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Smart City Design Principles

Prachi Deora[1], Sanjana Harkawat[2]
[1, 2]*Smart City Indore, Urban Planning*

Abstract: ***A smart city should embrace the concept of sustainable growth, as it is an urgent need, and we cannot hesitate in coping with precious natural resources and plunge into crisis. To make the city run as a smart city, several things should be included in the situation. To make the city run as a smart city, several things should be included in the situation. In the long term, smart city visions that are inclusive, pluralistic, and citizen-centric, focused on developing services and resolving local challenges, would be the most effective and cost-efficient. They are most likely to avoid potential issues by strengthening both physical facilities and amenities, as well as the city's sense of culture.***

Keywords: Smart City, Design, Principles, Urban Planning, Indore, All Abilities Park, Nehru Park, Kahn Riverfront, Landscaping, Hawker Zones

I. INTRODUCTION

Smart cities are cities that use digital technology and data to improve decision-making and quality of life. They use smart technologies and solutions to gain a better understanding of current conditions, forecast future changes, optimize city functions and provide solutions. For a city, or any town or community, to become smart, it needs to have a critical mass of connected sensors, smartphones and other Internet of Things (IoT) devices. The connected devices can connect to the Internet and share the data they collect with city officials, engineers and other key administrators and managers. Managers of city systems can use various applications to take this data and turn it into information that they can use to accomplish tasks and optimize operations.

Fig. 1 Smart City

The fast and inevitable emergence of Smart Cities has a huge impact on urban development policy and urban planning. The four main dimensions in regional and urban development are as follows:

1) *Quality Encompasses* livability, environmental quality, quality of life, and biodiversity respect. Planning would forbid the urbanization of seashores, lakes, and other natural areas in this sense.
2) *Viability Timeline:* This term refers to sustainable residential construction, which seeks to address the needs of current generations without jeopardizing future generations' ability to meet their own needs and ambitions.
3) *Capacity:* refers to the capitalization of both natural and human resources. This factor encompasses optimal population distribution and decentralization, water and other natural resource utilization, residential and agricultural allocation, and so on.
4) *History and Environment:* embrace urban history and landscape in order to achieve cohesive regional development. Archaeological zones, traditional practices, and other factors must be included in the preparation.

Smart City Framework

Smart cities introduce a variety of new practices and services which impact urban policy making and planning as they co-exist with urban facilities. And there are various ways that smart city framework can help city planners to meet the above-mentioned criteria and contribute to an urban life. The generic architecture of a smart city contains the following layer: User layer, Service layer, Infrastructure layer and Data layer. If looked closely, we can observe how those layers all correlate in one way or another with urban planning criteria.

For example, ideally the infrastructure layer shouldn't charge the local environment or the local protected areas and has to plan to uniformly develop smart cities across the regions for coherent development. When it comes to the Service layer, smart transportation services would align directly to the Quality and to the Viability Timeline planning dimensions. Or other way around: how the criteria can be met thanks to one or more layers. For example, the environmental data that is collected from the sensors can to contribute to Quality, History and Landscape dimensions. So what we can observe is a bidirectional relation between urban development policy and smart city framework. Smart city aligns easily to urban planning dimensions, while urban development policies should be on the lookout to capitalize what smart city solutions have to offer.

The importance of "place" in town planning and urban design has come to encapsulate experience from a variety of domains about what makes urban environments successful from the perspective of the people, businesses and communities who use them. It can be summarized as, "Consider urban life before urban space; consider urban space before buildings".

A. Objective

To study about the Design Principles of a Smart City to compare it from the Old City and gain knowledge in detail about its dimensions, layouts, guidelines and importance of:

1) All Abilities Park or All-Inclusive Park in urban areas
2) Riverfront Development
3) Hawker's zone
4) To contribute in developing urban infrastructure of Indore so that it grows as a Smart City

B. Motivation

Smart Cities focus on their most pressing needs and on the greatest opportunities to improve lives of the citizens. They tap a range of approaches – digital and information technologies, urban planning best practices, public-private partnerships, and policy change – to make a difference. They always put people first.

In the approach to the Smart Cities Mission, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions. The focus is on sustainable and inclusive development and the idea is to look at compact areas, create a replicable model which will act like a light house to other aspiring cities.

The Smart Cities Mission is meant to set examples that can be replicated both within and outside the Smart City, catalyzing the creation of similar Smart Cities in various regions and parts of the country. And for the budding civil engineers like me, it was a great opportunity to at least give my 100%, contributing to make my city better in the field I belong to.

C. Smart Cities Mission Strategy

1) Pan-city initiative in which at least one Smart Solution is applied city-wide
2) Develop areas step-by-step – three models of area-based developments
3) Retrofitting,
4) Redevelopment,
5) Greenfield

The core infrastructure elements:

a) Adequate water supply
b) Assured electricity supply
c) Sanitation, including solid waste management
d) Efficient urban mobility and public transport

e) Affordable housing, especially for the poor
f) Robust IT connectivity and digitalization
g) Good governance, especially e-Governance and citizen participation
h) Sustainable environment
i) Safety and security of citizens, particularly women, children and the elderly and
j) Health and education.

Fig. 2. Smart City Elements

D. Project Description And Goals

The Smart Cities Mission, a Government of India program for urban development, is projected as a high-profile initiative which will transform the urban landscape in India.

Under the mission, four modes have been proposed to undertake the development of a Smart City Indore - retrofitting, redevelopment, and Greenfield development and pan city development. These modes would be used to develop around 500 acres of the selected city where infrastructure already exists with the help of smart internet-based applications. The mission strategy further states that it should encapsulate either a retrofitting or redevelopment or Greenfield development model, or a mix thereof and a pan-city feature with Smart Solution(s). It is important to note that pan-city is an additional feature to be provided. Since smart city is taking a compact area approach, it is necessary that all the city residents feel there is something in it for them also. Therefore, the additional requirement of some (at least one) city-wide smart solution has been put in the scheme to make it inclusive.

This internship thus focuses on Smart City projects in Indore (Madhya Pradesh) includes an overview of the idea and the development work behind these projects falling in tenure of this internship. It begins with information about the city of Indore and a background of how Smart City Indore has changed according to the design principles and guidelines, and then executed through Area Based Development projects, Greenfield development and Pan City projects.

The main goals of this paper are:

1) Understanding landscape plans that are smart, sustainable and nature friendly
2) Ensuring that enough green spaces are provided during planning a site
3) Proper Solid Waste Management system provided in each plan
4) Keeping the citizens of Indore healthy and sound along with developing the city

Fig. 3. Smart City Indore

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II. TECHNICAL TERMS AND SPECIFICATIONS

Table I

Technical terms and Specification

Design Principle	Fundamental pieces of advice for you to make easy-to-use, pleasurable designs.
Urban Area	An urban area, or built-up area, is a human settlement with a high population density and infrastructure of built environment.
Sustainable Development Goals	The Sustainable Development Goals (SDGs) or Global Goals are a collection of 17 interlinked global goals designed to be a "blueprint to achieve a better and more sustainable future for all
Accessibility	The quality of being able to be reached or entered.
Green space	Green space (land that is partly or completely covered with grass, trees, shrubs, or other vegetation). Green space includes parks, community gardens, and cemeteries
Riverfront	A riverfront is a region along a river. Often in larger cities that are traversed or bordered by one or more rivers
Landscaping	Any combination of trees, shrubs, flowers, grass, other horticultural elements, paving, or other architectural elements, all of which are designed to enhance the visual amenity of a property.
Buffer zone	An important part of stream ecosystems because they decrease pollution, control erosion, and provide wildlife habitat.
Commercial shops	The concentration of small-scale retail, office and service businesses in locations that serve as hubs for neighborhood and city-wide consumer activity
Utilities	Utilities provide basic needs that significantly improve a community's quality of life, spurring social and economic growth.
Floor Area Ratio	The Floor Area Ratio (FAR) is the ratio of a building's gross floor area to the total size of the land upon which it is constructed. FAR = $\frac{\text{Total covered area of the floors}}{\text{Plot area}}$
Clusters	Residential cluster development is a form of land development in which principal buildings and structures are grouped together on a site
Ramps	A sloping surface joining two different levels, as at the entrance or between floors of a building

III. OVERVIEW OF INDORE CITY

A. Geography

Indore is located in the western region of Madhya Pradesh (approx.76^{o}E, 23^{o}N), on the southern edge of the Malwa plateau, on the Sarawati and Khan rivers, which are tributaries of the Shipra River. Indore has an average elevation of 553 meter above mean sea level. It is located on an elevated plain, with the Vindhyas range to the south.

B. Demographics

According to the 2011 census Indore District has a population of 3,272,335, roughly equal to the nation of Mauritania or the US state of Iowa. This gives it a ranking of 106th in India (out of a total of 640). The district has a population density of 839 inhabitants per square kilometre (2,170 /sq. m). Its population growth rate over the decade 2001-2011 was 32.71 percentage.

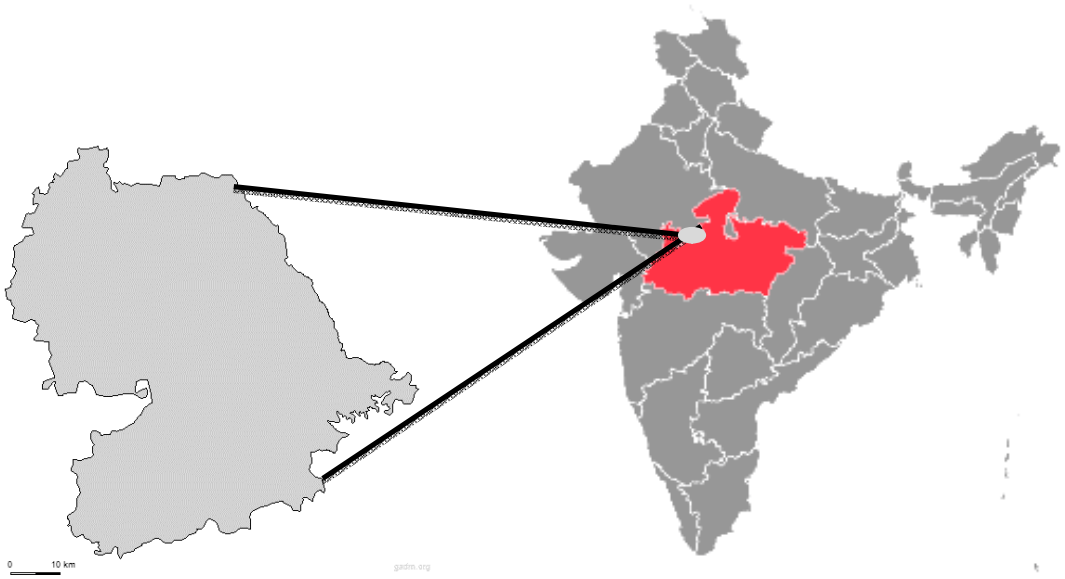

Fig. 4 Madhya Pradesh and Indore

C. Smart City: Indore

Smart cities or competition is the method to select cities for funding and using a strategy of area-based development. Indore has carried one of the widest citizen's engagement programmes for shaping of vision, goals & strategies, selection & planning of ABD & Pan-city proposal. The extent of citizens involved more than 25% of the city population (with 591965 interactions through all mediums). And Indore having historical background starting from the 1800's is a challenge accepted by the city to make its identity stronger and enhance its associational values. Indore has been successful in the competition for implementation of smart solutions in the first phase on the basis of its Smart city proposal. This SCP consisted of an AREA- BASED DEVELOPMENT as well PAN-City solution. The Proposal was scored based on the quality of city-level criteria like vision and goals, strategic plan etc. and the quality of proposals for ABD as well as PAN-city solution.

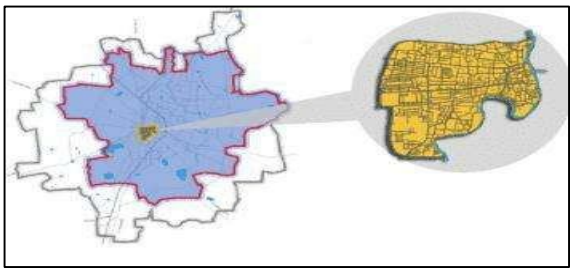

Fig.5. ABD Area

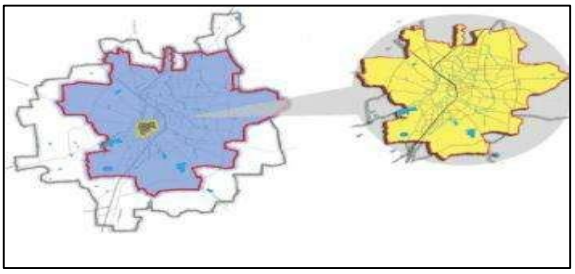

Fig. 6. PAN City Area

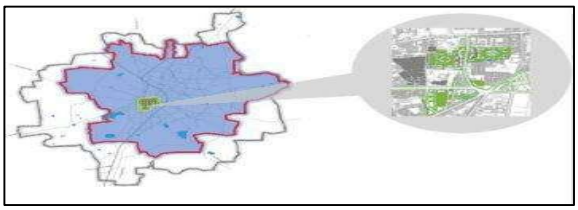

Fig. 7 Redevelopment Area

D. Vision Statement

"Imagining Indore to Inherit, Innovate, Include, Incubate and Invest" for "An ideal world-class smart commercial metropolis that thrives on investment opportunities, incubating business and ideas, rich inheritance and inclusive development"

Aligning with national goals of smart city mission the key themes/goals emerging from the shared vision are:

1) Rejuvenation and Innovation in spatial re-structuring of Urban Form
2) Inheritance of rich Cultural and Economic Heritage
3) Sustainable Urban Mobility, Environment & Infrastructure
4) Inclusive Urban Governance and Citizen Services for better lifestyle,
5) Incubation of the Urban Work Force

IV. DESIGN PRINCIPLES OF SMART CITY

A. Introduction

Next generation of urban evolution is here. Moving beyond just connected infrastructure and smarter things, the smart cities of tomorrow engage governments, citizens, visitors, and businesses in an intelligent, connected ecosystem. The goal: better city services and a higher quality of life. This evolution, enhances citizens' experience and city decision-making. Rapid urbanization puts tremendous pressure on population centers, and presents a challenge for cities to provide environmental sustainability and ensure the physical security and safety of residents. Economic advances represent little actual progress if they degrade the air, water, and soil. In addition, the threat of rising crime rates, poverty, and civic unrest make cities fragile. To avoid these challenges as much as possible, most thriving cities seek sustainable, but also resilient, growth. Smart city technology represents part of the solution. According to the design principles that each city should consider with respect to infrastructure construction, connectivity and information accessibility, economic development and viability, transport, governance, privacy and public safety etc. This chapter is inspired by the co-existence of the smart city and the urban space, and seeks to investigate the relation between the smart city and the urban planning, in terms of mutual support and benefit. In this context, various smart city's infrastructure and applications can contribute to urban planning data collection and decision making by the planning stakeholders' groups.

B. Design Life Of Smart City V/S Old City

Developing Smart Cities is like revamping the existing ones into better and much proficient cities that will not only promote growth of the region but provide a better living style to its residents. Development of smart cities largely attract employment, FDI, infrastructural growth and economic development of a region which will directly add to the GDP of the country.

1) *Technology:* We are now living in a generation where we have moved from wired world to wireless. While planning for a smart city technology plays the most crucial part. This is where the first distinguishing factor from any other city comes in. The technological elements of a smart city programme are – the GPS technology, telematics, a smartphone dispersion and high-speed bandwidth. All these technologies will connect the residents, government and businesses.
2) *Jobs:* The development of smart cities promises huge number of jobs. As any new city develops – from planning till it gets developed – it needs huge amount of manpower for its successful development. In comparison to any other city, smart cities will experience larger opportunities for employment. This is one of the prime factors that makes a smart city different and successful from other cities.
3) *Connectivity:* The success of any city lies in how well you are connected with other cities and countries too. Additionally, it's also important to see how the intercity connectivity has been planned. The transport system may seem similar to other cities but plays an important role in defining the theory of smart cities. For best possible use of mass transit systems, the expansion of last mile connectivity is essential. With the best possible planning and resources, it becomes easier to implement better transport system in smart cities in comparison to other cities.
4) *Reduced Costs:* Smart city technologies enable cities to reduce their costs by helping them to conserve resources, including electricity, gas and water. An Energy Data Management System (EDMS) can automate the recording of energy usage data and enable intelligent systems control to improve energy efficiency. This capability is available for both new and existing buildings. Software Platform allows you to, for example, automatically control the light levels, heating and cooling systems and external shades in a smart building based on weather conditions, solar radiation, occupancy plans and other factors. This optimized lighting reduces energy costs. In addition, data from smart sensors can inform predictive maintenance strategies, which helps cities to repair equipment issues before they cause more expensive problems. This feature can be useful across public transportation systems, wastewater treatment plants and buildings.

5) *Sustainability:* Smart cities can also achieve sustainability by monitoring environmental conditions and controlling energy systems. Smart sensors can continually take air quality measurements, add that information to a database and automatically send warnings if pollutant levels get too high. This monitoring can help the city track progress on environmental goals and identify sources of pollution.
6) *Improve Health:* Health is a critical component of quality of life, and smart city technologies can help ensure that residents have the things they need to live a healthy life, including a healthy environment. For example, cycling tracks, all inclusive parks, pink toilets, nurtured neighborhood, beautiful streets etc. Smart sensors can also monitor outdoor air quality, temperature and other parameters. If these sensors detect that one of these parameters has exceeded a predetermined limit, they can trigger an automated notification.
7) *Enhance Safety:* Smart city technologies can help improve safety through remote monitoring and control of important systems as well as alarms when problems occur.

The theory of smart cities is innovative, challenging and emergent. The smart cities aim to shape India into a 'smarter' country. Implementation of the smart city plan is key to harnessing the technological, job creation and overall growth potential of this mammoth infrastructure project.

C. *Designing And Planning Principles*

Smart Cities are smart in two ways. First, they harness technologies to improve the way that urban places are led and managed. Second, they create better outcomes for the people that use them. This two-pronged approach applies to all aspects of Smart Cities. When it comes to the planning and design of Smart Cities, technology can improve the performance of the places that are produced by planning and design (the outcomes) and the processes involved in creating plans and designs (the inputs).

A Smart City approach should direct the capabilities of urban planners and designers to:

1) Facilitate effective human transaction in new and existing places
2) Provide access to places of transaction, both physical and digital: on-land and on-line
3) Support the mobility required to access these places of transaction by providing networks of connectivity for all modes of transport, both physical (walking cycling rolling driving) and digital
4) Take an outcomes-oriented (i.e. transactions & emissions) approach first and foremost, aware of the inputs required (i.e. materials, energy & mobility) to achieve these desired objectives
5) Provide effective analytic and forecasting tools aimed at social economic and environmental impacts.

D. *Smart City To Urban Planning Alignments*

Both end-users and stakeholders of the smart city's User layer are obliged to follow the planning rules and to consult in cases of framework's construction. Thus, the User layer is influenced by all planning dimensions.

Moreover, the smart city's infrastructures have to conform to planning rules and not to charge the local environment or the local protected areas, while planning has to uniformly develop smart cities across the regions for coherent development. In this context, the infrastructure layer meets all planning dimensions.

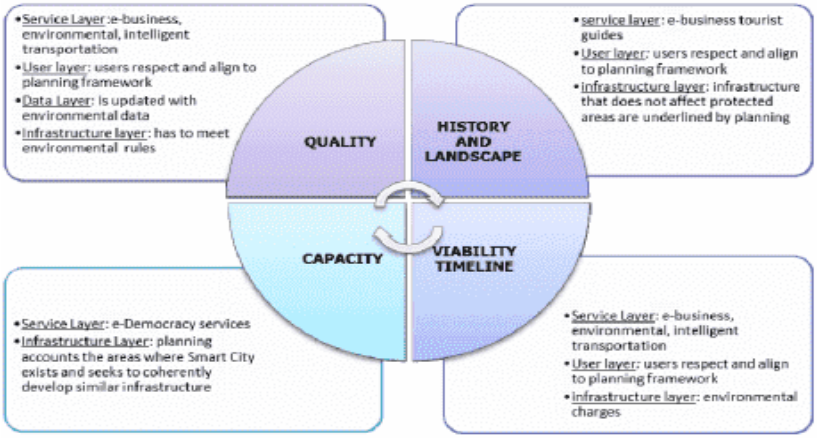

Fig.8. Smart City layers align to urban planning dimension

E. Proposed Project

ABD proposal titled "Raj Wada Rejuvenation", combines retrofitting with redevelopment to improve the core of the city. (This includes all 7 chhatris of Holkar dynasty). The components of ABD proposal which include all essential features among other additional features, which are:

1) *Transport and Walkability:* Road development, intersection improvements to ensure walkability and safety through use of street design guidelines for TOD, no-vehicle zone with smart parking & battery-operated e-rickshaw, real-time air quality monitoring & Intelligent Transport System (ITS – integration with pan-city proposal).
2) *Redevelopment Of Public Land:* Compact-high-density-mixed-use, walkable community with slum-housing, affordable housing, shared public open spaces (both neighborhood & sector level), shared parking, 85% built-up to be green buildings, rooftop solar power plants generating 25% of energy demand, rainwater harvesting & its re-use.

Fig.9. Citizen Charter

F. Conclusion

Smart cities are "booming" and various important cases can be faced worldwide, which can be classified in various approaches and can be evaluated according to their sophistication. All alternative approaches deliver emerging types of services to the local communities with the use of physical and of virtual resources. General suggestions that require further investigation concern that the smart city has to be accounted in the regional and the urban planning frameworks, with means that the ICT resources are capitalized for information retrieval and analysis for policy making; while the environmental charge of a smart city has to be measured and evaluated during regional and urban planning.

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V. ALL ABILITIES PARK

A. *Introduction*

Speaking at the inauguration of a two-day conference on "Building smart child-friendly cities in India for 21st Century" the Minister said "harsh urban realities" were adversely affecting the "brain development and perspectives" of young children, particularly those from the economically weaker sections. Deficient urban planning, the Minister said, resulted in an adverse impact on children in terms of poor behavioral and academic outcomes, high risk of diseases, inadequate early brain development and impaired physical development and skills.

HUDCO is the premier techno-financing public sector enterprise, in the field of housing and infrastructure development in our country. It organizes a country level competition every year. This year also the same was formulated and Indore was one of the participants in it. HUDCO Design Awards 2021 from professionals engaged in development and design of urban and regional places, buildings, neighbourhood or cities.

Under this Indore decided to develop an 'All Abilities Park' by renovating and adding more features to existing Nehru Park, Indore. The redevelopment of Nehru Park is also to cater to the recreational needs of the Area Base Development zone, as it is the major park lying in the vicinity of ABD zone. It is located at the distance of 1.4 kms from the ABD zone. We believe all kids are created equal. That's why we created play environments using inclusive playground equipment that welcome kids and families of all abilities. They are thoughtfully designed to provide a safe place where children of all abilities can play together, and are developmentally appropriate for children with and without disabilities.

B. *Design: The Playground*

1) *Play Experience:* Playgrounds can offer many opportunities for children to further develop physical, cognitive, sensory and social skills. An inclusive design includes a balance of play experiences to build all these skills.

a) *Sensory Stimulation:* All children are attracted to sensory activities. A sensory-rich inclusive play environment can bring children together while providing them with the sensory experiences they seek.

- Make a wide range of materials and textures available for touch—rough and smooth, hard and soft, warm and cool.
- Natural elements such as sand and water or flowers and plants provide ever-changing multisensory experiences.
- Interactive play panels captivate kids of all abilities with displays of color, moving objects and visually stimulating surfaces.
- Color can sometimes generate strong responses for visually sensitive children; consider simple color schemes in more muted color tones and/or earth tones. Include elements that offer strong visual contrast for children with low vision, especially to highlight sudden elevation changes.

b) *Swinging, Spinning And Sliding:* Most kids enjoy sliding, spinning/rotating and swinging. Besides being fun, these activities sharpen our internal senses— vestibular (awareness of how our body moves through space and against gravity) and proprioception (awareness of body position and how much force is needed for an activity).

2) *Variability:* This design intention meets a child's curiosity with developmentally appropriate challenge, building comfortably on the skills they already possess to help them gain new skills.

a) *Developmentally Appropriate Cognitive And Physical Play:* All kids benefit from physical activities such as balance and coordination, muscle strength and endurance, cardiovascular exercise and motor planning. A playground can reinforce learning and enhance problem-solving skills with games, mazes, maps of the world, tracing panel and more. To meet as many needs and skill levels as possible, consider including graduated levels of challenge, complex alternative routes, elements that encourage cross-lateral movement and a variety of developmentally appropriate risks.

b) *Flexibility/Options:* While many children readily flock to large play structures, some feel more comfortable in smaller, cozier spaces.

- Add ground-level activities to allow small groups to explore different play experiences at their own pace.
- Include overhead events at different heights or create combinations of stepping forms and balance beams.

c) *Self Directed:* Empowering children to choose the activities that capture their interest puts them in charge, building confidence in their abilities and contributing to their self-esteem. Offer a variety of equitable yet diverse options to accommodate the needs of the widest range of users, for example, install Saddle Spinners at different heights.

3) *Safety, Comfort And Access:* Creating a welcoming, safe and accessible environment is just as important as the play equipment you put in it. A well-designed environment makes the space more comfortable and user-friendly for children and families of all ages and abilities.

a) *Signage:* All people feel more comfortable when they have a better understanding of their surroundings. Include signage that identifies accessible facilities, meeting spots and play areas by age group as well as amenities such as water and restrooms.

b) *Seating:* Benches with backs and arm rests, tables and game tables may be strategically located around the play area (preferably in shaded areas) for supervision, resting and to promote multigenerational socialization.

c) *Pathways:* Accessible pathways that transition between activity areas should be short and direct, requires a minimum 60-inch width—wide enough for a wheelchair and someone walking next to them.

d) *Ramps And Transfer Points:* Wheelchair-accessible ramps and transfer modules to higher play events/overlooks offer more equitable access and encourage interactive play among kids and adults of all abilities.

e) *Protective Surfacing:* A truly inclusive playground should incorporate a unitary surface such as poured-in-place surfacing or rubber mats/tiles on the accessible routes. Continue a theme in your surfacing design.

C. *Technical Specification According To Standard Guidelines*

1) *Play Areas:* Play areas shall be proportionate to the size of the development and the number of children that will be using them. Play areas for younger children should provide the soft surface, edging around the play areas, equipment which is conducive to the play experience and creative in nature, hard surface apron around the play area (minimum 1.2 m width), sitting areas – benches with back rests, protection from traffic, screening from adjacent units, access to the play area and high branching trees for shade. Play areas for older children should provide: hard surface for activities like basketball and hockey, proper drainage, backstop for bouncing balls, protection from traffic, screening from adjacent units and access to the play area.

2) *Access For The Handicapped:* Handicapped parking spaces must be located as close to the main entrance as possible, preferably within 15 m. The space must allow immediate access to a walkway without requiring a person to pass behind or between parked cars or across traffic. The following standards shall be incorporated for barrier-free access design: Minimum unobstructed width: 920 mm, Maximum slope: 1:12, Maximum length of handicap ramp: 9 m, Minimum size landing for turning: 1.5 m^2. Handrails are required on at least one side of a ramp.

D. *Nehru Park, Indore Design Layout And Specifications*

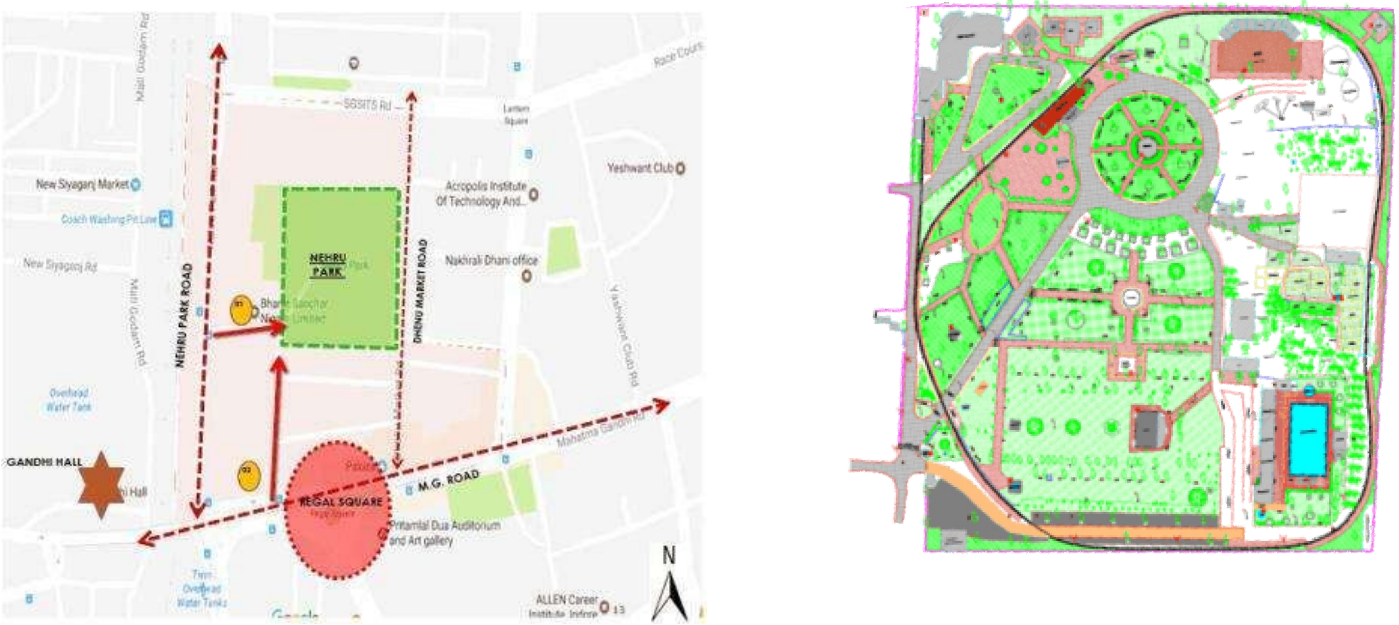

Fig. 10. Nehru Park location

Nehru Park is a well-known tourist spot in the city. It is the oldest centrally located park in Indore, but its glory has only augmented with time. The Park offers facilities like library, swimming pool, children's hobby center, a mini train and swings. The Park boasts of well-maintained lawns, vibrant flower beds, shimmering water sprinklers and playpens. The Park is dotted with beautiful misty fountains and also has a special children's play area. The Nehru Park also houses Smart City Office, Library, Swimming Pool, Quarters and Nursery.

The need of redevelopment arises due to:

- Less Gathering Spaces for Cultural Activity, Haphazard and Unorganized Parking. Public Washrooms inadequate.
- No dedicated area for Kids, No swings in Play area.
- Toy Train needs not functioning and Track in degraded condition.

Fig. 11 A. Survey plan (Existing plan)

1) Areas

a) Pathways (Hardscape)– 6285 sq. m
b) Jogging track– 478 sq. m
c) Flower beds– 345 sq. m
d) Toddlers kids play area– 707 sq. m
e) Kids play area– 1105 sq. m
f) Lawn– 3259 sq. m
g) Green around gazebo– 396 sq. m
h) Green around train track– 2250 sq. m
i) Green along parking– 1395 sq. m
j) Green around Smart City– 1670 sq.

1. Toy Train Track
   a. Running length of toy train– 635 m
   b. Track length up to yard– 50 m
3. Total parking
   a. Four wheelers – 40
   b. Two wheelers - 180

Fig. 11 B. Proposed plan

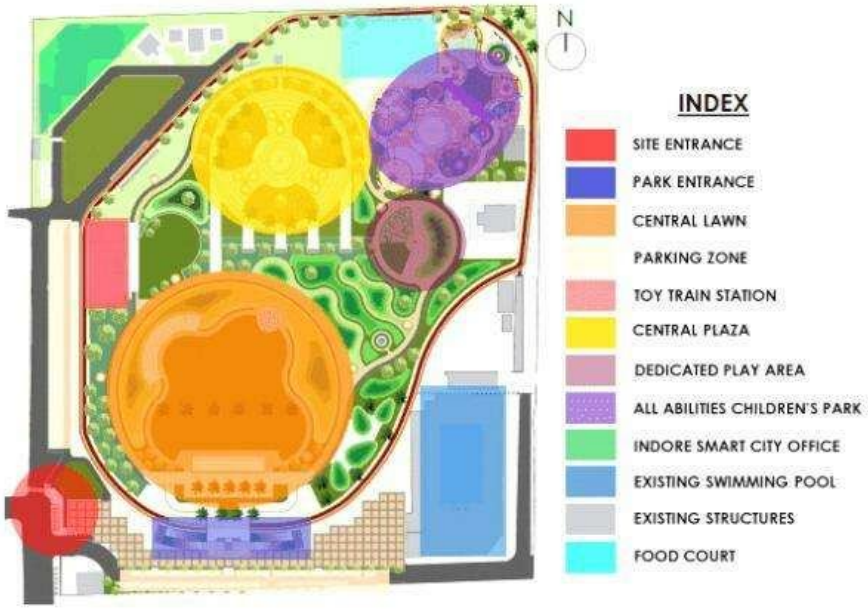

Fig. 12. Site zoning

Table II
Area Statement of Nehru Park

COMPARISON OF AREA STATEMENTS FOR NEHRU PARK, INDORE					
Sr. no.		Particulars	Existing Condition (in sq. m)	Proposed Development (in sq. m)	Remarks
1		Total Construction Area			
	a	*Permanent Structures*	1352.52	1745	Including some Existing Permanent Structures that are retained and Re-used.
	b	*Temporary Structures*	1174.75	1330.8	Including some Existing Temporary Structures that are retained and Re-used.
3		Vehicular Circulation Area	6132	5566.17	It has been reduced in Proposed Development.
4		Landscape Area	14288	25461.54	It has been increased in Proposed Development.
5		Parking Area	696	1402	Organized and Dedicated Parking was needed to accommodate future projection.
6		Pathway Area	4936.78	1808.55	Organized area to facilitate people's movement.
7		Kids Play Area		3030.26	For Kids Recreation
8		Entrance Plaza Area (at 1.15 m.)		870	Organized area to facilitate people's movement.
9		Entrance Plaza and Ramps (at 3.75 m.)		448.16	
10		Hardscape Areas (Yoga zone, near Fountain, Station, Library etc.)		3046.64	(For Recreational purpose and ease movement of people)

E. Interventions

1) Accessibility

a) Approach Roads and Gate Structures
b) Entrance Gate and Ticket Counter
c) Parking
d) Internal circulation – Defining Pedestrian and Vehicular circulation
e) Proposal of Cycle Stands.

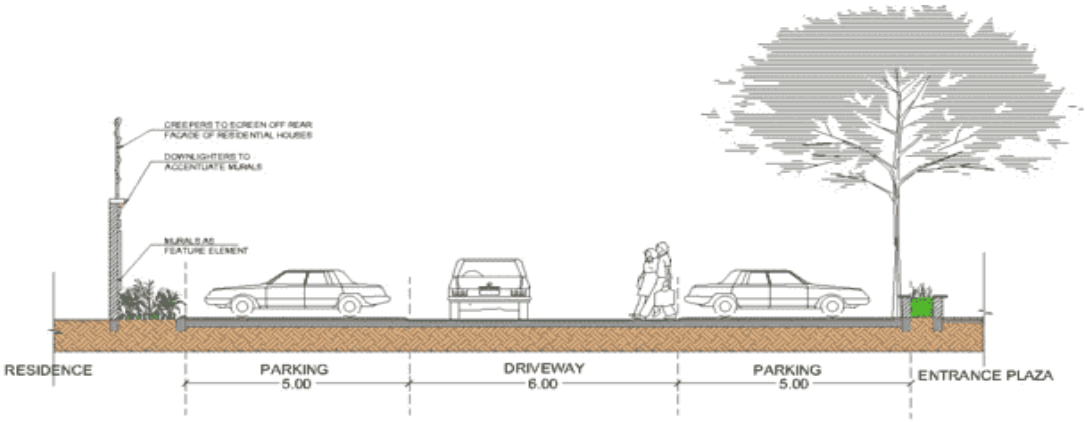

Fig. 13. Section through driveway and parking

Internal Circulation

Restricting Vehicular circulation to periphery

- And thus, ensuring complete pedestrian zone at Park
- Provision of vehicular service entry to Swimming Pool, Nursery, Food Court and Smart city office.
- Use of porous pavers instead hard impervious surfaces

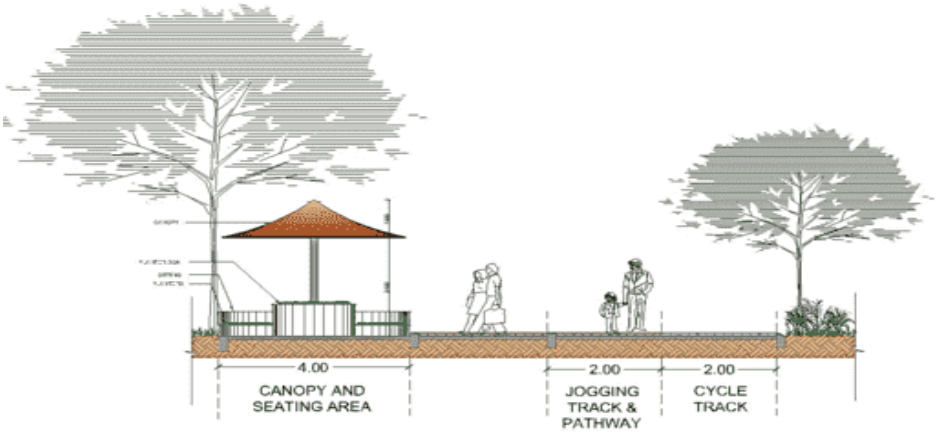

Fig. 14. Section through pathway and seating

2) Reconfiguring the Layout

a) Structures to be demolished – Existing Workshops

b) More of Green Lawn Areas and Organized Pathways

c) Reclaiming unused land (presently used for dumping)

d) Structures and site features to be retained

Fig. 15. Lawn area

Lawn Area- At present the park is fragmented and total usable green lawn area is thus limited. Planning of a single large green lawn at center and thus giving more of green lawn area for recreational purpose, less of unwanted activities takes place. The entrance plaza is designed in such a way that the train track does not conflict the pedestrian movement. The entrance has been raised to a certain level and accessibility is by the means of ramps.

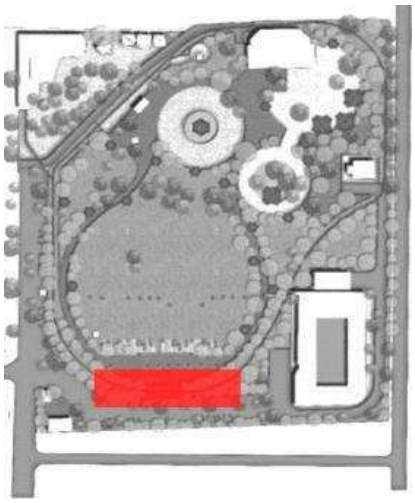

Fig. 16. Entrance of Park

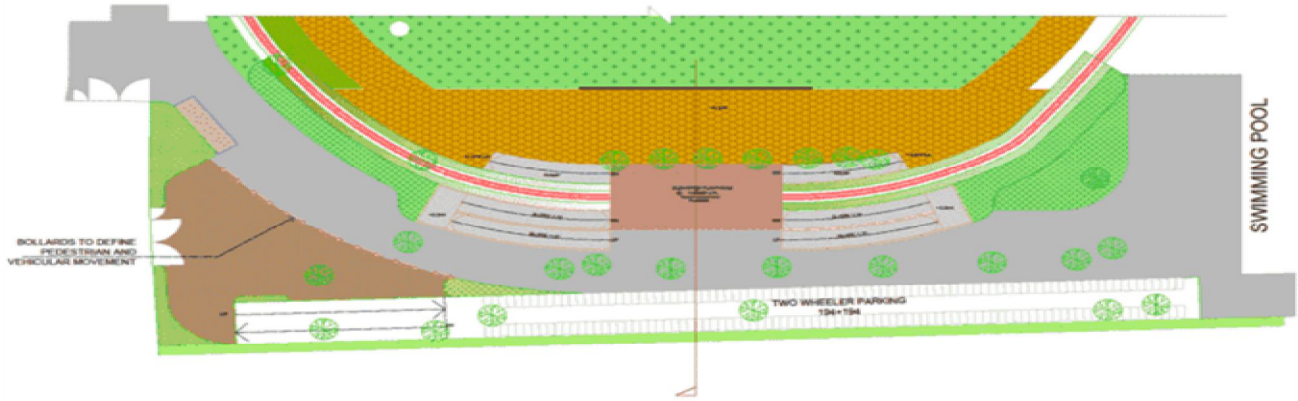

Fig. 17 A. Section through parking, entrance and waterfall

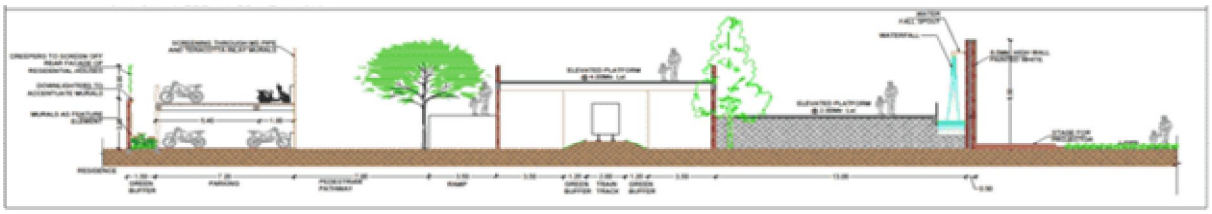

Fig. 17 B. Section through parking, entrance and waterfall

3) Toy Train revival and Focal Points
a) Theme Based Installations
b) Light and sound Effect
c) Elevating Track for the ease of maintenance.
d) Laying Of New Track and station

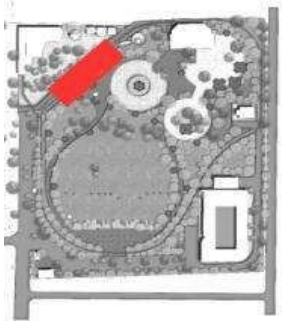

Fig. 18 Toy train location

Fig. 19. Existing track at ground level and proposed track on natural mounds

- *Green Buffer along Toy Train Track*- A green belt of dense plantation is proposed along Toy Train Track to act as natural barrier.
- *Elevating Track* – 1 m. From Natural Ground Level

4) Activity Generators
a) Central Gazebo with sit out area
b) Dedicated yoga and exercise zone to create awareness for good and sound health
c) Sit-outs defined by clustered canopies.
d) Reading Zones around the Plaza
e) Play zone- Play & Ride Structures
f) Dedicated Area for Food Vendors (Mobile Kiosks) and Food courts

The use of hard landscape to differentiate the central plaza from the site.

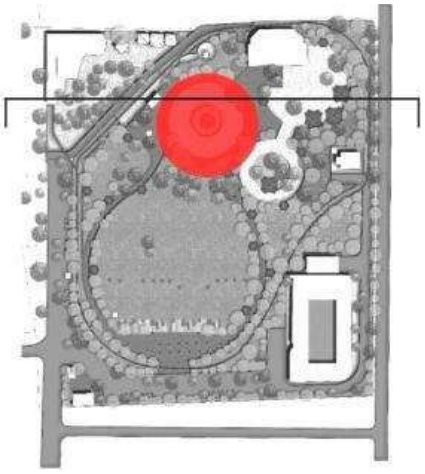

Fig. 20. Central Gazebo

Fig. 21 Open Paved Gym at Gazebo

Fig. 22. Section of Central Gazebo

5) Multilevel Parking

a) Number of four wheelers at ground level – 80

b) Number of two wheelers at ground level – 185 + top level 185

c) Total capacity- 370

d) Screen wall detail using spirox panel with M.S Fabrication as future element

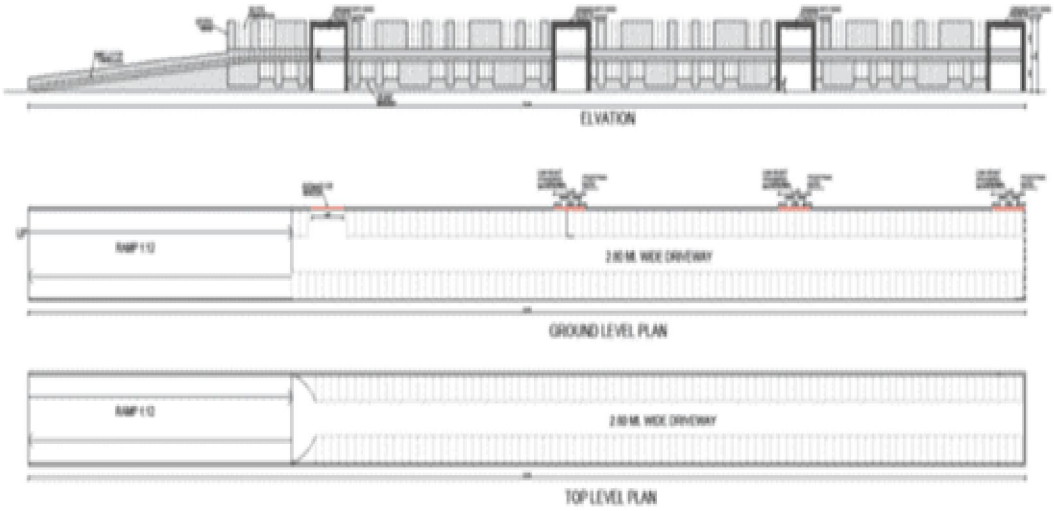

Fig. 23 A. Parking level section

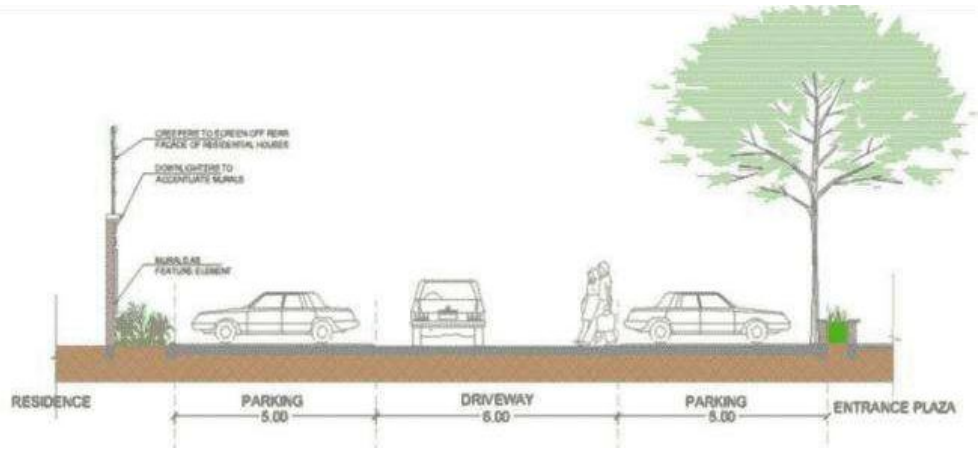

Fig. 23 B. Parking level section

6) *Activity Zone*

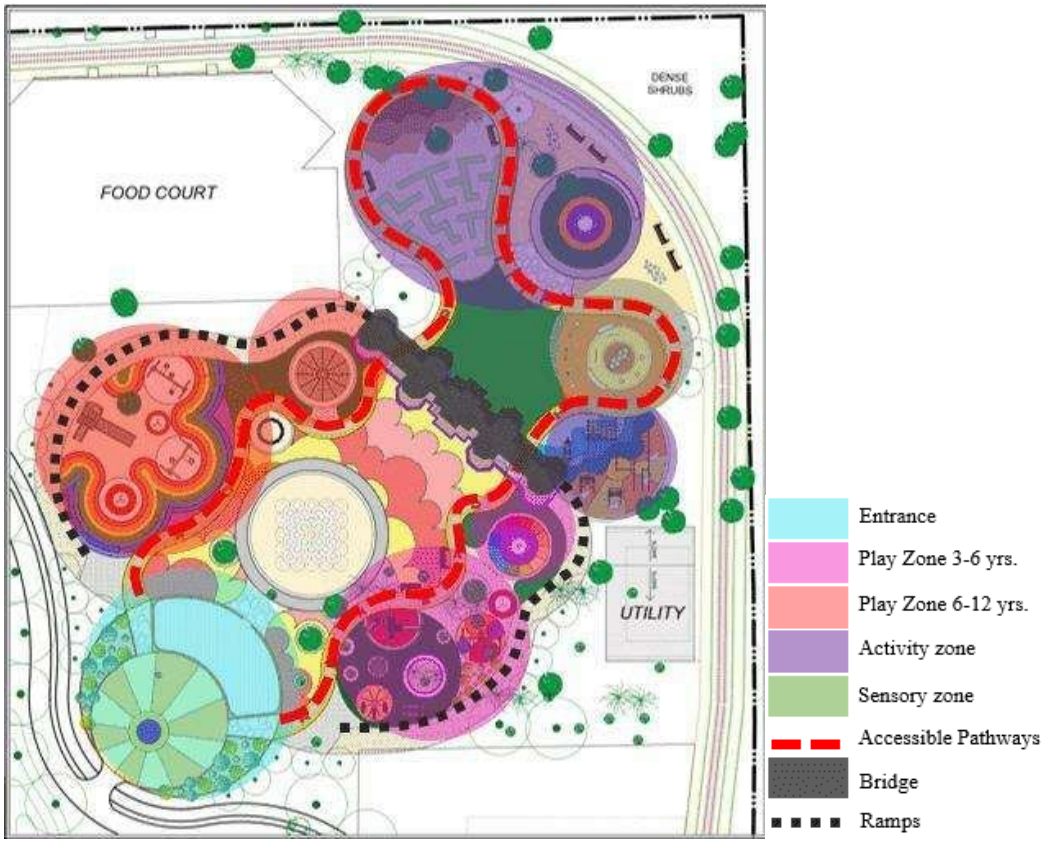

Fig. 24 Activity Zoning

The activity zone engages the child in active play area. This enhances the perception of space and surroundings.

a) Dedicated Play Zones
b) Wheelchair accessible equipment.
c) Impact free rubberized flooring
d) Markings to guide through the park.
e) Use of recycled material.

- Cycling Track for children and adult with pedestrian walking space.

Fig. 25. Cycle Track

- Open Gym with equipment specially adapted to the needs of especially abled children. These equipments are all inclusive.

Fig. 26. Open gym for Special children

- The sensory zone engages the child with various experiences in form of light, sound, smell, textures, and colors. (Fig. 26)

Fig. 27 A. Sensory Zone

Fig. 27 B. Sensory Zone

4.5.6.1 Street Furniture

a. Lighting

b. Seating

c. Signage

Fig. 28 A

Fig. 28 B

Street light and Bollards for ambient Lighting

Fig. 29 A. Seating around trees under natural shade to increase the green spaces

Fig. 29 B. Low maintenance benches inert to vandalism

Fig. 29 C. Seating for kids

Fig. 29 D. Map of the park at Entrance

4.5.6.2 Amenities

a. Utilities

b. Solid Waste Management

Fig. 30 A. Food Vendor Kiosks

Fig. 30 B. Water drinking spots

Fig. 30 C. large number of horticulture waste can be utilized through proper compositing

Fig. 30 D. Leaf litter composting pit
Of dimension 2.4m x 3m x 1.5m

4.5.6.2 Wall Art

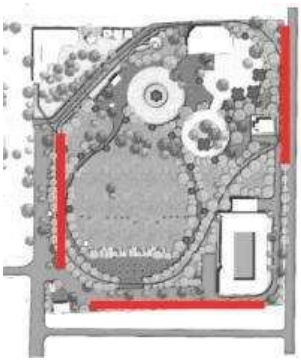

Fig. 31 A. Wall art locations

Fig. 31 B. Wall art through paintings and textures

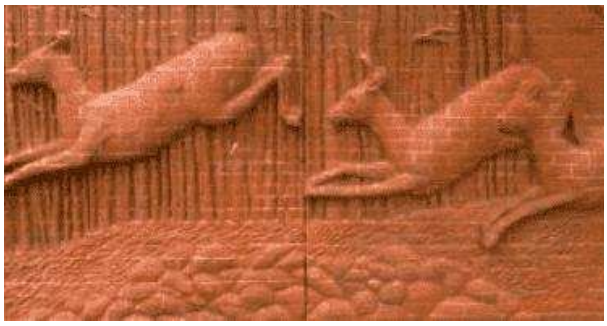

Fig. 31 C Siporex work on multilevel parking façade

4.5.6.3 Landscaping

Fig. 32 A. Porous pavers to increase water percolation

Fig. 32 B. Sun dial for kids

Fig. 32 C. Grass mounds with tunnels

Fig. 32 D. QR coded and geo-referenced existing trees

F. Conclusion

The concern over disproportionate appropriation of urban space and opportunities by the rich, and that 41 million (about 26 per cent) of the 158 million children in the country lived in urban areas, eight million of them in slums. Urban planners, architects and stakeholders to aim at creating an enabling environment for children for their all-round development.

While urban planning in the country focused on issues such as infrastructure development, sanitation and waste management, it was time city master-plans incorporated specific chapters to meet the needs of children and providing adequate open spaces and play centers to nurture children's creative faculties, and said "inclusive and child-sensitive" urban development strategies were the need of the hour.

Toy Station Entrance Plaza Central Lawn

Fig 33. Final View of the park

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VI. LANDSCAPING – RIVERFRONT DEVELOPMENT

A. Introduction

Sir Geddes inculcated elements of 'Garden City' concept in his plan for Indore and proposed construction of new suburbs on the said concept, i.e., a mix of country and town features. By proper levelling of these gardens, any excess of rainfall will be passed off into the storm water drains along the neighboring road-sides (Geddes, 1918).

Holkar's made check dams on river Kahn for using its water for drinking and other purposes. During their time, people practiced a mix of open defecation and toilets. All the silage and sewage was let off into the water body without scientific treatment. Since the population of Indore was not more than 1.5 lakhs, they relied on the river's self-cleaning mechanism for treatment of sewage flowing through the city.

Under Indore smart city mission, Riverfront Development has been taken as a pioneer project as they play a major role in the urban transformation of the Indore city. ISCDL envisaged developing a stretch of around 3.9kms by creating embankment walls, Prom-evade, walkways, parks, parking etc. The total length of 3.9 km has been divided into 8 stretches to carry out the work under Smart City Mission.

B. Present Scenerio

Indore is situated on the western part of the malwa (historically known as Deccan) plateau on the banks of two rivers, the Kahn and the Sarawati. These rivers meet at the center core area of the city, where the small 18th century temple of Sangamnath, the historical Chhatri, or Hindu temples and places, and the Rajwada area are located.

C. Background

Indore lies on the northern margin of the Deccan plateau, on the leeward side of the Vindhychal mountain range, which is on border of Ganga & Narmada basin. Central Indore lies at the confluence of the Sarawati - Kahn Rivers.

The total length of the two rivers Kahn, and Sarawati, traversing through Indore Municipal Corporation is approximately 44km whose widths vary from 25m to 60m.

At present the rivers are unhygienic, neglected and characterized by unplanned development. The city has turned its back to these rivers.

In order to cope up with these current issues and create a meaningful public realm along the river, the Indore Municipal Corporation has taken up the River Rejuvenation Plan for the two rivers and its tributaries in entire Indore Municipal Corporation area. This Report provides a brief background of the River Rejuvenation Project for Kahn, Sarawati Rivers and its tributaries in Indore city. It comprehensively analyzes and compiles all the parameters of the existing river and adjacent land.

Fig. 34. Riverfront development Map

D. Introduction To Neutral Drainage System In Indore

Indore, the largest city in the central state of Madhya Pradesh is blessed with two rivulets (River Kahn and River Sarawati) and their tributaries. It is pertinent to be mention here that the work on rejuvenation of River Kahn is already in progress since the year 2017 under Smart City mission and the various works related to abatement of pollution in River Sarawati has already been completed.

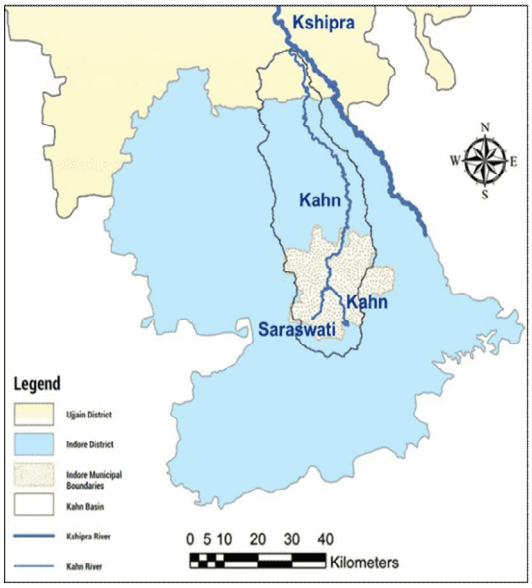


Fig. 35. Kahn and Sarawati River in Indore and Ujjain district

The Kahn River, a tributary of the River Kshipra, rises from a hill near village Umaria (22º 37' N and 75º 54' E) about seven miles south of Indore. It then flows from Krishnapura Chhatri, through Sanwer town & joins river Kshipra at Triveni Sangam near Ujjain after travelling distance of about 72 Kms. River Sarawati originates from Hukmakhedi Pond and joins river Kahn at Krishnapura Chhatri called Sangam. The Khan Joins the Kshipra in Ujjain

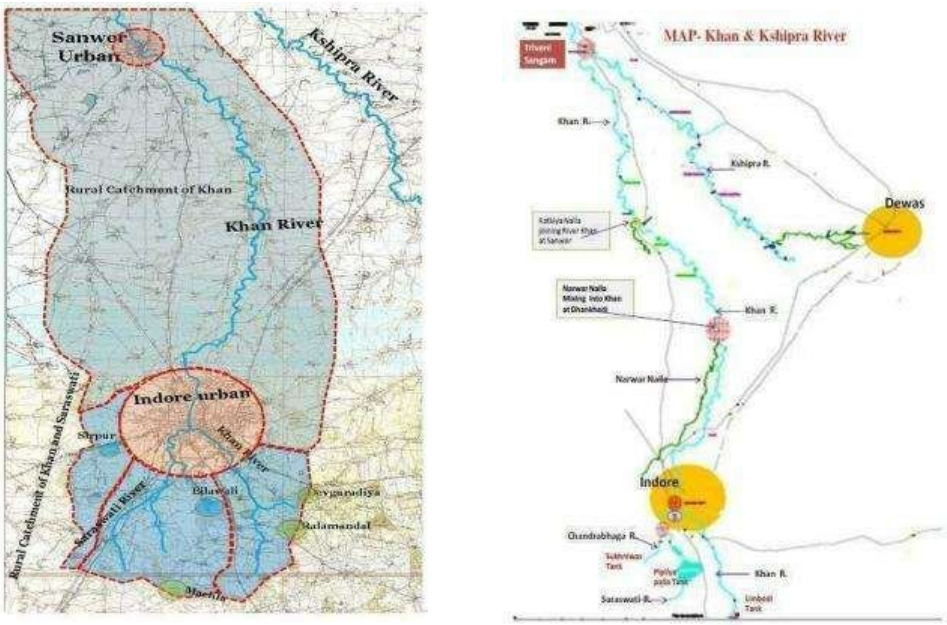


Fig. 36. Regional linkage of river kahn and Saraswati in Indore

E. AIM and Objective of The Project

Rejuvenation and redevelopment of rivers Kahn and Sarawati through 100% abatement of pollution and landscaping of the riverside. The main objective of this project is

1) To protect the environmental health of the rivers within and beyond the city boundary through abatement of pollution
2) To improve public health within and beyond the city boundary through safe sanitation and clean water discharge into the rivers
3) To improve the ground water level as well as quality of water
4) To develop the green pedestrian improvement
5) To convert the river as backyard to green and clean front yard of adjoining properties.

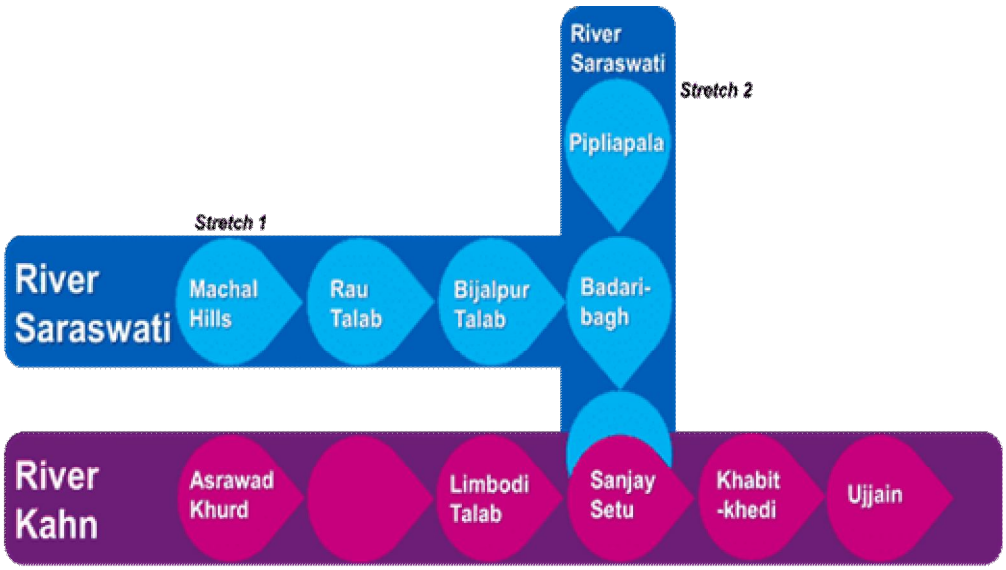


Fig. 37. Route of both the rivers

The approach followed by Smart City Indore has three-pronged approach to river restoration in Indore comprises the following:

- *Comprehensive:* Proposed indigenous solutions in a scientific manner that mimic natural systems of restoring water.
- *Sustainable:* Catered to the immediate needs of giving people access to safe waterfront and ensures reliable ecosystem services in the future.
- *Community-ownership:* Citizen led and citizen driven initiation and implementation.

F. Methodology

Given the extensively wide expanse and importance of the water bodies in the city, it is imperative to safeguard their cleanliness and environmental health. Being non-perennial/ intermittent rivers, the action plan for maintaining water quality will be different from that of the perennial rivers. The main focus will be on maintaining a safe and clean water flow in the rivers all throughout the year. With the aim of river rejuvenation at its heart, the city has pledged to take on the following measures in this regard:

1) Decentralized city sanitation system
2) Reuse of treated wastewater
3) River rejuvenation and redevelopment through treated wastewater
4) Ensuring encroachment free and GVP free water bodies

As a process in urban renewal, the Kahn-Saraswati Riverfront Development Project has all the elements of;

- Environmental,
- Transform the non-perennial river
- Cultural and social sustainability
- Financial

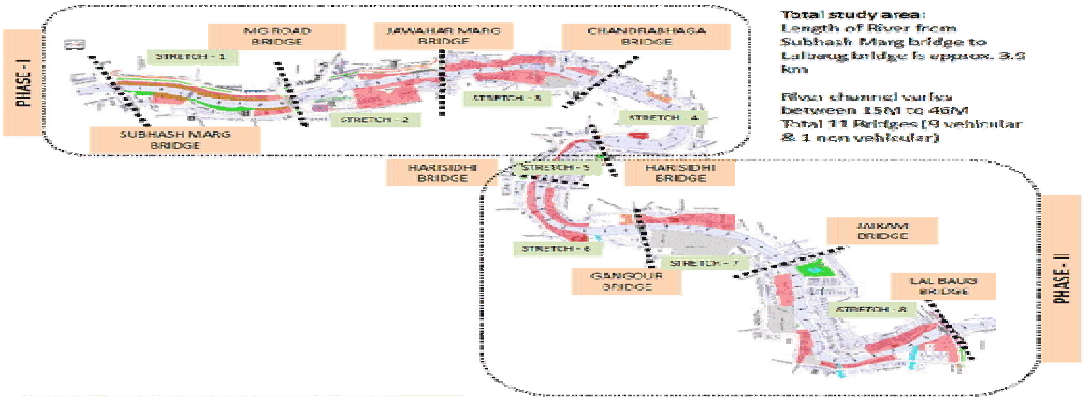


Fig. 38. The 8 stretches of the riverfront

Table III
Challenges and Difficulties

ENVIRONMENTAL	PHYSICAL	SOCIAL
Soil Erosion	Encroachment and waste dumping	River is converted as backyard
Along river edge	Uneven bed width leading to erosion or water spread	Detachment of water body due to misuse and inaccessibility
Sewage auto fall in river	Insufficient flow capacity leading to ponding	Unpleasant life due to foul smell and filthy look
Contamination of surface/ground water	Flooding in slum area	Encroachment and illegal activities
Stagnation due to waste disposal in river		

Fig. 39 A. Slum area

Fig. 39 B Slum area

Fig. 39 C. River

Fig. 39 D. River

G. Planning Perspective

From the planning perspective, a hierarchy and network of quality green spaces integrating residential areas with commercial and other uses improve the accessibility and attractiveness of local facilities and employment centers.

2 SITES IN ABD AREA OF INDORE WAS CHOSEN TO DEVELOP AND PLAN AROUND THE RIVER KAHN AND SARASWATI

Following things were kept in mind while planning was done. NBC was followed.

1) Maximum use of the natural landscaping features of the area was done.
2) For seating mounds were made usable instead of concrete benches
3) The seating was made 1.5 m wide as a person requires 1.2m to 1.8 m to sit properly.
4) No trees were cut or displaced so as to maintain the natural beauty of the place
5) Spaces for Yoga and exercise were created to create awareness of healthy lifestyle amongst the citizens.
6) Planning was kept as organic as possible that is no concrete/ less concrete was used to build this place.
7) A walking track of 2 m wide was made that is a standard dimension for accident-free two-way travel for pedestrians.

LOCATION 1 – Near Kahn River

Area – 11,623 sq. m

This area is situated in proximity to ABD area of Indore and is a part of old Indore. The area is densely populated with residential colonies and connects to the industrial area, Pologround of the city.

Fig. 40 A Location 1

Fig. 40 B. Kahn River, Near Lokhande Bridge

LOCATION 2- Near Sarawati River
Area - 13,071 sq. m
.

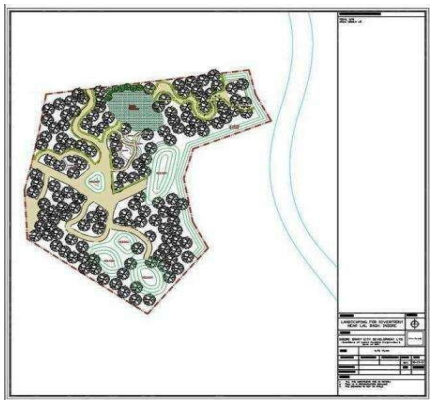


Fig. 41 A. Location 2

Fig. 41 B. Kahn River, Near Lokhande Bridge

The above-mentioned location is a little far away from the Old Indore but is covered in the ABD area. Lal Bagh palace is situated nearby which makes this place most visited place for tourists and hence had to be developed to enhance the scenic beauty

H. Conclusion

1) Clean and healthy water flowing through the city, contributing to better environmental health
2) Clean water in the river flowing beyond Indore to other cities, as a part of Indore's socio-cultural responsibility
3) A safe and clean water flow in the non-perennial rivers all throughout the year
4) A dry and clean natural storm water drains during the non-monsoon season
5) Improvement in public health and sanitary living conditions around the water bodies
6) Development of green area

This was an environmentally conscious approach for integration of the river into the urban fabric development. There has been an appropriate consideration of the natural potential of the land for developing into a biodiversity zone for conserving the natural heritage of the river basin as well as the local and transient requirements of facilities at the city level, like large level city greens of varying nature along with some recreational facilities.

VII.HAWKER'S ZONE PLANNING

A. Introduction

Street vending as a profession has been in existence in India since time immemorial. However, their number has increased manifold in the recent years.

Some studies estimate that street vendors constitute approximately 2% of the population of a metropolis. The total number of street vendors in the country is estimated at around 1 crore. Urban vending is not only a source of employment but provides 'affordable' services to the majority of urban population. The role played by the hawkers in the economy needs to be given due credit but they are considered as unlawful entities and are subjected to continuous harassment by Police and civic authorities.

This is reported to be continuing even after the ruling of the Supreme Court that "if properly regulated according to the exigency of the circumstances, the small traders on the sidewalks can considerably add to the comfort and convenience of the general public, by making available ordinary articles of everyday use for a comparatively lesser price. The right to carry on trade or business mentioned in Article 19(1) g of the Constitution, on street pavements, if properly regulated cannot be denied on the ground that the streets are meant exclusively for passing or re-passing and no other use."

There are 16 locations in Indore shortlisted for creating a space for the vendors nearby those areas. Indore being the cleanest city for the 4th time in a row in country has taken this initiative to provide hawker's a space they need and carry out their business without police dislocating them or them disturbing the traffic.

B. Overarching Objective

The overarching objective to be achieved through this policy is to provide and promote a supportive environment for earning livelihoods to the Street vendors, as well as ensure absence of congestion and maintenance of hygiene in public spaces and streets.

1) *Legal:* To give vendors legal status by amending, enacting, repealing and implementing appropriate laws and providing legitimate hawking zones in urban development
2) *Facilities:* To provide facilities for appropriate use of identified space including the creation of hawking zones in the urban development/ zoning plans
3) *Regulation:* To eschew imposing numerical limits on access to public spaces by discretionary licenses and instead moving to nominal fee-based regulation of access, where market forces like price, quality and demand will determine the number of vendors that can be sustained.
4) *Role in Distribution:* To make Street vendors a special component of the urban development /zoning plans by treating them as an integral and legitimate part of the urban distribution system. ·
5) *Rehabilitation of Child Vendors:* To take measures for promoting a better future for child vendors by making appropriate interventions for their rehabilitation and schooling.
6) *Social Security & Financial Services:* To facilitate/ promote social security (pension, insurance, etc.,) and access to credit for Street vendors through promotion of SHGs/co-operatives/Federations/Micro Finance Institutions (MFIs) etc.

C. Design Parameters

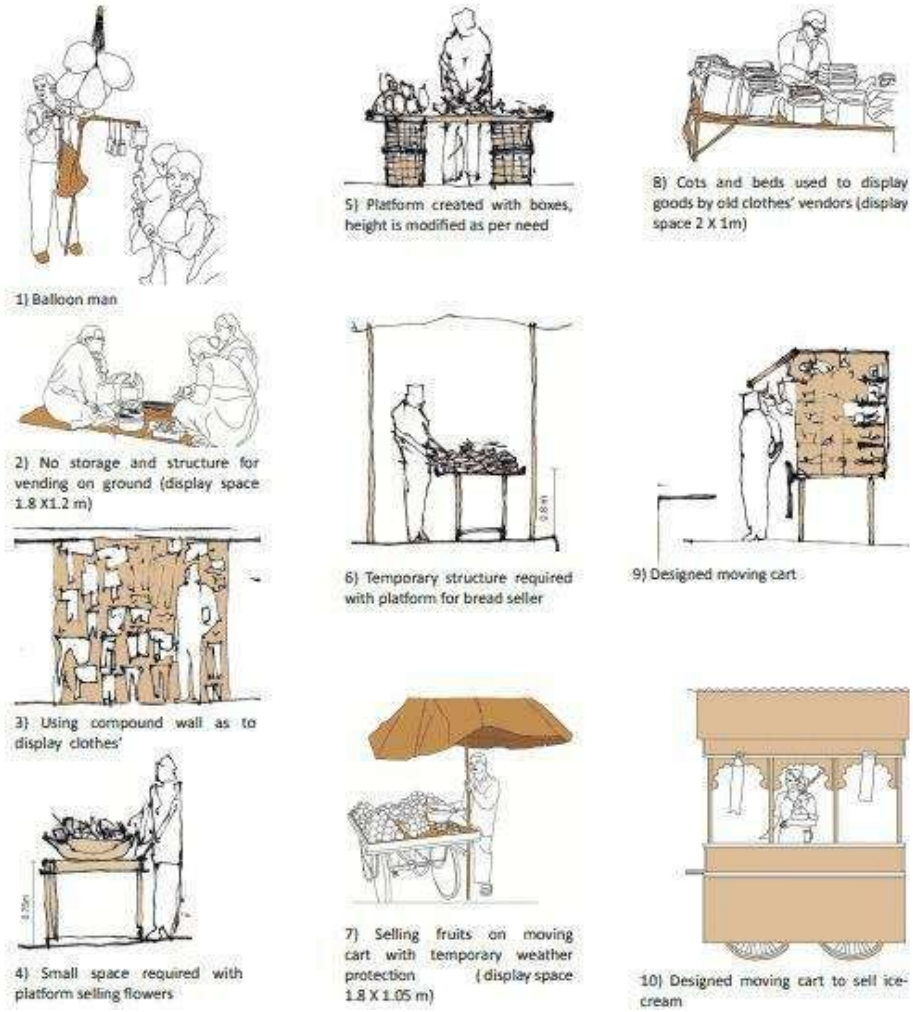


Fig. 42. Most common forms of vending display

According to the National policy of street vendors following are the details we incorporated in out plans to design the hawker's zone in Indore. As the spaces for the shops (carts) are important so is the utilities, drinking spots and commercial shops important for the zone. Since the Solid Waste Management will be collected collectively for one whole zone the waste points are needed to be specified. Parking spaces for the people is a necessity.

Following are the specifications and dimensions:

1) Enough green spaces
2) Proper solid waste collection points, and central road of 4.5 m wide for easy movement of the SWM vehicle was planned
3) Proper utility spaces were made for the people and the hawkers in that zone depending on the dimension of the spac
4) Food zones if needed
5) Parking spaces were made so that no vehicle is parked on main roads
6) A few commercial shops were planned
7) Fixed dimensions of shops were made
a) big shops: 2.4 m by 2.4 m
b) small shops: 2 m by 1.5 m

D. Design Layouts

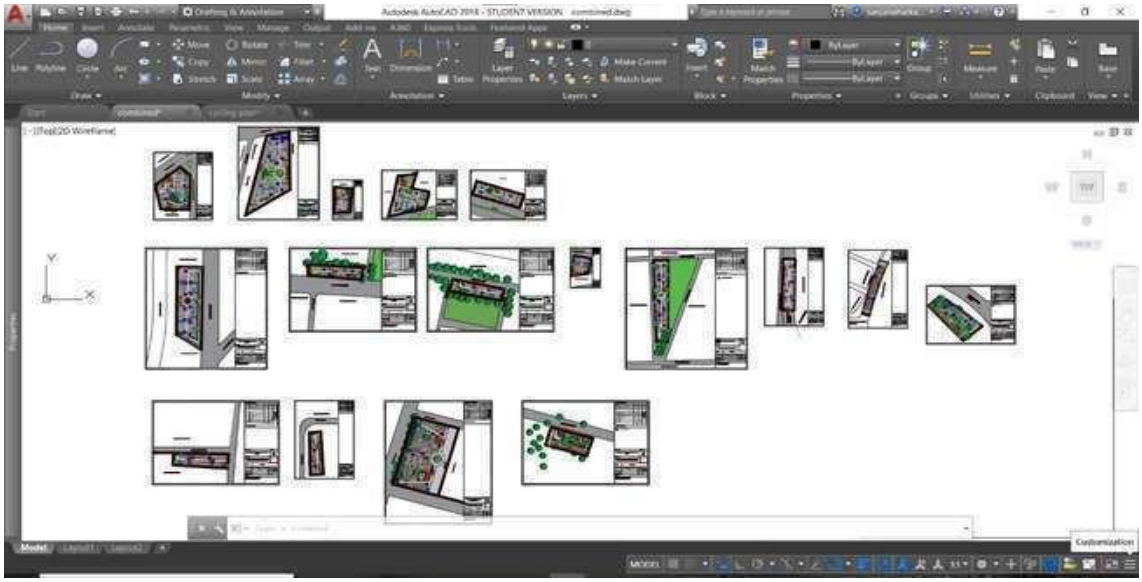
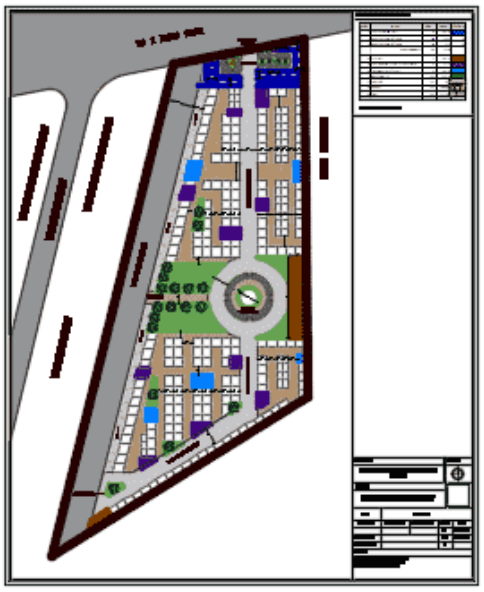
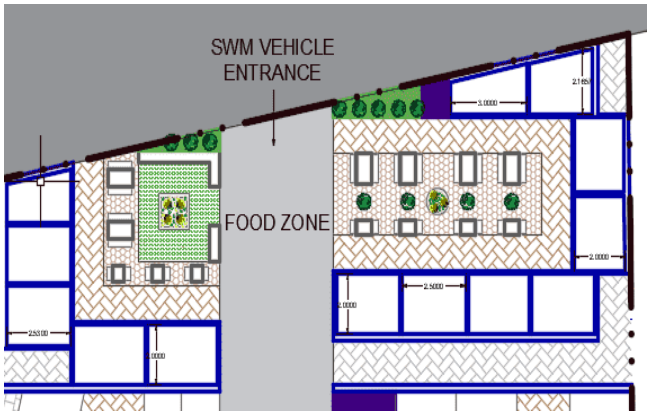


Fig. 43 Sixteen Plans

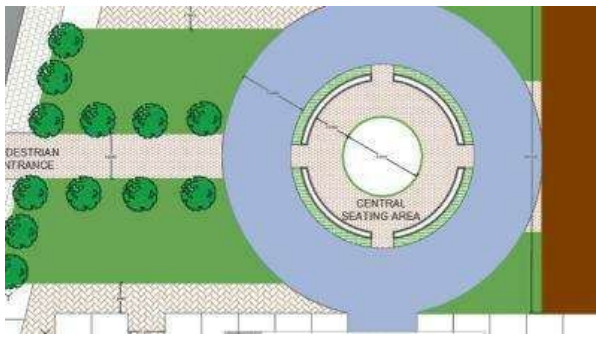




AREA STATEMENT AND INDEX:

S.NO.	ENTITY	NOS.	AREA	COLOUR
1	FOOD ZONE SHOPS	13	63.4	
2	HAWKERS (PLATFORM)	186	1079	nil
3	HAWKERS (PLATFORM)	45	135	nil
	Total Hawkers	**231**	**1214**	
4	UTILITIES	2	99.8	
5	SOLID WASTE COLLECTION POINTS	11	71.9	
6	COMMERCIAL POINTS	5	42.6	
7	GREEN SPACE	nil	295.9	
8	PARKING	nil	243	
9	PAVERS	nil	1068.4	
10	ROAD	nil	1713.5	
		Total	4812.5	

TOTAL SITE AREA: 4872.80 m²



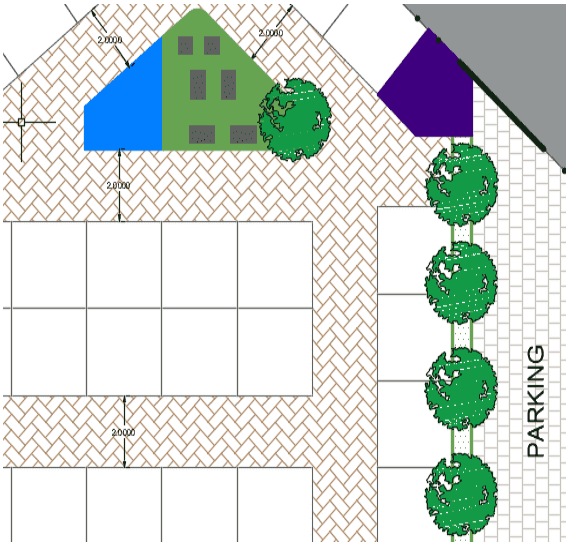
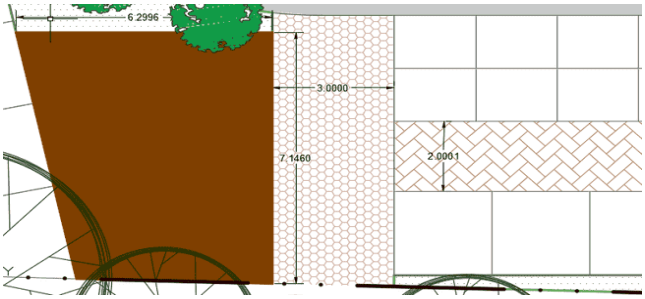


Fig. 44. Pipliyahana Indore

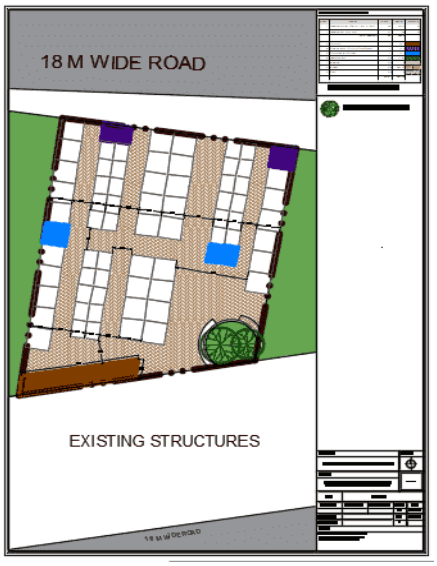


AREA STATEMENT AND INDEX:

S.NO.	ENTITY	NOS.	AREA	COLOUR
1	HAWKERS (PLATFORM)	117	669.7	nil
2	HAWKERS (PLATFORM)	47	141	nil
	Total Hawkers	**164**	**810.7**	
3	UTILITIES	2	72.7	
4	SOLID WASTE COLLECTION POINTS	8	32.1	
5	COMMERCIAL POINTS	6	40.1	
6	GREEN SPACE	nil	172.8	
7	PARKING	nil	247	
8	PAVERS	nil	736.3	
9	ROAD	nil	422.7	
		Total	2534.4	

TOTAL SITE AREA: 2546.4 m²

Fig. 45 Khajrana Indore



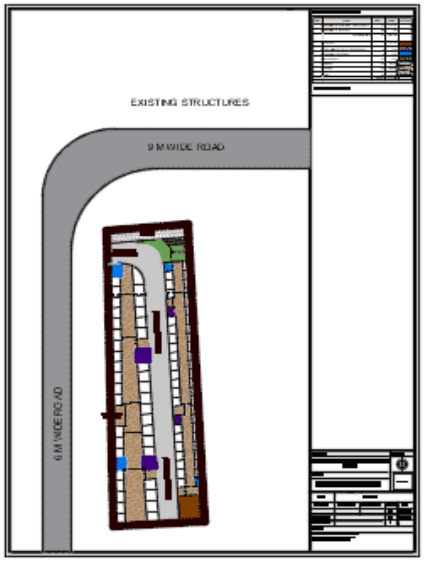


Fig. 46 LIG Link Road Indore

Fig. 47 Hawa Bungalow Indore

E. Conclusion

Street hawkers can be assets to the urban system if they are given the opportunity to contribute to its development. Being a part of the marginalized urban poor, they are treated as trouble-makers whose sole purpose is to create chaos on the streets. Whenever the question of citizens' initiatives for improving cities arises, the reference is invariably to the middle and upper middle class. The vast majority of the urban population is not only kept out of these initiatives but they are, more often than not, regarded as the main problem. The fact is that no plan for improving the city can be successful without the participation of the urban poor. They need to be integrated into the planning process and in the campaigns for better environment. With the NPUSV and passing of The Street Hawkers (Protection of Livelihood and Regulation of Street Vending) Act, 2014, it would be mandatory to making hawking and no-hawking in each city/ town of India. A proper allocation of hawking space is done with reference to accommodating them according to their space requirements and the work will get started soon.

VIII. CONCLUSION

Indore has now a proper proposed plan for cycling track that will be built and this will hence result in less pollution in city, will keep citizens fit. By developing the riverfront, it will enhance the tourism in Indore, will make Indore more eco-friendly. The riverfront can be used by all the citizens for the recreation purpose and also this could help Indore to keep its river clean. Scattered street vendors won't disturb the traffic areas and would have a proper accessible space for their daily work as well. This will help Indore to keep the roads clean and reduce the accidents and traffic. All abilities children park will help the disabled child to not be behind others in playing and also this will help Indore to become 1st ever city in Madhya Pradesh to have a accessible park like this.

IX. ACKNOWLEDGEMENTS

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List of Abbreviations

MOHUA	Ministry of Housing Urban Affairs
HUDCO	Housing Urban Development Corporation
SDGs	Sustainable Development Goals
FAR	Fixed Area Ratio
MUZ	Multi Usable Zone
IoT	Internet Of Things
ICT	Information and Communication Technology
ABD	Area Based Development
Ha	Hectares
NPUSV	National Policy of Urban Street Vendors
NBC	National Building Code
FDI	Foreign Direct Investment
UTTIPEC	Unified Traffic and Transportation Infrastructure (Planning and Engineering) Centre
AICTSL	Atal Indore City Transport Service Limited

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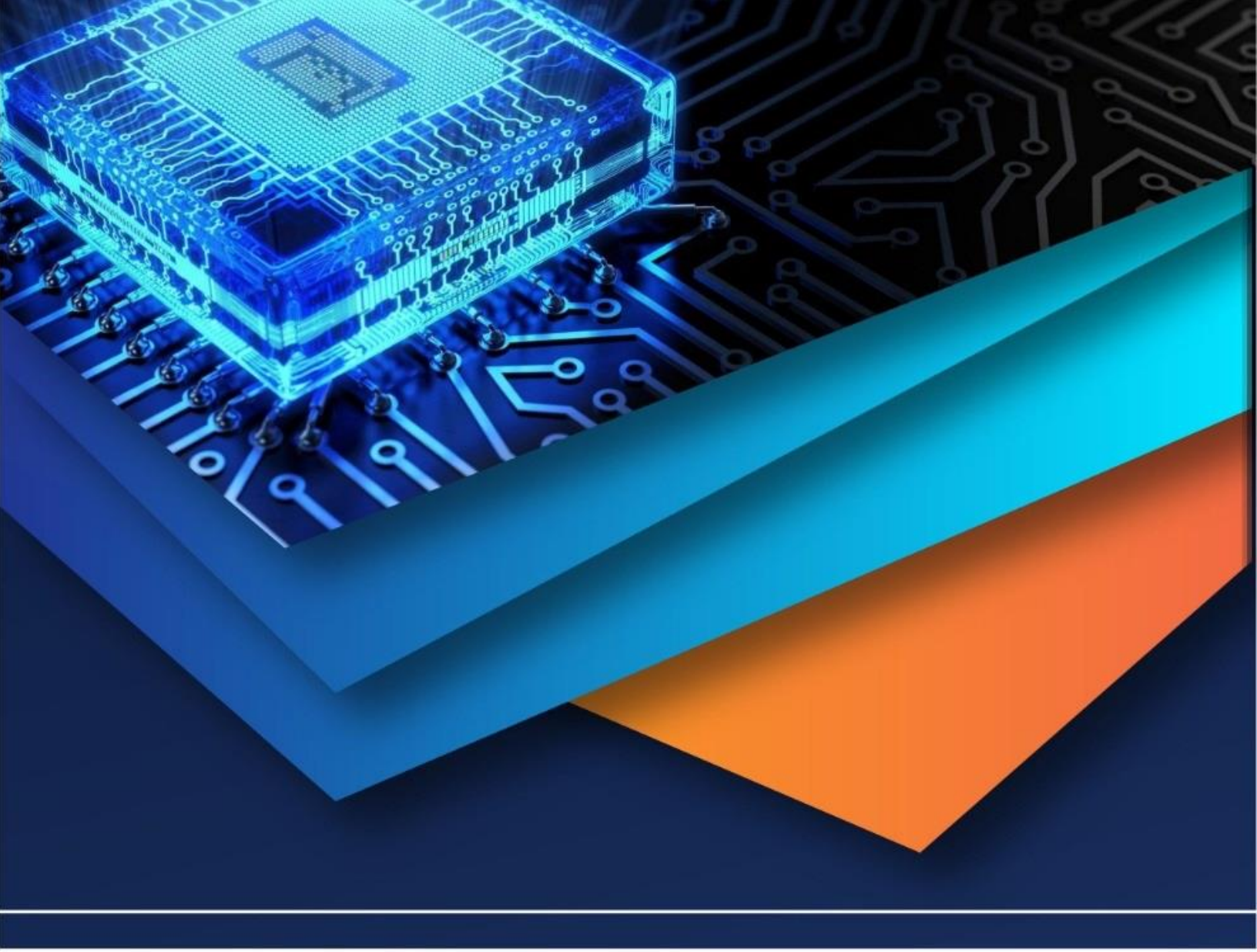

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