



INDIAN KNOWLEDGE SYSTEMS DIVISION

Ministry of Education, Govt of India.

AICTE Headquarters, Nelson Mandela Marg, Vasant Kunj, New Delhi-110070.

Website: www.iksindia.org

Tel: 011-29581523/1004.

PROJECT COMPLETION REPORT

Important Points:

- i. The Project Completion Report (PCR) should cover the complete work done during the entire project.
- ii. Timely submission of report is essential to facilitate release of funds.
- iii. Report should be in the format given below.
- iv. Write “NIL” against items where there is nothing significant to report or if these items are not relevant.
- v. One soft copy in .pdf format of the report giving information on items listed in the format given below are required. There is no requirement to send a hardcopy.

PROJECT COMPLETION REPORT

DESIGNING A PROTOTYPE SETTLEMENT FOR A CONTEMPORARY SUSTAINABLE TOWN AS PER THE PRESCRIPTIONS OF VAASTUSHAstra

SUBMITTED BY

Prof. Avlokita Agrawal
Associate Professor

Department of Architecture and Planning
IIT Roorkee
Uttarakhand - 247667.

&

Prof. Pravesh Vyas
Assistant Professor

Lal Bahadur Shastri Sanskrit Vidyapeeth.

(26 December 2024)

FUNDED BY

**Indian Knowledge Systems Division of Ministry of Education,
Govt of India**

IKS Division File Reference No: AICTE/IKS/RFP01/2021-22/06

Project Duration: From 23 June 2022 to March 2024

PROJECT COMPLETION REPORT

One soft copy of the Project Completion Report should be submitted on email. The Report should consist of Part A - Summary Report and Part B - Comprehensive Report. The report should be on the Standard Format provided.

1. Project Title: Designing a Prototype Settlement for a Contemporary Sustainable Town as per the prescriptions of Vaastushastra.

2. Duration of Project: From 23 June 2022 to March 2024

3. Focus Area: Architecture and Planning &
Sustainable Built Environment as per Vaastushastra

4. Principal Investigator

Name: Prof. Avlokita Agrawal.

Organisation/Institution: Associate Professor,

Department of Architecture and Planning, IIT Roorkee.

5. Co-Principal Investigator/s

Name: Prof. Pravesh Vyas.

Organisation/Institution: Assistant Professor,

Lal Bahadur Shastri Sanskrit Vidyapeeth.

6. Collaborating Organisations

Organisation	Team Members	Activities/Tasks assigned
NIL	NIL	NIL

Part A - Summary Report

1. Project Objectives

Objective as per the approved Project	Fully Achieved/Partially Achieved (indicate shortfall)	Reason for Partial Achievement
I. Study the ancient treatises of Vaastushastra for relevant content on city planning and list the prescriptions for the same.	Fully Achieved	NIL
II. Study the current prevailing city/town planning codes and guidelines applicable in modern times.	Fully Achieved	NIL
III. Document case studies of towns designed as per Vaastushastra prescriptions.	Fully Achieved	NIL
IV. Develop the prototype for contemporary sustainable city based upon prescriptions of Vaastushastra and guidelines of planning codes.	Fully Achieved	NIL

2. Deliverables

Deliverables as per the approved Project	Fully/Partially/Not Achieved	Reason for Partial/ Non-Achievement
Journal paper Publication	Fully Achieved	NIL
Conference paper Publication	Fully Achieved	NIL

3. Specific Benefits/Outcome

(Please give details)

- Patent, if any: **NIL**
- Product/Process developed/ technology transferred: **NIL**
- List of Publications arising from the Project
- Published and presented a paper on “**Assessment of Spatial sustainability of settlement layouts prescribed in Vaastu shastra using space syntax**”, Sandeep Kasina and Avlokita Agrawal, International Conference of Contemporary Affairs in Architecture and Urbanism (ICCAUA) 2022 / 2023, Turkey.
- “**Are Indian Cities Deteriorating Socio-Culturally Due to Adoption Of Western City Design Theories?**”, Kumar Jyoti Nandy and Avlokita Agrawal, Published and presented at International Conference of The ‘Urban Futures - Cultural Pasts – Barcelona, July 15-17, 2024
- “**The Inclusivity of System of Measurement of Space & Proportion in Silpa-Sastras: A Comparative Anthropometric Approach with European Design Perspectives**” (IJTK-#1577) by Avlokita Agrawal*, Kumar Jyoti Nandy, Sonali & Rajat Agrawal, Indian Journal of Traditional Knowledge (IJTK) Accepted for publication (communication received on 18th December 2024, to be published in Special issue on Architecture of IJTK) : **Impact Factor of IJTK is 1.091 (JCR 2021).**
- Linkages developed: **NIL**

4. Manpower trained

- No. of Students based on the project: **06**
- No. of Master’s Thesis/Reports based on the project: **02**
- Position and Number of Other Technical Staff Trained: **01**

5. Methodology (Minimum 250 Words):

The proposed study is largely literature based. It requires exhaustive literature review. Unfortunately, a lot of original literature of Vaastu Shastra is not available currently. Most of the books on Vaastu Shastra have been destroyed in the past 500 years. Those which survived the abuse, are written in original forms of languages which are difficult to decipher today. Thus, very few books on city planning have been converted to understandable language and form currently. The team has retrieved content from the books written in Sanskrit and also the translations of such books available. The content thus retrieved has been processed. Further, the prototype of a Contemporary Sustainable City is being developed.

• Salient Research Achievements

- i. Prototype Development.
- ii. Comparison of International City design theories with Vaastu Shastra City design Theories.
- iii. Using Space Syntax for the first time for assessing City design theories based on Vaastu Shastra.
- iv. Comparing URDPFI with Vaastu Shastra.

• **New Observations (minimum 200 words):**

- i. A sequential layered design and planning approach of settlements - the Vaastu shastra way.
- ii. System of Measurement of Space in Ancient India & Europe – An Anthropometric approach.
- iii. Assessment of Spatial sustainability of settlement layouts prescribed in Vaastu shastra using space syntax.
- iv. Comparison of City Design Approach of Modern City Design Theories and Nagar Vidhaan as per Vaastu Shastra.

Three western city design theories were studied – Garden City Concept, Radburn City Concept and Neighborhood Unit Concept.

In all the three international concepts, there were similarities with prescriptions of Settlement Design as per Vaastu Shastra. Following can be observed clearly-

- a. Limitation of population and number of housing units/density- All concepts limit the maximum population for which the city is to be designed.
- b. Complete master plan to be designed before start of the project – Complete master plan had to be designed even before the implementation began.
- c. Ecological services- Mandatory allocation of ecological services such as forest cover and water bodies have been proposed.
- d. Agriculture as an integral part – unlike the modern understanding of cities, all the three concepts integrate agricultural farmlands as an integral part of a self-sustaining city.
- e. Humans at the center- Like Vaastu Shastra, all the three concepts placed people at the center of whole concept. All cities were envisaged to be designed as walkable, free from traffic, having easy access to basic amenities and having less traffic, noise and pollution.
- f. Industrial unit integration- All concepts integrated industrial units within the concept.
- g. Geometrical configuration – All the concepts proposed a geometric configuration of the proposed city.

Additional features proposed in Vaastu Shastra-

- a. Unlike only one geometric configuration proposed in each of these concepts, Vaastu prescribes multiple geometric configurations.
- b. Unlike only one scale of settlement proposed in contemporary concepts, Vaastu proposes multiple scales of settlement design thereby proposing to design all settlements starting from the smallest scale of a village to that of a large city as per the prescriptions.
- c. Vaastu lays special emphasis on folk planning. It emphasizes diversity of occupations to be ensured within a city. However, planning plays a tool to equalize any inequalities that may be there.
- d. Vaastu has specific prescription to ensure how expansion of any city should happen without disturbing the essential ecosystem services and also by ensuring that any upcoming expansion is also self-sustainable.
- v. Comparison of City design guidelines as per URDPFI and Vaastu Shastra.

By comparing the prescriptions of Vastu Shastra and the guidelines of URDPFI, it can be concluded that the attempt of both is to achieve sustainable development through city design. There are certain points which have been emphasized in URDPFI while there are certain others that find a mention in Vastu Shastra. In order to be able to develop a prototype of city design Based upon principles of

Vastu Shastra it has to be contextualized to the modern-day requirements. This can be Based upon the understanding of URDPFI.

vi. Space Syntax Analysis.

It is evident from this section that all the three cities (which were based on Principles of Vaastu Shastra) and examined for their spatial sustainability, reveal that these cities continued to remain spatially sustainable even after several centuries of being in use. Thereby proving that Vaastu Principles can be applied in modern times to achieve sustainability.

Both contemporary city design theories and Vaastu shastra Principles give very good results as far as spatial sustainability is concerned. A contextualized prototype of City Design based upon Vaastu Shastra shall be developed based upon principles of Vastu and also integrating the learnings from URDPFI and contemporary city design theories.

vii. Prototype City Design Development based upon Vaastu Shastra Principles and contextualized using URDPFI.

• **Innovations (Give bulleted list):**

- Thousands of iterations based on multiple layers can be generated for any scale of settlement through an algorithmic approach.

6. Indication of scope for future work (Maximum 300 Words):

- Incorporation of Vaastu based city planning prescriptions while defining Urban Planning Guidelines for urban and rural development plans in India.
- Development of Online tool to generate spatial layout for development plan for any scale of settlement.
- Development of city & regional planning bye-laws based upon prescriptions of Vaastushastra.
- New City Planning Theories can be formulated by considering the Vaastu principles of Nagara-Vidhanam mentioned in different ancient treatises of Vaastu-Shastra.
- Exhaustive study of the treatises of Vaastu-Shastra will help in some way or other to develop several holistic prototype plans for any town, city, village or region.
- Taking into consideration the vision of National Education Policy (NEP) 2020, course modules of Ancient Indian Town, City & Regional Planning's Knowledge Systems are required to be prepared for the primary to higher studies' students.
- Several internship programs for the students, teacher's training programs, certificate courses related to Ancient Indian Town, City & Regional Planning's Knowledge Systems can be organized who are interested to know and implement them in their practice

7. Procurement/Usage of Equipment:

Sr.	Name of Equipment	Make/ Model	Cost (Rs.)	Date of Purchase & Installation	Remarks regarding maintenance/ breakdown
NIL	NIL	NIL	NIL	NIL	NIL

Part B – Comprehensive Report

(The Comprehensive Report should be precise in detail and self-contained)

1. Project Title: Designing a Prototype Settlement for a Contemporary Sustainable Town as per the prescriptions of Vaastushastra.

2. Literature Review

- Identify gaps in knowledge that your project aims to address
- Explain how your research builds upon or contributes to existing knowledge

i.) Ancient treatises of Vaastu shastra for relevant content on city planning and list the prescriptions for the same have been studied.

- A total of 87 literary resources are identified in original Sanskrit, Sanskrit to English and Hindi translations related to the Vaastu shastra originated from various parts of India. Also 22 Contemporary essays on interpretations of ancient Vaastu shastras are also identified.
- Vaastushastra texts have prescriptions ranging from Micro to macro scale of design.
- A matrix of prescriptions mentioned on various aspects of settlement planning like Settlement Typology; Settlement Layouts Topography; On Settlement Defences; Spatial Demographics; Urban Amenities from the selected texts.
- Illustrations of each type of settlement layout of a particular scale is also attempted, which further are analyzed spatially using space syntax method to understand the spatial configuration of these settlements.

ii.) The current prevailing city/town planning codes and guidelines applicable in modern times have been studied.

- Relevant codes and guidelines have been identified. URDPFI is the guideline which guides the formulation and implementation of Urban and Rural development plans. City Planning in Vaastushastra was meant to do exactly the same. Hence, URDPFI has been taken as a contemporary reference. Detailed reading of the URDPFI for interpretation of contemporary prescriptions has been completed.
- Four different modern city design theories namely- Garden City concept by Ebenezer Howard, Radburn City by Clarence S Stein, Neighbourhood City by Clarence Perry and Concise Townscape by Gordon Cullen are studied and compared to understand the philosophy behind modern city design theories and Vaastushastra Nagar Vinyas.

iii.) Case studies of towns designed as per Vaastushastra prescriptions have been documented.

- Three cities were identified to be documented (through literature) namely Jaipur, Madurai and Sadashivpet, through initial literature review.
- Data collection through literature has been completed.

3. Methodology adopted for Development of the Product/Process in the Research Project *(State briefly in 800 words)*

4. Description of the any Product/Process developed during the project

The prototype for contemporary sustainable city based upon prescriptions of Vaastushastra and guidelines of planning codes has been developed.

- Spatial layout is finalized for the prototype.
- Guidelines for the prototype have been prepared

5. Outputs & Outcomes:

a. Technology Development

- Technology developed at Lab scale/pilot scale/commercial scale:
- Technology demonstration in field setup - Yes/No
- Technology Transfer to industry: If Yes (Name of the Industry)
- Buyers/End users of product:
- Affordability: The cost-estimate of the developed prototype

b. Knowledge Creation

- Patent filings: **NIL.**
- Participation in conference/ training workshops attended:
 - i.) Published and presented a paper on “**Assessment of Spatial sustainability of settlement layouts prescribed in Vaastu shastra using space syntax**”, Sandeep Kasina and Avlokita Agrawal, at the International Conference of Contemporary Affairs in Architecture and Urbanism (ICCAUA), 2022 / 2023, Turkey.
 - ii.) Presented a paper on “**Are Indian Cities Deteriorating Socio-Culturally Due to Adoption of Western City Design Theories?**”, Kumar Jyoti Nandy and Avlokita Agrawal, at the International Conference of ‘Urban Futures - Cultural Pasts – Barcelona’, July 15-17, 2024.

c. Knowledge Dissemination

- Describe the strategies used to disseminate the research findings and knowledge.
- Examples of dissemination methods:
 - i. Conference presentations - **02**
 - ii. Workshops and training sessions - **01 (proposed)**
 - iii. Online resources (websites, open access repositories) – **NIL**
 - iv. List of Courses developed - **03**
 - v. Social media/other media outreach - **NIL**

d . Publications

Type of Publications	Number of Publications	List of Publications	Authors & Co-Authors	Theme of the publication	References/links of the Publications (link not required for books)
Research Papers	1	1	Dr. Avlokita Agrawal, Kumar Jyoti Nandy, Sonali, Dr. Rajat Agrawal	The Inclusivity of System of Measurement of Space & Proportion in <i>Silpa-Sastras</i> : A Comparative Anthropometric Approach with European Design Perspectives	NIL
Books	NIL	NIL	NIL	NIL	NIL
Articles	NIL	NIL	NIL	NIL	NIL
Poster presentations	NIL	NIL	NIL	NIL	NIL
Journals published through IKS center / Project	NIL	NIL	NIL	NIL	NIL
Magazines	NIL	NIL	NIL	NIL	NIL

e. Describe how the project resulted in integration of IKS and Contemporary knowledge.

I. A sequential layered design and planning approach of settlements - the Vaastu shastra way.

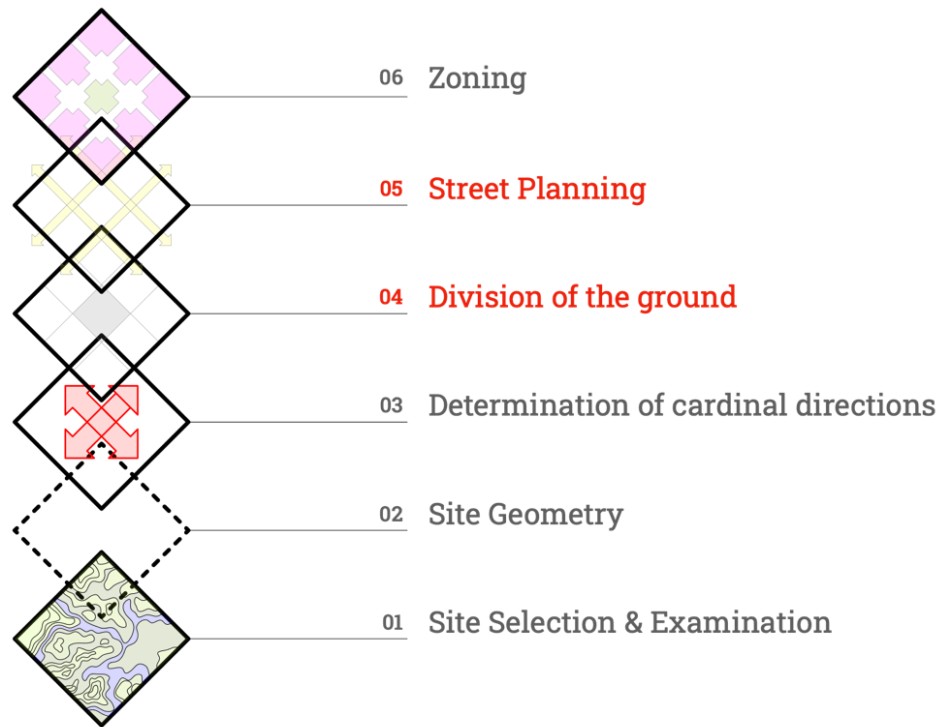


Figure 1. Planning approach as mentioned in 'Architecture of Manasara, Vol IV'

Urban planning had generally been assumed to be the physical planning and design of human communities. This kind of planning was physicalist and design-orientated and involved the production of masterplans and blueprints which would show precisely what the 'end-state' of land use should be, like architectural and engineering plans. Similarly, the theory of urban planning was mainly interested in visionary planning and design which would demonstrate how the ideal city should be organized spatially. Interestingly, rather than prescribing a resultant blueprint of an ideal settlement, Vaastu shastras treatise prescribe a systematic layered process to achieve such an ideal settlement for a certain function, location, size etc. Apart from the usually applied techniques on soil examination and site selection, two unique layers are captured and explained in detail in some of these treatises.

In general, the street planning divides the whole settlement into blocks/zones which further are utilized for varied activities to sustain a settlement. In Vaastu shastras, this street planning is preceded by dividing the site into certain grid of certain ratio, known as 'Padavinyasa'. The streets lay along the lines of this division. The zoning and distribution of various amenities and functions like residential, markets and industries along with open spaces are made entirely with reference to pada vinyasa. This division of site into quadrangular plots, known as 'Padas', vary from one to one thousand and twenty-four - a very large range, in accordance with its size and requirements. Preferably, the division of the site into 49 (Sthandila), 64 (Chandita), 91 (Parama sayika) padas or plots is applied for settlement designs.

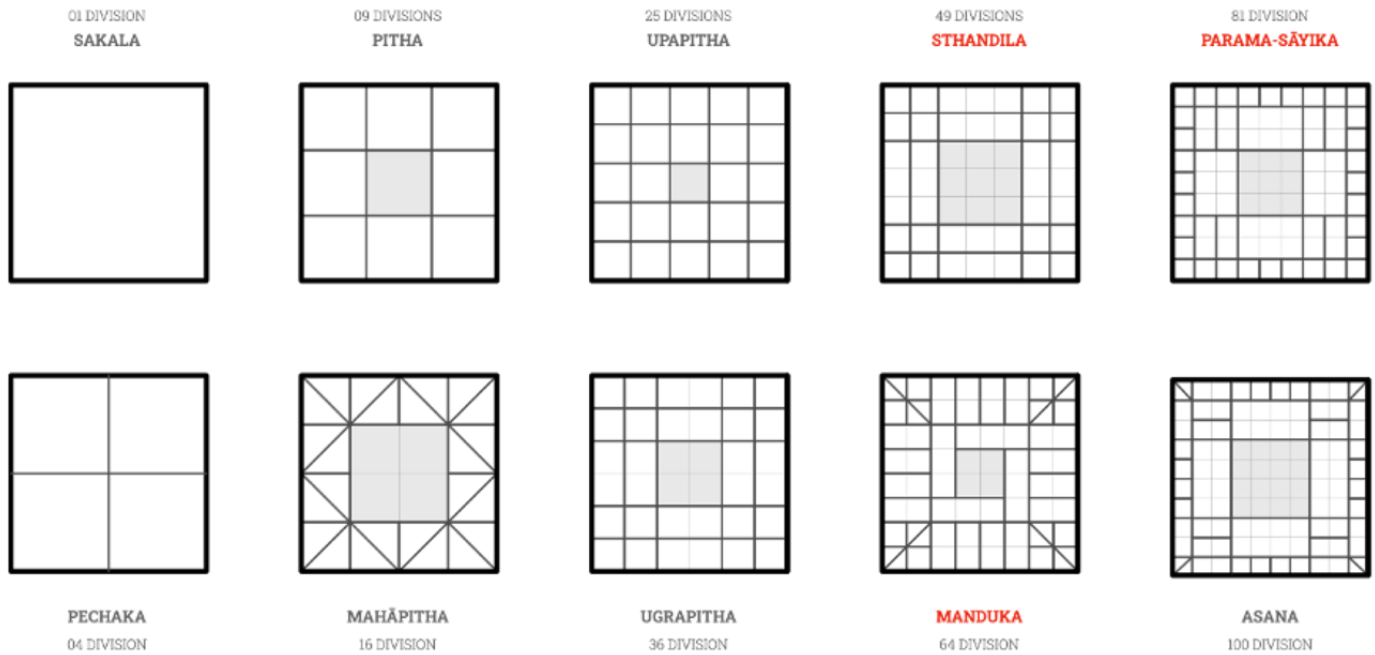


Figure 2. Types of Mandalas as mentioned in Architecture of Manasara, Vol IV

Secondly, a variety of street patterns are prescribed in detail in relation with their location, and purpose of the settlement like a hermit, an administrative town, a trade city etc. In Manasara, a total of 8 such types are explained in detail, namely Dandaka, Sarvotabhadra, nandyavarta, Padmaka, Swastika, Karmuka, Prastara, Karmuka and Chaturmuka, each with their unique street layouts. Each of these types have many no. of variations w.r.t their sizes and proportions. As per the settlement type and the size, the widths of the various streets from primary roads to connecting streets is also prescribed in these ancient texts in detail.

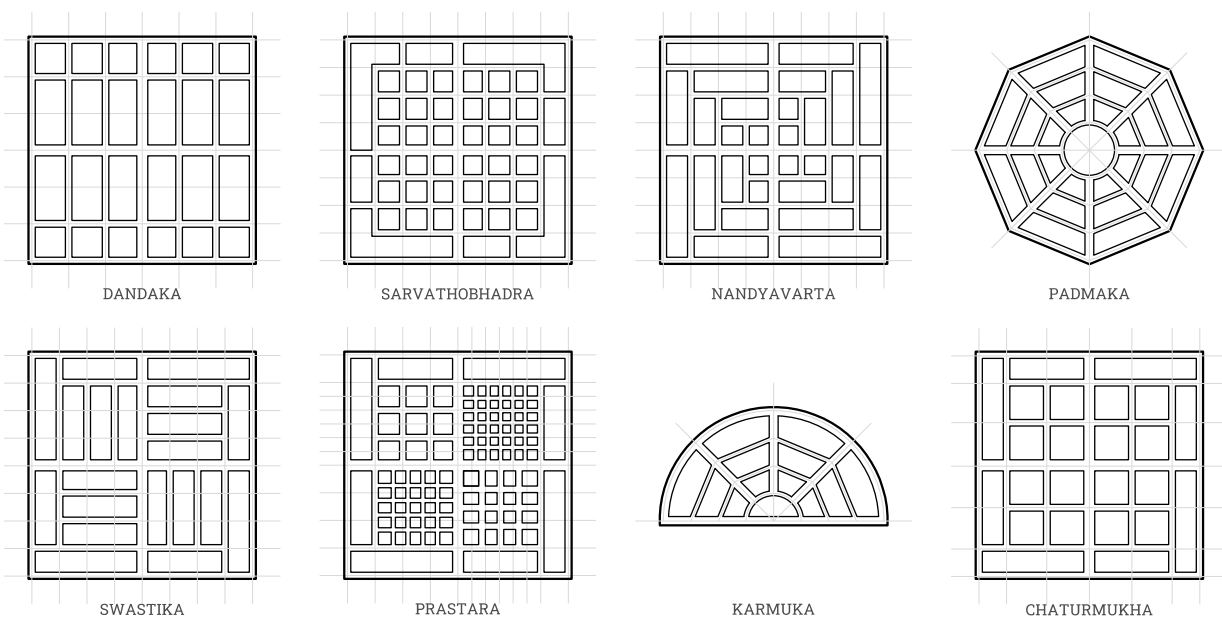


Figure 3. Settlement Street Pattern types, as mentioned in Architecture of Manasara, Vol IV. Not to scale.

II. System of Measurement of Space in Ancient India & Europe – An Anthropometric approach.

The system of measurement of space and anthropometry of users have always played a vital role in design; be it architectural design, product design, furniture design or any other design, the units and dimensions are very important. In the curriculum of design study, in modern days also, the students are taught anthropometry in the very first year. Human being is the prime use of most of these designs which govern the dimensions. Any design or product is considered good if it suits the user's

anthropometry well. But presently, the system of measurement is fixed irrespective of the user and then we relate the dimensions of the user with respect to this system. While, during the ancient times in India, system of measurement was derived from the user-end, making every product anthropometrically perfect, whose instances are found in ancient treatises like Manasara, Mayamatam, Vishwakarma Prakash, Samarangana Sutradhara, Vishnudharmottaram Puranam, etc. For understanding the prescriptions for cities, understanding the system of measurement in relation to anthropometry is essential. While units have been mentioned in Vaastushastra, the contemporary parallel of the same is not fully understood. Hence, an additional sub-objective was to understand the traditional units of measurement.

III. Assessment of Spatial sustainability of settlement layouts prescribed in Vaastu shastra using space syntax.

The concept of spatial sustainability focuses on the physical form of a city resulting from planning and development. Vaastu Shastra, the ancient Indian treatise on architecture, prescribes settlement planning concepts based on several layers of form, scale, mandala divisions, street patterns, sites' natural features, and inhabitants' zoning. These combinations result in thousands of layouts of different scales and shapes. The Space syntax approach is applied to quantitatively analyze and compare the spatial layouts of eight selected settlement types of similar scales prescribed in Vaastu Shastra. This syntactic approach critically analyzes the spatial configuration of these settlements to explore the interrelation of those ancient recommendations and contemporary theories of spatial sustainability. This assessment reveals the vital concepts underlying the planning of several cities of ancient India. At the same time, study promotes Vaastu Shastra's contemporary application for planning settlements of varied scales and presents it as a potent theory of planning.

In this study, the axial line is used to calculate the degree of global integration, synergy and intelligibility, using Space Syntax Approach.

- Global Integration is defined as the integration values of axial lines at the infinite radius which can be used to represent a picture of integration pattern at the largest scale. The results of analyses are then used to interpret the overall urban spatial structure. The axial line from red to blue in the axial view represent the strongest to weakest global integration.

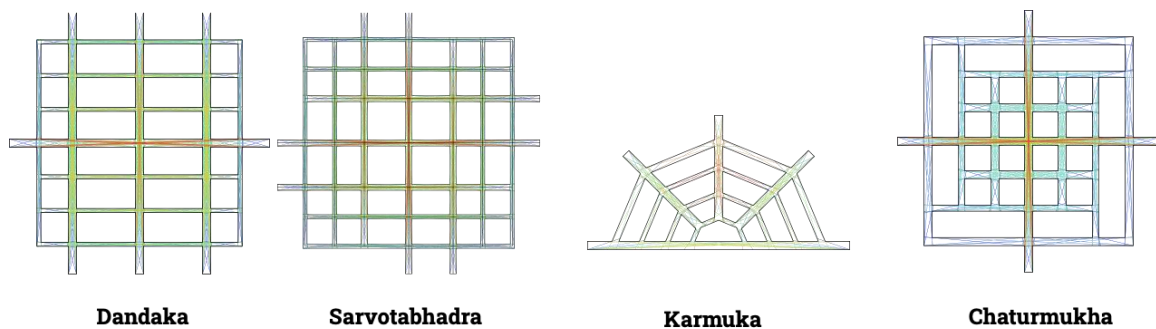


Figure 4. Global integration value of the axes of Settlement layouts (Group A) of breadth equal to 100 danda of danurgraha hasta (1 danda = 6')

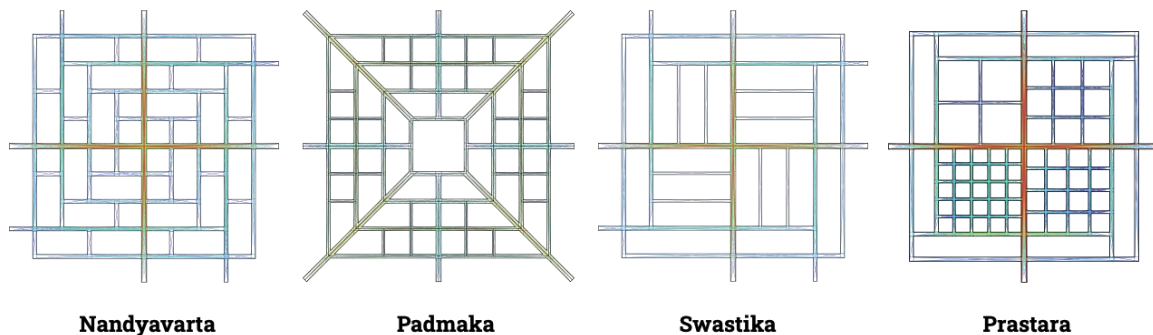


Figure 5. Global integration value of the axes of Settlement layouts (Group B) of breadth equal to 250 danda of danurgraha hasta (1 danda = 6')

- Intelligibility is a measure of axial map characterisation of global features, which together reflect the city's recognisability. High intelligibility indicates that the spatial system's local structure helps to build up a picture of the whole spatial system. Between 0.4 and 0.7 indicate that the coefficients are intelligible, and between 0.7 and 1 indicate that the coefficients are extremely intelligible.

Group A (Breadth of ~100 Dandas of Dharnurgrahasta)	Intelligibility	Synergy
Dandaka	0.9673	0.9718
Sarvotabhadra	0.9687	0.9673
Karmuka	0.8350	0.7335
Chaturmukha	0.9666	0.9908

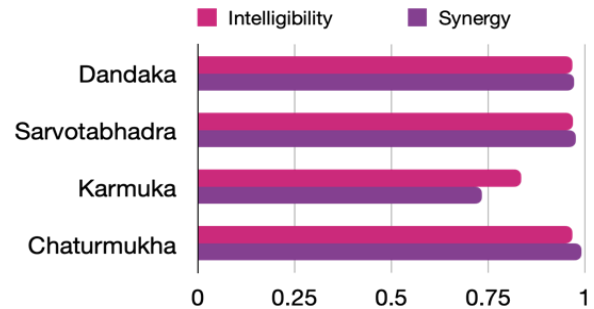


Figure 6. Intelligibility and Synergy of Settlement layouts (Group A) of breadth equal to 100 danda of danurgraha hasta (1 danda = 6')

Group B (Breadth of ~500 Dandas of Dharnurgrahasta)	Intelligibility	Synergy
Nandyavarta	0.9708	0.9780
Padmaka	0.7029	0.6194
Swastika	0.9606	0.9914
Prastar	0.9505	0.9074

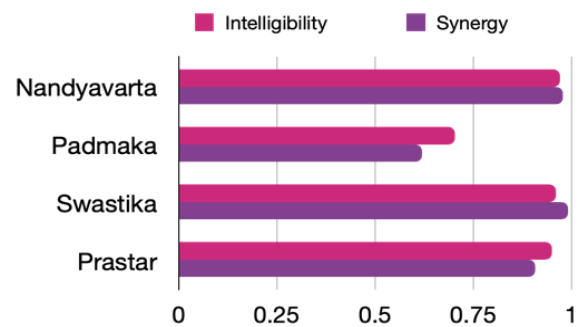


Figure 7. Intelligibility and Synergy of Settlement layouts (Group B) of breadth equal to 250 danda of danurgraha hasta (1 danda = 6')

- Synergy describes whether the local and global accessibility of the axes are consistent. Axial systems with high synergy are more likely to reflect the whole through to the local. The closer value of synergy is to 1, the more the tendency towards a single core. The closer it is to 0, the more the tendency of multiple cores, with low integrity.

IV. Comparison of City Design Approach of Modern City Design Theories and Nagar Vidhaan as per Vaastushastra

In order to understand the contemporary approach of city design, three established City Design theories have been identified and studied in detail. The identified theories are-

- Garden City concept by Sir Ebenezer Howard
- Radburn City Concept by Clarence S Stein
- Neighbourhood City by Clarence Perry

Each of these theories has been studied in detail covering the philosophy, its proponent, background on how the theory originated, administrative area where it was applied, and the spatial elements incorporated. Each of these has been presented here in detail.

a) Garden city Concept by Sir Ebenezer Howard

Post Industrial Revolution, a need was felt to create a 'social city', a small, self-contained space. In response to the need for a better life, uncontrolled growth since the beginning of the industrial revolution. In 1900s, Sir Ebenezer Howard proposed the concept of Garden City.

Proponent - Sir Ebenezer Howard was the pioneer of the English garden-city movement, which had an impact on urban planning all over the world. He was born in London, England, on January 29, 1850, and passed away in Welwyn Garden City, Hertfordshire, on May 1, 1928. Howard published Tomorrow: A Peaceful Path to Social Reform in the 1880s. This work, which wasn't released until 1898, was republished as Garden Cities of Tomorrow in 1902. In this book, he suggested the creation

of "garden cities," each of which would have 30,000 residents, be self-sufficient (rather than dormitory suburbs), and be surrounded by an agricultural zone that would be off-limits to construction. Howard was working to stop the mass emigration of people from small towns and rural areas towards the overcrowded cities. The goal of Howard's garden cities was to bring urban facilities and opportunity to previously rural areas.

Detailed Description - London was an example of an overpopulated poorly planned city. The term 'magnet' for was used to describe cities and 'needle' for people to explain attraction towards a city. However, due to poor planning, unhealthy living conditions and socio-economic inequality, people started to move out of the cities unless they were forced to stay due to economic reasons. In order to bring people back into the cities they would have to present attractions stronger than the prior ones.

To achieve this, the concept proposed 2 MAGNETS theory- Town magnet & Country magnet. Country magnet: source of all beauty & wealth. Town magnet: source of employment, high wages, cities with a lot of industry. It was proposed that a private corporation would be the owner of every garden city. Howard emphasized that the site would determine the actual location and planning of such a settlement. He had the pleasure of witnessing the execution of his design in 1903. A garden city called Letchworth was created in Hertfordshire, England, some 30 miles north of London. According to the rules he established, it was successful, and Welwyn Garden City was founded nearby in 1920. In the planning of succeeding new towns, Howard's idea of fusing country and city in a planned city of fixed size has found great acceptance. His emphasis on controlled population densities and greenbelt areas has become a crucial component of suburban and city development as well. Main Objectives (before the plan) were to:- provide Industrial population with higher work wages, secure healthier surroundings, regular employment, inculcate industrial-technical sectors and to raise the standard of health & comfort.

The town was proposed to be planned as a whole to reflect the unity of design and purpose.

Spatial Elements and SPECIFICATIONS:

SITE: - Built near 6,000 acres acre, and 1000 acre in a circular form: 1240 yards. [SCALE:- 20x130 ft (avg size), 20x100 ft (min size)]

6 boulevard (120 ft wide) from center to circumference.

Population: 30,000 in the city & 2,000 in the agricultural estate

Avg rent for a building in one of the prime locations on the boulevard: 5,500 building lots- EUR 33,000 gross/year.

Farmers are not separated from the town market: higher range of audiences is available to gain attention for the produce.

Rent is the prime if not the only source of income to generate revenue for the garden city.

The productiveness of the agricultural part, landlord payment rate change, and increase in public activities will increase revenue for the city.

SHAPE: - Central circular space: 5 1/2 acres- gardens, public buildings surrounding the gardens.

SITE: - Crystal Palace surrounds the public central space. Generates more attraction, especially during winter.

DIVISIONS: - A clear-cut open space that creates dual spaces and multipurpose spaces. vendors are set up here.

The 5 Avenues starts after this and is divided by the Grand (3rd) Ave between 4th and 2nd Ave.

Grand Avenue has an additional park: 115 acre within 240 yards of the most remote area.

6 Sites each of 4 acres occupied for public schools surrounding playgrounds, churches.

SHAPE: - The planning is arranged in a crescent shape; to enlarge the space and to create elongated space.

Rapid Railway Transits: are proposed to connect these developing cities which would continue to grow as more population would be attracted by them. It emphasizes on producer-consumer relations and how that affects the neighbourhood. The placement of parks, gardens, orchards, etc. in the midst of busy city life adds multiple pause spaces in between these busy lives of workers.

City Parts/Divisions: - Roads & Streets- paid by the building owner.

PROPORTION: - 1/3rd might be taken out for nature parks which would be used under the park's revenue. Country Roads: - 40ft wide, EUR 1,200/mile Circular Railway Bridges:- under trading-municipal sector Schools:- EUR 2,500/ 400 places. Town Halls&Expense Management:- EUR2,000/mang. Library%Museum:- generated from funds Parks & RoadOrnamentation:- agricultural revenue+left as it is Interest:- Equal source nature-equal security, high security for public interest, diff. to build security for a shift from an agricultural to an urban state. Local bodies' funds:- by new municipality.

Management of the City-For further rate extensions; if the tenants are well satisfied with the rate rent and find valuable contributions with the extension then they can proceed, and generate higher revenue. Public markets are not really made for the public, they are municipal projects built on public land. Municipality as the sole landlord is responsible for handling the power however they please.

Urban Design Elements incorporated -Nodes, Magnets,Shape, Landmarks, Open Spaces, Historic or Special Districts, Community Structure, Special activity center

Conclusion: Unless there is a parliamentary act no change can go on. A small garden city must be built on a working model to be implemented construction, by taking cities wrt to this just like London was chosen and then one can add extensions and add onto it for bigger cities; Paris, Berlin, Vienna, etc. With the increase in population, cities can further expand through branching and being connected through railways, highways, subways, etc.

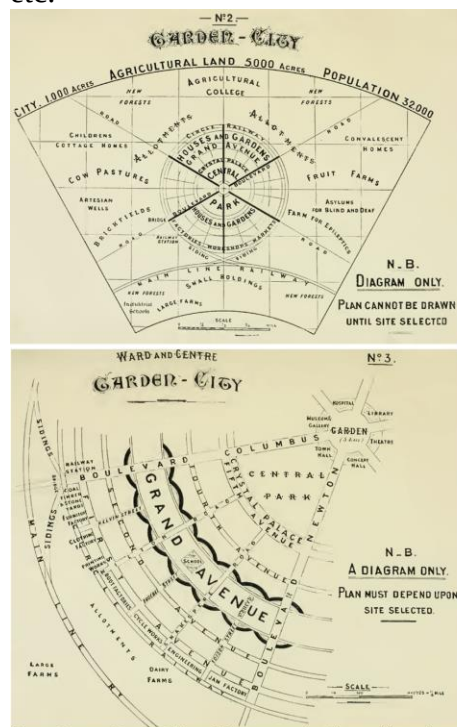
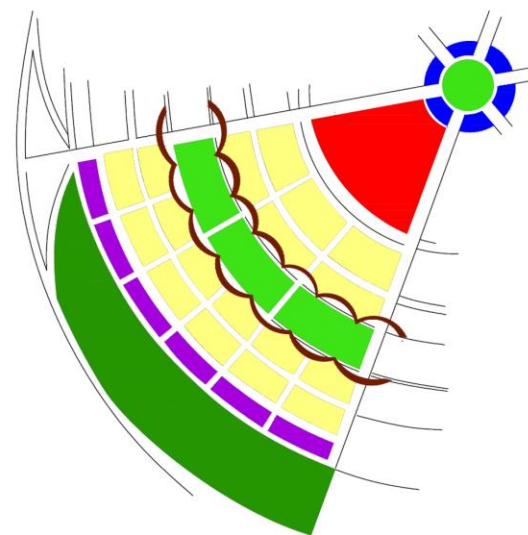


Image Source: Garden Cities of Tomorrow – by Ebenezer Howard, 1902

Ebenzer Howard's Garden City Planning Concept, London, U.K.



Landuse Colour Codes superimposed on the Garden City

Residential	
Commercial	
Industry	
Public and semi-public	
Mixed use	
Recreational	
Transportation and communication	
Primary activity	
Protective and undevelopable use zone	
Special area	

Landuse Classification as per URDPFI 2015 & NBC 2016

Figure 8. Garden City Concept

b) Radburn City Concept by Clarence S. Stein

After WW II a need to create a better world was generated. New York's governor wanted to replace slums of the city with liveable and healthy spaces. By looking at England's 'new towns after the war' during her visit (when the 2nd generation city was being built), the idea to start similar project in the US was conceived. Due to WW II, the depression that came over the Residents of Radburn resulted in them losing their jobs, sources of income, and homes. Opportunities were provided through the physical and social plan. The Radburn City concept was proposed in 1950s by Clarence S. Stein.

Proponent: Clarence S. Stein : An American architect, planner, and writer, Clarence S. Stein was born on June 19, 1882, and died on February 7, 1975. Stein, a key figure in the American Garden City movement who studied at Columbia University and the École des Beaux-Arts in Paris, founded his planning and design firm in New York City in 1919. In 1923, Stein helped establish the Regional Planning Association of America (RPAA). Major planning issues like the effects of suburbanization, cheap social housing, and wilderness preservation were addressed by the RPAA. Stein served as the New York State Housing and Regional Planning Commission's chair from 1923 to 1926. The designs

for Radburn, New Jersey; Sunnyside Gardens, New York; Greenbelt, Maryland; and Village Green, Los Angeles are among Stein's most well-known creations. Stein struggled with the difficulties of building what today we would refer to as "liveable," "walkable," and "green" communities during the ascendance of the vehicle as a planner, designer, and, at times, financier of new housing developments. He overcame these obstacles by combining private investment with public finance and working with friends in the fields of planning, architecture, real estate, and politics.

Detailed Description: Due to economic shortages, Sunnyside then Radburn were made based on the grids of NY. After 4 years of completion of Sunnyside: - projection of a completed garden city was to be made - Radburn City.

LOCATION: - 16 miles from NY, underdeveloped fertile land. Attractive land, rolling ground, moderate hills, attractive spaces for schools, very little marshy land, good for economical large-scale building. Provided great industrial opportunities; near Erie Railroad; great bridge between NY & NJ.

Outcome: - Wasn't intended to be a garden city; However, due to depression it became a financial failure and didn't become a complete town. Yet, it set the standard for cities by understanding urban living needs in America & differences in living conditions in adequate space for green belts.

Main Objectives: -

- How to live with automobiles while maintaining safe spaces for children as well:
Use of Superblock in place of a narrow rectangular block. Aristotle's ideology used: "A city should be built to give its inhabitants security & happiness" as automobiles were bringing havoc to the city & resulted in creation of remote town spaces which were filled like gridiron street park.
- It proposed specialized roads built for singular usage: Service lanes having direct access to buildings; express highways, freeways, etc.
- Complete separation of pedestrians & automobiles: Overpasses and underpasses were used.
- Living & sleeping rooms facing towards gardens/parks. Service rooms towards access roads.
- Large centre spaces in centres of superblocks: park as the backbone of the neighbourhood.

Specifications: -

SITE: - Built their homes around the periphery of large blocks. Because of heavier automobile traffic; few houses faced highways.

SCALE & GRID DIVISIONS: - Superblock was used to direct away from the standardized grid-like plan which would have caused collisions with automobile with 250 ft.

Area of streets, length of utilities: 25% less than typical American plan. Land cost: 6 cents/ ft squared. Cul-De-Sac: Dead-end lane used in England for peaceful economic needs & utilities. Separation of different communication means provides the comforts of privacy of family life in a house which relates living space to open space. (learned from architecture school, Waterford Ireland.)

Population of 2,500 - 7500 people.

STREET PATTERN: - Interior of Radburn superblocks- no additional cost. Direct access to houses- narrow roads; PROPORTIONS: - less expensive. 15-20 families living on each cul-de-sac. 75% of the present (at that time) of men- veterans of recent wars. Safety Stats: - After 20 years of Radburn city: - 2 road deaths on main highways, 1 serious accident on any lane- and a girl's arm being broken.

Creation of Radburn Idea & Plan: group activity. from an actual experience of Sunnyside influenced by the diverse technical abilities of experts.

Old residents re-appeared to allow their children and family to experience free living which they experience themselves in their youth.

Underpass: provides safe passage from home to school, swimming pool, and playgrounds.

Overpass: - connecting north & south sections of Radburn, crossing the highways.

Education: - general plan- 3 elementary schools, 1 combined junior and senior high schools.

Recreation: - Radburn was mainly planned for children; 2 playgrounds on the north and south mainly for elementary school kids, 2 swimming pools, and a wading pool with no fee required by residents paid by the Radburn association. Tennis courts for residents, athletic field: 6 and 3/4 acre; paid by Radburn association. Gymnasium (in small 2-storeyed building)- also houses quiet game rooms.

Suggestion: - Architects should always design these sites by keeping room for improvement/expansion in mind. Turns are constructed tightly instead use of circular cul-de-sac should go on.

Radburn was initially a failure but due to consistent planning and utilization of resources by keeping people in mind, it became useful for the urban planning sector. The economic depression brought upon the people was what brought much trouble to these people.

Conclusion: The proposed plan is Safer, convenient, spacious, peaceful, and surrounded by nature. To maximize living conditions the town should have an organization from its opening, centrally organized, membership benefits. Private political bodies should be provided to help with all this and the purchase of such a big piece of land. Continuous rapid growth especially by utilizing the industrial sector the latter was not consistent because of poor timing.

Urban Design Elements Incorporated – Topography, Edges, Pathways, Districts (indirectly), Nodes, Landforms & Nature, Tree Types, Vistas, Magnets.

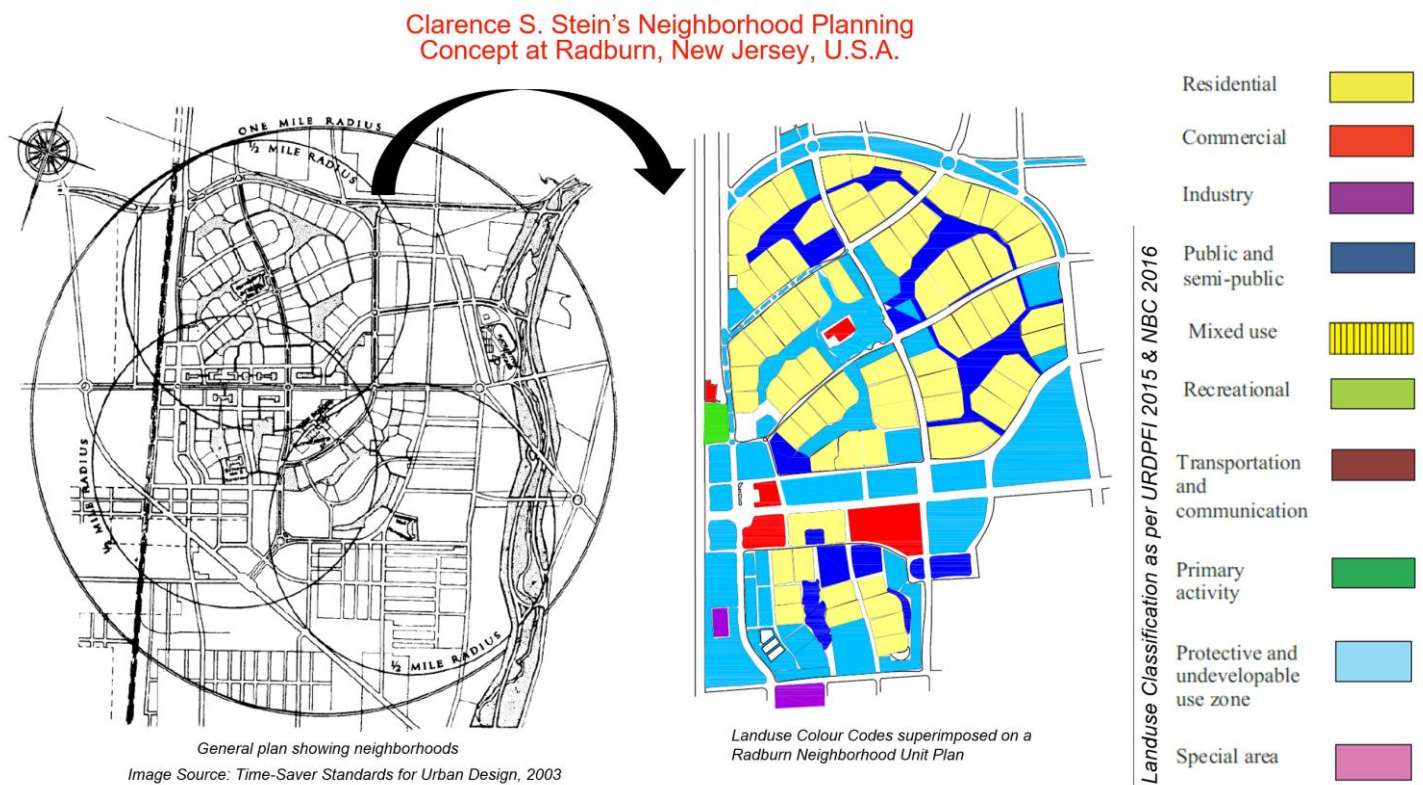


Figure 9. Radburn City Concept

c) Neighbourhood City Concept by Clarence Perry

Due to strong stress upon 'community building' and due to social and economic segregation, racial segregation of groups happened in Chicago. As a response to this, efforts were made to create neighbourhood residential spaces to meet the needs and provide for the families while being related to larger bodies yet being distinct and self-sufficient in their own plans. Additionally, a huge rise in motor traffic without proper resources to manage served as a threat to people. The facts of city life: - Increase in rural people because of the explosion of urban residents into the countryside around the city causing congestion. Increase in traffic because of the same which leads to high annual loss. The Garden City movement & the settlement house movement was a major influence for the same. Group structures for the design and zoning of spaces were also important. The Neighbourhood City Concept was proposed by Clarence Perry.

Proponent: Clarence Arthur Perry was an American urban designer, sociologist, novelist, and educator who lived from March 4, 1872, until September 6, 1944. Perry created the neighborhood unit plan, a residential community plan published in 1929 as part of the Regional Plan of New York and Its Environs, affecting city planning in the US. The New York Regional Plan and the City Recreation Committee, where Perry served as staff, were where he first developed his concepts of the neighborhood unit and communal life. He joined the Russell Sage Foundation in 1909 and served as associate director of recreation there until 1937. His ideas came to life in areas like Radburn. His *Housing for the Machine Age* (1939) and *The Neighborhood Unit* (*The Neighborhood Unit: From the Regional Survey of New York and Its Environs, Volume VII, Neighborhood and Community Planning*,

1929) are the two works for which he is best known. Perry's goals were designed with the human foot in mind, not the car. Please remember Perry's Neighborhood Unit was developed before the vehicle (1920s). He mentions walkable distances, narrow streets, and a diversity of uses in his notes on the aforementioned proposal. Another current victim of the road classification system is the somewhat interconnected network of streets.

Detailed Description:

Main idea for the neighborhood unit plan: - LOCATION: - centrally located schools (easy walking distance max 1&1/2 mile from the furthest dwelling)

- 10% area comprised of playgrounds and parks.
- shops, and markets around the perimeter of the neighborhood spaces.
- centrally located communal buildings, creation of a harmonious architectural environment; for a residential environment.

Below are the important factors taken into account when planning the neighborhood city.

Chicago's main elements: - Population: 45,000-90,000. of communities that are separated by industrial belts, highways, railroads, and expressways. to project as a small city. Interest and loyalty to the community must be supplied through schools, public centres, and playfields. Chicago site plan: Division of residential area into 5 neighbourhoods, High school-town centre, 600 acre. for parks (+ forest preserve), central shopping area: 600,000 ft², not a suburban but a satellite town; related to the metro area but self-sufficient.

San Francisco-- War Housing; (1500 units) great example with additional central space for shops, churches, schools, and playgrounds.

Future of England: population: from 7,000 to 10,000 people of n.hood center. Only some spirit of socialism might unite people.

Site: - Curving the residential streets by distributing 4 sets of mostly public activity spaces in close locality of the residential houses.

Main Objectives: - 3 main factors from the economic point of view: - 1. Land Development 2. Distribution of Community Facilities 3. Street system/ layout. However, the

Residential setup brought in an urban population could create instability in property, and physical values which resulted in the setup becoming slums. Social elemental issues with the layout:- Political and cultural were accepted as factors to be dealt with as well. Most of the urban communities provided almost zero feel of the presence of their local communities or 'local pride'. The grid-like layout was not useful for motor traffic and divided the neighborhood into 'rectangular islands' (segregation of the units). Parks and playgrounds are built along with the urban land to add some green spaces.

PROPORTION: - Elementary schools at the focus of the neighborhood. 1,000 - 1,200 children/ school. Maximum 1/2 mile away from the peripheral house in the neighborhood.

- Removal of traffic from the neighborhood streets: Deconcentration of cities.
- Shopping centres at the intersection of dense streets of the neighborhood.
- Basic standardized open spaces available. Savings: 15-40%/street-with no extra cost for interior parks' development.

Specifications: - Population: - 5,000 - 6,000; about 10 families/ acre. Total estimated acre:- 160 acres. Neighborhood size: - 30-60 families. Residential units: - 600 families with 2 such units sharing recreational and commercial areas.

- Use of natural resources to fix a natural issue: Use of rivers to treat marshlands of slums passing through in btw fields. Pros of Radburn: - reduced per. 80-90% residential spaces; 70-75% property tax.

- family living cost, inclusive environment, safe neighborhood separated pedestrians from motor traffic, and proper use of superblocks as the core of the planning style. Man is the fundamental unit of scale. Proper distribution of population throughout, unlike Hartford which ranks

Among the top, its south section is thrice in people than N&W.

- Suggestions by Clarence S. Stein (DESIGNER OF Hillside, Sunnyside, Radburn): - DIVISIONS: - 1. Creation of environments that provide individual playfulness (small neighborhoods).

2. Limited urban growth and a maintained sharp boundary to sustain natural features.

3. Joint use facilities for multiple neighbourhoods such as large hospitals, high schools, theatres etc.

4. Separate community centre for each neighborhood. The social character and interaction of physical plan are stressed. Proper organization based on community/ neighborhood units.

-No traffic inside the units hence, the units should be bounded by major traffic routes, physical boundaries, etc., to keep clear of any congestion. Separation of parts of the neighborhood to localize it. Measures to be taken to also ensure proper development of slum areas: -

1. Superblocks of 80 acres. after relocating traffic and transit.
2. Removal of industrial slums.
3. Public housing for the poor (indication to place the poor in good public housing to improve the condition of units.)
4. Providing education to slum dwellers through campaigns.
5. reallocation of slum areas.

OTHER CITIES: - How primarily New York but also other cities lacked proper urban development despite owning enough land masses: Yale Law Journal's reference for Manhattan: - to increase population from 11,000 to 25,000. similar law development in MD, MI, WI, IL, KE, MISS, and MA. However, citizen interest was considered important for any cultural, physical, or social construction.

Clarence Perry's Neighborhood Unit Planning Concept,
New York, U.S.A.

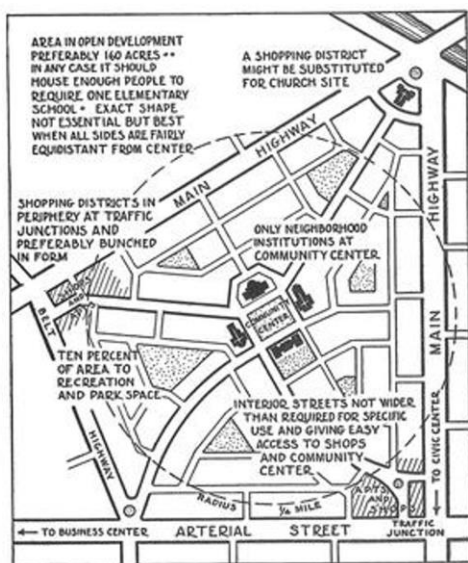
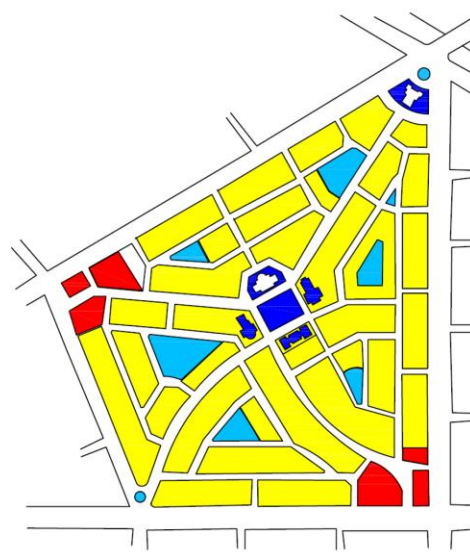


Image Source: A diagram of Clarence Perry's neighborhood unit, illustrating the spatiality of the core principles of the concept, from the New York Regional Survey, Vol 7. 1929



Landuse Colour Codes superimposed on the Neighborhood Unit Plan

Residential	
Commercial	
Industry	
Public and semi-public	
Mixed use	
Recreational	
Transportation and communication	
Primary activity	
Protective and undevelopable use zone	
Special area	

Landuse Classification as per URDPFI 2015 & NBC 2016

Figure 10. Neighbourhood Unit Planning Concept

LONDON: - Main 3 factors: - 1. small enough to build 'relations' 2. large enough for cross-sec for people 3. large enough for proper school, rec. facilities. Socialism was brewing through road systems & increase in segregation of people: Focus on people's identity which increased the degree of segregation.

Urban Design Elements Incorporated: Shape, Routes, Districts, nodes, Open Spaces, Magnets (indirectly), Points of Conflict, Community Structure

Conclusion:

In all the three concepts, there were similarities with prescriptions of Settlement Design as per Vaastushastra. Following can be observed clearly-

1. Limitation of population and number of housing units/density- All concepts limit the maximum population for which the city is to be designed.
2. Complete master plan to be designed before start of the project – Complete master plan had to be designed even before the implementation began.
3. Ecological services- Mandatory allocation of ecological services such as forest cover and water bodies have been proposed.
4. Agriculture as an integral part – unlike the modern understanding of cities, all the three concepts integrate agricultural farmlands as an integral part of a self-sustaining city.

5. Humans at the centre- Similar to Vaastu Shastra, all the three concepts placed people at the centre of whole concept. All cities were envisaged to be designed as walkable, free from traffic, having easy access to basic amenities and having less traffic, noise and pollution.
6. Industrial unit integration- All concepts integrated industrial units within the concept.
7. Geometrical configuration – All the concepts proposed a geometric configuration of the proposed city.

Additional features proposed in Vaastu Shastra-

1. Unlike only one geometric configuration proposed in each of these concepts, Vaastu prescribes multiple geometric configurations.
2. Unlike only one scale of settlement proposed in contemporary concepts, Vaastu proposes multiple scales of settlement design thereby proposing to design all settlements starting from the smallest scale of a village to that of a large city as per the prescriptions.
3. Vaastu lays special emphasis on folk planning. It emphasizes diversity of occupations to be ensured within a city. However, the planning plays a tool to equalize any inequalities that may be there.
4. Vaastu has specific prescription to ensure how expansion of any city should happen without disturbing the essential ecosystem services and also by ensuring that any upcoming expansion is also self-sustainable.

V. Comparison of City design guidelines as per URDPFI and Vaastu Shastra

After a comparison with western city design concepts, we looked at Indian City Design Theories. Unfortunately, there are no city design theories which were developed in last century in India. All the cities which were designed post-independence were based on western city design theories. Lately, Town and Country Planning Organization, Ministry of Urban Development, Govt of India has prepared Urban and regional Development Plans Formulation and Implementation (URDPFI) Guidelines in 2015. URDPFI attempts to develop a paradigm of Urban Development that would bring in higher levels of income and prosperity, while at the same time avoiding the issues perceived to be correlated with urbanization such as pollution, consumption and inferior quality of life.

It promotes sustainable development with a focus on planning for people, environment and financial viability. It also focuses on promotion of inclusive planning, people's participation and focus on specific issues relating to the elderly, women, the differently abled and the weaker sections of the society. It includes the provisions for affordable housing, management of waste, planning for mitigating climate change and also the economic aspects of plan implementation while preparing land use development plan.

Guidelines as per URDPFI

- Classification of Planning Units

Based on population, URDPFI has identified seven hierarchies of planning units: a 'housing cluster' of 5,000 people, a 'neighborhood' of 5,000 to 15,000 people, a 'community' of up to 1 lakh people, a 'district' of 5 lakh people, a 'zonal' of 10 lakh people, a 'sub-city center' of 15 lakh to 50 lakh people, and a 'city' of more than 50 lakh people. Each of these planning units is designed to be self-sufficient.

- Open spaces

URDPFI classifies open spaces into three distinct categories: organized green, recreation, and other open spaces (for example forest cover). Ideally, 10 to 12 square meters of open spaces are recommended to be provided per person.

A housing cluster and a neighborhood should ideally have three to four local parks and playgrounds. A community should have two to three community-level parks along with open spaces. A district or zone should have one district-level park along with a sports center. A sub-city center should have one city-level park along with a sports center and a botanical or zoological garden. URDPFI also specifies the area requirement and the population to be served for each of the organized green categories.

- Community Centre

Based on the hierarchy of planning units (housing cluster, neighborhood, etc), various levels of community centers are identified by URDPFI. A Housing cluster is to have dedicated a land area of 1,500 square meters for a convenience shopping center. A neighborhood is to have dedicated a land area of 4,600 square meters for a local shopping center. A community is to have dedicated a land area of 5 Ha for a community center. A district is to have dedicated a land area of 40 Ha for a district center. URDPFI specifies the number of shops to be provided based on each of these commercial centers. In addition, a local wholesale market (land area of 10 Ha) is to be provided for every 10-lakh population, and a weekly market is to be provided for every 0.5 or 1 lakh population.

- Norms for Informal Units for Urban Street Vendors

URDPFI specifies the number of informal units that are to be provided for urban street vendors across a range of categories such as hospitals, schools, retail trade convenience shopping centers, bus terminals, etc.

- Urban Amenities / Social Infrastructure Development

URDPFI specifies a list of urban amenities and facilities that are to be provided across the seven planning units. Each of the listed facilities is also detailed with the number of such units per population and the area requirement to be met.

A 'housing area' is to have a pre-primary school, primary school, Anganwadi, community room, religious facility, housing area park, residential unit play area, milk distribution, and a convenience shopping center.

A 'neighborhood' is to have a senior secondary school, dispensary, community hall, library, neighborhood park, neighborhood play area, local shopping including service center, post office counter without delivery, and bank with extension counter and ATM facility.

A 'community' is to have an integrated school with and without hostel facilities, a school for the physically challenged, a college, a nursing home, a child welfare, and maternity center, a polyclinic, an intermediate hospital, a multi-specialty hospital, a specialty hospital, family welfare center, diagnostic center, dispensary for pets and animals, music and dance center, recreational club, meditation, and spiritual center, community park, community level multipurpose ground, district sports center, gas godown, police post, police station, fire station, community center with the service center, weekly markets, organized informal eating spaces, dhobi ghat, telegraph booking counter, and bank with locker and ATM.

A 'district' is to have a general hospital, veterinary hospital, old age home, district park, district-level multipurpose ground, district center, cremation ground, burial ground, telephone exchange, telegraph booking and delivery office, head post office, and administrative office.

A 'zonal' planning unit is to have a school for the mentally challenged, a technical education center, an engineering college, a medical college, other professional colleges, nursing, and paramedical institutes, religious facilities, an orphanage, and children's center, care center for physically mentally challenged, working women and men hostel, adult education center, night shelter, socio-cultural center, exhibition cum fairground, science center, sub-city level multipurpose ground, divisional sports center, district office and battalion, police line, district jail, civil defense and home guard, and local wholesale market. A 'city' is to have a city center, international convention center, police training institute, and fire training institute.

- Road Infrastructure

URDPFI acknowledges and mentions the need to prioritize pedestrian and non-motor vehicles, however, there is no specific prescription given.

Streets to be optimized based on minimizing travel demand, travel time, and trip length. Road networks to maximize efficiency, accessibility, and comfort. URDPFI details six classifications of urban roads: urban expressways, arterial roads, sub-arterial roads, collector roads, local roads, and access roads.

Hierarchy of road network based on road width	
Classification of Urban Road	Road width in meters
Urban Expressway	50 to 60
Arterial Road	50 to 80
Sub Arterial Road	30 to 50
Distributor / Collector Roads	12 to 30
Local Street	12 to 20
Access Street	6 to 15

- Land use structure for developable areas in urban centers

URDPFI divides four broad classifications of urban areas into the proportion of land use to be planned.

Small towns ranging from a population of 5,000 to 50,000 should have 45-50 percent of residential land use, 2 to 3 percent of commercial land use, 8 to 10 percent of industrial land use, 6 to 8 percent of public and semi-public land use, 12 to 14 percent of recreational land use, 10 to 12 percent of transportation and communications and the remaining to be used for water bodies, agriculture, and special areas.

Medium towns ranging from a population of 50,000 to 5 lakh should have 43-48 percent of residential land use, 4 to 6 percent of commercial land use, 7 to 9 percent of industrial land use, 6 to 8 percent of public and semi-public land use, 12 to 14 percent of recreational land use, 10 to 12 percent of transportation and communications and the remaining to be used for water bodies, agriculture, and special areas.

Large cities ranging from a population of 5 lakh to 10 lakh should have 36-39 percent of residential land use, 5 to 6 percent of commercial land use, 7 to 8 percent of industrial land use, 10 to 12 percent of public and semi-public land use, 14 to 16 percent of recreational land use, 10 to 14 percent of transportation and communications and the remaining to be used for water bodies, agriculture, and special areas.

Metropolitan cities and megalopolis ranging from a population of 10 lakh to over 1 crore should have 36-38 percent of residential land use, 5 to 6 percent of commercial land use, 7 to 8 percent of industrial land use, 10 to 12 percent of public and semi-public land use, 14 to 16 percent of recreational land use, 12 to 14 percent of transportation and communications and the remaining to be used for water bodies, agriculture, and special areas.

Points Mentioned in URDPFI exclusively

There are some guidelines/prescriptions which are mentioned exclusively in URDPFI. It is important to look at these to understand the requirements of contemporary times. Most of these are missing from Vaastu Shastra due to the following reasons-

- The terminology did not exist. For example- There were no bicycles and multiple modes of transport did not exist. The speed of traffic was very slow and hence Transit Oriented Development was not present. Hence several such terminologies and the requirement were missing.
- The concept (as mentioned in URDPFI) was incorporated within the guidelines of Vaastu Shastra. For example – Sustainability which is discussed as a separate head and concept in URDPFI was an integrated concept in Vaastu Shastra.
- *Road Infrastructure*

URDPFI lays down specific regulations including minimum width, slope gradient, land width, etc. for planning cycle lanes and other non-motor transportation networks.

The width of the footpath is classified into five categories based on the adjoining land use, such as residential, commercial, shopping frontage, bus stop, and high-intensity commercial areas.

- *Parking regulations*
- *Safety measures*

Safety measures in terms of fire stations, fire training institutions, and disaster management centers are detailed. URDPFI specifies the area requirement, distribution, and population to be served per unit.

- *Education Facilities*

URDPFI specifies planning norms for pre-primary, secondary, higher education, and college facilities as per student strength, population to be served, and area requirements. Including education facilities for physically and mentally challenged persons.

- *Health Care Facilities*

Planning norms for various healthcare facilities such as polyclinics, general hospitals, veterinary hospitals, nursing homes, etc are specified by URDPFI as per the number of beds, population to be served, and area requirements.

- *Infrastructure Planning*

Infrastructure planning norms are detailed out according to different land terrains or uses such as for hilly areas, heritage cities, port cities, industrial cities, sports cities, tourism cities, etc

- *Transit Oriented Development*

To actively encourage non-motor vehicle, last mile connectivity, and public transportation and discourage private transportation modes. Based on the principle of compact planning (high density) through promoting mixed-use planning. Also promoting placemaking, walkability, and street landscaping to reduce or prevent the heat island effect.

- *Sustainability Guidelines*

Based on sustainable planning, energy efficiency, and green building through environmental policies and statutory obligations such as the national environmental policy (2006), EIA notification (2006), Environmental Protection Act (1980), etc. Environmental guidelines for coastal areas, eco-sensitive zones, water bodies, desert areas, wetlands, and hilly areas.

- *Barrier-free built environment for disabled persons*

URDPFI recognizes the need to promote barrier-free environments to ensure safety and ease for people with disabilities. A list of planning norms is suggested such as minimum width of public walkways, maximum slope gradient, parking space dimensions, use of tactile paving, etc.

- *Physical infrastructure*

Planning norms for physical infrastructure such as water supply, sewerage and sanitation, drainage, rainwater harvesting, electricity, solid waste management, domestic gas supply, and telecom services, etc. are specified as per requirement per population or unit. Acceptable water quality standards are quantified.

Points Mentioned in IKS exclusively

- *Shape and Proportion*

URDPFI does not give any specific indication of norms to the physical geometrics of town planning in terms of the shape and proportion of the physical boundary.

- *Grid and Street Patterns*

URDPFI has provided details regarding the hierarchy of urban roads in terms of road width including lanes for pedestrians and non-motor vehicles circulation. However, the grid and pattern for the same is not discussed.

- *Folk Planning*

URDPFI provides a guiding proportion for allocating land use (such as residential, commercial, industrial, public, recreational, transportation and communication, and agriculture) with respect to the population to be served within the urban areas. However, profession-based allocation such as folk planning is not discussed.

- *Defenses*

URDPFI focuses on disaster management and fire safety measures rather than defense as the priority for securing protection and combat has reduced over time.

Conclusion

By comparing the prescriptions of Vastu Shastra and the guidelines of URDPFI, it can be concluded that the attempt of both is to achieve sustainable development through city design. There are certain points which have been emphasized in URDPFI while there are certain others that find a mention in Vastu Shastra. In order to be able to develop a prototype of city design Based upon principles of Vastu Shastra it has to be contextualized to the modern-day requirements. This can be Based upon the understanding of URDPFI.

VI. Case Studies of Settlements based on *Vastu Shastra* principles

This part of review will look at some settlements (town/city) built with Vāstuśāstra principles and techniques to move beyond theory and investigate real applications. We will concentrate on three cities/towns: Jaipur City in Rajasthan, Madurai Temple Town in Tamil Nādu, and Sadashivpet Town in Telangana. These cities/towns have been the subject of substantial investigation and analysis from a Vāstuśāstra perspective.

Even though the Vāstuśāstra has been extensively used to study Jaipur and Madurai, Sadashivpet is a more recent addition where more academic research needs to be done. Nevertheless, by examining these three cases, we can learn much about how to put the Vāstuśāstra principles into practice.

- **Jaipur, Rajasthan.**

Jaipur, one of the oldest cities planned according to Vāstuśāstra principles, is an important example to understand this ancient approach to urban organization and to question its scientific credentials. This growing modern city has maintained the original planning intact throughout centuries, contributing significantly to the city earning the title of UNESCO World Heritage City in April 2019. According to George Mitchell, a well-known British historian, any research related to the architecture and symbolism of Asian cities must refer to the case of the walled city in Jaipur. Mitchell believes that Jaipur is not only the best-preserved example in India of a town laid out according to traditional principles, but also embodies ideas that may have travelled to India by way of the Islamic invasion, and which are pre-Islamic in origin. These ideas are concerned with linking the city with the heavens, either by recreating the structure of the universe in the form of a sacred mandala or by incorporating into the city how the heavens may be observed, and the movement of stars measured.

Jaipur was established by Maharaja Sawai Jai Singh II (r. 1699–1743) to perform the dual functions of a royal capital and a commercial centre. As per the norms of Vāstuśāstra, the temple of the royal household and the palace are placed in the centre of the nine-square mandala, with the city around it. The principal streets run east-west and north-south; they are lined with shops and intersect at crossroads where the main open markets are located. The quarters of the city are further divided by lanes and alleys. Each quarter is dedicated to the production and sale of specific crafts, and the principal lane of each quarter serves as its bazaar outlet.



Figure 11. Satellite Imagery of Jaipur Old City. (Image Source: After Google Earth, 2023)

Pusalkar, in her research article on ‘Understanding the Vastu shastra: city planning in walled city of Jaipur’ discusses that the habitation of the city was conducted in a controlled and coordinated fashion, following the standards of Vāstuśāstra, especially according to Mandala and Prastara principles (Pusalkar, 2022). First, the principal roads and quarters were demarcated, using the concept of the mandala, and the plots and shops were laid out within it. Leading merchants and craftsmen from the region and beyond were invited to settle in the city to produce and market their goods. Initially, the traders sold high-value commodities from a variety of sources, but as the goods produced in Jaipur itself became known for their excellent craftsmanship, the authorities required the traders to concentrate on these local manufactures. This meant that customers came to Jaipur to buy the well-known ‘made in Jaipur’ objects, thereby raising the city’s profile from being one among many trading towns to becoming the best place to shop. Thus, ‘who would live in Jaipur, what would they do for a living, where would they sell their produce’ were all matters that were carefully addressed and planned for beforehand. The result was a vibrant mix with an astounding number of craft skills. Apart from a strong commercial identity, Jaipur has a distinct visual identity.

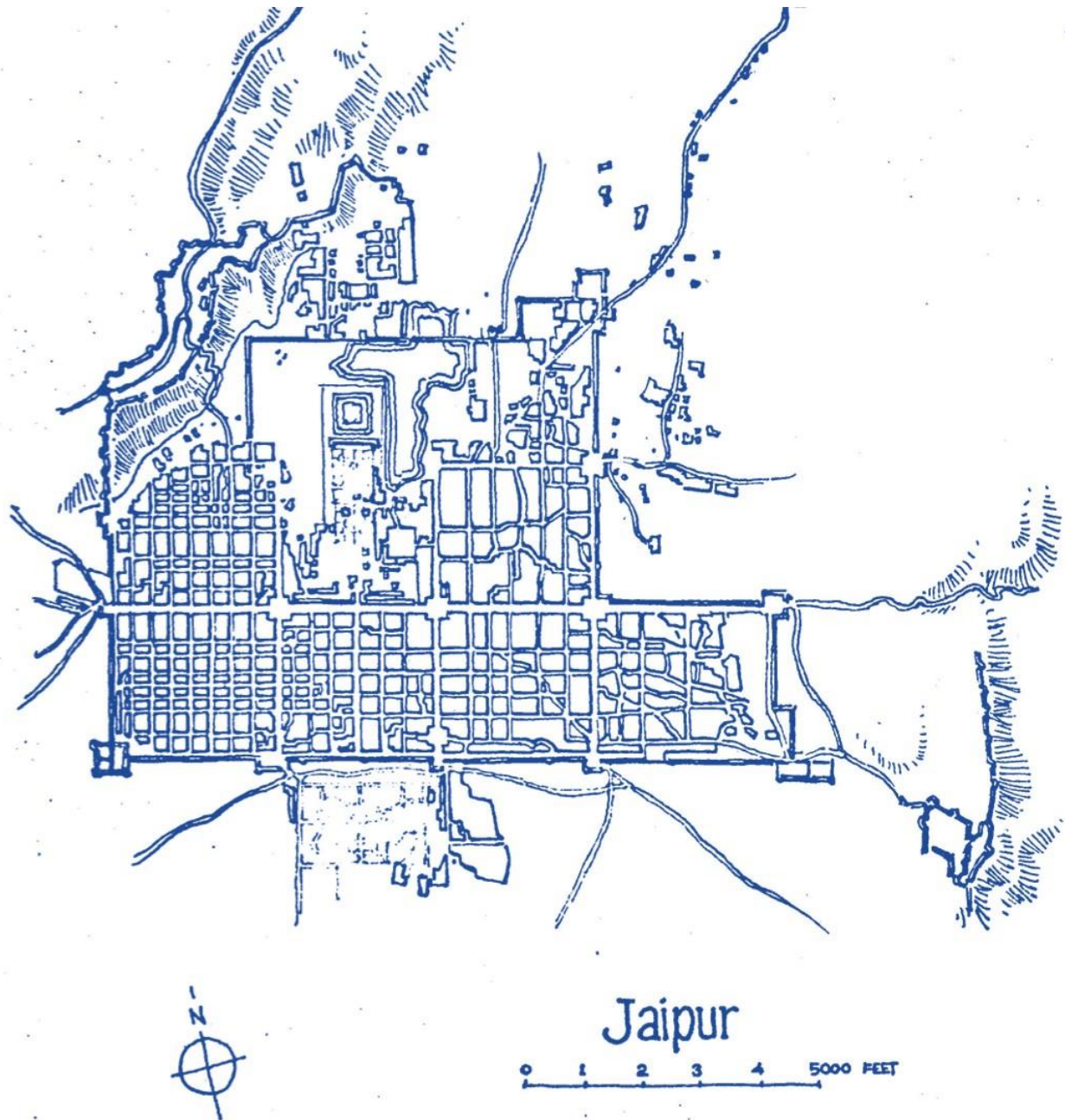


*Figure 12. Modified Nine-square Street Layout of (Old) Jaipur City.
(Image Source: After Smith, 1969)*

Even after almost 300 years of being in existence, the walled city of Jaipur was found to be retaining its originally planned functions intact. The markets and commercial areas continue to function as markets. Not only has the function been sustained even the specificity of the function has been retained. For example, the market originally intended to house craftsmen making Bell Metal utensils, continues to retain the same function even after 300 years. Public buildings such as town halls continue to be used as public buildings. Several other public buildings such as schools, colleges, temples, etc. have also retained their functions. While most other cities designed around the same time around the world have witnessed complete redesign or shuffling of functions, Jaipur has been able to retain the original planning of functions. This is the demonstration of spatial sustainability in practice. Additionally, the main streets/road widths continue to serve the traffic with little management (despite manifold increase in the volume of traffic and also the speed of traffic). This indicates how sustainability can be achieved through design and how Vaastu Shastra lays down principles to achieve sustainability in the long term.

- **Madurai, Tamil Nadu**

The actual chronology of Madurai's early existence is impossible to construct for lack of direct evidence. However, historians have traced its roots back to the first millennia B.C., when it was associated with the Pandiyan dynasty. The city's urban form is a series of concentric streets surrounding a central temple complex.



*Figure 13. Satellite Imagery of Madurai Temple City.
(Image Source: After Google Earth, 2023)*

Although the Vastu Mandala diagram emphasizes strict geometry, Madurai's urban form is not a rigid grid pattern due to its response to the natural landscape and topographical features. The fort's walls were constructed according to the land's natural topography, resulting in several deflections and a zigzag shape. The intricate network of connected pathways within the city includes small neighborhood centres, which are quieter than the main arteries. The festival processions occur in the concentric streets, delineating the Mandala throughout the year.

Madurai has a rich diversity within it for local interventions and distortions. The residential enclaves retain an almost village-like character, reflecting the principle of 'individuality within a group.' This process of city building as village aggregation became a method of combining disparate groups, each retaining its local identity within the larger whole. The distribution of trade groups gives a 'cross-grain identity' to the pattern and enhances the sense of both individuality and orientation within the urban form.

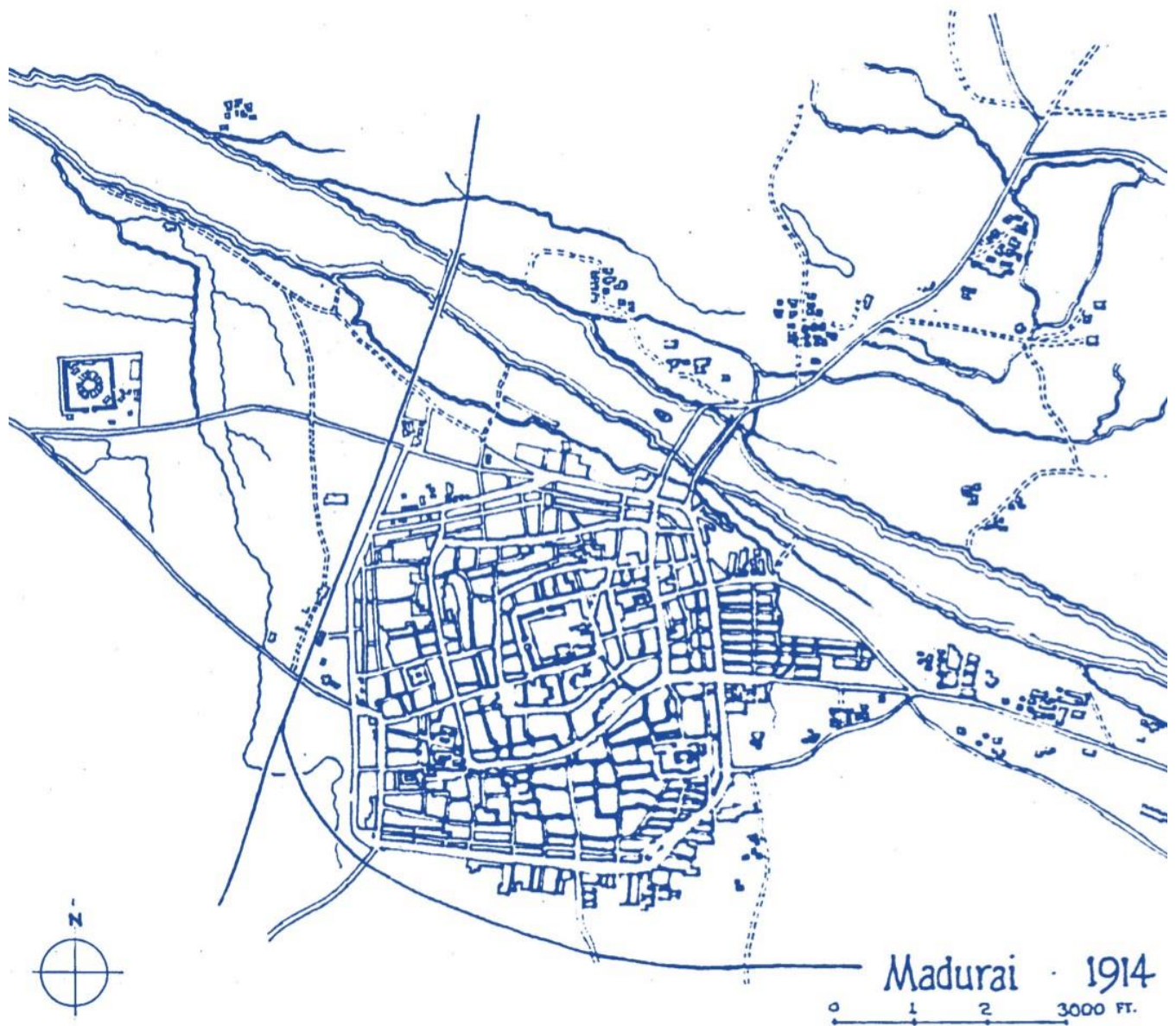


*Figure 14. Street Layout of Madurai Temple Town.
(Image Source: After Smith, 1969)*

The more prominent streets, the city's main corridors, have their character, and their gentle meandering softens the momentum of movement along them. This relaxation occurs primarily at the corners of the sizeable concentric avenue, which are demarcated for special events or rendered of a particular character using physical elements such as a tree to create a distinct sheltered environment. The sensitive treatment of transitions, nodes, and junctures is crucial to the city-building process.

- **Sadashivpet, Telangana.**



*Figure 15. Satellite Imagery of Sadashivpet Town, Telangana.
(Image Source: After Google Earth, 2023)*

The history of this unique town dates back to the 17th century C. This town was said to be conceived by Ranu Lingayamma, daughter of Sadashiv Reddy, who was the 5th ruler in hierarchy, during her regime between 1682 – 1692. During the British rule, Sadashivpet (Sadāseopet) was one of the prominent trade centres of the Medak District of then Hyderabad state, along with the district headquarters in Sangareddy town. It stood as a large emporium, with flourishing trade in both exports and imports, considering its location being in the mid of the trade route between Hyderabad and Bidar (See figure 3.2 and 3.3).

Sadashivpet town was surveyed in 1946 by the then town planner Mr. Fayazuddin., under the Nizam regime. The town depicts some of the unique features that are worth of the adulation. To start with, it is built on a square site and it is planned as per the Sarvatobhadra settlement layout prescribed in the Vāstuśāstra (See figure 3.4). The town was encircled by a moat comprising four gates leading to Nandikandi village on the East, Siddapur on South, Kohir on West, and Atmakur on the North. The town is fully occupied by various classes of people. The layout displays the cultivated lands on the south-east and north-east. The town has a weekly bazaar towards the east which still exists.



Figure 16. Survey map (1887-88) of Sadashivpet, Medak District, Andhra Pradesh.
(Image Source: After Survey of India, 1887-88)

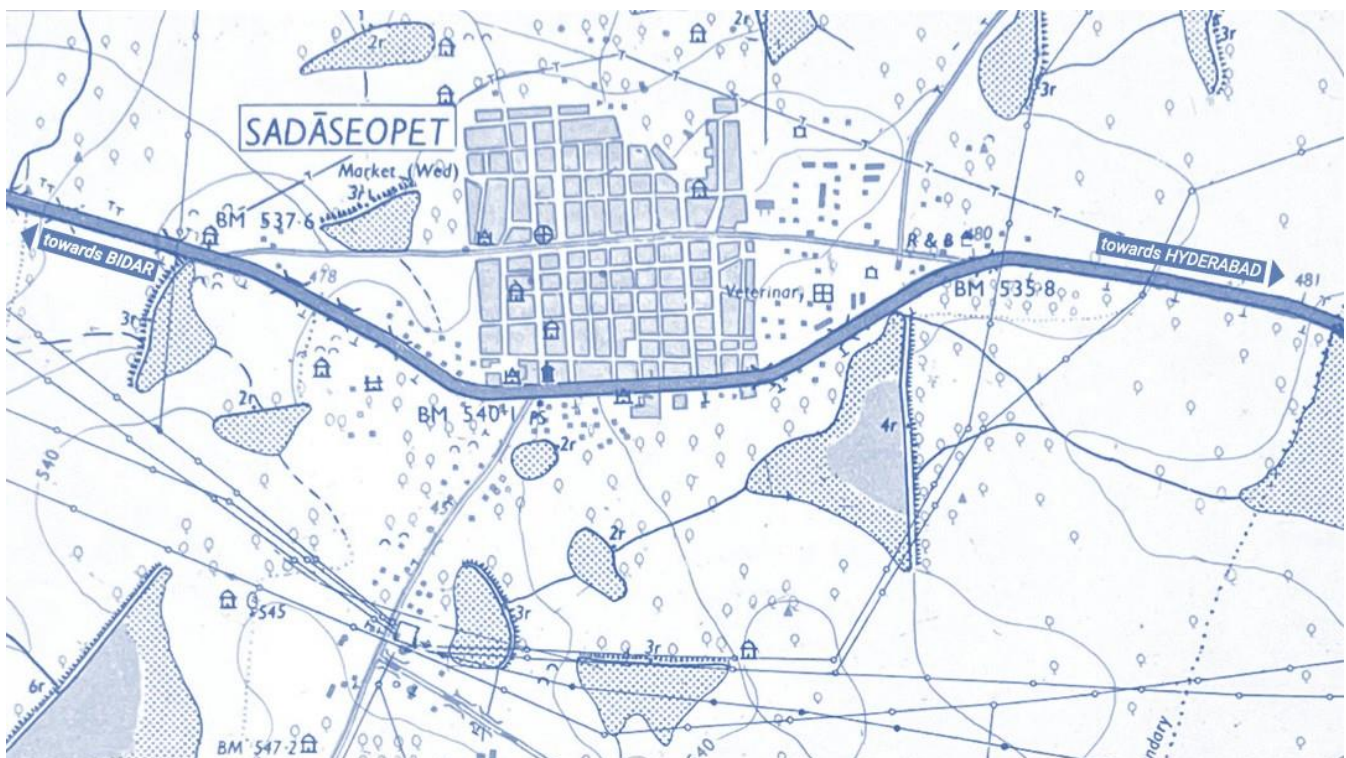


Figure 17. Typical Prastara Settlement Layout
(Image Source: After Imperial Gazetteer of India, v. 26, Atlas 1931 edition, Hyderabad)

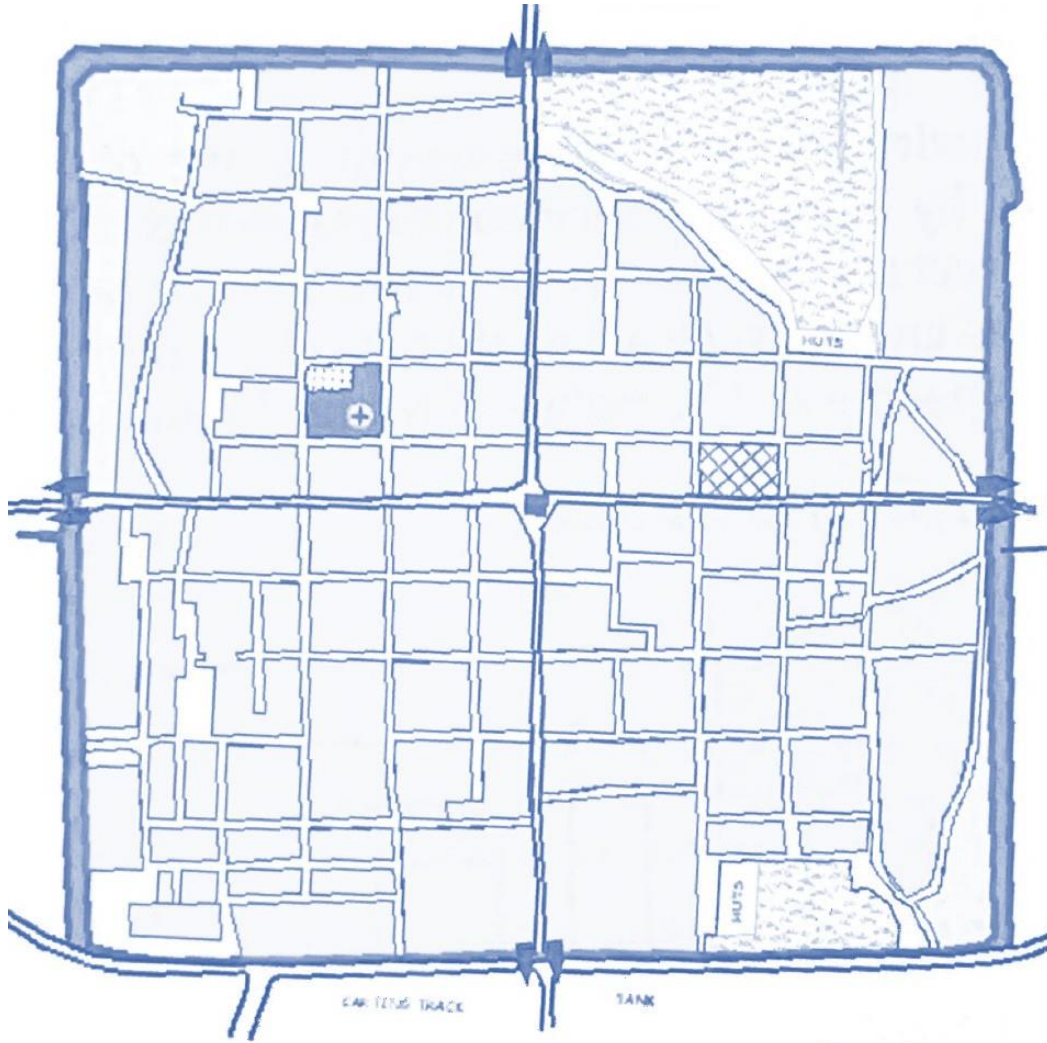


*Figure 18. Municipal Survey map (1946) of the Sadashivpet town, Medak District
(Image Source: Pakala, 2018. After M Fayazuddin, Town planner during the Nizam Rule, published survey map)*

- **Inference**

In summary, the literature review highlights the application of Vāstuśāstra principles in the planning and development of three cities/towns: Jaipur City in Rajasthan, Madurai Temple Town in Tamil Nadu, and Sadashivpet Town in Telangana. Jaipur stands as an exceptional example of a city that has preserved its traditional layout and successfully integrated the principles of the mandala and Prastara layout. Madurai, on the other hand, showcases a more flexible adaptation of Vāstuśāstra principles, with its concentric streets responding to the natural topography and incorporating diverse local interventions. Although Sadashivpet requires further academic research, it is recognized for its square-shaped layout and adherence to the Sarvatobhadra settlement layout prescribed in Vāstuśāstra. These three cases provide valuable insights into the practical application of Vāstuśāstra principles and demonstrate the significance of thoughtful city planning in creating vibrant and visually distinctive urban environments.

VII. Space Syntax Analysis

While analysis of ideal plan configurations as per Vaastushastra was already carried out, few questions remained-

- When applied on ground, do the configurations as per Vaastushastra still achieve high values of integration and synergy thereby ensuring Spatial Sustainability?
- Do the Western City Design theories lead to spatial sustainability too?
- Are the cities which were designed based upon Vaastu principles still spatially sustainable?

In order to answer the above questions, space syntax analysis was carried out for-

- Indian cities known to have been designed following Vaastu Principles of City Design.
- Ideal plans of cities as per western concepts.

Here is a summary of the results obtained from Space Syntax Analysis.

Space Syntax Analysis of three Indian Cities- Jaipur, Madurai and Sadashivpet

To understand whether cities planned based upon Vaastushastra guidelines are spatially sustainable and whether they retain the sustainability character after several centuries or not, three cities have been identified. The original plan and current day conditions were mapped and simulated using Depth Map X, a tool used to understand the spatial performance of each settlement.

Jaipur

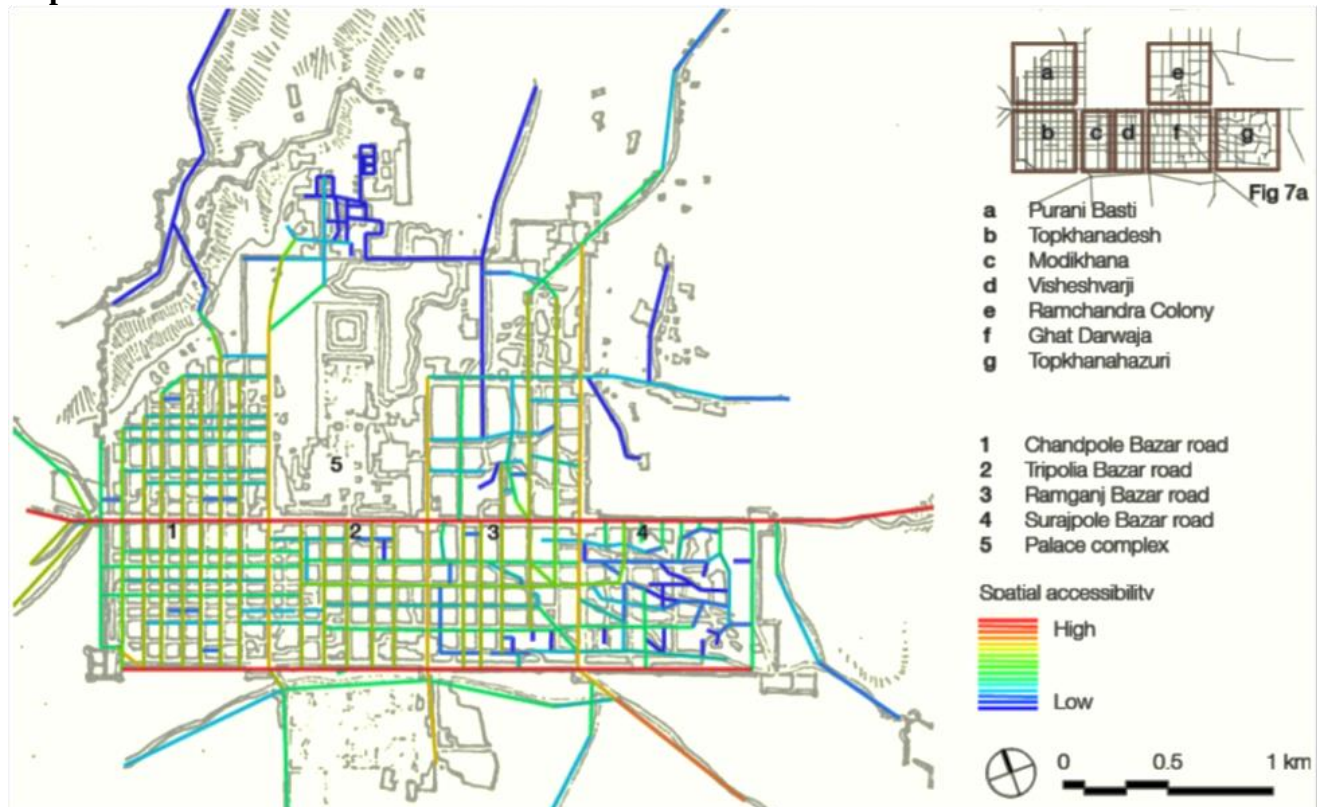


Figure 19. Spatial accessibility _ normalized integration, Old Jaipur,
(Source: Das, P., Rampuria, R. 2015)

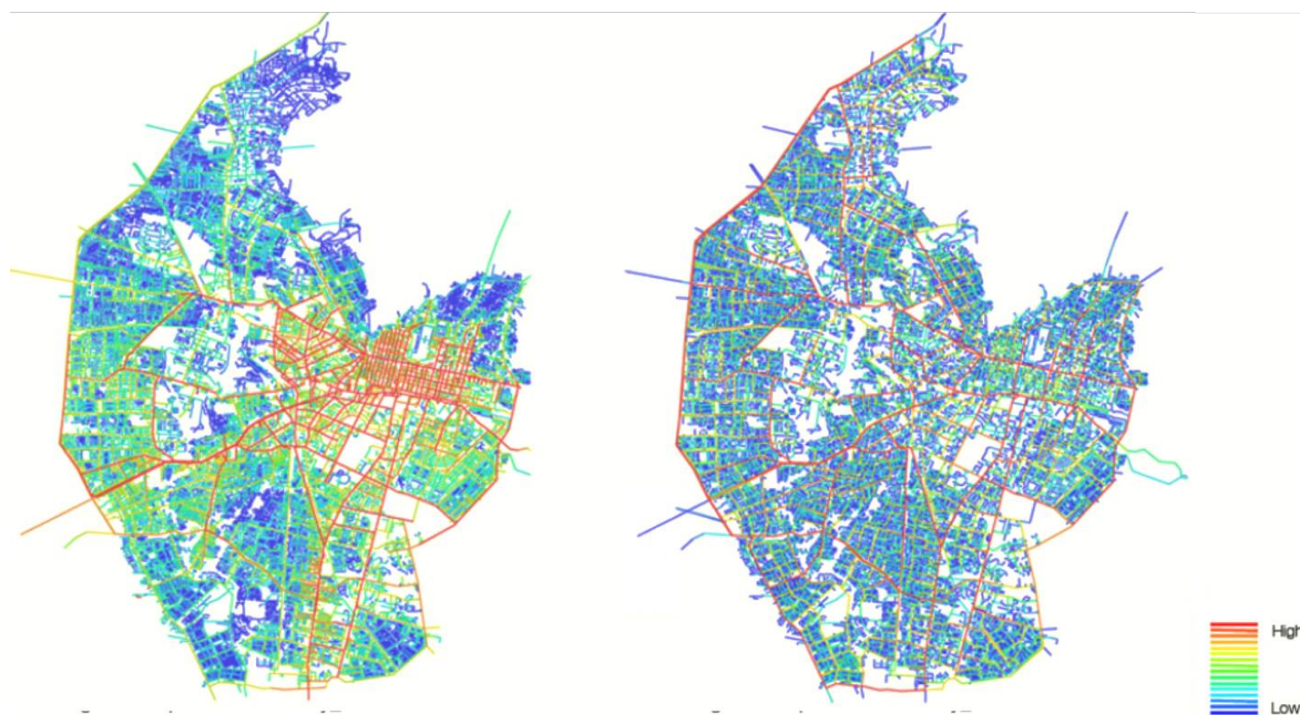


*Figure 20. Spatial accessibility analysis, present day Jaipur,
(Source: Das, P., Rampuria, R. 2015)*

The main route in the city, which connects Chandpole Darwazaa (gate) on the west to Surajpole Darwazaa on the east, has the greatest integration value, according to a spatial accessibility analysis of Jaipur (Figure.15). Many marketplaces have thrived along this roadway, which has been a well-traveled path since ancient times, including Chandpole Bazar, Tripolia Bazar, Ramganj Bazar, and Surajpole Bazar. (Das 2015).

This street has a high choice value on both a local and global scale, according to multiscale analysis of NACH n and NACH R400 (Figure.16). In this research, roads that are parallel to this main thoroughfare are also indicated. For instance, Kisanpole Bazaar Road, Johari Bazaar Road, Gangauri Bazaar Road, and Ghat Darwaza Bazaar Road are widely preferred for both global and local movements, respectively. In Jaipur, it's common to find similar trade groups clustered together, and frequently the street names correspond to certain trades. A few instances that are emphasised in the multiscale study are the Gheewalokarasta (road), Haldiyankarasta, and Jhalaniyankarasta because they have a high choice value on both the local and global scales. (Das 2015).

Jaipur's historic district continues to serve as the physical and conceptual centre of the whole city. confirms that it is the system's component that is most integrated. The historic market streets still have a high choice value, as shown by the spatial accessibility study in Figure.17, which makes it possible for these locations to be busy even today. (Das 2015).

In contrast to many other old cities throughout the world, Jaipur is thriving in the current metropolitan environment. These spatial patterns have undergone numerous cultural, social, and economic transformations without losing their significance. And this demonstrates how durable and resilient these ancient mechanisms are.

Madurai

The analysis of Madurai's spatial accessibility provides intriguing insights into the city's layout. Despite the Meenakshi Amman Temple being situated at the center of concentric streets, it is not the most integrated space in the city. Surprisingly, South Masi Street emerges as the most connected and accessible area, while South Veli Street also holds significant integration value, highlighting its importance in the city's spatial structure.

Further examination of movement patterns at different scales confirms that Masi Street is the most frequently chosen route for both local and global movement among the concentric streets. This suggests that Masi Street serves as a preferred pathway for navigating within the city. On a global scale, Veli Street gains prominence, particularly its East and South sections, indicating its significance for

longer-distance journeys. Additionally, East Chitrai Street near Pudhu Madapam and West Avani Moola Street are also favoured routes for global movement.

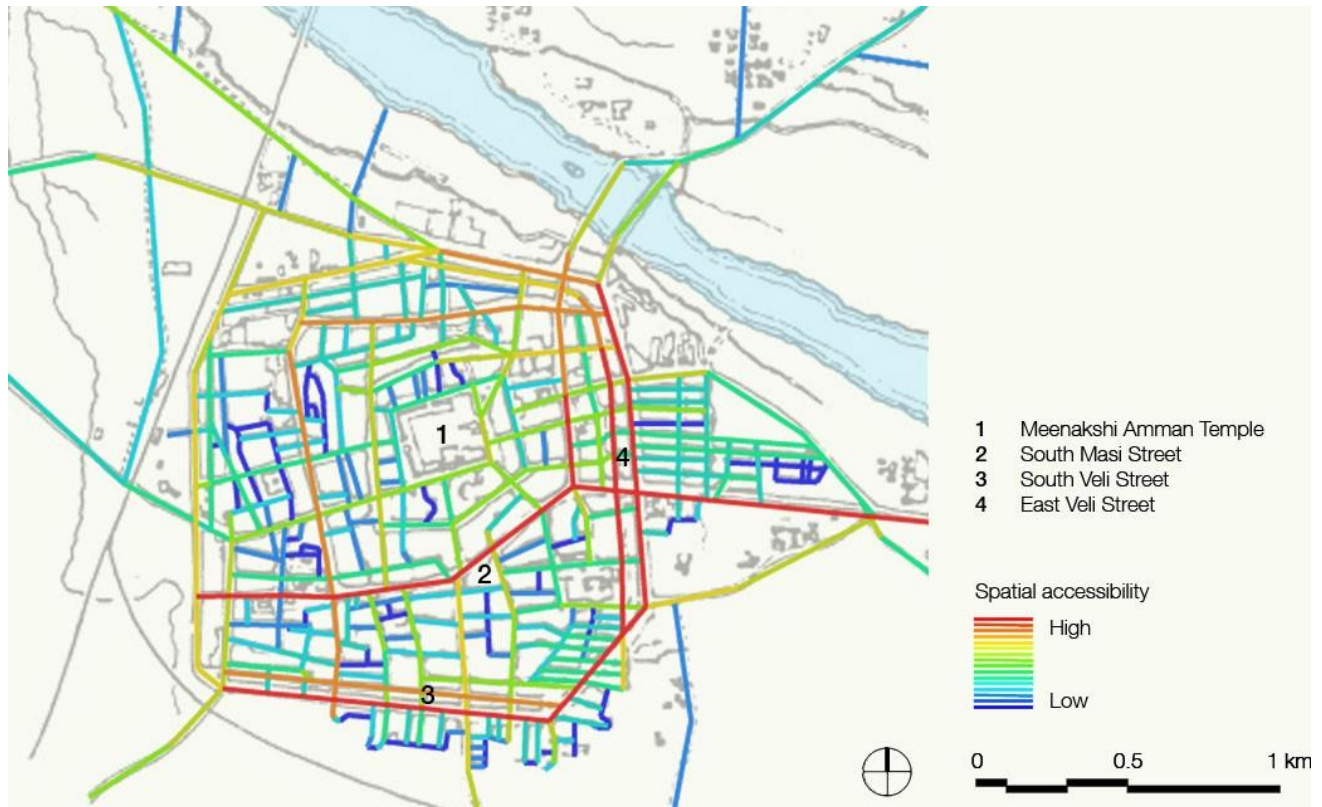


Figure 21. Spatial accessibility _ normalized integration, Old Madurai,
(Source: Das, P., Rampuria, R. 2015)

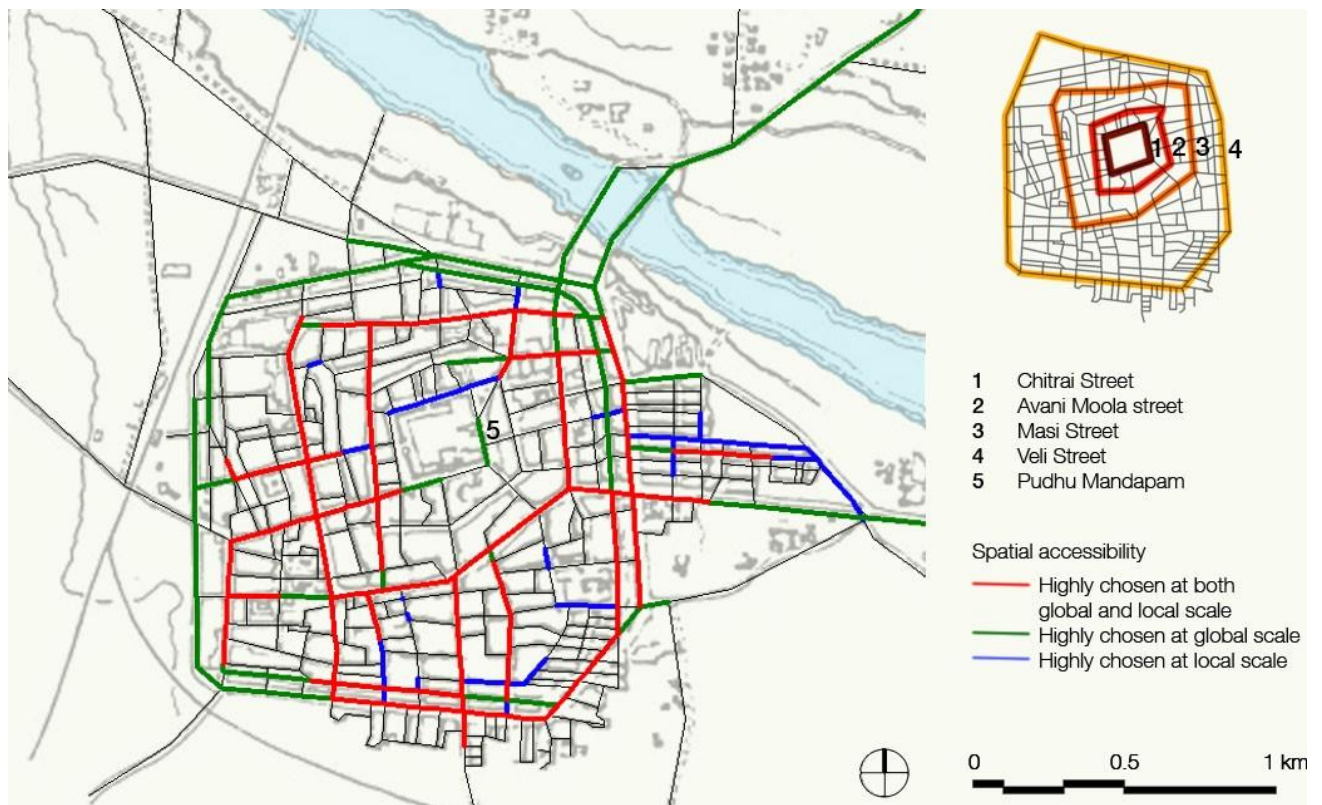


Figure 22. Spatial accessibility _ normalized integration, Old Madurai,
(Source: Das, P., Rampuria, R. 2015)

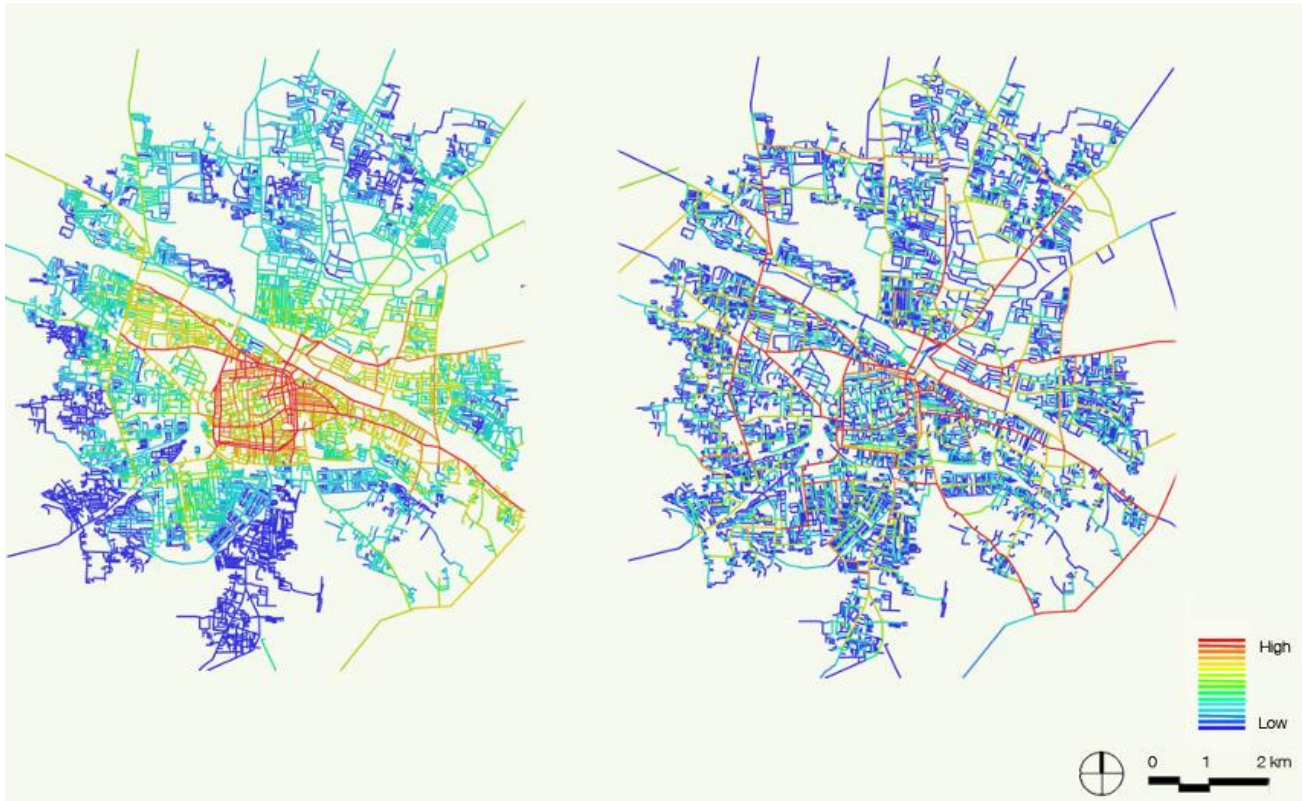


*Figure 23. Spatial accessibility analysis, present day Madurai,
(Source: Das,P., Rampuria, R. 2015)*

One intriguing finding is the correlation between choice value and commercial activity. The overlap of highly chosen routes with the current land use plan reveals that the majority of the city's commercial activity has thrived along these routes. This suggests that the movement patterns and accessibility of certain streets have influenced the clustering of specific trade groups. This distribution not only reflects the concept of "individuality within a group" but also highlights the manifestation of the caste system in the city's spatial layout.

The spatial model of present-day Madurai emphasizes the continued importance of the historic city core as the most integrated part of the spatial structure. South and East Masi Street remain preferred routes for global movement, underscoring their significance in the city's transportation network. Veli Street also retains a high choice value, facilitating movement and supporting vibrant commercial activities along its path. These transportation patterns effectively divert heavy traffic flow away from the main temple precinct, preserving its functionality and vitality.

Unlike many other historic towns, Madurai has successfully adapted to the present urban context while preserving its spatial structure. It has withstood cultural, social, and economic changes without compromising its historical significance.

Sadashivpet

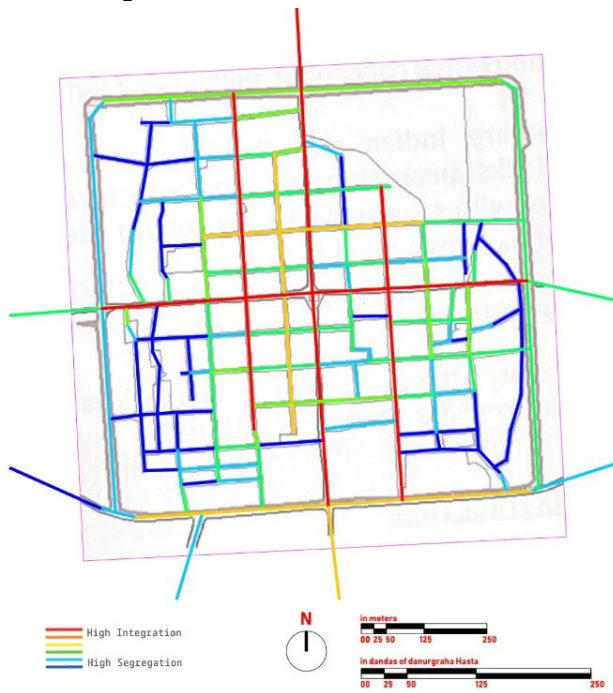


Figure 24. Global integration of the axes of Sadashivpet (1946)

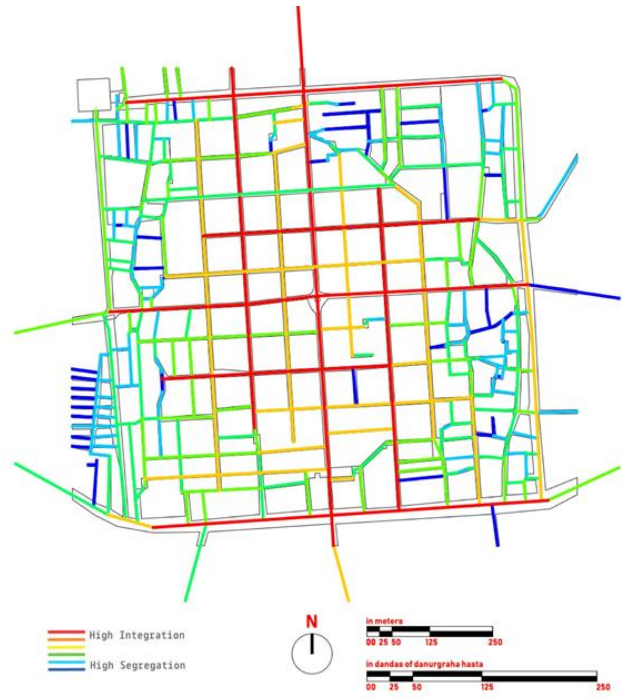


Figure 25. Global integration of the axes of Sadashivpet (2023)

The street accessibility analysis of Sadashivpet Town reveals its well-preserved spatial structure and historical relevance. The integration core, concentric streets, and historic market areas continue to play significant roles in the town's functionality and economic activity. The comprehensible layout and preservation of historic cores demonstrate the town's adaptability and resilience in the face of urban changes. By leveraging these principles, Sadashivpet Town showcases the successful blending of the past and present, making it a thriving urban environment.

Conclusion

It is evident from this section that all the three cities (which were based on Principles of Vaastushastra) and examined for their spatial sustainability, reveal that these cities continued to remain spatially sustainable even after several centuries of being in use. Thereby proving that Vaastu Principles can be applied in modern times to achieve sustainability.

Space Syntax Analysis of three Contemporary City Planning Concepts

Further, the three contemporary concepts of city planning are analyzed using space syntax to understand the effectiveness of each concept towards spatial sustainability. The intent is to understand whether modern city planning concepts are also leading towards the spatial sustainability or city planning as per Vaastushastra is a unique concept.

Garden city Concept by Sir Ebenezer Howard

The spatial analysis of Central City of Garden City concept reveals the following-

1. The primary roads (6 no.) are the primary routes which have highest integration. However, the integration values are not very high even towards the centre of the circle. Yet it clearly indicated that commercial activities would be best suited towards the centre. It is in line with the concept proposed in Garden City.

2. All circular Avenues/roads have almost the same level of integration. It is advantageous from economic point of view as all locations have similar connectivity and would be equally preferred. This would imply equality in pricing. However, the same may also be disadvantageous as the cost of residential areas may also go high.
3. Only the radial roads which are not connected to the centre are the ones having least traffic.
4. As far as Spatial Accessibility is concerned, it can be seen clearly that the layout leads towards spatial sustainability as it has higher values of integration and synergy.
5. However, the expansion of this layout cannot be perpetual. Once a central city has been designed, it can only be expanded to 8 times.
6. A worthy point to note is the proper delineation and conservation of forest, water bodies and agricultural land as an integral part of the city.
7. Industries have been proposed to be on the outskirts of the city which are directly fed by municipal railway. This allows for polluting activities to be limited to the outskirts of the city without compromising on their connectivity.

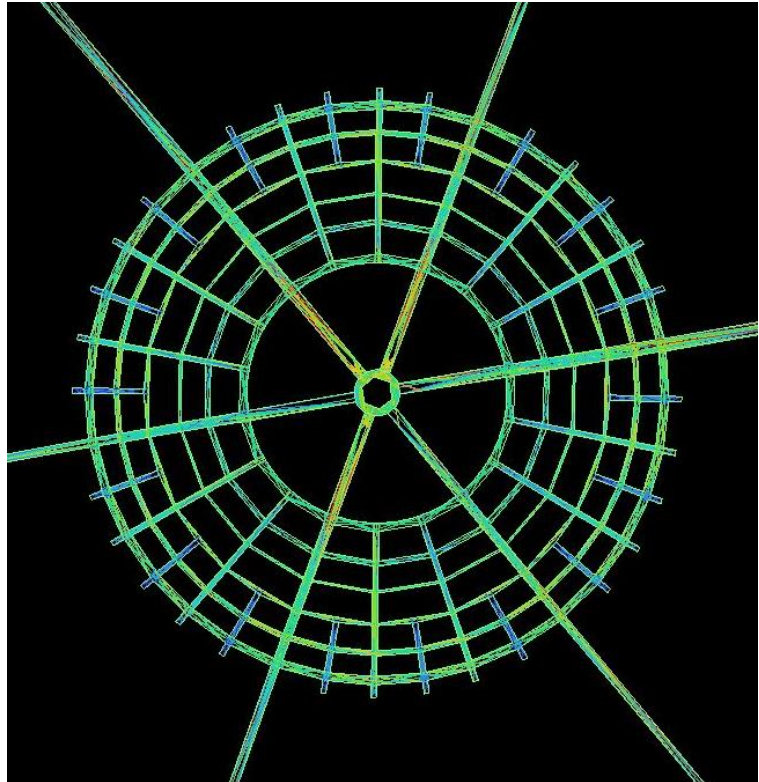


Figure 26. Spatial accessibility analysis, ideal Garden City plan

Radburn City Concept by Clarence S. Stein

1. Radburn city clearly defined the commercial/institutional and residential areas through its spatial accessibility. The main concept was to provide automobile free walking spaces which are safe particularly for children. As the Spatial Accessibility analysis reveals, most traffic will be limited to the two primary streets. All internal traffic can be pedestrian and safe.
2. The internal roads have lower integration values while the peripheral roads have higher integration values.
3. Common amenities have been placed closer to primary roads to allow better accessibility while they are also accessible from the internal roads.



Figure 27. Spatial accessibility analysis, ideal Radburn City Plan

Neighbourhood City Concept by Clarence Perry

1. Similar to Radburn city concept, Neighbourhood city concept also keeps all automobile traffic out of the neighbourhood. The internal sectors are well connected but remain traffic free.
2. Most amenities are planned along the three main internal roads.
3. All commercial areas are planned along the peripheral road.
4. However, there is not much discussion about ecological services.

Conclusion

Both contemporary city design theories and Vaastu shastra Principles give very good results as far as spatial sustainability is concerned. A contextualized prototype of City Design based upon Vaastushastra shall be developed based upon principles of Vastu and also integrating the learnings from URDPFI and contemporary city design theories.

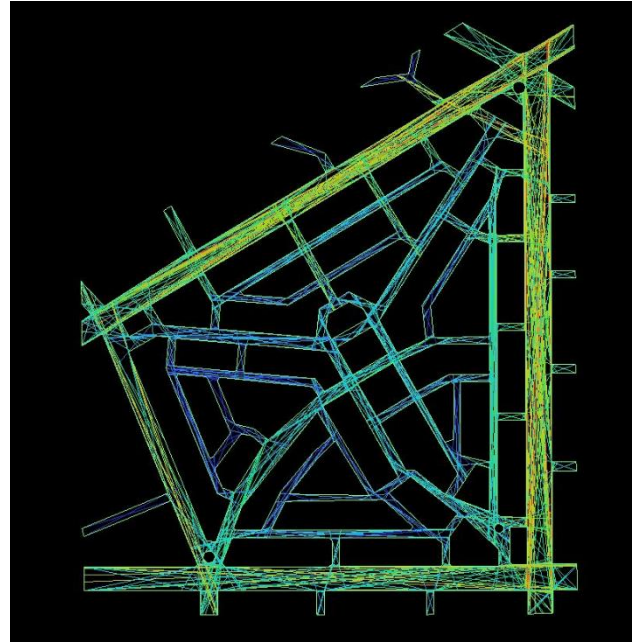


Figure 28. Spatial accessibility analysis, ideal Neighbourhood City Plan

f. Knowledge Repository

- Describe the structure and organization of the knowledge repository

The knowledge is disseminated through Journal and Conference publications. More research publications are underway and shall be available in public domain in the coming months.

- Explain how users/public can access and utilize the knowledge repository.

g. Capacity building

- Officers/faculty: 2
- Temporary manpower recruited/trained: 6

h. Results & Analysis with figures

- Present your findings in a clear and organized manner
- Include figures, Data analysis (Tables, Charts, Graphs), and Illustrations to support your findings.

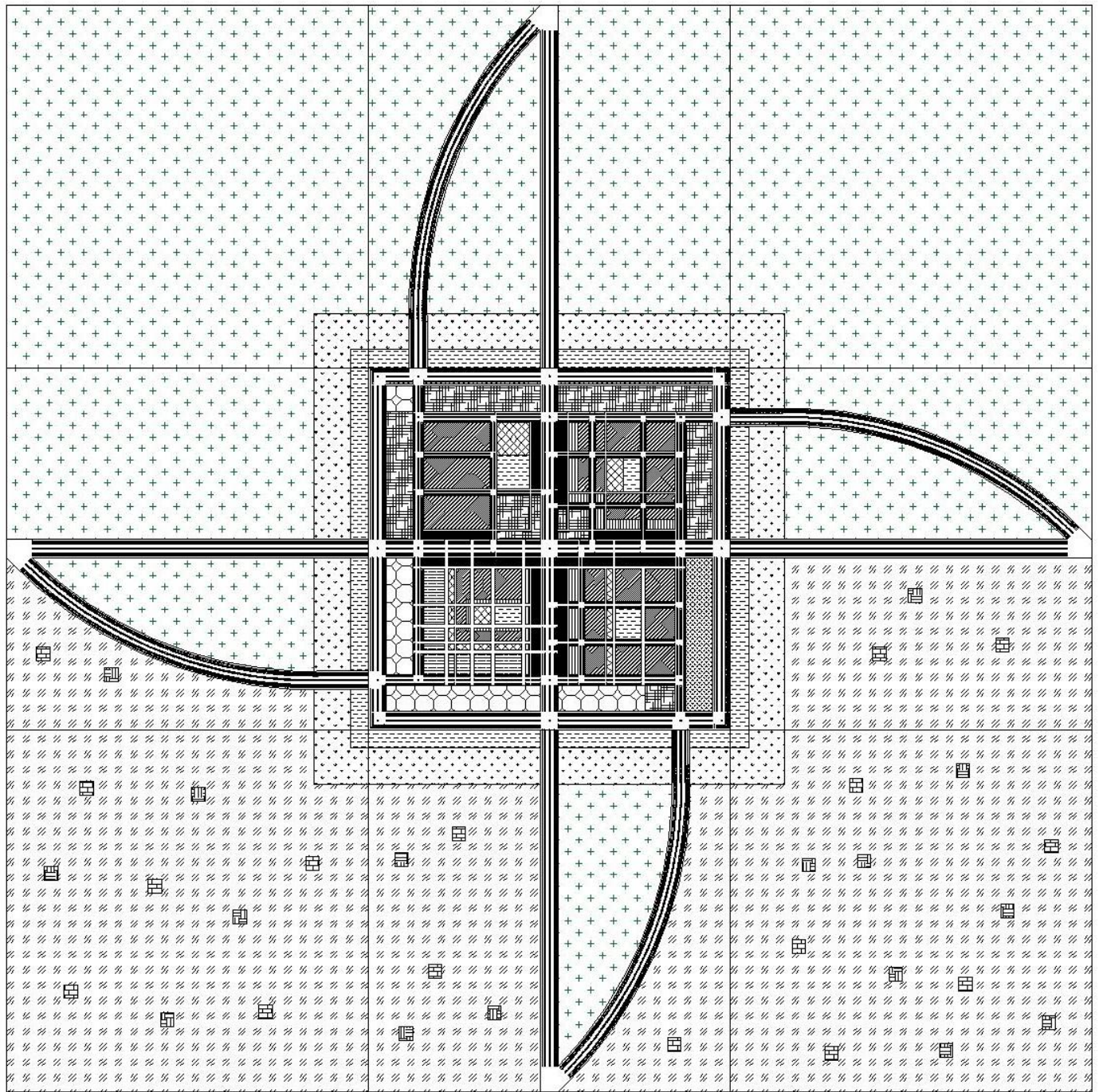
Prototype City Design Development based upon Vaastushastra Principles and contextualized using URDPFI

There is a possibility of preparing more than 10 lakh options. In order to develop a single prototype, most common typology of Prastara layout is used for the largest scale. This city can accommodate 60000/- inhabitants and covers 6600 acres as built area. Around the built part, 50000 acres of land is to be reserved for forests, water bodies and agriculture. The details of this prototype are given in this section.

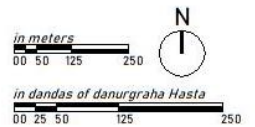
The city design as per Vaastu shastra incorporates some unique features as listed here-

1. Each city is supposed to maintain a mandatory Reserve Forest called Mahavana, at least 4 times the total size of the built part of the city.
2. Each city must have a water body all along the periphery of the city. It shall be connected with different water bodies planned within the city.
3. There must be at least 4 times area for agricultural land.
4. There must be brick kilns around the city and also some rural settlements.
5. The Industrial areas must be planned towards the periphery of the city and towards the end where wind leaves the city.
6. Commercial areas are planned along the most integrated roads.
7. Residential areas for Industrial workers are close to Industries while for administrative employees are close to their offices.
8. Residential areas for people involved in business are distributed across the city.
9. Commercial areas are also well distributed across the city.
10. There are total eight entries to the city. Four are for Industrial uses while all eight can be used for inhabitants. This segregates the large vehicles from that of the user vehicles.
11. Since commercial areas are distributed, the commercial areas are in walkable range. Also, schools are planned in the vicinity thereby reducing the need for motorized traffic.
12. All offices and workplaces are planned with their designated residential areas close to them, thereby further reducing the need for transportation.
13. The size of the city is limited to a 5km by 5 km square making most of the city walkable.
14. Each city is designed as self-sustainable from various aspects-

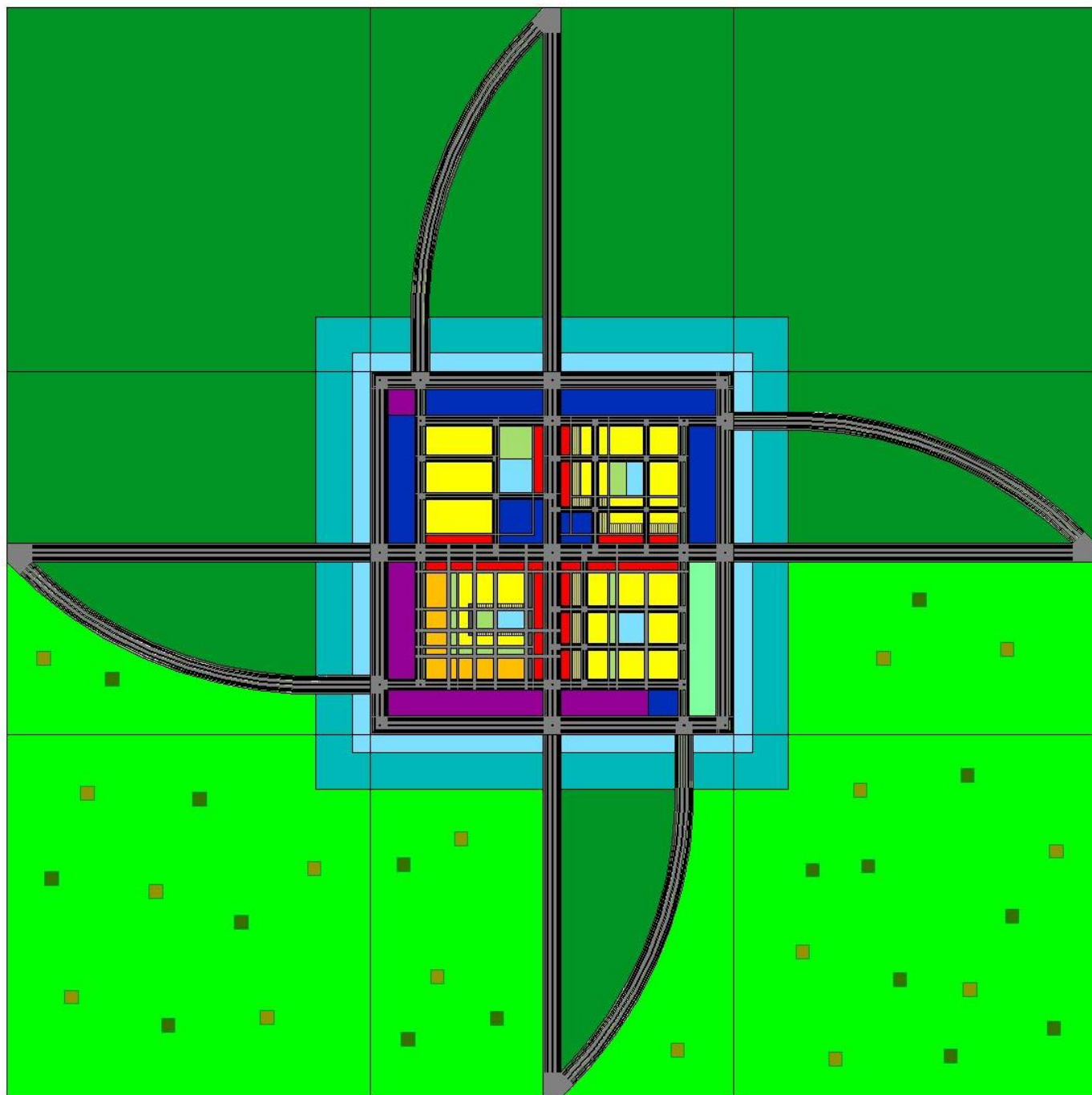
- City will grow its own food and will be food sustainable.
- It shall be water sustainable.
- It shall be energy efficient as less fuel for transportation is required.
- It shall be economically sustainable as most needs shall be fulfilled within the city.
- It shall be environmentally sustainable as it will have its own forest reserve to sequester the carbon produced by it.



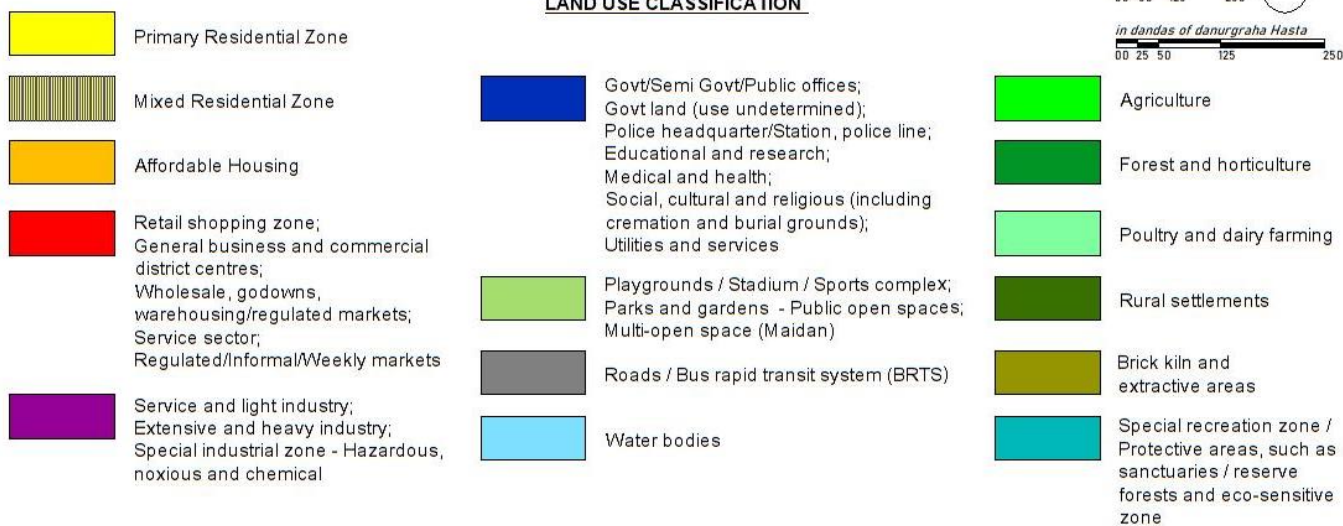
**PROTOTYPE PLAN
WITH
GRAPHIC SYMBOLS**



	Primary Residential Zone		
	Mixed Residential Zone		
	Affordable Housing		
	Retail shopping zone; General business and commercial district centres; Wholesale, godowns, warehousing/regulating markets; Service sector; Regulated/Informal/Weekly markets		
	Service and light industry; Extensive and heavy industry; Special industrial zone - Hazardous, noxious and chemical		



**PROTOTYPE PLAN
WITH
LAND USE CLASSIFICATION**



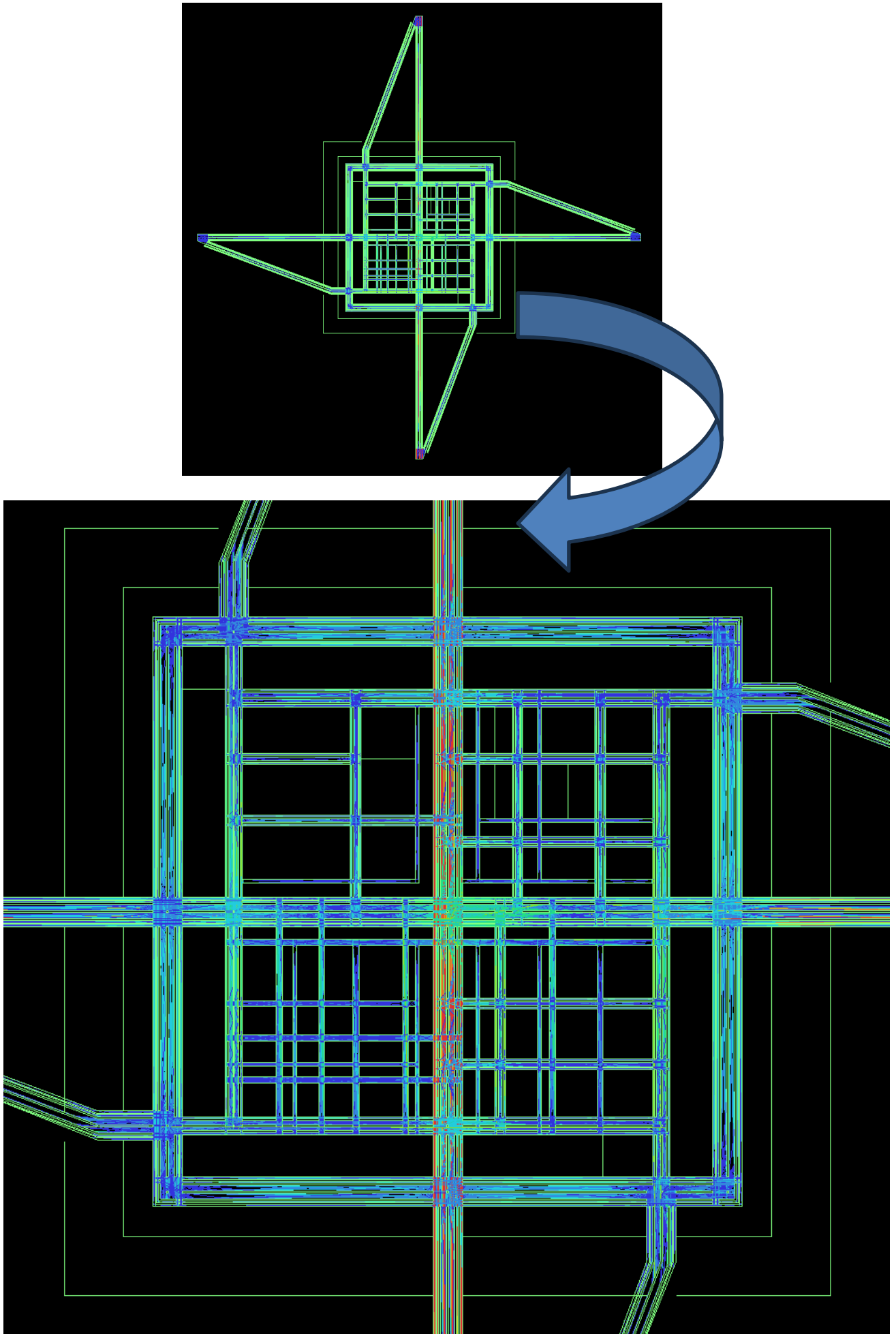


Figure 31. Spatial accessibility analysis of the Prototype Plan

Based on the proposed plan, area sharing percentages achieved are presented for the two cases-

1. Only the built part of the city.
2. City boundary including the ecosystem services.

Here is the percentage division of the areas-

<u>Area Calculation For Built Part of the City</u>			
Sl. No.	Use Category	Use Zone	Area Percentage
i)	Residential	Primary residential zone	15.34%
		Affordable Housing	2.49%
ii)	Commercial	Retail shopping zone	4.36%
		General business and commercial district centres	
		Wholesale, godowns, warehousing / regulated markets	
		Service sector	
		Regulated / Informal / Weekly markets	
iii)	Industry	Service and light industry	7.64%
		Extensive and heavy industry	
		Special industrial zone - Hazardous, noxious and chemical	
iv)	Public and semi-public	Govt / Semi Govt/ Public offices	12.86%
		Govt land (use undetermined)	
		Police headquarter / Station, police line	
		Educational and research	
		Medical and health	
		Social, cultural and religious (including cremation and burial grounds)	
		Utilities and services	
v)	Mixed use	Mixed residential zone	2.44%
vi)	Recreational	Playgrounds / Stadium / Sports complex	12.48%
		Parks and gardens - Public open spaces	
		Multi-open space (Maidan)	
vii)	Transportation and communication	Roads/Bus rapid transit system (BRTS)	37.08%
viii)	Primary activity	Poultry and dairy farming	3.06%
ix)	Protective and undevelopable use zone	Water bodies	2.25%
TOTAL PERCENTAGE AREA			100.00%

Area Calculation for entire City including Ecosystem Services			
Sl. No.	Use Category	Use Zone	Area Percentage
i)	Residential	Primary residential zone	1.70%
		Affordable Housing	0.28%
ii)	Commercial	Retail shopping zone	0.48%
		General business and commercial district centres	
		Wholesale, godowns, warehousing / regulated markets	
		Service sector	
		Regulated / Informal / Weekly markets	
iii)	Industry	Service and light industry	0.85%
		Extensive and heavy industry	
		Special industrial zone - Hazardous, noxious and chemical	
iv)	Public and semi-public	Govt / Semi Govt/ Public offices	1.43%
		Govt land (use undetermined)	
		Police headquarter / Station, police line	
		Educational and research	
		Medical and health	
		Social, cultural and religious (including cremation and burial grounds)	
		Utilities and services	
v)	Mixed use	Mixed residential zone	0.27%
vi)	Recreational	Playgrounds / Stadium / Sports complex	2.52%
		Parks and gardens - Public open spaces	
		Multi-open space (Maidan)	
vii)	Transportation and communication	Roads/Bus rapid transit system (BRTS)	7.56%
viii)	Primary activity	Agriculture	34.40%
		Forest and horticulture	42.40%
		Poultry and dairy farming	0.34%
		Rural settlements	0.25%
		Brick kiln and extractive areas	0.25%
ix)	Protective and undevelopable use zone	Water bodies	2.37%
		Special recreation zone / Protective areas, such as sanctuaries / reserve forests and eco-sensitive zone	4.90%
TOTAL PERCENTAGE AREA			100.00%

If we compare these area percentages, it can be clearly seen that the area designated for residential areas is much lower than that prescribed in city design today. Instead of 35-38% area to be designated for residential, Vaastu Shastra based plan considers only 18-20% area for residential. The land uses which consume higher than URDPFI vales are for roads/transportation and reserve green areas.

i. Achievements/ highlights of the project

j. References

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k. Appendices

- Include any additional information that supports the research, may not fit within the main body of the report.

List of Books referred on the subject of Vaastu Shastra

List of References

Sanskrit Language

#	Title of the Book / पुस्तक का शीर्षक	Editor / Author / लेखक	Language / भाषा	Year of Publication / प्रकाशन का वर्ष	Publisher / प्रकाशक	Status
VASTU S 001	The Manushyalayachandrika	T. G. Sastri	Sanskrit	1917	The Superintendent, Government Press, Trivandrum	In LAB Library
VASTU S 002	The Mayamata of Mayamuni	T. G. Sastri	Sanskrit	1919	The Superintendent, Government Press, Trivandrum	In LAB Library
VASTU S 003	Samaranganasutradhara by King Bhojadeva (Volume I)	T. G. Sastri	Sanskrit	1924	Baroda Central Library	In LAB Library
VASTU S 004	Samaranganasutradhara by King Bhojadeva (Volume II)	T. G. Sastri	Sanskrit	1925	Baroda Central Library	In LAB Library
VASTU S 005	Samarangana-Sutradhara of Maharajadhiraja Bhoja, The Parmara Ruler of Dhara	T. G. Sastri & V. S. Agrawala	Sanskrit	1966	Oriental Institute, Baroda	In LAB Library
VASTU S 006	Kautaliyarthasastra of Sri Visnugupta	H. Deveerappa & N. S. Venkata nathacharya	Sanskrit	1960	Oriental Research Institute: University of Mysore	In LAB Library
VASTU S 007	Shatpath-Brahmanam (Part-I)	T. Sayanacharya & K. Saraswati	Sanskrit	1990	Nag Publishers, Delhi	In LAB Library
VASTU S 008	Shatpath-Brahmanam (Part-II)	T. Sayanacharya & K. Saraswati	Sanskrit	1990	Nag Publishers, Delhi	In LAB Library
VASTU S 009	Shatpath-Brahmanam (Part-III)	T. Sayanacharya & K. Saraswati	Sanskrit	1990	Nag Publishers, Delhi	In LAB Library
VASTU S 010	Shatpath-Brahmanam (Part-IV)	T. Sayanacharya &	Sanskrit	1990	Nag Publishers, Delhi	In LAB Library

		K. Saraswati				
VASTU S 011	Shatpath-Brahmanam (Part-V)	V. B. Bhagwat	Sanskrit	1990	Nag Publishers, Delhi	In LAB Library
VASTU S 012	The Taittiriya Brahmana (Astaka I)	A. M. Sastri	Sanskrit	1985	Motilal Banarsidass, Delhi	In LAB Library
VASTU S 013	The Taittiriya Brahmana (Astaka II)	R. S. Sastry	Sanskrit	1985	Motilal Banarsidass, Delhi	In LAB Library
VASTU S 014	The Taittiriya Brahmana (Astaka III, Part I)	A. M. Sastri & L. Srinivas acharya	Sanskrit	1985	Motilal Banarsidass, Delhi	In LAB Library
VASTU S 015	The Taittiriya Brahmana (Astaka III, Part II)	A. M. Sastri & L. Srinivas acharya	Sanskrit	1985	Motilal Banarsidass, Delhi	In LAB Library
VASTU S 016	Kashyapa Shilpa Shastram		Sanskrit		Maharishi University of Management Vedic Literature Collection	In LAB Library
Sanskrit to Hindi Translations						
#	Title of the Book / पुस्तक का शीर्षक	Author / लेखक	Language / भाषा	Year of Publication / प्रकाशन का वर्ष	Publisher / प्रकाशक	Status
VASTU H 001	मयमतम् / Mayamatam Vol. I	Dr. S. Pandey	Hindi Translation	2020	Chaukhambha Surbharati Prakashan	In LAB Library
VASTU H 002	मयमतम् / Mayamatam Vol. II	Dr. S. Pandey	Hindi Translation	2020	Chaukhambha Surbharati Prakashan	In LAB Library
VASTU H 003	राजवल्लभमंडनम् / Rajavallabhamandanam	Dr. S. Pandey	Hindi Translation	2001	Chaukhambha Surbharati Prakashan	In LAB Library
VASTU H 004	विश्वकर्मवास्तुशास्त्रम् / Visvakarma's Visvakarma-Vastu-Sastram	Dr. S. K. 'Jugnu' and Prof. B. L. Sharma	Hindi Translation	2010	Parimal Publications	In LAB Library
VASTU H 005	विश्वकर्मप्रकाशः (वास्तुशास्त्रम्) / Vishvakarma Prakash (Vaastu Sastram)	M. A. Katayayan	Hindi Translation	2021	Chaukhambha Surbharati Prakashan	In LAB Library
VASTU H 006	समराङ्गण-सूत्रधार-वास्तुशास्त्र (भवन-निवेश) / Samarangana-Sutradhara-Vastu-Sastra (Civil Architecture in Ancient India)	Dr. D. N. Shukla	Hindi Translation	2003	Meherchand Lakshman Das Publications	In LAB Library
VASTU H 007	बृहत्संहिता / Brihat Samhita	P. A. J. Sharma	Hindi Translation	2003	Chaukhambha Vidya Bhawan	In LAB Library
VASTU H 008	बृहदवास्तुमाला / Brihad Vastu Mala	Dr. B. Dwivedi	Hindi Translation	2021	Chaukhambha Surbharati Prakashan	In LAB Library

		& Dr. R. Sharma				
VASTU H 009	वास्तुरत्नाकर / Vastu Ratnakara	V. P. Dwivedi	Hindi Translation	2020	Chaukhambha Sanskrit Series Office	In LAB Library
VASTU H 010	मुहूर्त चिंतामणि / Muhurta Chintamani	V. P. Dwivedi	Hindi Translation	2020	Chaukhambha Surbharati Prakashan	In LAB Library
VASTU H 011	वास्तुसौख्यम् / Vaastu Saukhyam	Prof. K. Shukla	Hindi Translation	1999	Sampurnanand Sanskrit University	In LAB Library
VASTU H 012	वास्तुसारसंग्रह / Vastusarasangraha	Prof. K. Shukla	Hindi Translation	2002	Sampurnanand Sanskrit University	In LAB Library
VASTU H 013	वास्तुसौख्यम्: Vaastu Saukhyam	Dr. S. K. 'Jugnu'	Hindi Translation	2017	Chaukhambha Sanskrit Series Office	In LAB Library
VASTU H 014	अपराजितपृच्छा: / Aparajitaprccha Vol.I (Part-1)	Dr. S. K. 'Jugnu' and Prof. B. Sharma	Hindi Translation	2011	Parimal Publications, Delhi	In LAB Library
VASTU H 015	अपराजितपृच्छा: / Aparajitaprccha Vol.I (Part-2)	Dr. S. K. 'Jugnu' and Prof. B. Sharma	Hindi Translation	2011	Parimal Publications, Delhi	In LAB Library
VASTU H 016	विश्वकर्मा प्रकाश - भाषातिकायुत / Vishwakarma Prakash - Bhashatikayut		Hindi Translation	2019	Khemraj Srikrishnadass Prakashan	In LAB Library
Sanskrit to English Translations						
#	Title of the Book / पुस्तक का शीर्षक	Author / लेखक	Language / भाषा	Year of Publication / प्रकाशन का वर्ष	Publisher / प्रकाशक	Status
VASTU E 001	A Summary of the Manasara	Prasanna Kumar Acharya	English Translation	1918	E. J. Brill Ltd., Leiden	In LAB Library
VASTU E 002	Manasara Series : Vol.I : A Dictionary of Hindu Architecture	Prasanna Kumar Acharya	English Translation	2008	Low Price Publications, Delhi	
VASTU E 003	Manasara Series : Vol.II : Indian Architecture according to Manasara-Silpasastra	Prasanna Kumar Acharya	English Translation	1927	Indian India	
VASTU E 004	Manasara Series : Vol.III : Manasara on Architecture and Sculpture - Sanskrit Text with Critical Notes	Prasanna Kumar Acharya	English Translation	1934	The Oxford University Press	
VASTU E 005	Manasara Series : Vol.IV : Architecture of Manasara - Translated from Original Sanskrit	Prasanna Kumar Acharya	English Translation	1934	Munshiram Manoharlal Publishers Pvt. Ltd., New Delhi	
VASTU E 006	Manasara Series : Vol.V : Architecture of Manasara - Illustrations of Architectural and Sculptural Objects - With a Synopsis	Prasanna Kumar Acharya	English Translation	1934	Oriental Books Reprint Corporation, New Delhi	
VASTU E 007	Manasara Series : Vol.VI : Hindu Architecture in India and Abroad	Prasanna Kumar Acharya	English Translation	1946	The Oxford University Press	

VASTU E 008	Manasara Series Vol.VII : An Encyclopedia of Hindu Architecture	Prasanna Kumar Acharya	English Translation	2001	Low Price Publications, Delhi	
VASTU E 009	Samarangana Sutradhara of Bhojadeva	Sudarshan Kumar Sharma	English Translation	2007	Parimal Publications Ltd.	
VASTU E 010	Mayamatam Volume I	Bruno Dagens	English Translation	2007	Indira Gandhi National Center for Arts	In LAB Library
VASTU E 011	Mayamatam Volume II	Bruno Dagens	English Translation	2007	Indira Gandhi National Center for Arts	
VASTU E 012	The Brhat Sanhita of Varaha-Mihira	Dr. H. Kern	English Translation	1865	The Baptist Mission Press, Calcutta	
VASTU E 013	The Brihat Samhita of Varaha Mihira	N. C. Iyer	English Translation	1884	The South Indian Press, Madura	
VASTU E 014	Vastumandanam of Sutradhara Mandana	Dr. Anasuya Bhowmik	English Translation	2017	Motilal Banarasi Dass Publisher Pvt. Ltd.	In LAB Library
VASTU E 015	Vastu-Sastra Vol. I Hindu Science of Architecture	D N Shukla	English Translation	1961	Punjab University, Chandigarh	In LAB Library
VASTU E 016	Vastu-Sastra Vol. II Hindu Canons of Iconography & Painting	Dr. D N Shukla	English Translation	1958	Gorakhpur University, Gorakhpur	In LAB Library
VASTU E 017	Narada Silpasastra	R.N. Iyengar	English Translation	2018	Jain University Press	In LAB Library
VASTU E 018	Aparajitaprccha of Bhuvanadeva	P. A. Mankad	English Translation	1950	Oriental Institute, Baroda	In LAB Library
VASTU E 019	The Arthasastra of Kautilya : Part - 1 & 2 Adhikaranas	M. T. G. Sastri & Dr. N. P. Unni	English Translation	2006	New Bharatiya Book Corporation, Delhi	In LAB Library
VASTU E 020	The Arthasastra of Kautilya : Part - 3 Adhikaranas	M. T. G. Sastri & Dr. N. P. Unni	English Translation	2006	New Bharatiya Book Corporation, Delhi	In LAB Library
VASTU E 021	Bhoja's Samarangana-Sutradhara : Vol.I	Prof. P. Kumar	English Translation	1998	New Bharatiya Book Corporation, Delhi	In LAB Library
VASTU E 022	Bhoja's Samarangana-Sutradhara : Vol.II	Prof. P. Kumar	English Translation	1998	New Bharatiya Book Corporation, Delhi	
VASTU E 023	Varahamihira's Brihat Samhita	P. V. S. Sastri & V. M. R. Bhat	English Translation	1946	V. B. Soobbiah & Sons., Bangalore City	
VASTU E 024	Varahamihira's Brihat Samhita	P. V. S. Sastri & V. M. R. Bhat	English Translation	1947	V. B. Soobbiah & Sons., Bangalore City	
Contemporary Texts on Vastu Shastra						
#	Title of the Book / पुस्तक का शीर्षक	Author / लेखक	Language / भाषा	Year of Publication	Publisher / प्रकाशक	Status

				/ प्रकाशन का वर्ष		
VASTU C 001	Indian Architectural Theory: Contemporary Uses of Vastu Vidya	V. Chakrabarti	English	1998	Curzon Press, Surrey	In LAB Library
VASTU C 002	Essay on the Architecture of the Hindus	R. Raz	English	1828	Oriental Translation Fund, London	In LAB Library
VASTU C 003	Living Architecture: Indian	A. Volwahren	English	1969	Oxford & IBH Publishing Co., Calcutta	In LAB Library
VASTU C 004	Text into Form: Dwelling, Cosmos and Design Theory in Traditional South Asia	B. G. MacDougall	English	2008	Cornell University	In LAB Library
VASTU C 005	Building Jaipur: The Making of an Indian City	V. Sachdev & G. Tillotson	English	2002	Reaktion Books Ltd., London	In LAB Library
VASTU C 006	Design in Vastuvidya	Dr. B. T. S. Prabhu & Dr. A. Achyuthan	English	2012	Vastuvidyapratisthanam, Calicut	In LAB Library
VASTU C 007	A Text Book of Vastuvidya	Dr. B. T. S. Prabhu & Dr. A. Achyuthan	English	2020	Vastuvidyapratisthanam, Calicut	In LAB Library
VASTU C 008	Principles of Plot Selection in Indian Architecture	Dr. S. Koyithatta	English	2001	Vastu Darshan Books, Thalassery	In LAB Library
VASTU C 009	The Spirit of Indian Architecture	D K Bubbar	English	2005	Rupa & Co.	In LAB Library
VASTU C 010	वास्तुशास्त्रस्य भाषा - संस्कृत पथ्यताम्: मनुष्यालयचंद्रिका/ Learn Samskrit - The Language of vastusastra: manusyalayacandrika	P. Kumar, Dr. R. P. Aurulli & P. Powrel	Sanskrit	2022	Sanskrit Promotion Foundation, Delhi	In LAB Library
VASTU C 011	वास्तुशास्त्रस्य भाषा: संस्कृत पथ्यताम् / Learn Samskrit: The Language of vastusastra	P. Kumar, Dr. R. P. Aurulli & P. Powrel	Sanskrit	2022	Sanskrit Promotion Foundation, Delhi	In LAB Library
VASTU C 012	Introduction to Indian Knowledge Systems: Concepts and Applications	B. Mahadevan, V. R. Bhat & N. Pavana R. Nagendra	English	2022	PHI Learning Private Limited, Delhi	In LAB Library (Kumar Jyoti Nandy)
VASTU C 013	The Penguin Guide to Vaastu The Classical Indian Science of Architecture & Design	S. Ananth	English	1998	Penguin Books India	In LAB Library (Sandeep K)
VASTU C 014	Fluid	A. Jaiswal	English	2021	Wisdom Tree, New Delhi	In LAB Library (Kumar

						Jyoti Nandy)
VASTU C 015	Town Planning in Ancient India	B. B. Dutt	English	1925	Thacker, Spink & Co., Calcutta	In LAB Library
VASTU C 016	Town planning in Ancient Dekkan	C. P. V. Ayyar	English	1916	The Law Printing House, Mount Road, Madras	In LAB Library
VASTU C 017	Album of Hindu Iconography	P. O. Sompura	English	1976	The Late Shri Balwantrai Prabhashankar Sompura & Brothers, Ahmedabad	In LAB Library
VASTU C 018	Building Architecture of Sthapatya Veda	Dr. V. G. Sthapati	English	2005	Dakshina Publishing House, Chennai	In LAB Library
VASTU C 019	भारतीय वास्तुशास्त्र का इतिहास / History of Indian Vastusastra	Dr. V. Singh	Hindi	2010	Eastern Book Linkers, Delhi	In LAB Library
VASTU C 020	Kautilya The Arthashastra	L. N. Rangarajan	English	1992	Penguin Books India (P) Ltd.	In LAB Library
VASTU C 021	Kautilya's Arthasastra	Dr. R. Shamasastri	English	1929	Mysore Printing & Publishing House, Mysore	In LAB Library
VASTU C 022	Vastu Astrology and Architecture	G. V. Vasudev	English	2009	Motilal Banarasidass Publisher Pvt. Ltd.	In LAB Library
VASTU C 023	The Canons of Indian Art or A Study on Vastuvidya	T. Bhattacharya	English	1963	Firma K. L. Mukhopadhyay, Calcutta	In LAB Library
VASTU C 024	The Hindu Temple : Vol.I	S. Kramrisch	English	1946	University of Calcutta	In LAB Library
VASTU C 025	The Hindu Temple : Vol.II	S. Kramrisch	English	1946	University of Calcutta	In LAB Library
VASTU C 026	History of the Banaras Hindu University	S. L. Dar & S. Somaskandan	English	2007	Banaras Hindu University, Varanasi	In LAB Library
VASTU C 027	The Universal History of Numbers: From Prehistory to the Invention of the Computer	G. Ifrah	English	2000	John Wiley & Sons, Inc., USA	In LAB Library

I. Project Outcomes Contribution to (Bullet points. No more than 250 words in each category)

- **Dr̥ṣṭi:**
- **Jñāna:**
- **Laukika-prayojana:**

Prof. Avlokita Agrawal

Name of PI

Signature of PI

Prof. Pravesh Vyas

Name of Co-PI

Signature of Co-PI

Prof. Mahua Mukherjee

Head of the Institution

Signature