The relevance of Manasara planning model in walled cities of India: An assessment review of Rajasthan

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Abstract
Whenever town planning of old towns is discussed, various planning models of the traditional towns that were planned in the Vedic times are always referred. To make these planning models a success, careful consideration was given to all the aspects associated with a town such as its size, scale, allocation of spaces for various activities based on their role, road layouts, and widths, building heights, assigning of housing sectors based on caste residing within the town and how all of these justified the means to achieve the same. At the same time, various walled cities and fortified towns of Rajasthan have always been studied while understanding newer planning models. This research aims to find a connection between the planning concepts that were given in the Manasara and the walled cities of Rajasthan in terms of their planning. To correspond to the local on-site conditions for these walled cities and determining the similarities and differences with the Manasara town models shall be an objective of this study with the conclusion of how much original character has been retained in their planning.

Keywords: Manasara, Medieval Towns, Settlement, Traditional Planning, Rajasthan, Walled Cities, Danda.

Introduction
Assessing the efficiency of a town always boils down to how its planning has been done. To achieve the same, an in-depth study is carried out to understand their planning concepts and principles. These principles offer a glimpse of what the town planners of that era had in mind for bringing their ideas to life. In terms of delivering a solution for better liveable areas, many planners over the years have theorized and developed a variety of planning models, some of them are Madrid, Radburn, Letchworth, Welwyn etc. These city models were planned for a dedicated amount of population and expected to expand outwards, once their projected population figures were achieved so that no burden is created on the city's infrastructural services. But not all towns are conceived similarly, despite having a common goal of catering to the needs of their inhabitants. Analyzing American towns such as New York, Chicago, and Miami, we observe that they were laid in grid-based planning, for achieving sufficient spaces for both the residential & commercial needs of the city. At the same time, some American cities were also conceived as motor-vehicle depended towns by putting on a great amount of focus on road infrastructure development. While at the same time looking at European cities such as London, we see how they were

planned in a concentric zoning method that not only retains the original topographic features of the city but at the same time, creates large breathable residential sectors. Further, these European cities were designed as pedestrian-friendly cities, and to this day they can achieve high walkability and dedicated cycling routes. When discussing the concept of sector-based planning, Barcelona and its super blocks [1] is one prime example of how efficiently the residential areas were able to incorporate green spaces amongst themselves while enhancing the walkability of areas around them and hence, reducing the emissions from vehicles and promote urban walkability and using streets as an urban space by its inhabitants as well as the tourists visiting them. Not only have superblocks solved the carbon emission issues for Barcelona over the years, but this has also helped in shaping the entire image of the city uniquely [2].

In terms of the Indian context, we have a vast variety of towns in our country that are famous for their planning. Cities such as Chandigarh, Gandhinagar, Bhubaneshwar, and Naya Raipur are a few prime examples of our urban planning in modern times [3]. Not only that since ancient times, cities were tailored based on a set of rules. One such set of rules comes from the ancient text of Shilp Shastra. Planning principles for new towns was one of the important subjects that were covered in it. Observing the planning of towns of Rajasthan in particular gives us a sense that something groundbreaking was being done in the Western state that was not only complying with the local needs but at the same time giving urban spaces that were truly aesthetically appealing.

Methodology

To identify the traces of traditional planning in the modern context and to what extent they can be observed, this entire research has been divided into four sections. First, an in-depth study of the planning principles of various old cities has been conducted, including scenarios from Indian and Global perspectives. This research also includes village models that were provided in the Manasara text. After this study, the planning principles of the towns of Rajasthan are examined to gather a set of generic parameters. This is followed by a selection of those cities within the state, exhibiting a high tourist footfall with a specific purpose to extract the walled city/old urban core/fortified town area within them. The next phase of the research involves data collection in the form of reconnaissance surveys, questionnaires, and key-person interviews to identify areas that comply with traditional planning practices. The comparative spatial analysis was done based on master plans made available by the "Urban Development and Housing Department". Lastly, an analysis between the similarities and differences from the traditional planning model was done to summarize the planning concepts adopted as well as discarded in the cities selected for research.

Framework

Traditional town models of Manasara Shilp Shastra

The meaning of Shilp Shastra translates to the "Science of Sculptures". It is one of the most ancient texts in Indian history dating back sometime in the 1st millennium B.C., covering a wide range of design principles for subjects such as arts, crafts, sculptures, and architecture. Various aspects that were required for designing any new building or settlement were included in that varying from macro to micro level of detailing. Some of them included site selection parameters, the defense mechanism of the city (including features like types of fortification, classes of forts, designing of moats, city gates design parameters), construction parameters applied according to the caste, categorization of roads and their respective widths,

classification according to their shapes and development criteria for artificial water bodies and water gates[4].

As time progressed over the years, the application of Shilp Shastra could be observed in the development of small towns and villages. The reason behind developing small-scaled settlements was because it would serve as a miniature model for a similar town of a larger scale with a few modifications, catering to a wider range of the population [5]. The major parameter after the scale of a settlement that differentiates a town from a village is the applicability of the defense mechanism as it is generally observed that towns were protected by a trench and a boundary wall while the villages were left comparatively unprotected. The reason behind adding extra protection to towns was because they were inhabited mostly by merchants and the royal family with their associates, while the village was occupied by people who practiced agriculture [6].

In terms of the scale of a new village, Shilp Shastra states that it is predominantly defined based on the number of its inhabitants so that it could help in providing adequate services and its smooth operation [7]. According to that, villages are classified into five kinds: the smallest village is 20,000 dandas and for bigger villages, the perimeter shall be increased by adding consecutive 20,000 dandas to that of the preceding one [8]. Based on the shape and layout pattern of streets along with the placement of temples in a town, there are a total of 15 planning models provided in the Manasara text, namely Karmukha, Dandaka, Swastika, and many others [9].

Generic typology expressed by the towns of Rajasthan

Much like how Arthashastra defines the objective behind constructing any town based on its end users and how its planning characteristics will be determined accordingly, old towns of Rajasthan are also classified primarily on their purpose of use. The town typology of Rajasthan is classified broadly into three categories [10]:

1. Urban planning patterns ranging from grid-iron patterns having axial and symmetric planning to the organic planning pattern responding to the non-axial hilly terrain.
2. Topographical variations were categorized as hill towns, hill towns having large water bodies, valley towns, and towns located in the plains.
3. Economic structure comprised of Military, Mercantile, Religious, and Agrarian.

Given the natural terrain of Rajasthan, a set of features is found to be common in the majority of cities i.e. concentric development corresponding to the topographical variations with the center or the most powerful dwelling at the highest point. Any fort or a major temple of a traditional settlement would always be located on top of a mountain as they represent a feeling of strength, power, and obstruction. Most of the traditional settlements had their entrances located near a waterbody as they are low, inviting, and represent a source of life. Ancient towns of Rajasthan also allocated spaces in respective cardinal directions, regarding what they represented. East was associated with life, light, and good omen while West was associated with darkness and the negative feeling [11].

Rajvallabh (Om, 2021) mentions that the entrance for a settlement or dwelling should be kept on the north-eastern side while the south-western direction to be blocked as it is the side of evil and death. This shows

how the occupant's basic awareness of the environment was translated into harmonic grids like the Swastika and the nine-square grid, which are crucial symbols in all Hindu social and religious rites.

The cities and towns had a hierarchical layout. King's fortress was built at the most strategic location with two or more concentric fortified walls around it and surrounded by a dense fabric of dwelling units. Royal priests and Brahmans were located near the fort or palace so that they assist in performing social and religious ceremonies and the ruler could consult with them for major administration matters. Next set of people that were located after Brahmans were nobles with significant stature, traders, and financiers. Their dwelling units were allocated on main streets so that they could overlook the processional. Rajput thakurs were provided with agricultural land on the outskirts with the havelis normally located outside the walled city as observed in the capitals of Jodhpur, Jaisalmer, and Jaipur. The city gates were definite demarcations for helping in the establishment of city hierarchy at every level [12]. According to Spiro Kostof [13], the urban-rural continuum is more feasible for assessing any planned settlements based on dwellings, and tradition to establish the origin of a town on the fact that it is always initiated by a ruler's need to establish it.

Table 1: Selection criteria of Walled Cities based on significance

City	Planning model correspondence	Phase of development	Year of Development	Tourism Footfall
Chittorgarh	Karmukha	Before Jaipur		Average
Jodhpur	Nandyavarta	Before Jaipur		Medium
Jaisalmer	NA	Before Jaipur		Very high
Jaipur	Prastara	NA	1727 AD	Very high
Danta Ramgarh	Prastara	After Jaipur		Low

Analysis
Jaipur

The first-ever town in Rajasthan to truly adapt the gridiron layout, Jaipur truly stood with the majority of planning principles that were introduced in the Mansara, especially residing with the Prastara model. The central core of the walled city comprises all the buildings that are associated with the royal family such as City Palace, Jantar Mantar, and Jaleb Chowk which is a public square that used to house offices of various government departments till 2004. As mentioned earlier, how the presence of big city temple associated with lord Narayana should be located in the central region of the planning model where all the roads are meeting, Shri Govind Devji temple which happens to be a major temple of Jaipur is located in the Northern-Eastern side of the central core of the city.
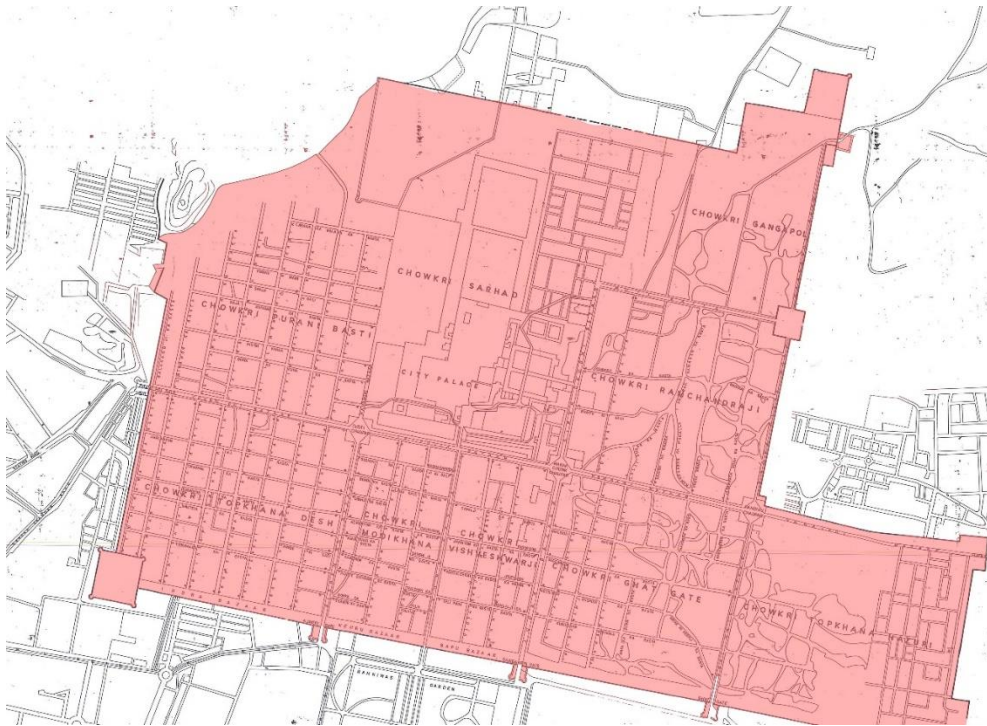
Figure 1: Map of Jaipur (Source: Rajasthan Urban Development) with the demarcation of the old urban core by the author

The entire planning model of Jaipur is divided into various sectors. Two primary roads are running in the cardinal direction that does that major division of the city into nine large sectors/districts. Then a series of secondary roads (usually two or three) are running within these sectors that are responsible for the next set of divisions and eventual demarcation of land at a plotted level. The width of all of these roads decreases gradually so that only pedestrian-friendly streets are left at the end and are designed in such a way that they always end up at a main road, hence working like a set of arteries within the planning model. This eventually helps in thermal comfort because all the heated air within any of these districts is rushed outside on the main roads, leaving behind a significantly cooler sector. Not only that, but structures are also ranging from a height of one to three stories which offer mutual shading that results in a decrease in the temperature of these districts as compared to areas that are located along the main roads. The width of these roads is as follows: 90 feet (15 Danda) for major roads while the initial width of the secondary road is 40 to 30 feet (6-5 Danda) that further shrinks down to 10 to 15 feet (1.5-2.5 Danda) at a neighborhood level, that satisfies the dimensions given in the Mansara text.

In terms of assigning directions based on caste followed by the plot sizes, it is done very wisely in Jaipur that it helps in segregating the residential district from the market areas. Instead of having a planning cluster of people belonging to a particular workmanship, dedicated streets were allotted for the same and these streets were then spatially distributed as per the directions within the city, and existing topography was also included while planning the residential district.

As we can observe in the Prastara model houses of varying plot sizes can be observed within sectors and the same can be said in this case. Bigger plots that are square or even rectangular in shape are associated with having an introvert planning model typically having a centrally placed open-to-air courtyard with its height varying from two to three stories and some exceptions having a dedicated open/parking area/area

for future extensions based on the size of plots. Only a few exceptional cases and the ones that are reconstructed to suit modern needs do not have open courtyards, otherwise all the dwelling units are comprised of the same.

Jaisalmer

Jaisalmer's planning model does not confine to any of the traditional planning models due to its irregular triangular shape. However, it cannot be classified as an organically developed city due to the presence of proportionately laid gridiron streets. The street width for the upper city is observed to be 12 to 15 feet (2-2.5 Danda) while a variation is present in lower city streets ranging from 8 to 20 feet (1.67-3.3 Danda) with up to 30 feet (5 Danda) in a select few places.
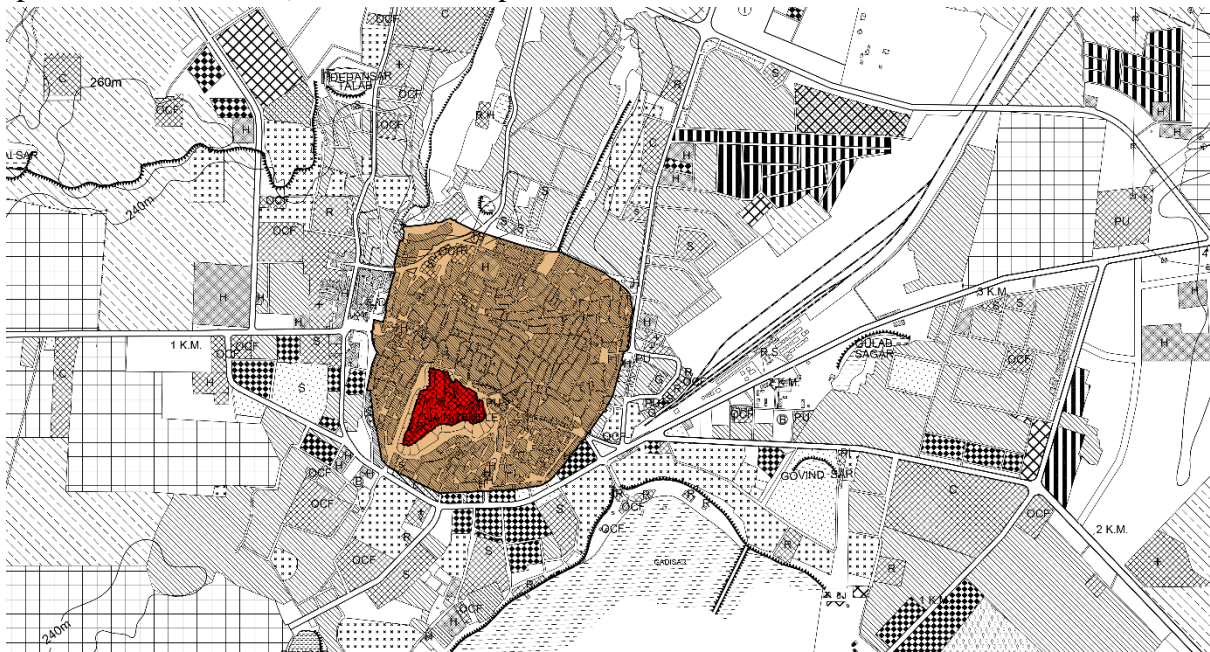

Figure 2: Map of Jaisalmer (Source: Rajasthan Urban Development) with the demarcation of the old urban core by the author

The location of ruling family and their officials are present right in the middle of town, followed up by royal priests and their apprentices located nearby to the royal square. Warrior class and their families occupied the bastion houses that are located along the edge of the upper city. Beyond this, the placing of each community's settlement was done like any other traditional town so that they could be grouped as per their position in society. However, very little of it could be seen in Jaisalmer due to the restructuring of the town.

Dwellings of rich families can be seen easily both in the upper and lower parts of town. A striking difference amongst the dwelling of various castes is that as we move down towards the lower sections of the society, the size of the plot and level of ornamentation decreases along with it.

To mitigate the harsh weather conditions, buildings are constructed compactly with heights ranging from G+2 to even up to G+5. Even the clustering of houses is done in such a way that about 12 houses open up in a common area.

Jodhpur

Jodhpur is often referred to as the "Blue City" because of the blue-painted houses that are found in its walled city areas, particularly around the Mehrangarh Fort. One popular theory is that the blue color was traditionally associated with the Brahmin caste and hence the residents of Jodhpur painted their houses blue to signify their high social status but in reality, the blue color was adopted as a precautionary measure to keep the houses cool during summer. Caste-based zoning is observed but assigning them in a particular direction is not that evident. Assigning the areas for each caste is done in rather a sequential order. The royal officials stayed immediately adjacent to Mehrangarh Fort and lower warrior class next to them and the lowest of warriors around the periphery of the city wall. Brahmins had large plot sizes, enough to them have a large courtyard and sometimes two courtyard-based havelis. Vaishya (traders) were located along the major roads in such a way that anyone accessing market place is not much deep into the residential quarters and at a good distance from the fort complex. Smaller-sized quarters of the Shudra class were assigned on the southern side of the city.

The old urban core of Jodhpur is enclosed by a 10 KM long wall with eight gates as it was planned as a fortified settlement, comprising of narrow streets and alleys, which helps in reducing the impact of the harsh sun and heat while creating a sense of intimacy and closeness in the community. Internal roads laid in the residential neighborhoods have a width ranging from 6 to 8 feet with a max of 10 feet and even 5 feet in some areas (1-1.35 Danda) while the external roads surrounding the city and market district are of 20 feet and in some cases 30 feet as well (3-5 Danda).
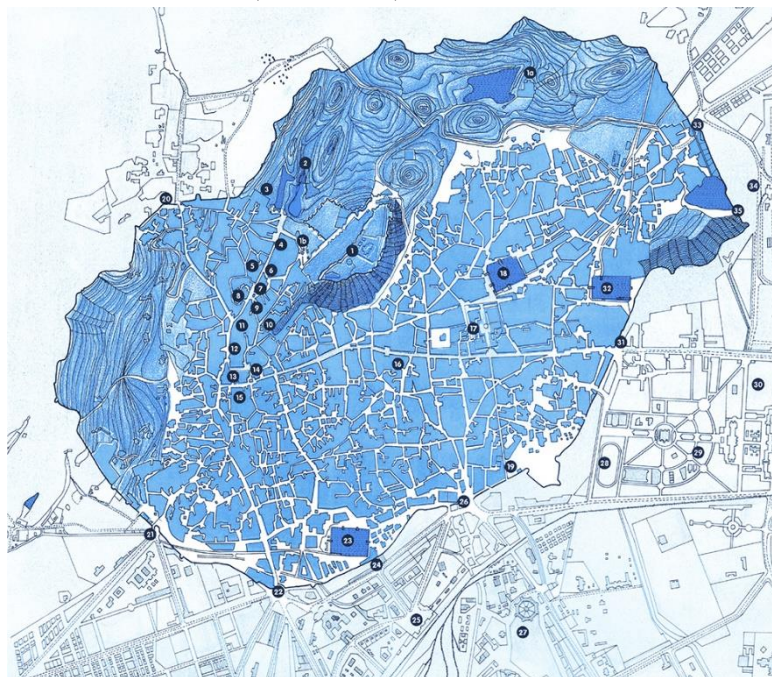

Figure 3: Map of Jodhpur demarcating the old urban core (Source: JDH Urban Regeneration Project)

The majority of the walled city of Jodhpur is covered by dense residential sectors, followed up by commercial & mixed-use areas with a few small-scale industries coexisting in the same area. This helps to create a vibrant and dynamic community, with a range of services and amenities available to residents. To provide a reliable source of water for the community, the city developed a water management system in the form of several step-wells.

But despite the presence of 8 city gates along the respective cardinal axes and caste-based planning, the city was not planned according to any of the traditional planning models in terms of the geometry of the city as the entire city is laid organically as per the existing terrain around the hill fort. Even the roads are completely organically laid, except the major roads as they are radial in nature.

Chittorgarh

Based on the site survey, it was observed that the city of Chittorgarh was developed in many phases from the 16th to the 18th century. The urban heritage core that we see today in the city of Chittorgarh was developed to dwell for the residents of that time, after a shortage of land was observed in the fort complex. Based on its shape, it resembles the Karmukha style of planning. While the Karmukha planning model had one of its sides surrounded by a natural water body as a defense mechanism, a little variation can be observed in Chittorgarh as it is surrounded by the valley side of the rocky hill on which Chittaur fort is situated.
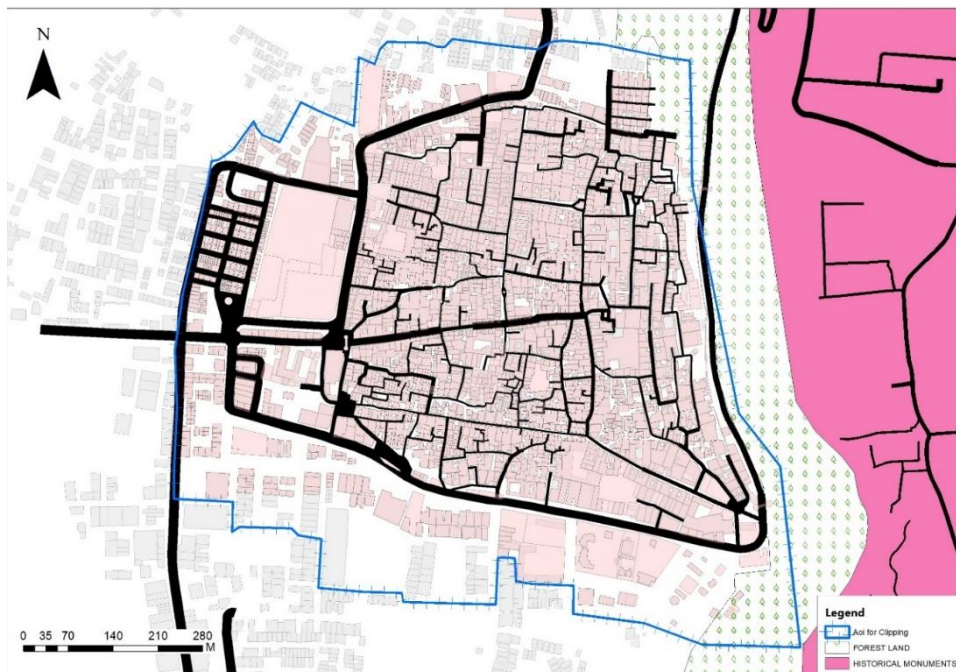

Figure 4: Map of the old urban core of Chittorgarh (Source: Author)

A total of five city gates are to be found in this area that are strategically located at the end of all major roads in the area. Unfortunately, one of these gates (Paota Gate) does not exist today. Based on observation, the placement of housing sectors based on caste can easily be observed within the city. Brahmin community sector is to be located on the Northern & Western sides having the biggest plot sizes followed up by the Kshatriya and other warrior clans to be located in the Western and Central parts of the city, Shudras community sector is associated with smaller plot size and are to be found on the Eastern side. Market spaces are located along the major roads, however, the southern side is mainly associated with vendors offering products such as meat, leather products, oil & lubricants, and other small-scale industrial products which are again adopted from traditional planning principles.

The road width of the old city varied ranging from 8-10 feet (1.3-1.6 Danda) for the internal streets to a maximum of 40 feet which also satisfies the dimensions as per the traditional planning models in which the roads varied from 3 to 10 Danda. The diagonal major roads that defined the internal division of the

model were absent in this area and the reason for the same was to mitigate the housing needs of residents at that time. However, as all the major roads met at one point that was associated with a religious place or any building associated with the royal officials, a major temple can also be found in this heritage core.

A few sectors are irregular in shape due to road layout and hence the houses located on the extreme ends of these sectors are observed to be irregular in shape. Apart from these, the majority of houses are regular in shape; mostly rectangular or square. The rectangular shape is associated with houses that are either located on smaller plots or not having a central courtyard, housing a small family. Whereas square-shaped dwelling units comprised of large plot sizes having central courtyard mansions that house large families having two or more entries. Courtyards are an integral part of planning and could be observed in many housing units, even in some rectangular-shaped houses.

Danta Ramgarh – Shekhawati

Shekhawati is one of the regions that got developed after the establishment of the pink city, various similarities can be easily observed in the planning model of its respective cities that are available in any post-jaipur era town. Danta Ramgarh is one such town of Shekhawati. It was originally planned to serve as a merchant town and to accommodate 21 Mahajan trading families from Churu. As it was promoted more of a trading town rather than a military town, Ramgarh attracted people from all societies due to this flexibility [14].

A city wall surrounding it along with four major gates is placed along the cardinal axes, and eight smaller entrances are given within the city wall to allow pedestrian passage during night time. Unlike Jaipur, not all sectors are regular in shape (perfect square) that are coming out after the laying out of streets due to the local topographic conditions, but despite that, all of the houses are rectangular in shape. Clustering of housing sectors as per castes and their activities is done and the plot sizes varied in a top-down manner. Commercial zones are located along the East-West oriented major road with the core of it located along the street connecting to Ramgarh fort. The width of the streets for the residential sector is 10 to 15 feet (1.6-2.5 Danda) while all the major roads are 23 feet (3.8 Danda).
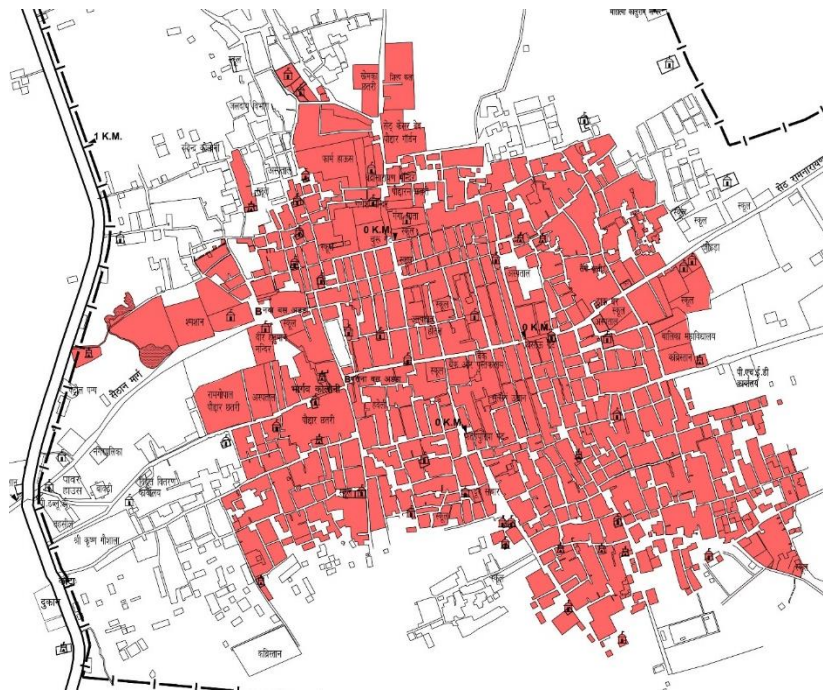
Figure 5: Map of Danta Ramgarh (Source: Rajasthan Urban Development) with the demarcation of the old urban core by the author

As observed in the Prastara model, Danta Ramgarh also has a fort in the middle of the city at a higher elevation and then the rest of the town is established at a lower elevation. This variation in the topography helps in water management by storing rainwater in the step wells constructed on the North-Eastern side.

A special planning feature that could be seen in the case of Ramgarh is the presence of cenotaphs on the western side of the outer edge of the city to commemorate ancestors (much like as we see in the case of Lower Egypt), which was absent in the planning of Jaipur as well.

Conclusion

While every town has followed some set of rules that are provided with the Manasara planning models, none of them has adopted every single rule of spatial planning that is mentioned in the text. Based on spatial analysis, it is concluded that local topography and the primary use of each town, in general, have always dominated their respective planning. The maximum level of fortification can be observed in the military towns, with a general trend of strategically laying out of plot sizes and roads. Whereas, the religious and trading towns have an ease of security due to their functioning and strata of inhabitants from all walks of society.

Table 2: Comparative Analysis Summary (Source: Author)

City	Planning model	Elements Adopted	Elements Discarded	Road Width
Chittorgarh	Karmukha	• Road Layout • Activity & Caste based zoning • Sector size,	• Positioning of city gates • Numbers of city gates • Presence of a major building	Major Roads: 3-10 Danda Minor Roads: 1.3-1.6 Danda

			• belonging to the royal family.	
Jodhpur	Nandya-varta	• Caste-based zoning • Number of city gates	• Positioning of city gates • Shape of the planning model • Plot sizes	Major Roads: 3-5 Danda Minor Roads: 1-1.35 Danda
Jaisalmer	NA	• Grid Iron Streets • Caste-based zoning • Fortification at the city center	NA	Major Roads: 3-5 Danda Minor Roads: 2-2.5 Danda
Jaipur	Prastara	• Grid Iron planning • Royal precinct in the center of the city • Activity-based zoning • Plot and sector sizes • Road Layouts	• Majority of the planning elements have been adopted as per the study.	Major Roads: 5-6 Danda Minor Roads: 1.5-3 Danda
Danta Ramgarh	Prastara	• Activity-based zoning • Grid Iron planning • Fortification at the city center	• Shape of the planning model • Number of city gates	Major Roads: 3.8-4 Danda Minor Roads: 1.5-2.5 Danda

The advantages of adopting traditional rules were their confiding with the planning suitability for each of the cities. Zoning within the town was very easy because it was done based on activities that each caste member had to perform. Major buildings got strategically located right in the middle of the city that belonged to the Royal families or any other ruling officials for ensuring their maximum security and serve as a public space with the highest interaction. Each direction was assigned works or activities that were permitted based on Vastu. However, many disadvantages were observed. The biggest one was the unfairness based on caste in terms of distance from the city core, plot sizes, and assignment of specific directions for construction. The next issue with traditional town models was a lack of expansion to suit the future demands as their planning was done for only a specific number of residents to ensure its continuity. As the years progressed, due to the simplified layout of streets and regular plotted sectors, more preference for Prastara or Sarvatobhadra models was given over the rest of the traditional models. Irregular street patterns that were once adopted to add up extra security in a case of siege, in modern times felt not required due to the creation of irregular plot sizes and wastage of open spaces in some cases.

The purpose of this study can further be performed on the remaining towns of Rajasthan as well as other traditional towns across India to access how they confine with the models of Manasara.

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