

# CRIME PREVENTION THROUGH CITY PLANNING: CASE STUDY OF PUNE CITY

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## Abstract

The need for vital services has expanded because of the impact of urbanization on the sociocultural character and demography of an urban environment. The significant disparities in access to resources, power, wealth, social systems, and opportunities have led to an increase in crime. The threat to public safety is among the most important problems. Hence, there is a need to consider the link between urban safety and the environment to build spaces that are safe for the public. The aim of this is crime prevention through city planning in the case of Pune city using GIS as a tool for crime mapping. The methodology includes an analysis of crime hotspots using parameters of city planning. In this research, the identification of major hotspots in Pune city was carried out through Weighted Overlay Analysis (WOA). Further analysis of the microenvironment in crime-prone zones in one of the identified hotspots has helped in proposing strategies for city planning to improve the safety of crime-prone zones. Understanding the various spatial and non-spatial dimensions of planning for crime prevention is aided by the study's findings. The findings of this study also assist in identifying high-risk regions and potential criminal targets where safety audits can be carried out to enhance city safety.

*Keywords:* Crime, Crime Prevention, City Planning, Non-Spatial, Likert Scale, Geographic Information System (GIS).

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## Introduction

Urban crime is a result of social marginalization and inequality, not a uniform, random, or spontaneous event that occurs over time and geography. The demographic characteristics and sociocultural existence of an urban context have changed because of rapid urbanization and population growth. These significant gaps in resource availability, power, money, social institutions, and opportunities have increased crime, threatening human security, generating gentrification, and posing a threat to peace. One of the most significant issues is the danger to public safety, which is an unavoidable element of living in a city (UNHSP, 2007; Oliveira et al., 2017). Crime is influenced by a multiplicity of factors such as economic, social, and governmental as well as physical elements (Newman, 1972). Crime is defined as an activity that is against the law. The linkage between criminal activities and the socioeconomic development of society is undeniable. According to Clark and Marshall “A crime is any act or omission prohibited by public law for the protection of the public and punishable by the State in a judicial proceeding in its name.” (Clark and Marshall, 1952). Crime Prevention comprises strategies and measures that seek to reduce the risk of crimes occurring, and their potentially harmful effects on individuals and society, including fear of crime, by intervening to influence their multiple causes (UNODC, 2002).

The core concepts of crime prevention are examined in the context of the theories with which it is most associated. The safety of the physical environment is also an integral part of the creation of sustainable development (Black, 2004). Crime rates are not evenly distributed over geographical areas in urban settings. Some neighborhoods are more troubled by crime, and even within neighborhoods, there are considerable differences between areas because of subtle interplays between physical characteristics and people’s behaviours (Gupta, 2020a, b, 2021). Wirth states that special urban characteristics such as size, density, heterogeneity, and impersonality are responsible for a mode of living that generates more crime (Wirth, 1964). The relation between variables and crime type provides an understanding of crime in a spatial context (Mitchell, 2014).

The National Crime Prevention Institute (1986) explains crime prevention as “The anticipation, recognition, and appraisal of a crime risk and the initiation of some action to remove or reduce it” (CPTED, 1986). Jane Jacobs, author of ‘The Death and Life of Great

American Cities', pioneered the concept of crime prevention, which was later extended by Jeffery in 1971 as Crime Prevention through Environmental Design (CPTED) and Newman as 'defensible space.' The strategies employed in this approach are natural surveillance, natural access control, territorial reinforcement, and maintenance (Cozens et al.,2005).

## Methodology

This study was conducted in six stages. The first stage included the identification of the parameters of city planning for crime prevention. This was based on an extensive literature review. The second stage involved the 'Expert's Opinion Survey' to determine the weights of crimes that are studied in the research. In the third stage, identification of crime hotspots were done with crime mapping. A secondary survey of various crimes from the police department was carried out for collecting crime data. In the fourth stage, the analysis of non-spatial parameters included the study of socioeconomic parameters of the area based on Census data. In the fifth stage, an analysis of spatial parameters was done by analyzing the microenvironment of the delineated hotspot. For this inventory, maps were prepared which were supported by a reconnaissance survey. The final stage involved results and discussions of the finding of the study.

### *Identification of Parameters*

The parameters of city planning for crime prevention were identified with a research study of literature based on the analysis of crime through mapping. The study highlighted the influence of various aspects of planning on crime rates. This study analyzed past studies in both the domains of physical planning characteristics and the socioeconomic status of the people. Table 1 highlights the summary of the literature referred, with the parameters explained in the respective works of literature.

It is essential to understand the character of the factors to analyze crime patterns, and hence identified parameters were further categorized into spatial and non-spatial parameters. Table 2 illustrates spatial and non-spatial parameters along with their variables and attributes.

Table 1: Identified Parameters of Planning for Crime Prevention

Study	Author	Parameters Analyzed
Crime mapping analysis of Ajmer city -A GIS approach	Ravi Sharma, 2016(Sharma et al., 2016)	Location, Population Density, Timing, Crime Type, Proximity, Surroundings
Crime in relation to urban design. Case study: The Greater Cairo Region	Heba Adel,2016(Adel et al., 2016)	Illiteracy, Unemployment rate, Population density, Land-use, Surroundings, Informal areas
Crime Mapping in India: A GIS Implementation in Chennai City Policing	K. Jaishankar, 2004(Jaishankar et al., 2004)	Population Density, Location of the Crime, Timing
Planning For Crime Prevention	Richard H. Schneider, 2017(Schneider & Kitchen, n.d.)	Building layout, Neighborhood, Surveillance, Access, Site Management, Housing Types
Crime Prevention Through Environmental Design (CPTED): a review and modern bibliography	Paul Michael Cozens, 2005(Cozens et al., 2005b)	Access control, Surveillance, Activity Support, Image, Territoriality.
Crime Prevention, through Urban Design and City Planning in Delhi using Geo-Informatics	Rupesh Kumar Gupta, 2021(R. K. Gupta, 2021b)	Location and distance of the crime incident, Surroundings, Land-use, Population, Street Network, Infrastructure, Income Group
Application of Physical Planning and Design Strategies to Urban Violence and Crime Prevention in Nigeria	R.O. Oladosu, 2015(Oladosu et al., 2015)	Land-use, Open spaces, Surveillance, Access, and Escape Routes,
Mapping and Analysis of Crime in Aurangabad City using GIS	Shahebaz M. Ansari, 2014(Ansari & Kale, n.d.)	Location of Police Stations, Road network, Density, Distance

Table 2: Categorization of Identified Parameters

Parameter	Variable	Attributes
Spatial	Location	Crime Spot, Accessibility, Proximity
	Land Utilization	Land use, Building Use, Built Density, Slum and Congested Areas, Neighborhood
	Infrastructure	Road Network, Transportation, Surveillance
Non-Spatial	Crime Database	Types of Crime, Frequency, Crime Rate
	Socio-Economic	Illiteracy, Unemployment, Population Density

*Identification of Crime Hotspots*

In previous research studies, GIS software was used for different studies such as assessing the transformations in the peri-urban areas of Pune City and provide rational parameters for decision making while expansion of city limits (Lad &Petkar, 2022). In this study, for the identification of crime hotspots within Pune city police limits, weighted overlay analysis was done using GIS. It involves weighted overlay analysis for various crimes. The total weight assigned to all crimes was 1 with calculated weightage for each crime based on its rank so that the crime hotspots are not biased with regard to a particular type of crime. The rank of crime was calculated based on the level of impact which has been determined in the consultation process with experts by Expert Opinion Survey and then analysis of the opinion of experts using the Likert Scale Analysis. Crimes included in the research were ‘Murder, Attempt to Murder, Robbery, Dacoity, Housebreaks, Thefts and Vehicle Thefts’. These crimes have a major influence on the physical distribution of activities and land. Based on ranking, using the ‘Straight Ranking Sum Method’ described by Malczewski, normalized weight was calculated (Jaipuria S. &Petkar A.S., 2020).

The formula used is as follows

$$W_j = (n - r_j + 1) / \text{SUCM}(n - r_j + 1)$$

where  $W_j$  is the normalized weight of the  $j$ th factor,  $n$  is number of the factors under consideration, and  $r_j$  is the rank position of the factor. Fig 1 shows a weighted overlay analysis indicating identified major hotspots in Pune city.

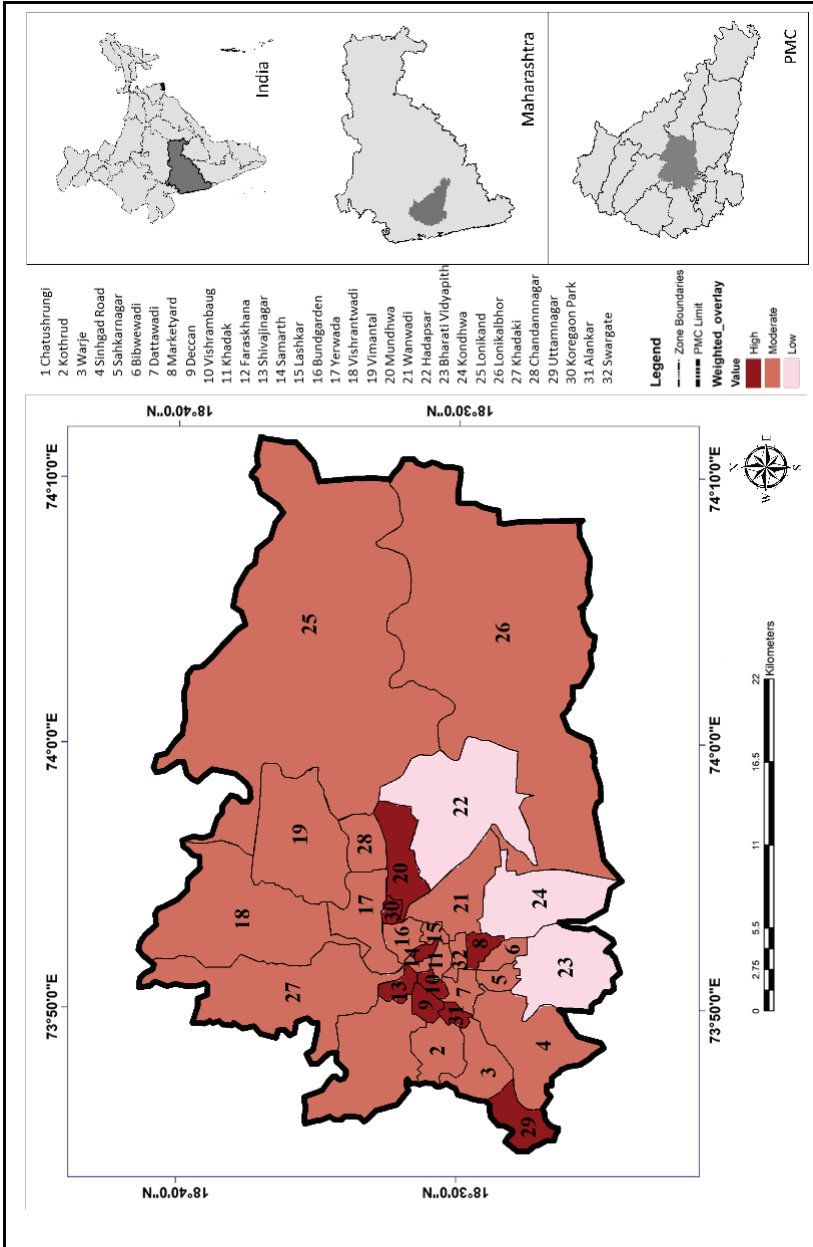


Figure 1: Map of Weighted Overlay Analysis showing identified major hotspots in Pune

### Survey and Analysis

After weighted overlay analysis, as indicated in fig 1, identified crime hotspots were Shivajinagar (13), Samarth (14), Vishrambaug (10), Deccan (9), Alankar (31), Mundhawa (20), and Uttamnagar (29) out of which Shivajinagar was selected for further detailed analysis as Shivajinagar is part of the core area of the city. The study area was assessed using the parameters identified and the crimes. The data for crime statistics in the study area were collected from the police station and crime mapping was done using GIS to analyze the spatial pattern of crime. Based on an analysis of crime mapping, heinous and non-heinous crime-prone zones were identified. Section 2(33) of the Indian Penal Code (IPC) defines “heinous offenses” as those for which the minimum punishment under the Indian Penal Code or any other law at the time in force is imprisonment for seven

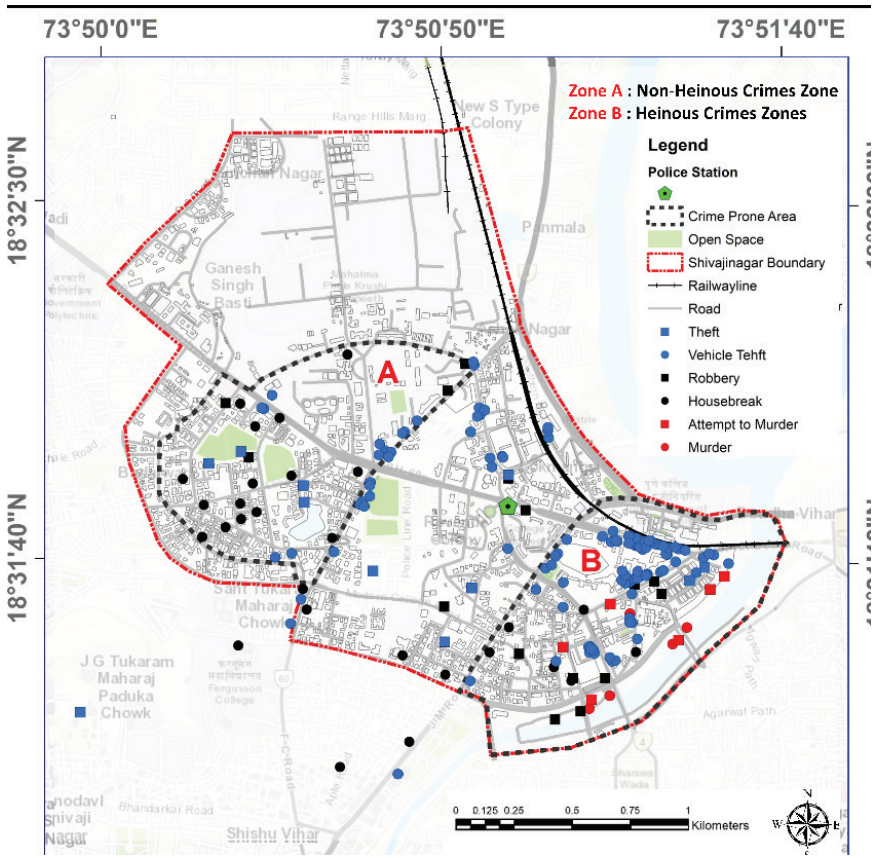


Figure 2: Location Map of Crime Spots

years or more. These include crimes such as murder, rape, dacoity, etc. Section 2 (54) defines non-heinous crimes as “serious offenses” as those for which punishment under the IPC, or any other law in force, is imprisonment between three to seven years (IPC). Figure 2 shows Zone A is a non-heinous crimes zone and Zone B is a heinous crimes zone. The data for the microphysical environment for these zones was also collected by reconnaissance surveys of these areas and making inventory maps for built density, land use, road network, and existing infrastructure. Figure 3 shows crime spots in the study area along existing land use.

The study area has a total area of 4.52 Sq. Km. From the spatial pattern of crime, it was observed crimes are repeated at similar locations and of a similar type forming a cluster of crime spots. Criminal activities and heinous crimes such as murder, and attempts to murder took place along the river and under bridges, near the riverside which covers undeveloped accessible vacant land alongside. Non-heinous crimes such as housebreaks, thefts, and robbery were

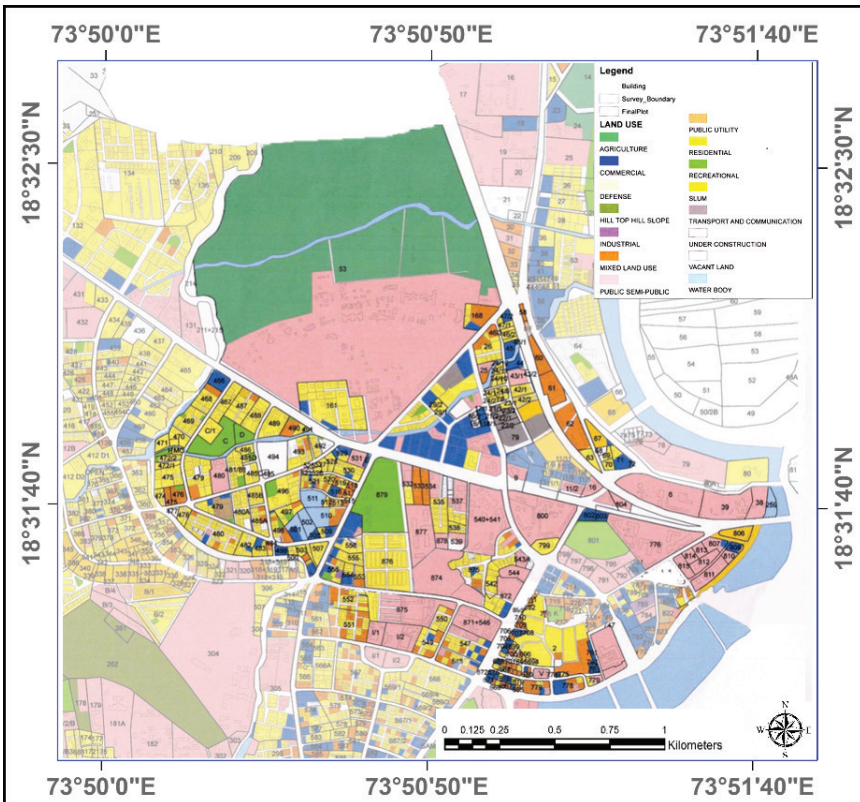


Figure 3: Existing Land Use in the Study Area



mostly identified in residential zones. Vehicle thefts occurred mostly along the busiest streets of the area. The lowest number of crimes were spotted in the lowest built-density areas.

Also, land use distribution helps in understanding the functionality of an area. From fig 3 it can be observed that the area under study has 25.02% of public semi-public land use. It consists of educational institutes, and administrative and public buildings. The residential area is also observed to be relatively higher than other land uses which have well-planned residential areas as well congested slums. Mixed-use land is observed to be very low in the study area and unevenly distributed. Also, transportation contributes significantly as the delineated area has many transit places such as bus stands, bus depots, and metro stations under construction which has caused the formulation of slum areas along transit hubs.

### *Non-Spatial Parameters*

This study has covered the analysis of the socio-economic characteristics of crime-prone zones with non-spatial aspects of the population residing in the area to understand the interrelationship between population and crime rate. The study was done based on Census data for the population in the study area. Crime and population density, employment, and literacy were observed to be strongly associated as it depicts the social growth of the area and the demand for increased services and employment, to prevent crime from happening.

### POPULATION DENSITY

It was observed that the area where the lowest population density is found also has the lowest crime frequency. Low density gives fewer opportunities for crime to criminals while residential areas in a highly populated area with high-income groups attract more criminals.

### UNEMPLOYMENT

The lowest number of employed people was found where sites of slums and unauthorized development are observed. The highest number of employed people was observed where there is the lowest population density. It is understood that the need for employment and crime frequency is directly proportionate. Unemployed youth is strongly related to issues of crime as it undermines human capital hence work abilities, and motivates criminal activities.

## ILLITERACY

The highest number of illiterate people was found in areas with low-income groups and slums where the need for employment was also the highest. Literacy is one of the important factors in crime prevention as social awareness is relatively higher among literate people. Literacy generates employment opportunities which reduce the number of criminals while illiteracy causes poverty making it difficult for people to even have a daily meal. It causes slum settlements which are characterized by decrepit structures and filth.

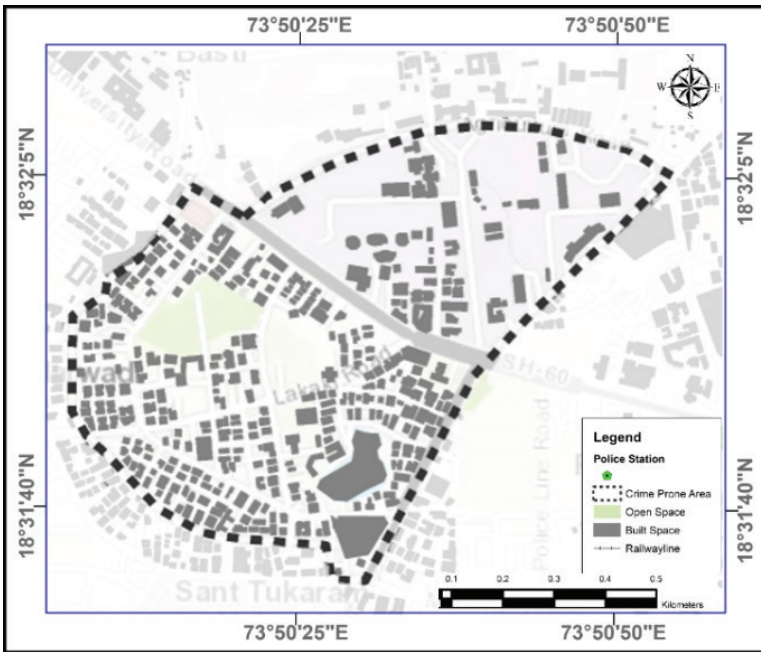
### *Spatial Parameters*

This research included the analysis of spatial parameters to understand the physical characteristics of an area and its relation to the safety of the city. The physical characteristics of an area are defined by its built density, land use activities, connectivity, available amenities, and facilities. It required a study of the microenvironment of the crime-prone zones which is marked through various maps indicating built spaces, road networks, and physical and social infrastructure. The study was supported by a reconnaissance survey to analyze the existing built environment. A reconnaissance survey has been carried out for identified crime-prone zones of two types, one consisting of clustering of heinous crimes and the other with a clustering of non-heinous crimes. This study has analyzed the impact of physical planning on the built environment, safety, and hence fear of crime in that area. Spatial parameters helped in understanding the need for proper physical planning and its implementation in crime prevention.

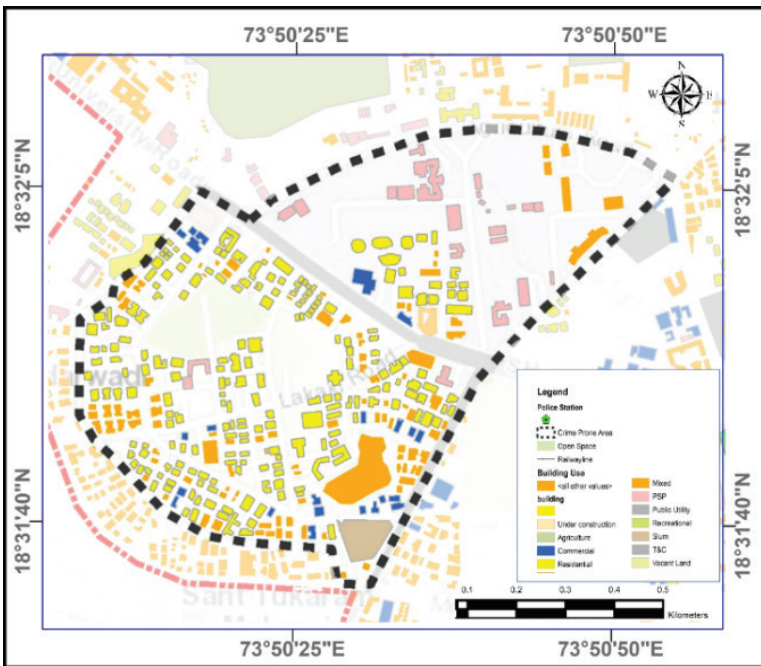
### ANALYSIS OF ZONE A: NON-HEINOUS CRIME ZONE

Zone A was observed to have a certain typology of crime which included non-heinous crimes such as housebreaking, theft, and vehicle theft. The area is studied based on the parameters listed in the literature for spatial aspects. Proximity from Shivajinagar police station is around 0.5-1km. Figure 4(a) to 4(d) explain the existing scenario of crime zones for non-heinous crimes' typology through built density, building use, road network, and existing infrastructure.

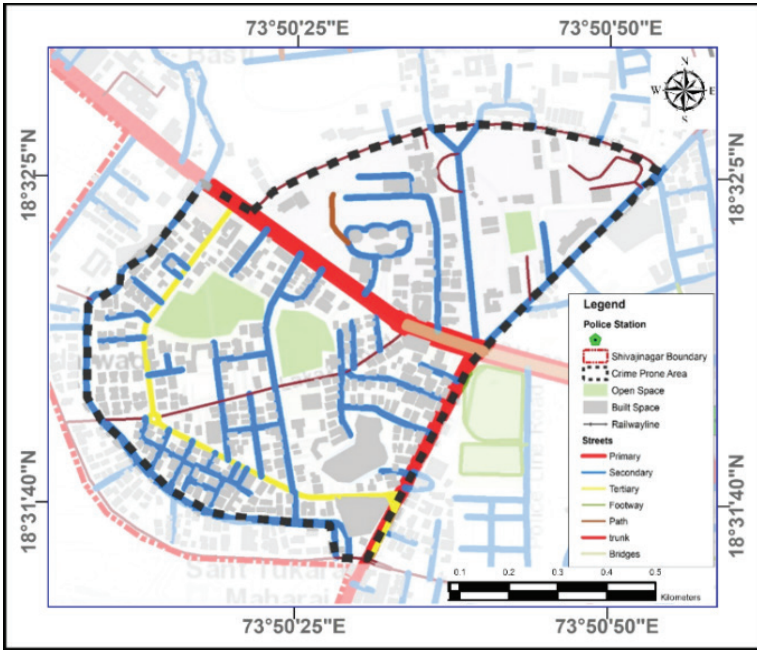
Figure 4(a) shows a figure-ground map of Zone A which explains the built density in this area. This zone is a moderately dense area where most of the residential plots are under private ownership. Clustering of the built area was observed in this zone. Though the



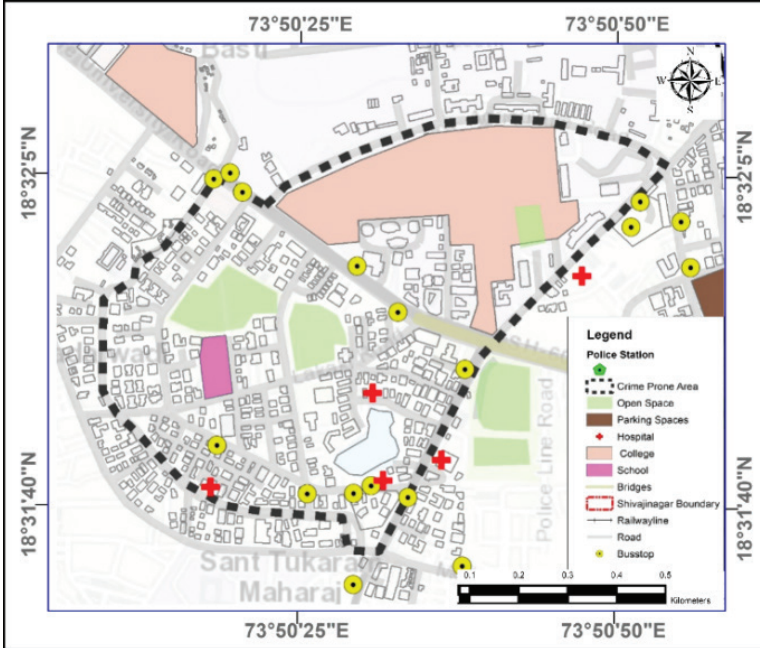
4(a)



4(b)



4(c)



4(d)

Figure 4: Inventory Maps of Zone A: 4(a) Figure Ground Map 4(b) Building Use Map 4(c) Road Network Map 4(d) Existing Infrastructure Map

area has well-defined plots and adequate open spaces, the latter are not well distributed, and the residential zone is surrounded by a cluster of highly dense slums which causes discontinuity in the existing urban fabric. It causes monopolizing of public spaces by groups and the exclusion of other groups, resulting in social conflicts. Housebreaks and thefts are observed to have occurred most here as high-income groups generate opportunities for crimes of this nature. There are vacant, unmaintained, and abandoned land pockets which create fear of crime in this place. Figure 4(b) shows the building use and land use of existing buildings in the studied area. The separation of land use was noticed, that creates districts with streets and public spaces which are not used at some times of the day or days of the week, curtailing natural surveillance. There is a lack of mixed-use land use, reducing the flow of people and period of activity on internal roads. The intensity of activities on internal roads is very low causing drastically reduced traffic flow. It creates fear of crime at night as roads become inactive during the night period. Parking areas were also studied which gives accessibility to outsiders.

Figure 4(c) explains connectivity through the mapped road network and its hierarchy in this area. Encroachment on the road and inadequate parking spaces cause traffic congestion on the streets. In the residential area, streets are visually obstructed by high fences, tall hedges, and densely wooded or overgrown areas. Figure 4(d) shows existing physical and social infrastructure in Zone A. Primary roads are well connected by public transport but there is a lack of public transport in internal areas which reduces the accessibility and traffic flow, reducing natural surveillance. Also, bus stops are poorly maintained without the provision of proper infrastructure. Entrances to public spaces are not equipped with surveillance systems near bus depots and schools. But well-illuminated street lighting is provided which reduces crimes during night-time.

#### ANALYSIS OF ZONE B: HEINOUS CRIME ZONE

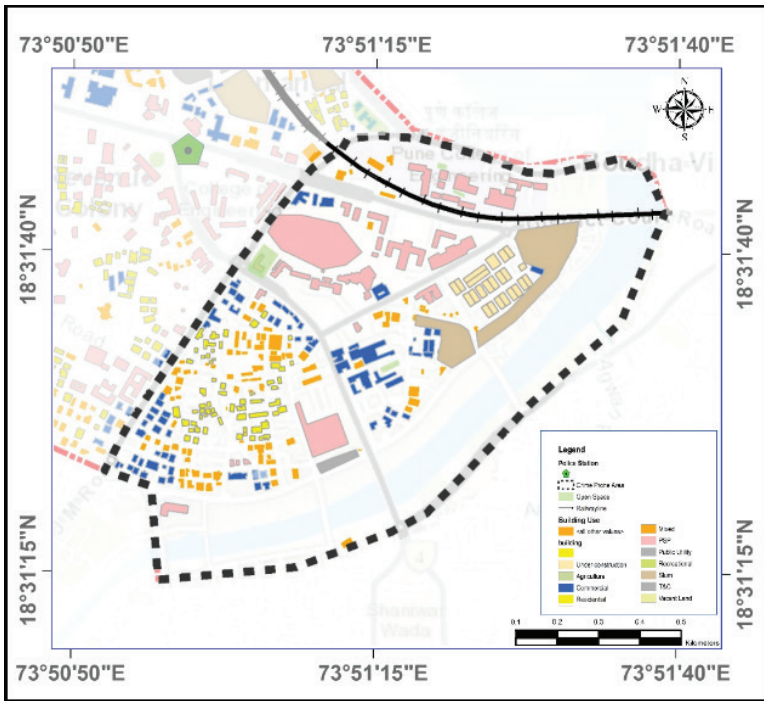
Zone B is observed to have a typology of crime that includes heinous crimes such as murder, attempt to murder, and robbery. The area is studied based on the parameters listed in the literature for spatial aspects. Proximity from Shivajinagar police station is around 0.5-2km. Figures 5(a) to 5(d) explain the existing scenario of the crime zone for non-heinous crimes typology through built density, building use, road network, and existing infrastructure.

Figure 5(a) shows a figure-ground map of Zone B which explains the built density in this area. The River Mutha passes through this zone which is a relatively high density area than Zone A. Discontinuity in urban fabric was observed as the area near transit places has a high built density with slums and unauthorized development while the area near public buildings has lower housing density and a higher mix of uses. It results in uneven distribution of built and open spaces. The area along the riverside is a no development zone but it is also poorly maintained and has three bridges crossing over the river creating invisible under-bridge situations.

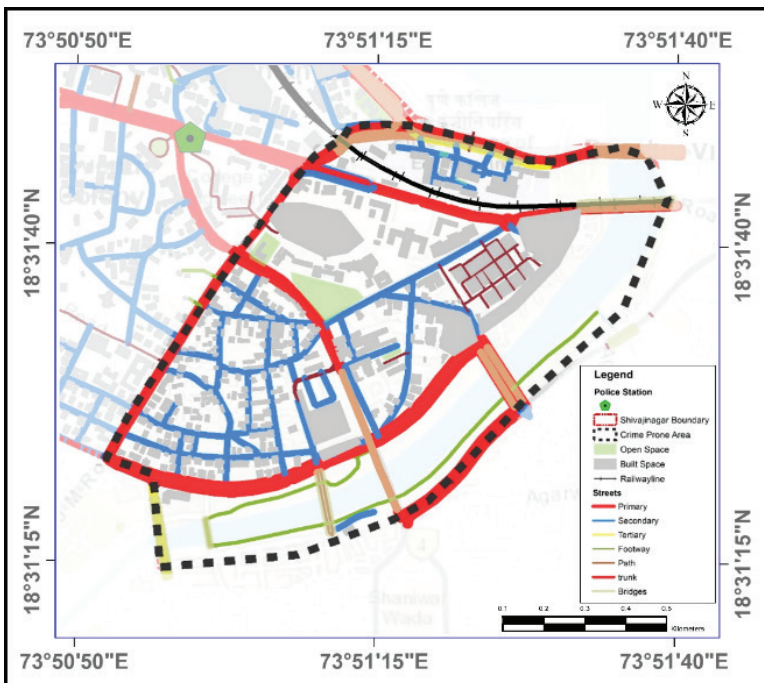
Figure 5(b) shows the building use and land use of existing buildings in this area. Land use pattern has a major impact on the typology of crime. Robbery and theft crimes were observed in crowded areas. Overcrowding and inadequate spaces generate opportunities for crime while all heinous crimes like murders and attempts to murder were spotted along the riverside, under bridges, and near transit places like a foot over bridge, and bus stand. These areas lack mixed-use land use and public activities, hence reducing the vitality of the area. The density of activities in this area is low which generates fear of crime. Most of the commercial and mixed-



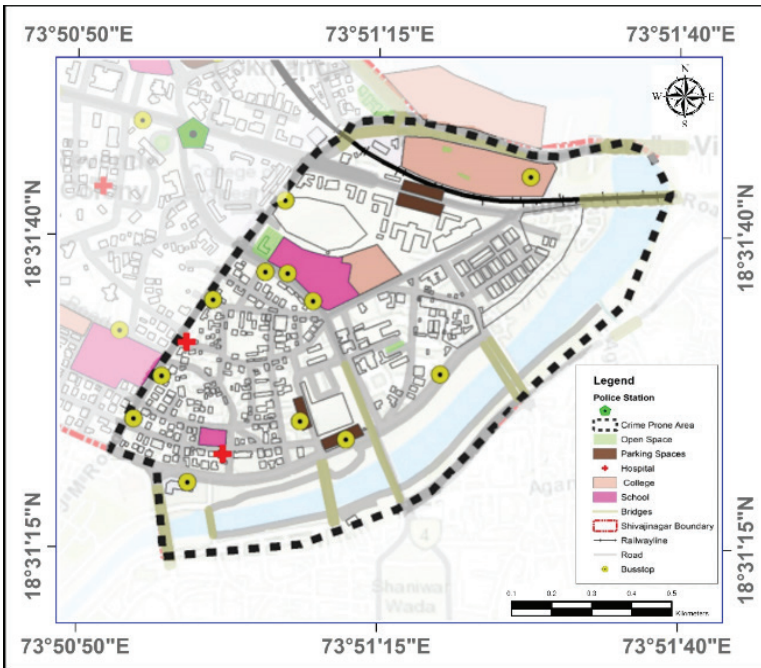
5(a)



5(b)



5(c)



5(d)

Figure 5: Inventory Maps of Zone B: 5(a) Figure Ground Map 5(b) Building Use Map 5(c) Road Network Map 5(d) Existing Infrastructure Map

use land use is observed along primary streets. Violent crimes are not observed in this area because of all-day-long activities.

Figure 5(c) explains connectivity through the mapped road network and its hierarchy in this area. The road density is higher in this area than in Zone A. Primary roads are major connecting roads with all commercial activities along the streets. These are dense areas with long day activities and higher traffic flows which provide sufficient natural surveillance. But internal secondary and tertiary roads near slum areas and public places are congested and with inadequate parking spaces which causes illegal parking under bridges and along streets. This creates overcrowding and hence opportunities for vehicle theft are generated. Also, accessibility to riverside vacant land is provided but there is no wayfinding and vigilance to those land pockets. No physical barriers were observed under bridges which creates invisible escape routes for criminals. These areas are accessible but not visible during the night period which causes opportunities for heinous crimes Figure 5(d) shows the existing physical and social infrastructure in Zone B. It was observed



that public transportation is sufficient in this area but maintenance of the public transport facilities like bus stops, and parking areas are very poor. Decayed and poorly maintained material were noticed in transit hubs like the area near a railway line, and near the bus stand. Open nallas and drains were observed hampering built spaces. Internal roads giving access to administrative buildings and institutes are congested lanes and access through such areas does not create a sense of public place.

### Results and Discussion

It is evident from the findings that the typology of crime gets highly affected by spatial planning and the physical characteristics of an area. Most criminals search for accessible places that are easy to move through, and which provide high opportunities for an escape after commit a crime. The differences in physical distribution of activities and characteristics are distinguished between low and high-crime neighborhoods. It causes the creation of enclaves to a higher extent. This social segregation results in slums and unauthorized development. It defines the interrelation between spatial and non-spatial aspects.

The findings explain how land use and activities contribute to the vitality and hence safety of an area. Major causes of heinous crimes were lack of visibility, unmaintained under-bridge areas, unauthorized and slum development, lack of surveillance, illiteracy, and unemployment causing a lack of social awareness. These were also areas generating crimes. Major causes of non-heinous crimes were isolated areas, segregation of high and low income groups, and inactive internal areas. Areas of isolated high-income groups became a major reason for inviting crimes. This research study helped in identifying spaces that are unsafe for the public and the factors and dimensions of spaces that need to be improved to enhance the safety levels of the public.

### Conclusion

City planning is concerned with the distribution and physical arrangement of activities and people in urban areas. Proper planning may help crime prevention in cities as crime and the built environment of urban spaces are strongly interlinked. The study shows that there is a need to consider crime as one of the factors when proposing new plans or development projects. Spatial planning

systems should consider crime prevention objectives at the inception stage of planning proposals. The significant considerations for crime prevention via city planning include accessibility, density, diversity of uses, integration, and vibrancy. As a result, planning proposals in terms of physical planning interventions can address safety. It should focus on the distribution of functions and activities, infrastructure layout, and the location and character of the areas. Also, good management by local governance should be ensured which includes proper maintenance, monitoring, regulations, user communication for awareness, and the provision of suitable safeguards for vulnerable populations to reduce the risk of crime.

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