian movement i.e., across the road, along the road at high pedestrian locations on a typical day.

Survey Locations

Phadatare chowk

Bajirao Road Nagarkar Talim Chowk

Shivaji Road Belbaug Chowk

JM Road Alka Talkies Chowk

Survey outcome

The survey outcome is counted in terms of along the street and across the street. These counts are conducted in a 16-hour time frame on a typical day. Weekends or festivals will have a substantial effect on given numbers, but as the material is available, these results can clear the picture.

No.	Location	Section	Along	Across
1.	RB Kumthekar Road, Phadtare Chowk	Chitale Chowk to The Pheonix Library	932	214
2.	Bajirao Road, Nagarkar Talim Chowk	Nagarkar Talim Chowk To Bajirao Road	1,562	329
		Nagarkar Talim Chowk To Laxmi Road	1,514	510
		Nagarkar Talim Chowk To Bajirao Road	1,625	631
		Nagarkar Talim Chowk To Laxmi Road	1,279	700
3.	Shivaji Road, Belbaug Chowk	Belbaug Chowk To Laxmi Road	1,262	1,187
		Belbaug Chowk To Chatrapathi Shivaji Maharaj Road	3,500	1,064
		Belbaug Chowk To Laxmi Road	1,538	1,356
		Belbaug Chowk To Chatrapathi Shivaji Maharaj Road	2,829	694
4.	JM Road, Alka Talkies Chowk	Alka Chowk To Laxmi Road	415	143
		Alka Chowk To Lal Bhahathur Sastri Road	745	216
		Alka Chowk To Sambhaji Maharaj Bridge	788	184
		Alka Chowk To Nc Kelkar Road	347	72

Table 19 - Pedestrian Counts at important intersections (Source – CMP, 2018)

Table 19 shows the impact of cultural landmarks on the pedestrian count. For example, the maximum number of pedestrian traffic observed at Belbaug Chowk is around 13,000; this is because of Dagdusheth Halwai Ganapati Temple and commercial areas on Shivaji Road. On the other hand, JM Road-Alka Talkies Chowk shows the lowest pedestrian count because of the lack of any major landmarks around it.

Figure 57 - Schematic pedestrian count in Belbaug Chowk and Nagarkar Talim Chowk (Source - CMP, 2018 modified by author)

On Street Parking Survey

The CMP 2018 also provides an extensive information on parking where, on-street parking survey was conducted at four key locations to analyse the parking patterns and demand within the case study area. The objective of this survey was to evaluate the extent of parking usage, the types of vehicles parked, and the overall parking behaviour at these locations.

To standardize the measurement of parking demand, the Equivalent Car Space (ECS) units were used. These units convert the parking space occupied by various types of vehicles (e.g., two-wheelers, cars, and commercial vehicles) into a single standardized value, allowing for a uniform assessment of parking requirements across different vehicle categories. Table 20 shows the ECS values used for each vehicle category.

No.	Vehicle Type	ECS
1	Two-Wheeler	0.20
2	Auto Rickshaw/ Share Auto	0.5
3	Car	1.00
4	Van/ Maxi cab/ Big Car	1.50
5	LCV/Tata Magic	1.75
6	Multi Axle Vehicles	3.0
7	Trucks	2.5
8	Cycles	0.20
9	Cycle Rickshaw	0.80

Table 20- The ECS values used for each vehicle category. (Source -CMP 2018)

Survey Locations

Bajirao Road

Shivaji Road

Laxmi Road

NC Kelkar Road

Survey outcomes

All the given survey locations are, in a way, the spine of the case study area where Bajirao Road and Shivaji Road run on the axis with all the traffic from one end to another. On the other hand, Laxmi Road and NC Kelkar Road run on the X axis, which they are responsible for the business district of the area. Altogether these locations are in charge of mobility within the case study area. This survey was conducted on a typical day for 16 hours.

No.	Location	Parking Demand		Total Parking Accumulation (ECS)
		LHS	RHS	
1	Bajirao Road	2,131	2,667	4,798
2	Shivaji Road	5,872	5,106	10,979
3	Laxmi Road	9,874	5,077	14,950
4	NC Kelkar Road	5,475	5,615	11,091

Table 21 - Parking Accumulation at Various On-street Parking Locations (Source -CMP 2018)

According to CMP (2018), among all the locations in the PMC area, the maximum parking accumulation is observed on Laxmi Road (14,950 ECS), NC Kelkar Road (11,091 ECS) and Shivaji Road (10,979 ECS) as these roads are in the commercial business district area.

No.	Location	Quick parkers (upto 30 min)		Short Stay parkers B/w 0.5 hr & 1 hr		Medium Stay Parking B/w 1 hr & 2 hr		Long Stay Parking B/w 2 hr & 3 hr		Very Long Stay Parking >3 hr	
		LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS
1	Bajirao Road	58%	50%	16%	16%	10%	13%	6%	8%	10%	13%
2	Shivaji Road	60%	56%	16%	16%	10%	11%	5%	6%	9%	11%
3	Laxmi Road	48%	41%	17%	27%	14%	17%	7%	5%	14%	10%
4	NC Kelkar Road	58%	56%	15%	16%	11%	11%	6%	6%	9%	11%

Table 22 Parking Characteristics Based on Parking Duration at Various Locations (Source – CMP, 2018)

It can be observed that at all locations vehicles were parked for mostly short durations (up to 30 min duration) in the case study area. But CMP (2018) states that compared to the rest of the city, a considerable percentage of vehicles are parked for a long duration on case study area roads like Laxmi Road, Bajirao Road, and Shivaji Road. This is obviously because of the due to the high commercial activities on these roads

Analysis of Speed & Delay Survey

CMP (2018) also provides an analysis of speed & delay Survey because journey speed is a crucial parameter for evaluating the traffic flow and determining the Level of Service (LOS) for a road network. It provides information about the efficiency of the transport system by reflecting the average speed at which vehicles travel along a specific corridor. The measurement of journey

speed is essential for assessing the performance of the road network system, offering valuable data for developing transport demand.

For this information in CMP 2018, a speed and delay survey was conducted during peak and off-peak hours using the Moving Car Observer Method. This method involves recording the speed of a test vehicle while it travels through the network, simultaneously noting delays caused by congestion, traffic signals, or other obstructions. The survey by the CMP 2018 covered all major roads within the case study area, accounting for unique road configurations and types. As mentioned earlier, this survey was conducted under a 16-hour time frame.

No.	Name of the road	Average speed in peak hour (Km/hr)
1	NC Kelkar Road	12.05
2	Laxmi Road	11.07
3	Bajirao Road	11.00
4	Shivai Road	12.55
5	Dengale Road	16.00

Table 23 - Average Speeds on Major Road Networks (Source – CMP, 2018)

Table 23 shows that speeds are very low on roads like Laxmi Road, NC Kelkar Road, Shivaji Road, and Bajirao Road, as these roads are in the Commercial business district area with more intersections causing more vehicular pedestrian conflicts. Also, these roads are historical, and that is why they are narrow with heavy vehicular flow, unregulated on-street parking, and encroachments.

7.3 Mobility Supply

This section examines the character and adequacy of the infrastructure available to accommodate the generated mobility discussed in the previous section. As mentioned in the contextualisation of the case study area, many of the streets in the area are narrow historical streets. While these streets are integral to the area's historical fabric, they pose additional complications to the already challenging traffic situation.

This section evaluates the condition and functionality of the streets using a combined approach of field observations and study of available records. It also explores the public transport options available for the city's residents, assessing their role in facilitating mobility within the case study area. This includes an analysis of the existing bus network and proposed metro network.

Physical characterisation of the mobility infrastructure

As shown in Figure 58, the streets in the case study area can be categorised into three types: primary, secondary and tertiary, each with distinct mobility challenges. Primary roads, with widths ranging from 9 to 12 meters, serve as the main spine of the case study area and provide connections to other parts of the city. They are relatively better suited to handle heavy traffic, but they are consistently busy due to the traffic flow from the secondary and residential roads converging onto them. Given the amount of load these streets carry they are not designed to accommodate parking, but unregulated parking patterns can be observed, which adds further stress to their capacity.

Secondary roads exhibit a wide variety of characteristics as they pass through commercial districts, residential areas, and historical precincts. Their widths vary between 6 and 9 meters, and they primarily cater to commercial purposes, which results in a heavy load of vehicular traffic and pedestrian activities. Streets in commercial areas experience the greatest strain due to the high volume of shoppers, street vendors, and parked vehicles.

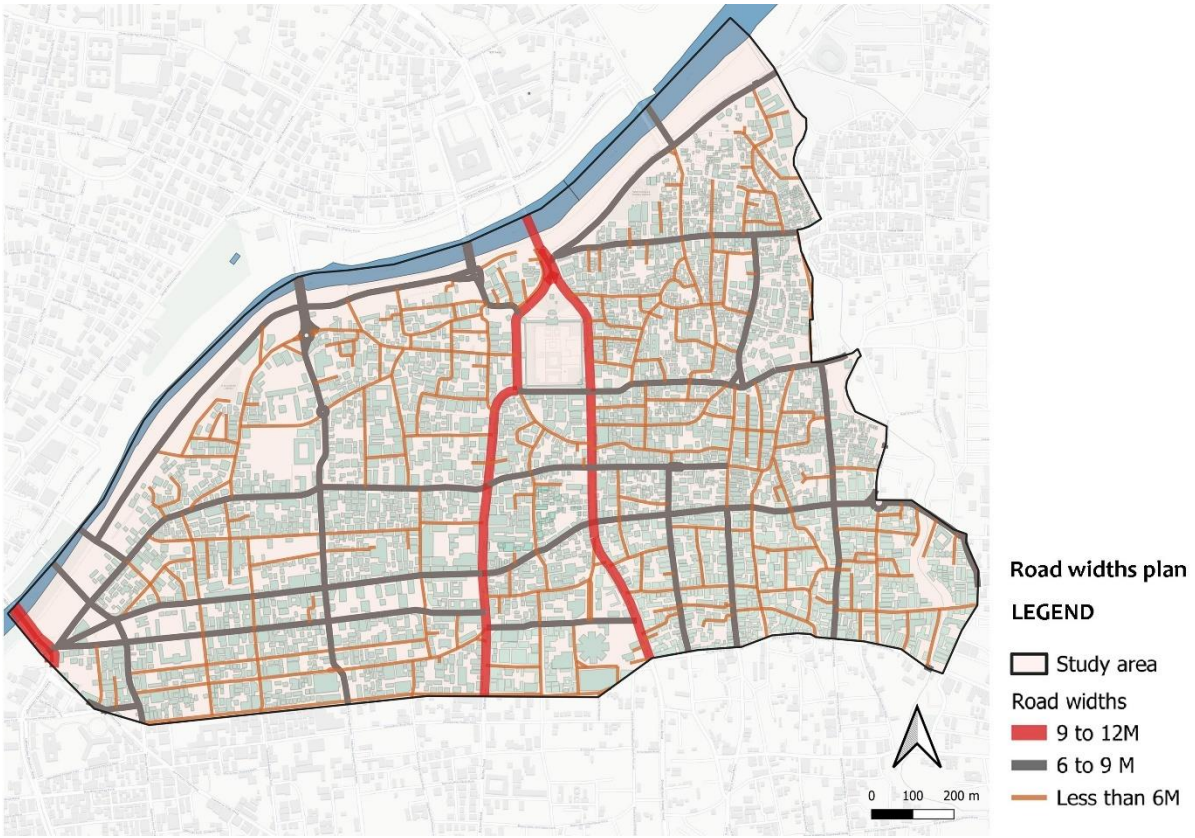


Figure 58 - Widths of all the streets in the case study area (Source - Author)

The third type includes streets primarily designated as residential but heavily influenced by commercial activities within these areas. These streets are often below 6 meters wide and follow the historical patterns of road networks, which are inherently narrow. Despite their incompatibility with modern traffic and parking needs, residents and visitors involved in commercial activities illegally park on these roads, further narrowing the available space. Many shops in these areas also use their warehouses along these streets, and the vehicles carrying goods frequently cause bottlenecks, compounding the mobility challenges.

Street Direction

Over the last decade, traffic issues in Pune have significantly worsened, which led the municipality to implement measures aimed at managing the growing congestion. One notable decision has been to designate certain streets as one-way roads, altering the overall traffic flow dynamics in the case study area. This section investigates the directionality of streets, focusing on the network of one-way and two-way streets to better understand how these configurations influence traffic patterns. By mapping and analysing these street directions, the study aims to identify the bottlenecks, diversion points, and key intersections that play a crucial role in regulating mobility within the area. This understanding is critical for evaluating the impact of these measures on traffic management and the broader urban mobility system.

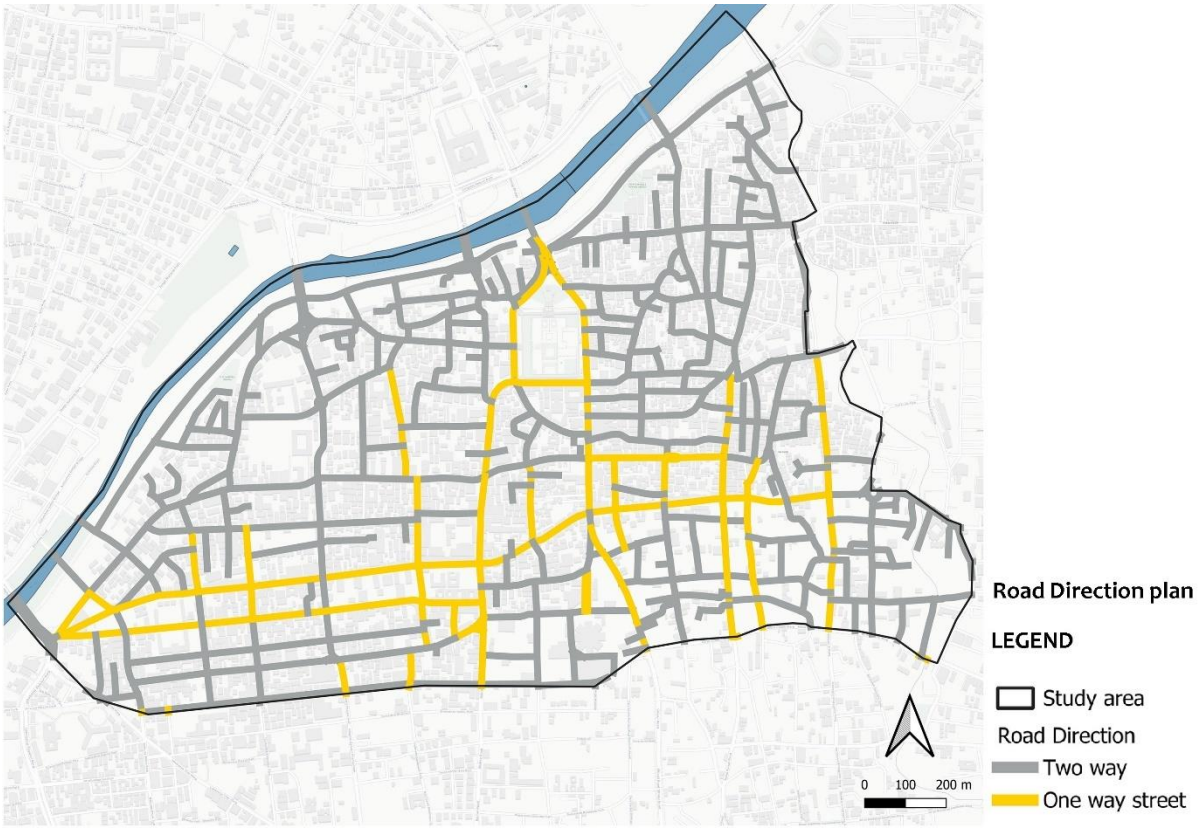


Figure 59 - Street directions (Source - Author)

During field observation, it was found that the primary and major secondary streets in the case study area have been designated as one-way streets, particularly in and around commercial markets and other busy areas where traffic congestion is most severe.

However, this system of one-way streets has created a complex and often confusing network, especially given the sheer volume of traffic on these roads. Observations during the survey revealed that clear signage is lacking in several places, making navigation difficult. The heavy reliance on diversion routes further adds to the navigation challenges, particularly for visitors and tourists who are unfamiliar with the area. Given the popularity of these locations among tourists, this confusion has become a regular phenomenon, affecting both local mobility and the visitor experience. It can be inferred that this system places significant stress on intersections, where traffic from different directions converges, leading to bottlenecks and further complicating the mobility dynamics of the area.

Pedestrian Infrastructure

In addition to accommodating vehicular traffic, the case study area experiences a high volume of pedestrian movement, primarily driven by its commercial activities. It was observed that there is no visible infrastructure for cyclists, such as designated cycle lanes or parking facilities, within the case study area, leaving cyclists to navigate through the same congested streets as motorized

vehicles. So, the next step in the analysis will be to assess the pedestrian infrastructure, including the condition, width, and connectivity of sidewalks which are known as the "Footpaths"

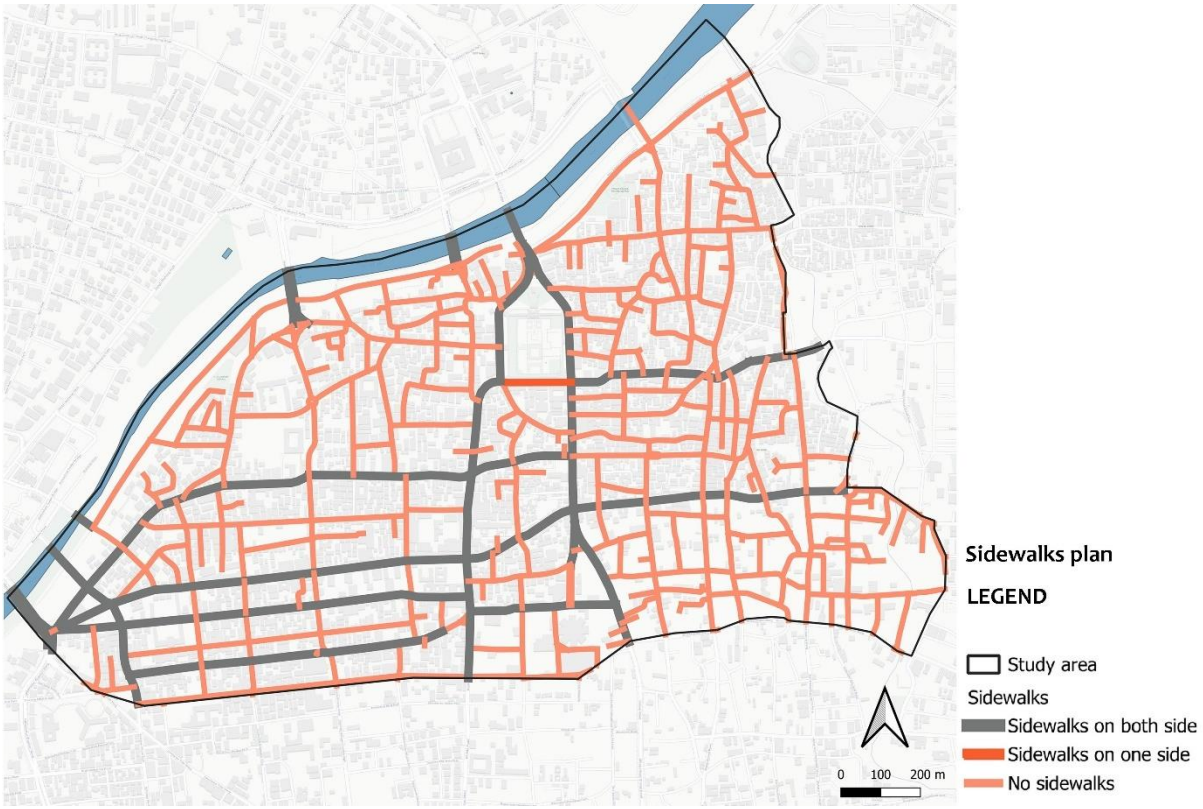


Figure 60 - Availability of sidewalks (Source - Author)

Figure 60 presents an observational map documenting all the streets equipped with pedestrian infrastructure in the case study area. As observed, the availability of dedicated pedestrian infrastructure is extremely minimal, with most streets lacking designated spaces for pedestrians, such as sidewalks or pathways. This absence of proper infrastructure results in direct interaction between vehicular and pedestrian movement, leading to safety concerns and further contributing to the chaotic mobility dynamics of the area.

Figure 61 - Condition of footpaths in the case study area (Source - Author)

Figure 61 illustrates the condition of sidewalks within the case study area. As previously discussed, the area already has a scarcity of pedestrian infrastructure, and the existing sidewalks face multiple challenges. The width of the sidewalks, where present, is at most 1.5 meters, which is insufficient to cater to the high pedestrian volume. Furthermore, these limited spaces are often obstructed by lampposts, trees, and other urban fixtures, reducing the effective width available for pedestrians.

Furthermore, hawkers and street vendors frequently encroach upon these sidewalks, leaving little to no space for actual pedestrian movement. This forces pedestrians onto the streets, creating direct conflicts with vehicular traffic and further exacerbating the mobility challenges in the area.

Public transport characterisation

Lastly, this section presents field observations on the public transport system and its characteristics within the case study area. This analysis aims to understand the extent and nature of public transport connectivity, including the routes, frequency, and accessibility of buses, rickshaws, and other modes of public transit.

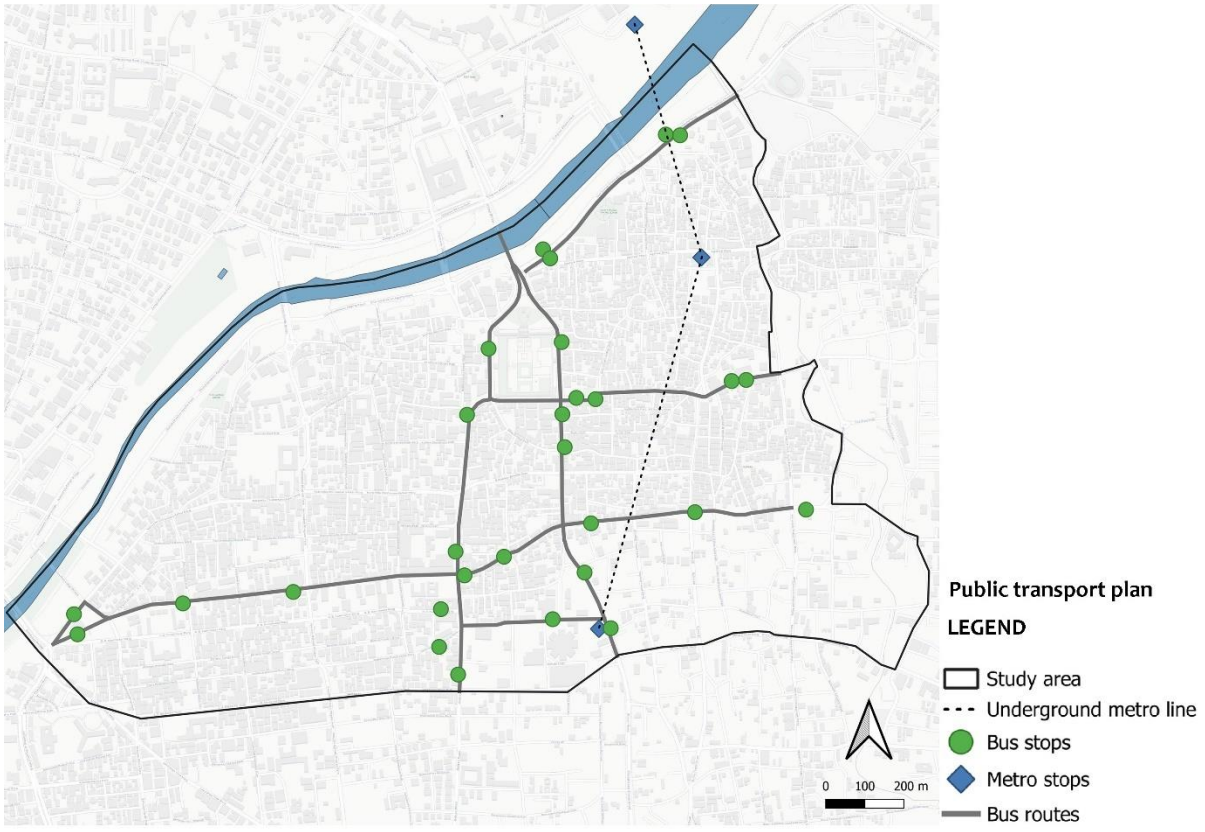


Figure 62 - Public transport network (Source - Author)

Figure 62 illustrates the bus and metro networks within the case study area. The bus network, which has been operational for a long time, forms the backbone of public transport in the area, while the metro network is still under construction and yet to be fully functional.

As shown in figure 62, the bus routes primarily operate along the main roads, which are also the busiest roads in the case study area. These roads pass through both commercial zones and historical areas, ensuring connectivity to key locations. The bus stops are spaced approximately 500 to 800 meters apart, providing reasonable coverage for commuters accessing the central commercial and heritage precincts. However, it can be observed that the concentration of bus routes on already congested main roads contributes to traffic congestion, and the reliance on buses for mobility places additional stress on these corridors. The eventual integration of the metro network is expected to alleviate some of this pressure by offering an alternative mode of transport, but for now, the bus network remains pivotal in shaping the mobility patterns of the case study area.

According to official records, the buses connecting the case study area to various parts of the city operate for 30 to 36 minutes. However, due to its compact size and the convergence of multiple bus routes within the case study area, intra-area travel is observed to be very efficient. Despite this, the actual frequency of buses often deviates from the estimated time due to traffic congestion on the main roads. These delays can significantly impact the overall efficiency of the bus network, especially during peak hours when congestion levels are at their highest. This highlights the dual challenge of managing traffic flow while ensuring the reliability of public transport in the case study area.

In addition to the bus network, another prominent paratransit option available in the case study area is rickshaws. These vehicles dominate the streets of Pune and are especially prevalent within the case study area. Rickshaws offer a high degree of flexibility, allowing passengers to navigate the narrower and deeper parts of the case study area that may be inaccessible to larger vehicles or public buses. Their ability to provide on-demand service and reach destinations within the densely packed historical and commercial zones makes them a preferred mode of transport for many residents and visitors.

7.4 Mobility behaviour and stakeholder survey

To better analyse mobility patterns within the case study area, this section focuses on understanding the behavioural patterns of the stakeholders with a society-centric approach. For this purpose, a qualitative data collection approach was adopted, utilizing the following three methods:

Survey of Stakeholders: Structured offline surveys were conducted during the fieldwork to gather quantitative and qualitative data from various stakeholders - including residents, shop owners, street vendors, and commuters, to understand their mobility patterns, preferences and the daily challenges they encounter.

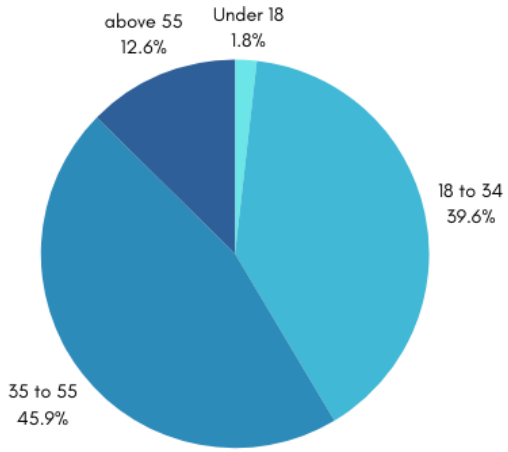
Informal Interviews with Stakeholders: Conversational, informal interviews were simultaneously conducted with stakeholders to capture their personal experiences and perspectives on mobility and its impact on daily life.

The surveys and interviews together helped establish a comprehensive understanding of mobility patterns from the perspective of users. This dataset provided insights into the expectations of various stakeholders on the functionality and accessibility of the streets and transport infrastructure, ensuring a holistic approach to analysing the study area's mobility challenges and opportunities.

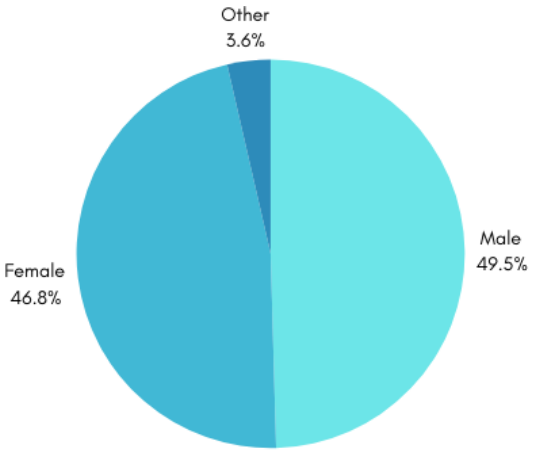
Results of the Survey of Stakeholders

The survey was conducted on the 30th and 31st of August 2024, a few weeks ahead of *Ganeshotsav*, the biggest Hindu festival celebrated in the city. The timing of the survey coincided with an exceptionally busy period for the streets as they prepared for the festival. This allowed the participation of a diverse range of stakeholders in the survey process. 30th August was Friday and also a working day. On the other hand, 31st August was a Saturday and weekend. In spite of this, it showed no significant difference in the crowd density on the streets. Both days were equally crowded marking the festive season, highlighting high levels of activity and mobility during this time.

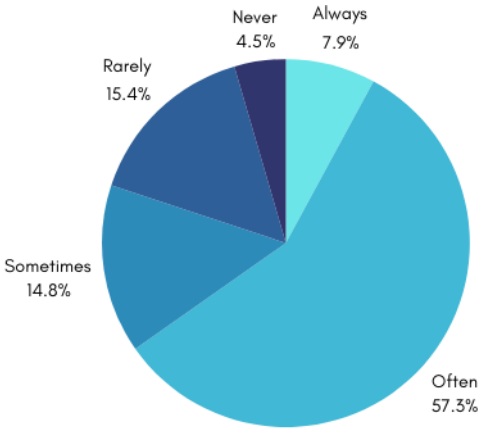
The total sample size of 111 participants was achieved, which included representation of various stakeholders, including residents, shop owners, street vendors, and commuters. Here the intent was to comprehensively record mobility patterns and challenges during a peak activity period in the city centre.



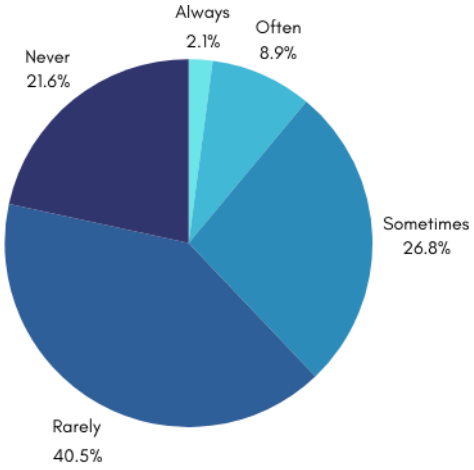
What is your age group?



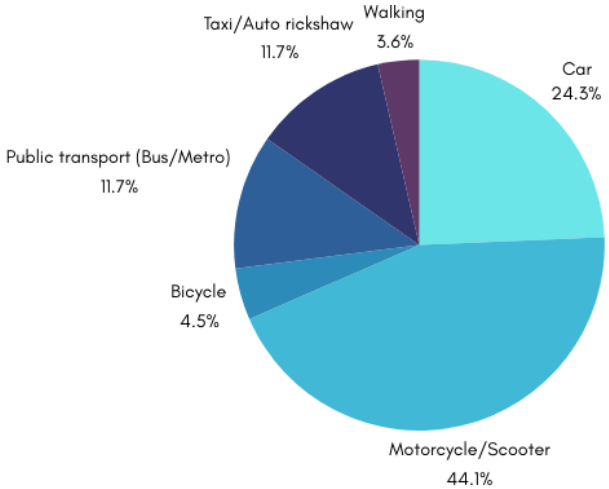
What is your gender?



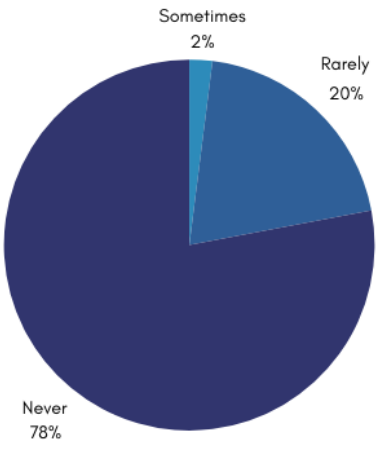
Do you find public transport (Bus/Metro) compatible for mobility within the city center of Pune?



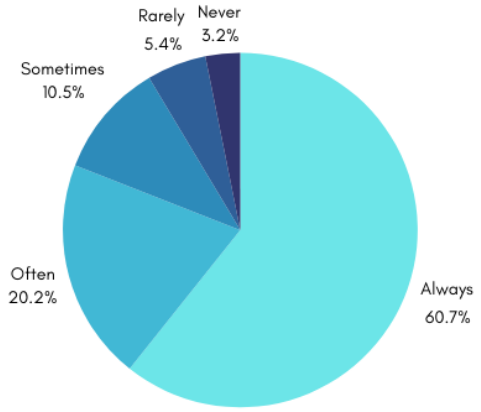
Are you satisfied with the frequency of the public transport (Bus/Metro) within the city center?



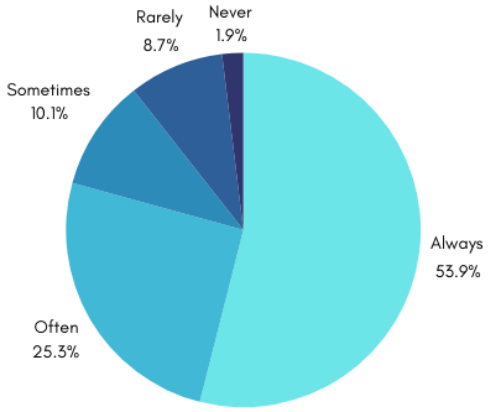
What is your primary mode of transportation to the city center?



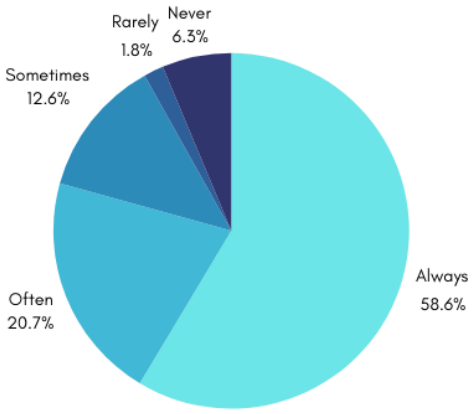
Do you find the streets of the city center of Pune walkable?



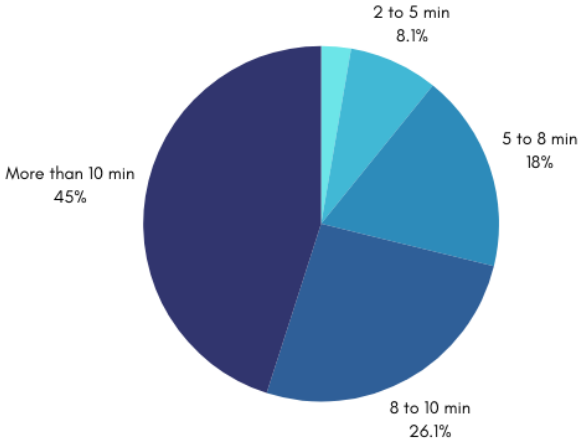
Do you find the paratransit (Auto-rickshaw/Taxi) compatible for the mobility within the city center?



Would you prefer your private vehicles over public transport/paratransit options?



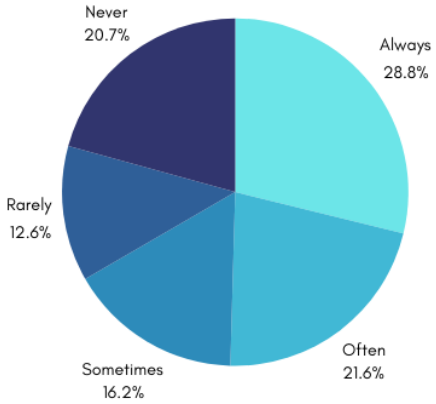
Do you face difficulties finding parking in the city center?



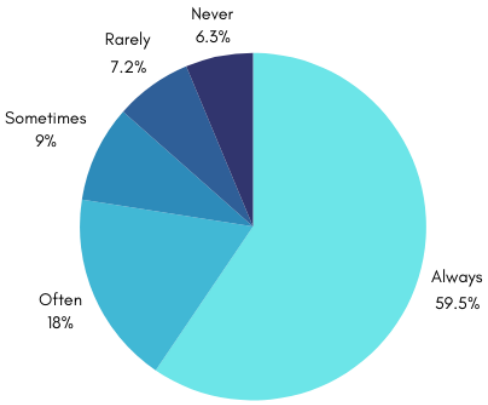
How much time do you typically spend looking for parking?

How far do you usually park from your destination in the city center?

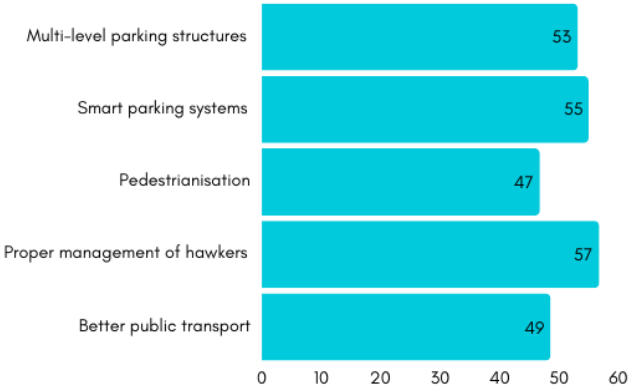
What type of parking do you usually use?



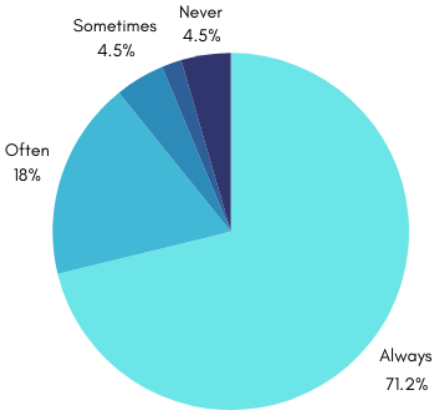
What is the frequency of receiving a parking ticket in the city center?



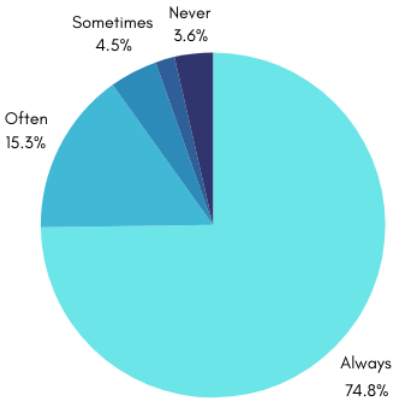
Do you think the presence of hawkers or other informal economy activities create the barrier to mobility?



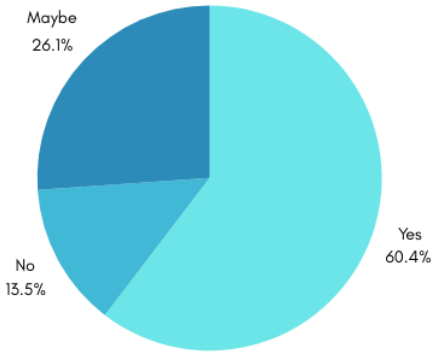
What improvements would you like to see in the current scenario?



Do you think the state of traffic makes it difficult to access and practice the Religious/cultural sites in the city center?



Do you think the state of parking and traffic makes it difficult to celebrate the popular festivals in the city center?



Would you prefer the focus on the access to cultural sites by NMT(non-motorised transport) over providing more parking and road widening?

Random Survey responses from participants of various ages, genders, and occupations were recorded on the ground, without any sampling strategy. Due to the presence of many schools, students under the age of 18 formed a critical group among responses. Similarly, the shopkeepers, making them important stakeholders in understanding the activity patterns and demands of the streets. A notable portion of female participants who identified themselves as homemakers, has significant impact on the mobility patterns through their daily activities and errands. The presence of street artists was also observed, some also belonging to the transgender community. A notable portion of the participants included daily visitors - residents and non-residents. Among the non-residents, the majority visited the study area for commercial activities, while others were students attending educational institutions in the area. A significant number of participants indicated that they visited the city a few times in a week or a month, primarily for shopping or going to the temples.

The most widely preferred option for transport were private vehicles which primarily included motorcycles and scooters. Bicycles were primarily used by students, reflecting their practicality for short-distance commutes. Public transport also emerged as a popular option among certain groups, complemented by a preference for auto-rickshaws for flexible, short-distance travel. In the city center, walking was a common mode of transport, especially among residents and shoppers navigating the dense commercial districts and the recognized heritage zones.

Around 80% of participants opined that the streets in the case study area were not walkable, while some mentioned that the streets might occasionally be walkable in part, typically during weekday afternoons when activity levels are lower. This indicates a widespread dissatisfaction for suitable spaces and conditions for walking. Satisfactory levels were recorded in favour of public transport among many participants in the case study area. At the same time, there was a notable dissatisfaction regarding the frequency of buses.

Another observation was the favourable view of paratransit modes such as auto-rickshaws over private vehicles stating their convenience and ease of movement in the dense and busy urban environment. The preference for auto-rickshaws was further reinforced by the widespread difficulty in finding parking spaces where nearly 90% of participants reported challenges in locating parking spots for private vehicles, highlighting a significant issue with parking availability. Furthermore, about 50% of respondents indicated that it took them more than 10 minutes to find a parking spot, reflecting the inefficiency and time-consuming nature of parking in the area.

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At the same time, more than 80% of participants reported that they primarily rely on on-street parking, with some respondents admitting to occasionally parking in no-parking zones for short durations. This highlights the widespread use of informal parking practices within the case study area. For residents, parking challenges are less pronounced, as most have access to designated parking spaces within their residences. However, for non-residents or visitors, the reliance on on-street parking remains significant. Around 75% of participants acknowledged receiving parking tickets from traffic police indicating frequent enforcement of parking regulations. This reflects the ongoing struggle between high parking demand and limited regulated parking options, which continues to contribute to the overall mobility challenges in the area.

The city center is well-known for its vibrant informal economic activities, particularly the presence of street vendors, which contribute to the area's character and economy. However, these activities also create traffic issues, as vendors often encroach upon roadways and sidewalks, increasing congestion and reducing mobility efficiency. around 80% of participants reported that the impact of street vendors on traffic flow is an issue that is more than often prevalent.

Considering all the above constraints and factors, the survey participants unequivocally stated that these conditions create a significant barrier to accessing religious and culturally important sites within the city center. The congestion, parking challenges, and unregulated street activities unhindered mobility and challenge the accessibility of people reaching historically significant sites. Similarly, participants noted that these barriers also negatively impact the ability to fully participate in famous festivals and cultural practices, which many a time occupy the street space. The lack of effective traffic management and mobility planning during peak times and festivals exacerbates the situation, limiting the accessibility and participation of these events and traditions, which are integral to the city's identity.

When asked about potential solutions, participants expressed the significant interest in the implementation of multi-level parking structures, smart parking systems, and proper hawker management to address the ongoing mobility and congestion issues. These solutions were seen as practical and immediate ways to alleviate parking shortages and traffic disruptions caused by street vendors. Fewer participants, less than or about 50%, preferred solutions such as

pedestrianization of streets or improvements to public transport systems, indicating a relatively lower level of interest or confidence in these approaches.

When participants were asked about their willingness to opt for Non-Motorized Transport (NMT) over conventional infrastructural modes, more than 60% people directly favoured them, with around 25% voiced conditional support. This suggests that while there is an acknowledgment of NMT's benefits, its adoption may require more significant infrastructural support, awareness, and encouragement for a broader acceptance.

Results of Informal Interviews with Stakeholders

Informal interviews were also conducted alongside the structured surveys. Out of the 111 participants, 83 participants agreed to participate in these informal interviews. This provides deeper understanding of challenges faced by various stakeholders. The summaries are as follows:

1) Residents (Sample size - 46) –

- Pune has lost much of its charm due to the overwhelming challenges of traffic congestion and the pervasive presence of parked vehicles everywhere. This growing pattern is deeply concerning as it has permanently altered the city's identity from a calmer, laidback city to the one where traffic jams most frequently occur.
- The trust in the authorities is reducing among the citizens, citing years of unmet expectations in resolving these issues. While some believe the infrastructure of roads, flyovers, and multi-storeyed parking facilities is urgently needed to tackle mobility issues, others argue in favour of restricting vehicles in the city's core areas.
- The public transport system, especially the city's bus network, is appreciated for its satisfactory coverage. However, its frequency and the number of buses is insufficient to handle the growing number of passengers. Many participants found buses to be an economical and suitable option, but traffic congestion severely affects their punctuality and overall travel time.
- Auto-rickshaws are considered effective for their last-mile connectivity in reaching the deeper areas of the city center. However, wholesale markets are densely overcrowded that even rickshaws struggle to navigate through. Additionally, rickshaw drivers often refuse short-distance trips and demand higher fares for late-night rides. New paratransit options like online pre-booked taxis, have emerged, but they are only moderately economical and frequently refuse to travel in narrow street areas.
- In the last decade, motorcycles have become a popular choice for mobility among young people aged 16–18, offering the flexibility to navigate anywhere in the city. However, despite

the scarcity of parking spaces, many motorcyclists do not adhere to traffic and parking regulations, adding another layer of complexity to the already congested streets.

- Owning a car is seen as a status symbol and a sign of personal progress. However, car owners often avoid using their vehicles for short trips due to the intense competition for parking spots, leaving cars parked for long durations on streets. Despite the lack of parking spaces, people continue to purchase cars.
- The sidewalks are effectively inaccessible for pedestrians, either clogged with vehicles or obstructed by sidewalk vendors. The residents of the area believe that authorities are not taking adequate measures to license vendors and clear walkways.
- Cultural and religious sites tend to suffer from encroachment from unauthorized parking and street vendors with no control. These sites tend to be inaccessible through public modes of transportation, with no provided parking facilities for private vehicles. Moreover, the traditional shared spaces surrounding these sites, which had enabled a sense of community in the past, are no longer present, causing the cultural richness of these places to be lost.

2) **Shopkeepers (Sample size - 11)**

- The landscape of the city has changed phenomenally over the years, with the population multiplying and people migrating from all over the country to Pune. There has been remarkable growth in enterprises in the past twenty years, while the markets in the centre of the city have gained prominence as they are strategically located.
- However, the significant traffic congestion has turned into a grave concern, sometimes adverse to business activities. Since the urban expansion has occurred, residents who are further away from the city centre do not avail themselves of such markets due to the inconvenience caused by traffic. The fortunes of businesses in the city centre greatly rely on exposure and accessibility provided by their respective locations.
- Private vehicles are the primary means of transport for the majority of consumers, and retailers cannot provide exclusive parking spaces to customers. This often leads to unauthorized parking, which at times blocks business entrances, causing shopkeepers to go out of their way to keep their shops open to consumers.
- The festive season is marked by a boom in commercial activities, leading to a significant rise in foot traffic. However, due to the range of festivals and events that take place throughout the year, the businesses tend to function well even during off-season. A constant issue for such establishments is the encroachment by hawkers and street vendors, who often block shop frontages. This not only causes inconvenience to patrons but also adds to traffic congestion in the area.

- Suppliers usually send their merchandise to retail stores early morning to escape the peak hour traffic congestion. Wholesale stores are less flexible, as their merchandise arrives and departs dozens of times a day in order to satisfy the business operational demands of the business. These products are mostly carried via large trucks or tempos, which play a tremendous role in traffic congestion, especially in the high-density and narrow roads of the urban areas. The intermittent travel of such trucks interrupts the general flow of traffic, thereby worsening the existing mobility issues in such regions.
- A majority of retailers are resistant to Non-Motorized Transport (NMT) proposals because of a common fear that such plans could harm their businesses. It is feared that customers will stay away from the city centre altogether if significant changes, like pedestrianization, are made, which could lead to decreasing customer flow to the area.

3) Street vendors/hawkers (Sample size - 9)

- A majority of the hawkers belong to low socioeconomic status, having moved to Pune in search of better economic opportunities. These vendors hail from various corners of the country and make their living selling items from street food, apparel, or accessories.
- These vendors have a close network among themselves, with many of them supporting each other in the establishment and operation of their businesses. Although the city government issues licenses to some of them, a vast majority conduct business without any formal approval. They typically move about on foot or by motorcycles, selecting selling locations based on places where they identify viable business potential.
- Quite a large portion of their customers usually park their vehicles right outside their makeshift retail outlets, normally for short or temporary periods. As much as the practice contributes to traffic congestion issues, customers are often advised by vendors to park in a manner that minimizes complications, as the municipal anti-encroachment authority intermittently enforces strict actions against illegal vending activities.
- Most of the sellers embrace Non-Motorized Transport (NMT) initiatives since the majority of their clients are pedestrians who walk to their premises. Cultural events and festivals experience a palpable rise in clients, further boosting their sales during these periods.

4) Auto- Rickshaw drivers (Sample size - 12)

- The urban area has seen a record increase in the population and in the number of vehicles using its roads. Many rickshaw pullers reported that the volume of congestion in the roads had doubled over the last decade, thereby putting unmatched pressure on the city's transportation network. Increasing automobiles are at the core of the deteriorating traffic.

- Though online platforms have helped expand the customer base for the rickshaw drivers, it has become more uncomfortable and difficult to ply through the crowded city centre streets. This tends to disrupt their business activities, with some of the drivers declining services to highly congested places or during traffic peak hours.
- Rickshaw drivers usually do not require a special parking space for their vehicles, given the constant flow of clients found along the roads. Nevertheless, the absence of sufficient rickshaw stands in the inner city compels them to take fares directly from the roadside, hence adding to more congestion on the roads. Regardless of all these setbacks, rickshaw drivers continue to be an important element of the city's transport industry, evolving to meet the needs of an increasing urban populace.

5) Traffic police (Sample size - 5)

- Illegal parking, especially in no-parking areas and in the vicinity of heritage and commercial sites, has exacerbated the already existing problem. Traffic police officers do issue challans on a daily basis; however, the number of violations is so high that effective enforcement becomes an uphill task. In spite of their efforts, the absence of authorized parking facilities and non-adherence to parking rules by the people continue to be serious challenges.
- It is difficult to cope with the heightened traffic volume during festivals and cultural events since the huge influx of visitors overwhelms the current infrastructure. Furthermore, the encroachment of hawkers and street vendors on roads and pavements poses additional challenges, thereby making it hard to attain a continuous traffic flow and ensure pedestrians' safety.
- Inadequate coordination with other city departments, including those dealing with urban planning and vendor management, regularly impedes the putting into practice of sustainable solutions. Further, the paucity of resources, both in terms of personnel and sophisticated traffic management systems, restricts the traffic police's capability to deal with issues competently.
- In spite of these hurdles, the traffic enforcement authorities still cope with the situation as well as they can, realizing the pressing need for more parking facilities, better public transport systems, and enhanced enforcement mechanisms to battle the mounting traffic problems of the city.

8. Findings and conclusion

The final section of the thesis includes a summary of the methodology employed throughout the thesis. Then, it elaborates on the results in the form of a list of problems faced by the stakeholders within the case study area and the opportunities this overall scenario presents.

This section elaborates on the need for this research and its broader implications for India and its historic cities. While structuring the argument, the thesis faced some limitations, so this section also reflects those. Then, it hypothesises new research avenues that can be explored using a similar approach.

8.1 Summary of research approach and methodology

This research intended to propose a need to integrate mobility, heritage, and landscape into a local area mobility plan for the city centre of Pune, India. To explain the proposed need, this thesis used a multi-phase approach to assess the governance and policy gaps, document the tangible and intangible value of the area, and complex mobility-related scenarios on the ground.

Before analysing Pune's case study, some practices worldwide, with their different approaches to integrating Mobility, heritage, and Landscape, were studied because the research on the specific issue that this thesis addresses is scarce. This analysis laid the foundation for understanding the influence of mobility and heritage on one another and the trade-off among these factors in a landscape.

In the first phase, to make an argument for the city centre of Pune, a case study area was determined based on the city's heritage concentration. Historical cartographic data was employed to map the city's historical expansion. Further, some statistics related to socio-economic conditions, building conditions, and photographic data were used to profile the chosen case study area.

In the second phase, the governance structure and their tools/policies related to mobility planning and heritage conservation were studied and analysed to identify the root cause of the complex scenario in the case study area. It was found that the governance of India works in a top-down manner, so every governance system and its tools related to mobility and heritage were scrutinised, and gaps were identified. These gaps and lack of integrated effort made an argument for the need for local area mobility pan for the case study area.

Based on the proven need for LAMP in the second phase, the third phase conducted an in-depth assessment of the mobility and heritage scenario for the case study area. First, the heritage sites were documented and mapped according to the various official sources for the heritage assessment. Then, based on their governance authority these sites were assessed regarding excessive mobility impact. The photographic documentation was conducted to support the assessment. Secondly, for intangible heritage aspects, all the festivals, celebrations, rituals, and craftsmanship were enlisted with their significance, spatial setting, and the relation of this spatial setting within the case study area. Then, these practices were mapped, and along with photographic evidence, the assessment was conducted.

For mobility assessment, the case study area was analysed in terms of mobility generation factors, mobility demand, mobility supply, and mobility behaviour. Mobility generation factors involve the assessment of mobility generation according to the designated land use by the municipality to understand the complex nature of mobility generation factors. Mobility demand provided the number of pedestrians, buses, autorickshaws, cars, bikes, and motorcycles travelling in the case study area. It also provided the number of on-street parked vehicles, which hinders smooth mobility. Mobility supply provided the condition of mobility infrastructure in terms of streets, sidewalks, public transport, etc., to accommodate the mobility demand discussed earlier. This section also explains mobility behaviour through surveys and informal interviews of multiple stakeholders in the case study area.

This research approach and methodology provided valuable findings that helped draft the proposal for a LAMP that integrates mobility, heritage, and landscape. It also provided insights into the LAMP framework.

8.2Summary of findings and LAMP framework

This section summarises the extensive analysis conducted in the earlier chapters in the form of a list of problems. It includes data on gaps identified in the governance system and assessment of historical landscape and mobility scenario. This section also includes the list of opportunities the analysed scenario presents. It draws inspiration from the initial study about the practices and research related to integrating mobility, heritage, and landscape and imagines it in the context of the case study area. These lists are significant in drafting the framework of LAMP.

Based on the findings in terms of problems and opportunities, this section further drafts a proposal for the LAMP framework in the form of recommendations and guidelines. The proposal includes a detailed list of who should be part of the LAMP and in what capacity. Drawing inspiration from the

HUL approach, it also explicitly explains a functional framework within the current governance system framework.

This framework includes a matrix developed based on the findings, which will help make decisions about the LAMP. The proposed framework includes the modus operandi for integrating mobility, heritage, and landscape through recommendations and guidelines. This section also reflects upon the challenges and limitations of this thesis and its broader implications. The final segment concludes with the future research avenues this thesis opens up.

Problems

This section presents the findings as a cumulative and extensive list of the problems identified throughout the methodological exploration.

Governance

- The fields of transport planning and heritage conservation are overly centralised at the national level of governance. At the national level, new infrastructure policies are being formulated for transport planning, which are heritage-blind and one-size-fits for all cities, failing to integrate the unique characteristics of cities.
- Heritage conservation at the national level is monument-specific, landscape blind and not a part of any development plan. It does not recognise the heritage sites of local importance and restricts any kind of development/repair in a 100 to 300M radius.
- Despite states having complete autonomy over urban planning, their policies are prone to political pressures. The tools at the state level have not seen a remarkable evolution with respect to the process of urbanisation. Heritage sensitivity and landscape recognition are also severely lacking in the planning process.
- The regional authorities and their plans are too infrastructure-oriented in terms of transport planning and mention NMT with no actual framework. CMP also severely lacks NMT implementation strategies. The tools at the disposal of regional authority are also heritage and landscape blind with their mobility vision.
- The timelines set by regional authorities and the time taken to produce, approve, and implement the CMP, regional or local development plans are incompatible with the rapid urbanisation process.
- At the municipality level, the policies are much more comprehensive than the upper tiers of governance, yet the resources and autonomy are lacking. Even the policies drafted by the municipality lack a heritage and landscape-sensitive approach to their mobility vision.

- In overall heritage governance, intangible heritage is majorly missing. The resources are at the disposal of monuments of national importance, thus ignoring many important local sites.
- Overall governance of mobility planning and heritage conservation currently operates in silos, with minimal or no horizontal coordination across all the governance levels. This lack of integration creates significant pressure on both systems, resulting in conflicts between infrastructure development and heritage preservation.

Historical landscapes

- In the case study area, there is one monument of national importance, one state-protected monument and many grade-wise recognised heritage sites. Still, all the resources are allocated majorly to the monument of national importance. Even that monument is protected in terms of its built structure and building developments around it. The landscape remains vulnerable to excessive mobility, among other factors.
- Heritage sites are vulnerable to traffic jams and uncontrolled parking, and vice versa; mobility is influenced by the tourist agglomeration around these heritage sites and informal economic activities. The overall visual setting of heritage sites is under severe threat because of the unregulated parking and traffic jams.
- Intangible practices of cultural landscapes are not recognised as part of the living culture for any planning practices, including mobility planning. Traffic and parking significantly affect celebrating festivals and practising rituals, yet this problem remains unnoticed in the planning practice. Urbanisation (not necessarily mobility) has displaced many craftsmen out of the city. Once a year prolonged festivals and their organisations do not have a dedicated space, even though the impact on mobility is clearly observed every year.

Mobility

- The municipality's development plan does not consider heritage land use separately from public and semi-public land use. The land use does not even match its published list of heritage sites, severely impacting mobility planning.
- Despite having most of the case study area as a mixed-use type, the development plan with its land use map does not consider it. The reality on the ground and the land use map are totally contradictory to each other. This lack of recognition of land use types severely impacts the decisions related to planning practices.
- There are many historical markets, temples, mosques, and schools in the case study area, but its consideration in mobility planning severely lacks leading distortion of historical landscape and hazardous traffic conditions in the area.

- Most of the streets, roads and allies are historical and according to the Maratha style of planning, which are incompatible with the vast mobility demand that is present today.
- Public transportation, especially buses, does not have a dedicated path on the streets. Bus stops are often dilapidated and surrounded by illegal parking. The bus is prone to getting stuck in a traffic jam, which affects its frequency and functionality.
- The NMT infrastructure, including sidewalks, is virtually non-existent. The sidewalks that are available are often encroached by street vendors, hawkers or illegal parking.
- Every stakeholder has a unique issue related to their day-to-day mobility needs. Traffic congestion and excessive mobility majorly impact accessibility to heritage sites and practising rituals.
- There is a concept of public feedback for formulating a development plan, but the locals lack awareness about it. The commercial interests also hinder any mobility-related bold steps. The coordinated effort from the municipality and every other stakeholder is lacking.

Opportunities

Given this scenario, the results of the analysis and initial study of practices regarding integrating mobility, heritage and landscape also present some opportunities to rectify the situation. The following list enlists the opportunities –

- Even though historical landscape planning is not prevalent in the current governance structure, the results of informal interviews in this thesis showed that the locals value and care for it. Banking on this emotion and sense of identity, steps could be taken to adopt the rectifying measures in collaboration with the locals.
- There are constant voices and efforts by the NGOs/CSOs to improve mobility and heritage preservation. Some of them are also collaborating with the municipality to rectify the situation. So, a collaborative approach with them could also help integrate mobility, heritage and landscape.
- According to the initial study regarding practices worldwide for integrating mobility, heritage and landscape, the scenario in the case study area is most suitable for adapting the HUL approach. This thesis and its analysis can be used as a vulnerability assessment report on heritage.
- There is an opportunity to develop an LAMP using the principles of HUL and integrate mobility, heritage, and landscape to create a local solution for the case study area.

- As discussed in the governance tools section for heritage protection, some policies, such as HRIDAY and AMRUT, are working on other historical cities and their sustainable planning. LAMP could be an extension of it.

Recommendations and guidelines for the framework of LAMP

This section proposes the framework of LAMP through recommendations and guidelines. These are based on the principles of the HUL approach. This proposal starts with the four tools suggested by the HUL approach: community engagement, Knowledge planning, and regulatory and financial tools. The proposal initiates with the recommendations and guidelines on how to form a LAMP committee and whom to include. Then, it elaborates on the working within the system. It also explains the duties of each member. This proposal includes a matrix system to evaluate the impact of mobility on heritage and landscape on each street in the case study area. It will help to make informed mobility-related decisions on each street.

Figure 63 - HUL toolkit for the case study area. (Source - Author)

Figure 63 presents an overview of the recommendations and guidelines in the form of the HUL toolkit. The municipality will form the LAMP committee as a community engagement, which will be responsible for conducting cultural landscape mapping, tangible/intangible heritage documentation and vulnerability assessment of heritage which are planning tools for the case study area. The final regulatory system will be designed as LAMP for the case study area. This kind

of scheme will be a pilot project, but it can fit itself within the framework of HRIDAY and AMRUT for financial tools but on a case study-specific scale.

The detailed and descriptive recommendations and guidelines for the case study area are as follows:

1. **Formulation of the LAMP committee within PMC:**

1.1 The first and foremost step is formulating the LAMP Committee, which should ensure comprehensive stakeholder participation in decision-making and co-creation activities. This will provide a platform for inclusive, localised, and collaborative planning.

1.2 Under the mayor's observation, the municipality shall take the lead in formulating the committee. This ensures that the initiative is anchored in local governance while maintaining transparency and accountability.

1.3 The committee shall be divided into specific panels to address different aspects of the Local Area Mobility Plan. These panels may include:

No.	Panels	Members	Task
Advisory and fund allocation panel			
1.	Advisory and Observational Panel	Indian Administrative Service (IAS) officers, Mayor	IAS officers are to provide advice and align policies with national and state-level policies. The mayor shall look after the formulation and smooth working within the committee. This panel shall also provide fund allocation from the state and central levels under various schemes.
Expert panel			
2.	Heritage panel	Local historians, Conservation architects, CSO/NGOs (e.g. INTACH, PARISAR)	The panel shall create an inventory of tangible structures and intangible practices. This panel shall enlist the important attributes and values of the historical landscape of tangible-intangible heritage. The panel shall asses and make a report on the impact of the current condition of mobility on the heritage and landscape.

3.	Mobility panel	Transport-traffic engineers/planners, mobility planners	This panel shall be responsible for mobility planning interventions for the area. This panel shall include the heritage planners' report of concerns and guidelines, and accordingly, they shall plan the mobility solutions.
Stakeholders panel			
4.	Consensus panel	Ward corporators, Shop owners' association, hawkers' associations, "Ganeshotsav Mandal" association, Rickshaw association, PMPML representative.	Ward corporators will act as intermediaries between the expert and stakeholder panels to build consensus on the local area mobility plan. The mobility solutions shall be reviewed in this panel, and give their feedback. The concerns of this panel shall again be presented to the heritage and mobility panel.
5.	Public outreach and co-creation panel	Ward corporators and volunteers from NGOs (Parisar)	Under ward corporators' supervision, this panel shall conduct public outreach and explain the strategies. This panel shall also collect feedback from people and convey it back to an expert panel.
Execution panel			
6.	Execution panel	Ward corporators, architects, planners, contractors etc.	Ward corporator shall publish a tender and employ architects and planners
7.	Monitoring panel	Ward corporators, experts, traffic police and NGOs	This panel shall monitor and supervise the work and notify if there are any problems.

Table 24 - The structure of the LAMP committee (Source - author).

2. The heritage committee report:

2.1 The heritage panel shall first create a comprehensive list of historically and culturally significant structures, such as public, semi-public, and private buildings within the area.

2.2 This list shall also include practices recognised under the ICH (Intangible Cultural Heritage) definition, encompassing traditions, festivals, rituals, craftsmanship, and other culturally significant activities.

2.3 The panel shall prepare a report of the attributes that make these structures and practices significant. These attributes may include:

- Architectural uniqueness (e.g., specific styles or construction techniques).
- Cultural significance (e.g., traditional festivals or rituals).

- Historical importance (e.g., age, historical associations, or events connected to the site).
- Craftsmanship (e.g., unique or rare artisanal techniques).

2.4 The report shall also map the values of these attributes within the broader context of the urban landscape based on a layered approach:

- Cultural Value: How the attribute contributes to the area's cultural identity.
- Historical Value: Its role in representing or preserving the area's history.
- Social Value: Its importance to the local community, including its role in gatherings or rituals.
- Economic Value: The attribute's influence on livelihoods, tourism, or commerce.

2.5 Then, this report shall evaluate the impact of the current mobility scenario on the attributes and values that were prepared in 2.3 and 2.4. it can be evaluated in terms of the matrix as follows –

Categories		**No.**	**Attributes**	**Traffic impact**	**Parking impact**	**Street design impact**
Tangible attributes	**Assets**	1.	Building			
		2.	Building typology			
		3.	Urban setting			
		4.	Façade visual setting			
	Area	5.	Ensemble			
		6.	Context or setting			
		7.	Area			
	Landscape	8.	The result of layering			
		9.	Overall Urban landscape			
Intangible attributes	**Asset related**	10.	Concept			
		11.	Relation(s) to context (location)			
		12.	Character			
	Societal	13.	Use, function			

		14.	Knowledge, traditions, practices			
		15.	Relation(s) to meaning (association)			
		16.	Community / people(s)			
	Process	17.	Management process			
		18.	Development or evolution			
Landscape value	**Traditional**	20.	Aesthetic value			
		21.	Age value			
		22.	Historic value			
		23.	Scientific value			
	Societal	24.	Social value			
		25.	Ecological value			
		26.	Scientific value			
	Process	27.	Economic value			
		28.	Other cultural value			

Table 25 - Proposed evaluation matrix (Source - Veldpaus (2015) modified by author)

2.6 Based on the above matrix system, each road shall be evaluated, which will help the heritage committee prepare the vulnerability assessment report

2.7 This report shall include the clear impact of mobility-related issues on the recorded heritage and landscape.

3. The Mobility planning interventions

3.1 The Mobility Panel shall begin by preparing a detailed mobility assessment report for the case study area. This report shall include:

3.1.1 An evaluation of mobility infrastructure (e.g., road networks, pedestrian pathways, public transport systems).

3.1.2 An analysis of mobility demand, such as the number of vehicles, passenger counts, and modal share, to understand the current traffic flow and challenges.

3.2 The panel shall incorporate the Heritage Panel's report on tangible and intangible heritage and vulnerability assessment into the mobility framework. This ensures that heritage values and landscape sensitivities are prioritised while planning mobility solutions.

3.3 Based on the overall landscape assessment provided by the Heritage Panel, the Mobility Panel shall develop a design framework that is context-sensitive and aligned with the area's historical and cultural attributes.

3.4 Public outreach and co-creation panel the final design shall include specific interventions to address the challenges identified:

3.4.1 Parking Management: Strategies for regulating on-street and off-street parking, including smart parking systems and multi-level parking where appropriate.

3.4.2 Traffic Decongestion: Measures to reduce vehicular loads, such as diversion plans, time-based traffic restrictions, and prioritisation of public transport.

3.4.3 Street Design Improvements: Enhance NMT infrastructure by creating pedestrian-friendly pathways, cycling tracks, and streetscapes that are sensitive to the heritage environment.

4. Co-creation and consensus-building workshops –

4.1 After the mobility department prepares the final design, it will first go to the impacted stakeholders and their representatives for their feedback.

4.2 This exercise shall be the responsibility of the elected ward representative to the municipality of Pune, who shall act as an intermediary between the stakeholders and the expert authorities.

4.3 It shall be the job of the ward representative or corporation to reach a consensus and find common ground through constant talks with the representatives of the stakeholders.

4.4 This committee shall comprise representatives from Rickshaw organisations, PMPML representatives, hawkers' organisations, Shop owners' organisations, etc.

4.5 After finding common ground, if some changes need to be made, they shall be reported back to the Heritage and Mobility panel for amendments.

4.6 It shall be the responsibility of the ward corporators to carry out this operation smoothly.

5. Public outreach and co-creation workshops

5.1 After consensus with other stakeholders, now ward representative shall pitch the plan to the residents.

5.2 It is his job to convince, collect feedback, and, if necessary, report back to the expert panel.

6. Implementation

6.1 After getting sanctions from the public, the implementation phase shall be done in collaboration with the Advisory and fund allocation panel

6.2 The ward corporators shall publish the tender and allocate it to the competent company.

6.3 It is his job to monitor the pace of the work, which shall be periodically supervised by NGOs and other concerned expert panels for its intended purpose.

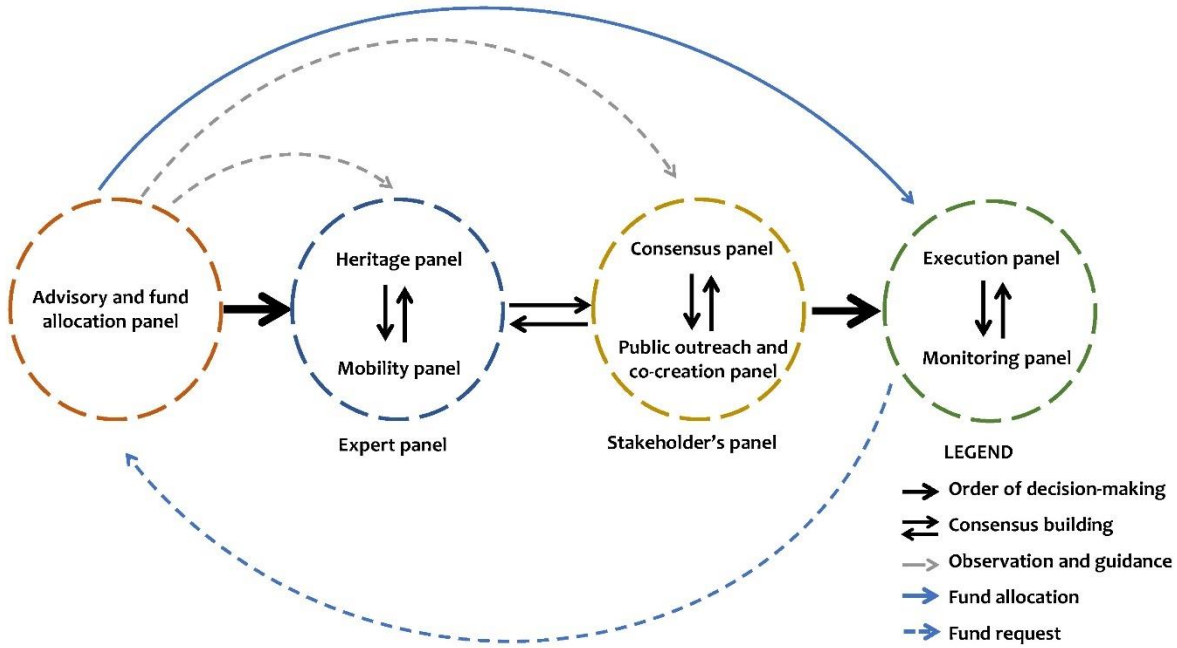

Figure 64 - The proposed LAMP framework for the case study area (Source - Author)

Figure 64 shows the schematic version of all the earlier recommendations and guidelines. In summary, these recommendations and guidelines provide an overview of the formulation to execution of the LAMP committee. This committee divides the tasks into four panels, each with its own significant task. While advisory and fund allocation panels are important for supervision and providing funds, the expert panel of Heritage and mobility decision-makers will make the integration of mobility, heritage and landscape possible. To further democratise the decisions, it shall receive stakeholders' feedback in the next step, and if necessary, the decisions can be revised.

The success of LAMP shall be that it fits within the current governance structure yet is the most decentralised form of governance for the city centre of Pune. While many reforms are needed, as discussed in the governance and planning section, LAMP can be made possible at the grassroots level without going through the aforementioned reforms from the national level. With the help of the HUL approach, this tool will promote cooperation and collaboration to preserve the identity of the city centre of Pune.

8.3 Broader implications

Based on observing India's ongoing urbanisation, it is clear that Mahatma Gandhi's famous statement, "India lives in its villages," no longer reflects today. This rapid transformation, coupled with the aspirations of the growing middle class, has led to an explosion in vehicle ownership (Verma M. , 2015). The governance system of India is coping with this evolving situation, but concentrated power at the national and state levels is no longer effective (Kandpal & Okitasari, 2023). There is an urgent need first to localise the issues and address them (Singh S. K., 2005). Every city is evolving according to its unique character, different job markets and regional importance. Pune is just one of the numerous other cities where the evolved urbanisation has put forth many challenges; mobility planning and urban heritage protection are two major aspects of them.

This thesis has put forth the issues at stake in the context of mobility planning and heritage conservation practices in India and not just in Pune. A detailed analysis of governance has resulted in uncovering the priorities of governance, which are majorly towards infrastructure development. While building the infrastructure is necessary, especially to accommodate the needs of 1.4 billion people (Census of India, 2011), the heritage which is transferred from generation to generation also needs to be preserved. The case study area is a good example of landscape disruption due to governance gaps. SDG goal 11 clearly calls for safeguarding cultural and natural heritage for sustainable city development, but the scheme HRIDAY, which is evolved for that, is restrictive to only 12 cities overall in India. This means the governance needs to take cognisance of what cultural heritage and cultural-historical landscapes are, and this thesis is exactly what it tries to deliver.

This thesis attempted to stir the conversation about integrating heritage and mobility planning at a local level and add landscape consideration to the equation. In the Indian context related to planning, an approach to historic urban landscapes is missing. That results in departments of planning and heritage conservation working in silos. So, by applying the historic urban landscape to a case study area, this thesis made an attempt to bridge that gap.

Today, in many cities of India, like Pune, Historic landscapes are neglected and at the mercy of evolving urbanisation, and excessive mobility is part of it. So, the approach adopted by this thesis can work as a module to be replicated in other cities. This thesis not only applied the HUL principles to the case study area of Pune but also assessed the policies related to planning from the national level to the municipality. This policy-led approach helped to go into the root cause of the issue, so building on its foundation, other cities can create a similar module. This thesis specifically worked on the integration of heritage and landscape into mobility planning, but a similar approach can be applied with the integration of other planning faculties for sustainable and holistic development.

8.4 Limitations and future avenues

In complex urban areas such as Indian cities, different planning faculties are interlinked in the form-making that we see today. There are numerous facets to city planning that need to be integrated, but because this thesis is an academic exercise, the author chose the specific integration of faculties that seems to be most affecting and affected by each other yet most ignored in the context of Indian cities: mobility and heritage.

This thesis is confined to Pune, India, where the above-mentioned issue is prevalent. Due to Pune's vastness, the research is also confined to a case study area within the city. The literature on the integration of mobility, heritage, and landscape is scarce in India and globally. So, the thesis applied a more policy-based approach than academic research-based to make an argument. To uncover the root cause of the heritage blind mobility policies was also an intention behind the study, so it also contributed to a policy-based approach rather than an academic one. The proposed LAMP framework is designed to work within the existing governance system rather than creating a new one, offering practicality and adaptability.

This thesis and its research is one of very few that calls for the integration of heritage and landscape into mobility planning in the context of Indian cities, so this thesis analysed and adopted global practices where this convergence can happen. There is also a lack of GIS information, official documents, and academic literature on the planning framework of Indian cities. The last official census of India was conducted in 2011, so limitations such as these led to the dependence on the recognised global index and news agencies for statistics, which led to many limitations for this thesis. The maps were produced with the help of open street map information, which was inaccurate in many instances, so the author had to recreate many maps due to inaccuracies in the available material. Also, a mobile camera was employed due to a lack of professional photographic instruments.

During data collection, due to the lack of an official record of the influence of tangible heritage on the surrounding parking pattern, the number of organisations or "Mandals" to organise festivals in the case study area, etc., information like this had to be collected from informal interviews with the concerned community members and field observations. Due to the vast number of vehicles, commuters, and passengers passing through the case study area, the count of them had to be collected from CMP 2018. Also, given the number of stakeholders within the case study area, the number of surveys to understand mobility behaviour is low but adequate to argue for this thesis.

This thesis also opens up multiple other research avenues for Pune and similar cities. Regarding this thesis, a Local area mobility plan can be drafted with the mobility-related interventions. In the

realm of planning, a much more comprehensive analysis of governance and its tools, including its other faculties, such as urban, environmental, etc., and their impact on one another, can be conducted. The impact of mobility on the visual settings of historical landscapes can be evaluated. The role of tangible and intangible heritage in the city's sustainability can be outlined.

The thesis attempts to create a new approach to the planning system in the context of Indian cities. Multiple other avenues can be explored, and the author believes they must be explored for the sustainable development of Indian cities.

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