The Tale of Twin Cities:

Hyderabad and Secunderabad—now a legend?

by

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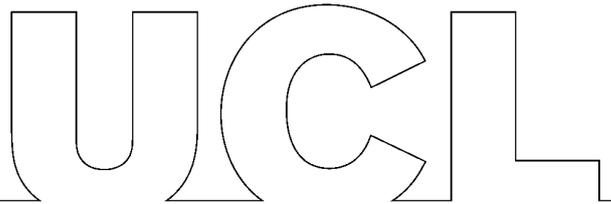
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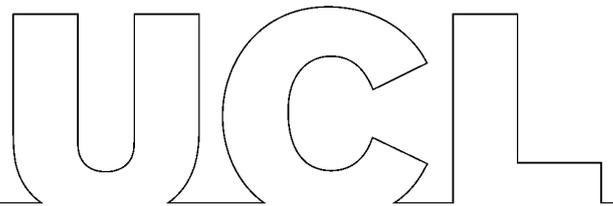
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ABSTRACT

Cities as spatial settlements operate under various closely linked processes. One such process is their expansion, which puts forth cities as dynamic phenomena. The temporality associated with this process gives way for the assimilation of a myriad of definitions towards the functioning of a city. However, only a few of these definitions remain embedded in a city's culture, and persist through time. The city of Hyderabad in the southern state of Telangana in India is one such city that has for long been referred to as the Twin Cities of Hyderabad. This dissertation explores to what extent this widely accepted definition of the city as twins pervades its contemporary mode of functioning. Since the process of expansion of a city, irrespective of the reasons behind it, has to manifest spatially—the spatial relationships are taken as the starting point of the analysis to provide objective descriptions of the spatial structure of the city, using space syntax theories and methods to examine the claimed duality. In addition to this city-wide study, the twins are further explored, individually, to trace their operation in a twin relation drawing from historical urban descriptions of the principal retail thoroughfares and CBDs and comparing them with their current spatial and functional disposition. The findings show a vivid contestation to the twin city definition, identifying parts of the city which provide spatial possibilities that are comparable, and in some cases greater than that of the twins. The investigation of the individual twins highlights a greater inertia in the spatial structure of Secunderabad compared to that of the Old Hyderabad, to the force exerted by the new centres; and a fractured spatial link between the twins. This research is to be seen as an initial step that brings analytical descriptions to aid the understanding of Indian cities that are widely perceived to be complex and chaotic, by taking the space first approach.

Keywords: Twin Cities, Hyderabad, Secunderabad, Spatial Memory, Space Syntax

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1. INTRODUCTION

1.1   Introduction to the Twin Cities

The city of Hyderabad, India, has for long been referred to as the Twin Cities of
Hyderabad. The twins being: the city of Hyderabad founded in 1591 by the Islamic
ruler, Mohammad Quli Qutb Shah, which is the Old Hyderabad of the present time; and
the colonial settlement of Secunderabad constructed to comply with the terms of the
subsidiary alliance of 1798 with the British East India Company. One of the earliest
occurrences of the city's popular title as the Twin Cities is in Shah Alam's work of
1962 on urban geography of the twin cities, where, as he clarifies that his study would
deal with Hyderabad and Secunderabad as independent cities, adds–

 "…but their close relationship has been recognised by giving them their accepted name
of The Twin Cities (or Dual Cities) because, though widely apart in their dates of
origin, and isolated from each other, they are now contiguously built up urban centres."
(Alam, 1962, p. 1).

The label continues to be used in contemporary research into the city, including studies
such as: vehicle routing in large systems (Sateesh and Ray, 1992); impact of urban
growth on water bodies (Ramachandraiah and Prasad, 2004); land alienation and local
communities (Reddy and Reddy, 2007); GIS-based advanced traveller information
system for Hyderabad city (Kumar et al., 2005); and, information technology and social
development (Ramachandraiah, 2003). Such studies commonly situate the twin cities in
their research primarily to delimit the geographical extents for the application of their
particular thinking. Thus, no other reference to the duality, though implicit in the term–
twin cities, can be found in their work.

However, an understanding of the duality of Hyderabad was noted, as early as 1968, in
a geographical study of the spatial patterns of population in Indian cities by John Brush.
His focus was on the density gradients from the highest levels or near the centre of the
city, and intra-urban density changes that accompany growth of an area (Brush, 1968).
The twin cities of Hyderabad were one of the case cities in his analysis. Explaining his
finding in which four patterns of deviation from the Bleicher-Clark model–based on
negative exponential decline of density with increase of distance from the city centre;
specific to the group of cases which contains the twin cities shown in Figure 1, he
notes–

"…the third configuration is found in cities with two distinct nodes of population concentration, one around a bazaar of traditional type, the indigenous city, and the other around a former British centre that may be two miles distant or more. Hyderabad-Secunderabad and Bangalore are examples of such dualism, in which two distinct density gradients can be recognized." (Brush, 1968, p. 373).
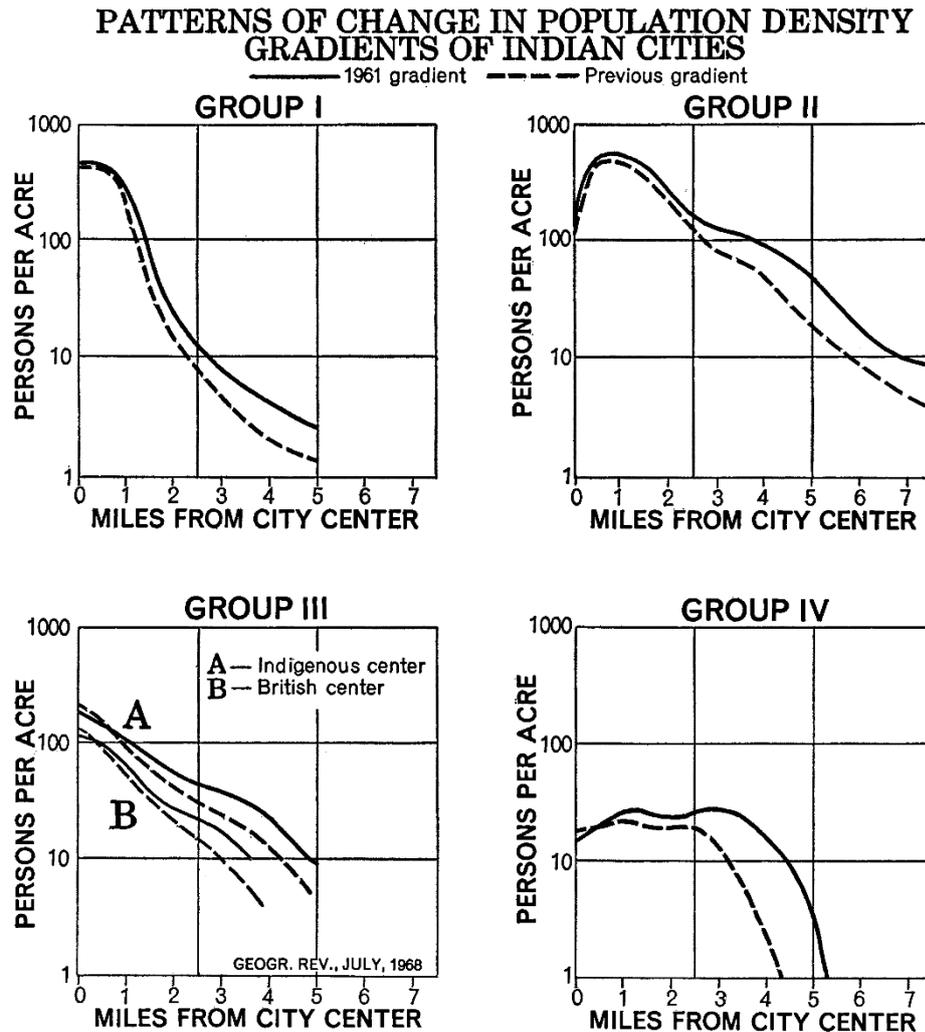
Figure 1: Patterns of change in population density gradients of Indian Cities. Source: (Brush, 1968, Fig. 1).

Further explaining his observations on the twin cities, in addition to the general classification of the cities as above, he adds (refer Table 1 and Figure 2)–

"temporal changes (1951-1961) in density according to distance increments show in both Hyderabad-Secunderabad and Bangalore a trend toward decline of the centres of

population and increase in the interstitial and peripheral areas of low density" (Brush, 1968, p. 388).

The range of studies discussed above presents the focus of this research. That is: to what extent is this duality apparent from the current spatial structure of the city?

CITY CENTER	CENSUS DATE	PERSONS PER ACRE *Miles from city center*					
		0.00–0.50	0.55–1.00	1.05–1.50 1.55–2.00	2.05–3.00	3.05–4.00	4.05–6.00
Hyderabad (Old City)	1961	147.8	118.1	29.9	48.1	35.5	10.1
	1951	150.7	117.2	27.8	44.6	28.2	3.2
Secunderabad	1961	119.5	68.4	33.8	32.5	13.0	—
	1951	122.6	67.0	24.0	24.3	10.2	—

Table 1: Temporal changes in gross density of population by distance increments, Hyderabad-Secunderabad. Source: (Brush, 1968, Table VIII).
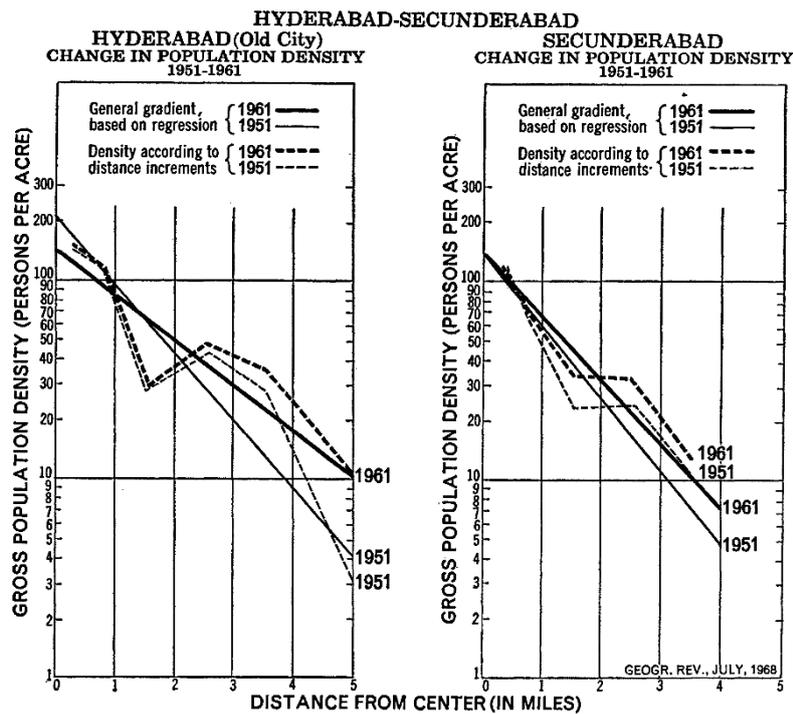
Figure 2: Graphical representation of the above table along with the linear regression lines. Source: (Brush, 1968, Fig. 16)

1.2 Research questions concerning the phenomenon of Duality

In the above light, with an aim to explore the spatial structure of the contemporary city of Hyderabad, the overarching question that this research attempts to respond to is–**to what extent is the widely accepted notion of twinness or duality manifested in the current spatial structure of the city?** Other questions stemming from this are: Is the city still binodal as it is popularly regarded to be? Are there emergent centres, which as identified by the late geographer John Brush in 1968 as interstitial and peripheral areas of low density with increase in population upon distance increments from city centres, that contest against the twin cities' definition of the city of Hyderabad?

Along with the urban growth's effect, factoring socio-economic changes within the two nodes presents another perspective on the aforementioned duality. This perspective helps define the twin cities' region of Hyderabad, not only as an urban object but also a social artefact in a contemporary context, bereft of the founding socio-political and socio-economic groups which configured the twin cities with their characteristic spatial practices. **This study thus also enquires whether there is a latent spatial memory of the dual phenomenon from the past conditioning the operation of the current spatial structure of these two nodes.**

1.3 The city of Hyderabad

This section introduces the geographical boundaries and other mapped data from the city of Hyderabad which would serve as the base layers for the analysis. The city of Hyderabad is broadly divided into six municipal zones (Figure 3) which also delimit the administrative boundaries of the city at a zonal level. However, this research concentrates on the Secunderabad zone and Charminar zone for its detailed analysis. The historic twin cities' region (Figure 4) to the east of Hussain Sagar Lake, being nested in them is the basis for their selection. The vicinities from this zone are shown in orange in Figure 5. This figure illustrates crowd sourced data from the Geofabrik OSM database that defines the whereabouts of the city's centres and neighbourhoods. This data consists of a single parameter which is the name of the vicinity assigned to the marker placed at the location of the respective vicinity. This data is used to assign these labelled markers with values from spatial analysis, and study patterns from the graduated markers. For the analysis at the scale of the individual two nodes, the areas of interest data obtained from Google Maps is translated into GIS as shown in (Figure 6).

These areas show building blocks with high commercial activity like restaurants and shops; and also, schools, banks and hospitals. These areas too will be assigned with values from spatial analysis, further explained in the methodology section, to assess their spatial potential.
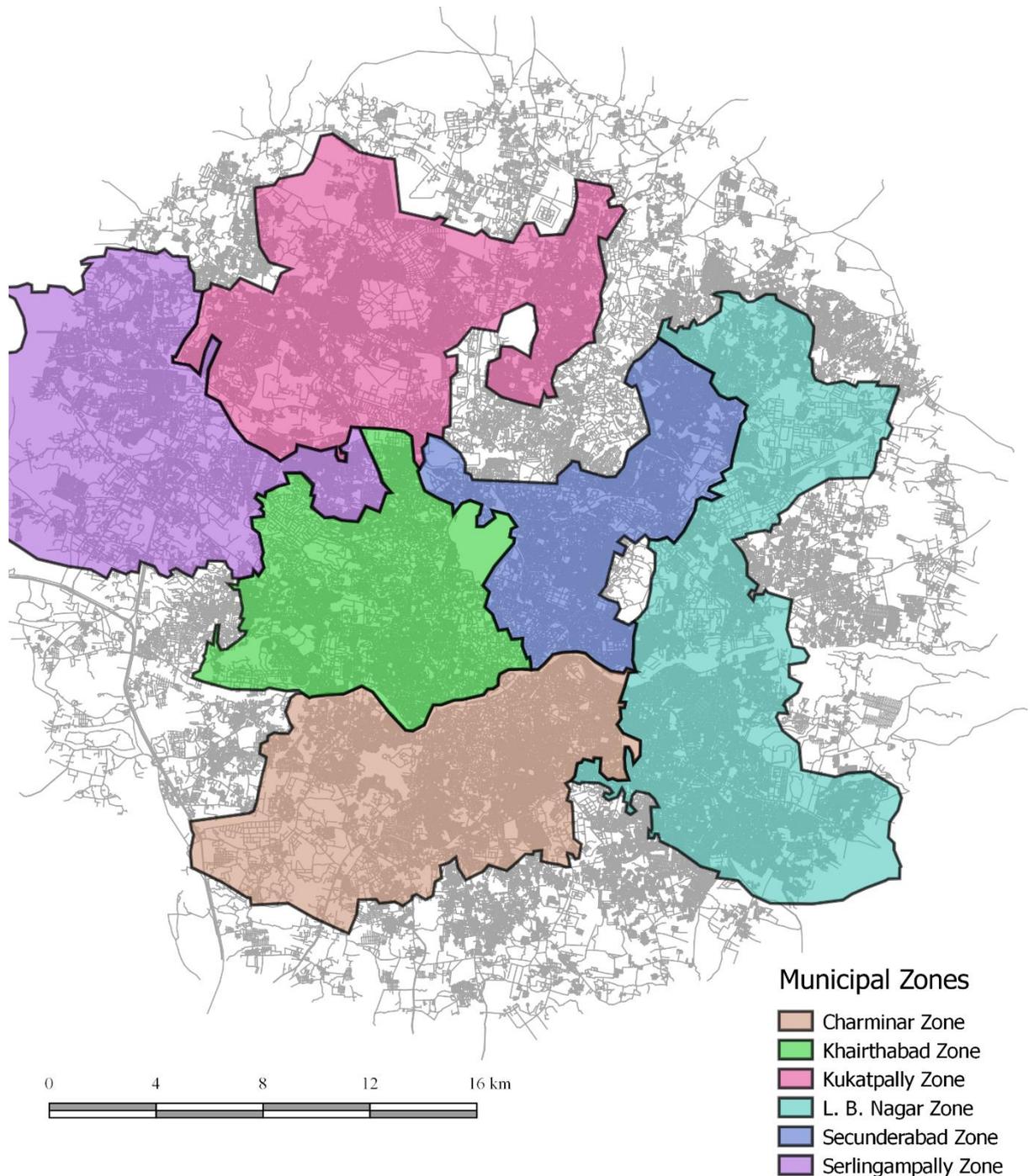
Figure 3: Municipal zones overlaid on the spatial network of the city used for this research. Source: Municipal zones -
https://www.ghmc.gov.in/Documents/NEW%20ZONES,CIRCLE%20MAP.jpg
Spatial network – road centre-line model from Geofabrik OSM, simplified into segments on QGIS– http://download.geofabrik.de/asia/india.html
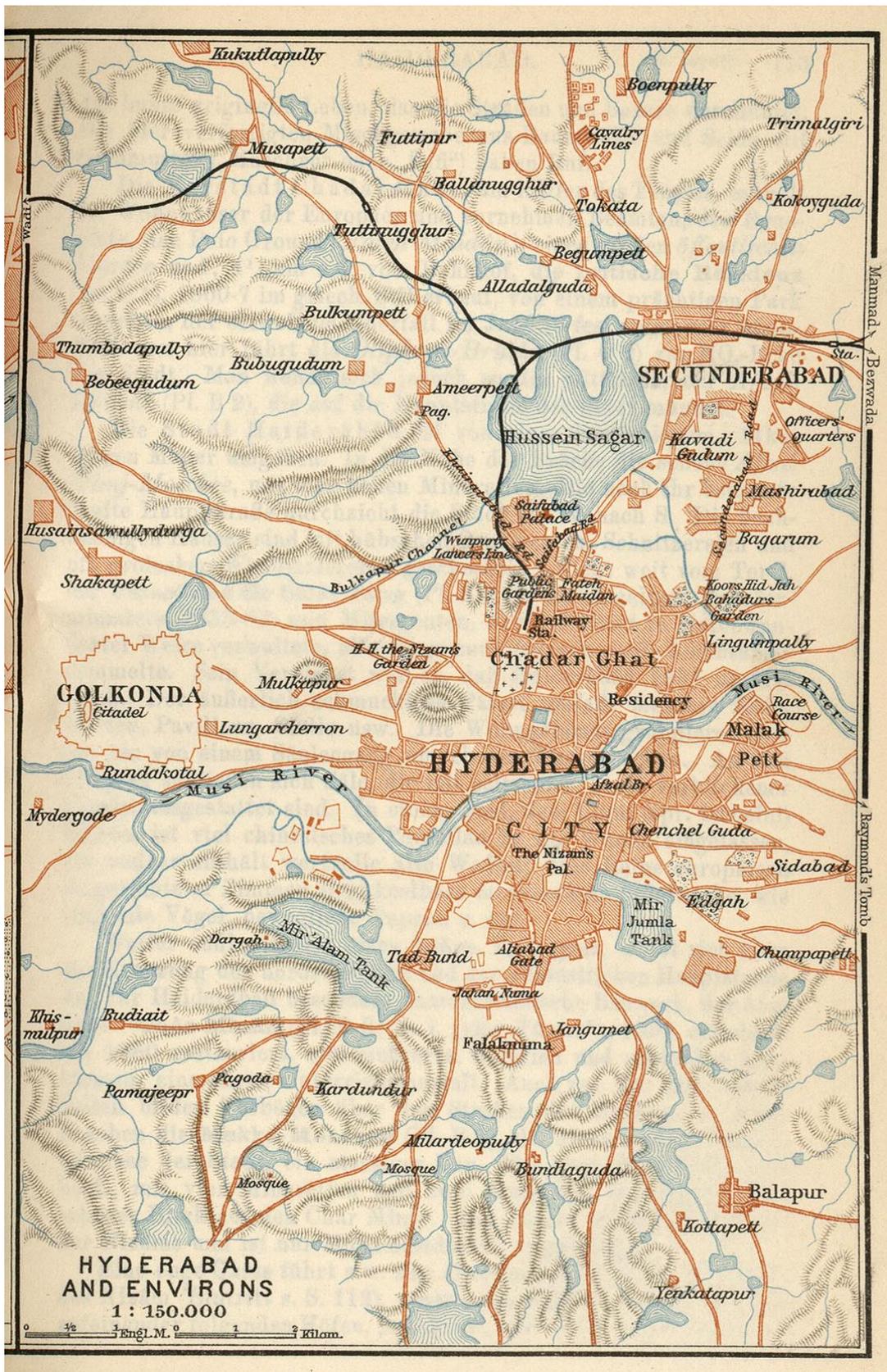
Figure 4: Historical map showing the Twin Cities from 1914. Source:
http://legacy.lib.utexas.edu/maps/historical/baedeker_indien_1914/txu-pclmaps-
hyderabad_1914.jpg
Used by permission of the University of Texas Libraries, The University of Texas at Austin.
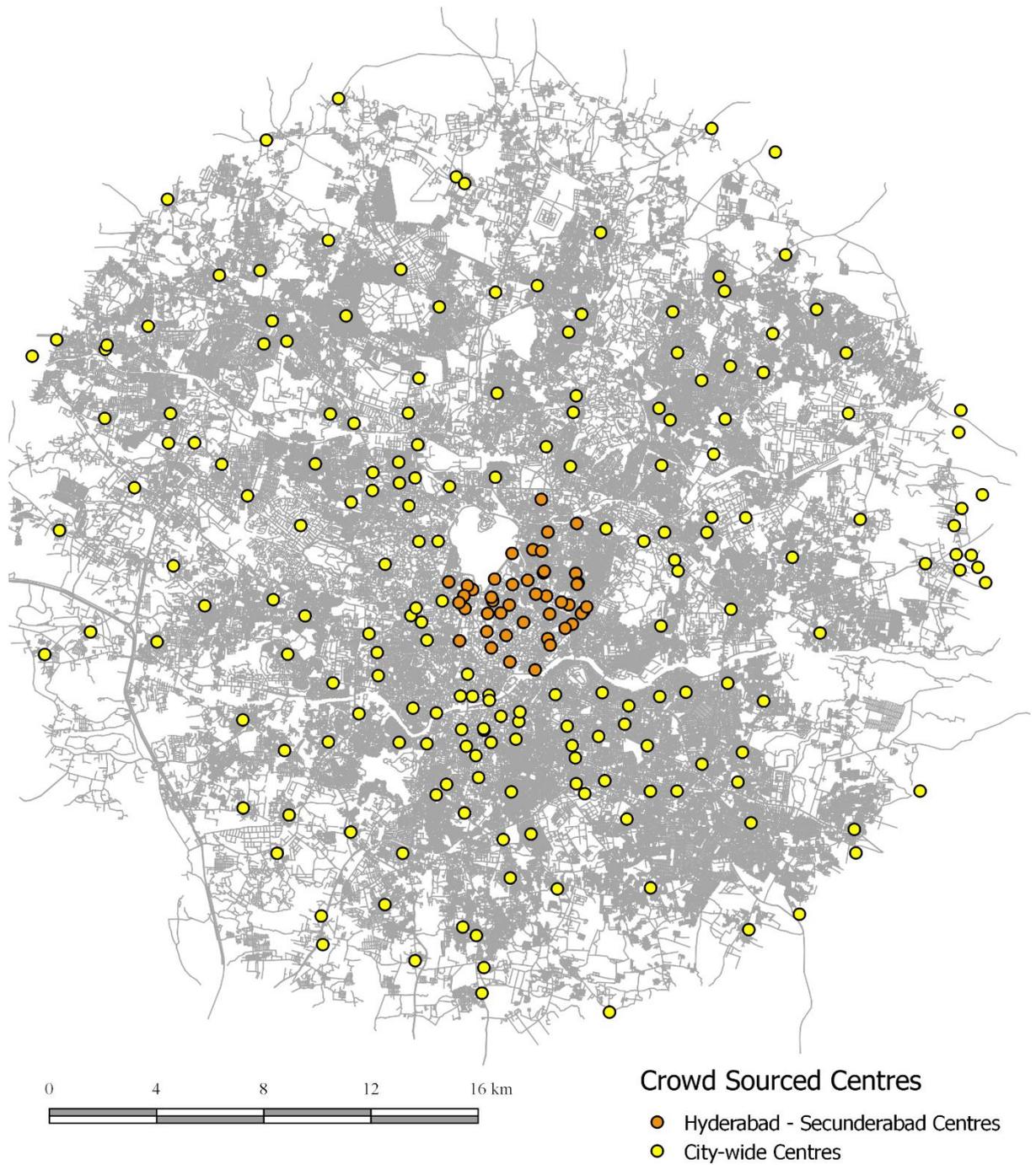
Figure 5: Markers showing locations of vicinities across the city of Hyderabad with areas from the twin city region in orange. Source: shapefile named places in Hyderabad from Geofabrik OSM data– http://download.geofabrik.de/asia/india.html
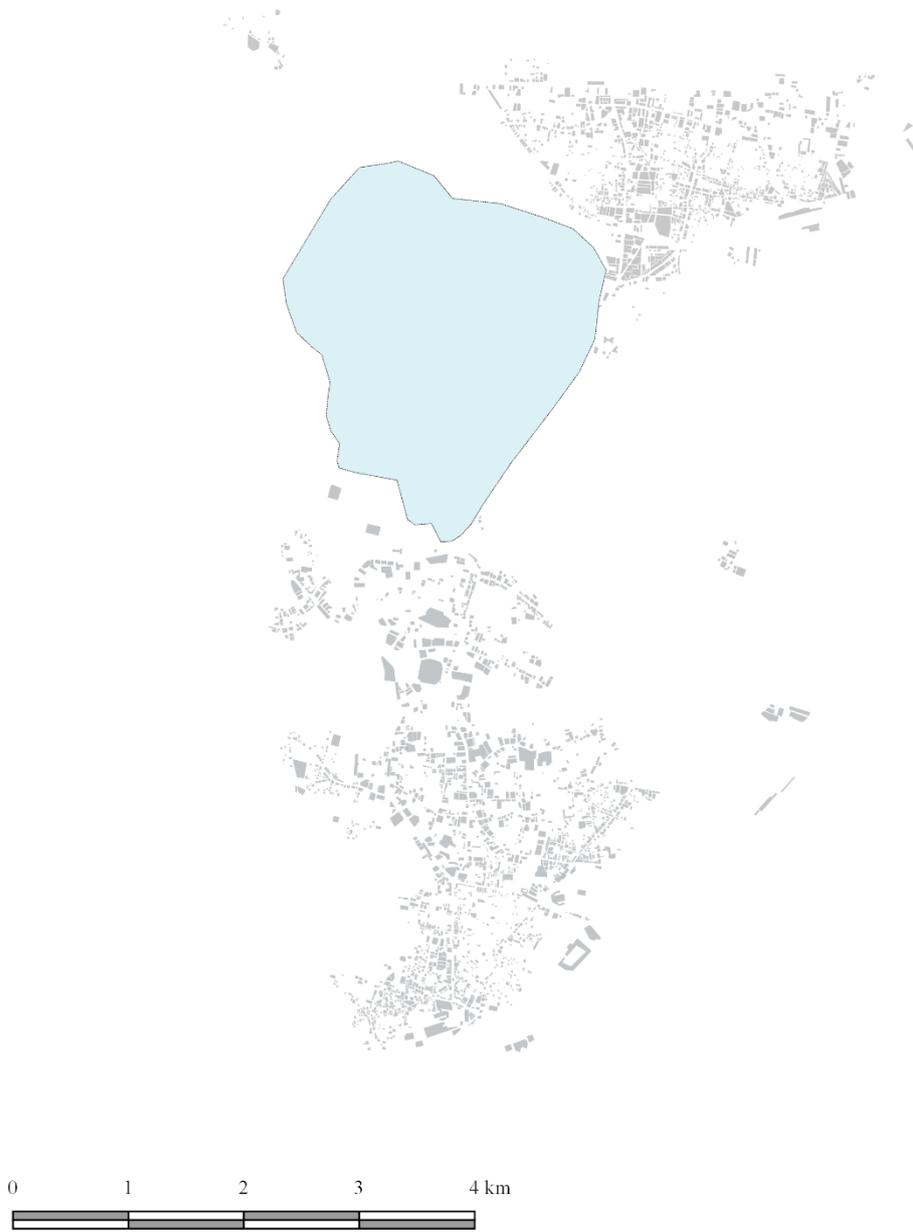
Figure 6: Areas of Interest from Secunderabad and Old Hyderabad mapped from Google Maps.

2. LITERATURE REVIEW

The focus of the research to explore the apparent duality of the city of Hyderabad can be reframed as a question concerning centres in cities. This is to borrow from discussions and theoretical arguments on urban phenomena, and assess the peculiarity of this case with two historically claimed centres from the standpoint arrived at through this literature review.

2.1   Centres as vehicles of top-down approaches to cities

Hierarchical and top down approaches to contain cities as authored entities in the minds of planners and policy-makers have been perennial; ranging from utopian concepts that re-imagined cities like the garden cities in Howard (1898) and Le Corbusier's masterplan of Chandigarh constructed in 1953, to theoretical conceptions like urban hierarchy and retail hierarchy, first in Smailes (1944) further developed in Hall et al. (2001). The concept of city centres is adapted to either impose these utopias as masterplans or to classify them with an aim to provide with descriptions of a city on the basis of presence or absence of functions.

The critique by Robert Fishman that, "these ideal cities are perhaps most ambitious and complex statements of the belief that reforming the physical environment can revolutionise the total life of a society…and physical facilities could by themselves solve social problems" (Fishman, 1996, p. 20) holds relevance, for it points at the implicit social beliefs that guide urban utopias. These concepts impose city centres as spatial packages composed of prescribed functions oblivious of their interdependencies, both at phenomenological and institutional levels.

Smailes introducing his work on urban hierarchy and ranking, defines urban centres as, "collecting and marketing points for the products of their surrounding territories, and as distributing centres for goods from outside… as well as transmitters and disseminators of external influences." (Smailes, 1944, p. 41). Though a relational existence of an urban centre with other centres in its vicinity is implicit in this definition, the task of ranking on the presence or absence of functions neither reflects this fact nor does acknowledge it in its assessment. This work on urban hierarchy was further developed upon by (Hall et al., 2001) to introduce retail and composite urban-retail hierarchies.

The issues with such approaches are vividly presented in (Griffiths et al., 2008) where they argue that such a retail-based ranking system would naturally reinforce the visibility of the larger centres. They further call for caution against the effects of such ranking-systems by noting that, "A retail-centric view of suburban centres threatens to create a vicious circle in which the economic vulnerability of smaller centres is continually reinforced by their relative invisibility in policy and investment terms." (Griffiths et al., 2008, p. 1164). It is their arrival at the suburban centre as a, " particular kind of socio-spatial milieu rather than dwelling on relative presence or absence of any particular functional category" (Griffiths et al., 2008, p. 1183) that presents as an alternative method of assessing centres in general, that neither assumes the resolution of social problems by reforming the physical environment (as done by urban utopias) nor is biased in its descriptions of urban centres as ranking systems on functional categories. They comment on the difficulty with existing socio-spatial approaches as being too deterministic in trying to relate patterns of built environment to the generic social patterns of movement. The missing aspect in such researches, as they note, is that they do not address "this relation at the human scale at which the urban grid is encountered – whether by pedestrian or vehicle" (Griffiths et al., 2008, p. 1174). In response to this, they employ space syntax methods which bring out patterns of movement at the street-scale; and then bringing these patterns, as generic socio-spatial factors, to bear on reading social data. In support of this method, "(Vaughan, 2006) argues that the advantage of space syntax over traditional morphological approaches to built form is its ability to assign a range of spatial variables at the street level against which social data at a similar resolution can be compared at the same resolution." (Griffiths et al., 2008, p. 1175).

2.2   The role of space

Having brought to light the importance of understanding the relationship between social and spatial factors in assessing urban centres and also, a prospective method of doing so using space syntax; a brief discussion of this relationship is crucial before considering centres as a spatial phenomenon.

Hillier argues that social theories fail to inform the built environment with design-level propositions for they approach the society-environment relation society first and in that,

"the form of the environment is sought as the product of the spatial aspects of the social processes." (Hillier, 2008, p. 218). He calls this the spatiality paradigm. What it does, as he briefly summarises; is to say that space reflects society. Highlighting the latent suggestion from this understanding that if space reflects society; he adds that then one could detect in space some describable pattern which in some sense has been generated by social forces. Developing this line of thought, his idea was, "to look at the society-space relation 'space first' by examining the patterns of real space found in the built environment and asking in what sense these could be seen to be the outcome of social and economic processes." (Hillier, 2008, p. 224). This approach is called space syntax, and its aim has been said to be–

" to give rigorous quantitative descriptions of built space so that we can acquire with greater precision and argue with greater conviction about the social and cultural consequences of opting for one 'solution-type' rather than another." (Peponis, 1989, p. 4 Foreword)

It is this space-first approach that is employed in this research to quantitatively trace the spatial manifestation of a dualistic functioning, if any, in the city of Hyderabad.

2.3   Configurational analysis of space: spatial variables

Spatial configuration of an urban grid refers to– "the way in which the spatial elements through which people move–streets, squares, alleys and so on–are linked together to form some kind of global pattern" (Hillier et al., 1993, p. 29). Space syntax methods resort to description retrieval from these spatial configurations to comment on the differences between one spatial pattern and another. This is done by assigning configurational values to individual spaces describing the links of each to all (Hillier, 2008).

The spatial configuration is constructed by drawing a set of intersecting lines through all the spaces of the urban grid so that all the rings of circulation are represented (Griffiths et al., 2008). The configuration values are then calculated for these lines. The power of the line representation to pick up properties of space that are critical to movement dynamics, and how the line graph internalises geometric and metric patterns of the urban grid are discussed in depth in Hillier (1999). The configurational values

can be computed to examine the relationship between one street segment to all other street segments in the system, or a limit can be specified to analyse the relationships to a certain distance from each street. This limit is called the radius of analysis and enables studying spatial relationships from a local scale, for example, a street to other streets in its 800m radius, to a global scale, that is, the relationship of each street to the city-wide spatial network.

Syntactic measures can thus be calculated at different radii, and have been shown to correlate with the patterns of movement shaped by the urban grid. Hillier and Vaughan describing to- and through- movement as the two principal components of human movement, explain: "for every trip, we select a destination to go to, and a series of spaces to pass through on the way. Both obviously matter to how cities work." (Hillier and Vaughan, 2007, p. 213). They then introduce the syntactic measures of integration and choice to calculate both these movement potentials for streets– "The measure of accessibility for to-movement of a space is our integration measure. The measure of through-movement potential assesses the degree to which each space lies on simplest or shortest paths between all pairs of spaces in the system. In syntax this is called the choice measure" (Hillier and Vaughan, 2007, p. 214).

The enhanced fitness upon normalising these measures for predicting movement over the angular integration and angular choice measures in Depthmap is demonstrated in Hillier et al. (2012). Normalised values allow for comparison across systems of different sizes and the indexing of values on a same scale; and thus, enabling comparison of streets from one city to another in terms of their underlying movement potentials (Hillier et al., 2012). The current research uses these normalised configurational measures to study the spatial patterns.

2.4   Cities and spatial centrality

Sketching a theory of self-organization of the city, Hillier argues that– "the urban space comes to reflect the differentiation of the phases of social life, such as going to shops, or going home or going to a religious ceremony, on a continuum from integration to segregation" (Hillier, 2008, p. 226). He further clarifies that, "urban space does not reflect the relation between this activity and that activity, but the generic relations between kinds of activity" (Hillier, 2008, p. 227). As a further development, to extract

the differentiation in the kinds of activity, Hillier devices the method of capping the normalised angular choice (NACH) values at different peaks to capture the thresholds at which different kinds of functions but not the functions themselves establish in the urban grid. Explaining this through an example, he says, "…shops do not seem to begin to group below a peak radius value of about 1.2, while a peak of 1.3 seems to be associated with continuous shops. A peak of 1.4 seems to be a significant local centre, while 1.5 is likely to be a main centre. Being able to compare the numbers is the critical asset" (Hillier et al., 2012, p. 165). However, the mention of local and main is not in reference to the scale (radius) of analysis for NACH values but concerning to the general nature of clustering of functions. Hence, borrowing from another argument by Hillier on the relationship between pattern of centres and scales of analysis helps further his proposition on identifying differentiation in the kinds of activities. He identifies an intricate pattern of centres at all scales of spatial analysis and argues that emergent multi-scale centrality should be seen as a pervasive function in cities, with clear spatial correlates, and not simply as a hierarchy of locations (Hillier, 2009). Fusing these two arguments: an objective method of bringing to light the differentiation in the nature of centres using NACH structures and; how these patterns vary with scale with corresponding spatial correlates, presents a method of extracting patterns of pervasive centrality from the twin cities' region taking the space-first approach to be analysed against historical centres. The theory of pervasive centrality is further elaborated during the synthesis of findings.

Changing the lens–from centrality as a fundamental property of the spatial structure of a city to centrality as process in itself–Hillier regards the pattern of centres and subcentres as attraction inequalities within spatial configurations (Hillier, 1999b). This particular understanding of centres and subcentres as attraction inequalities within the spatial configuration aids the assessment of duality in the current study by providing a framework to bring to light the difference in the attracting power, and thus difference in centrality, of each of the two nodes using syntactic analysis of the spatial configuration. And commenting on the dynamism of patterns of centrality, he notes, "As settlements grow, the pattern of global integration is likely to change, and this will create spatial pressure for a shift in the focus of centrality" (Hillier, 1999b, p. 108).

Hillier argues that, "the distribution of integration in an urban system, together with its associated built form and land use patterns, is not a static picture of the current state of

the system, but a kind of structural record of the system."(Hillier, 1996, p. 269). He then concludes this argument by saying that the 'structural inertia' imposed by such an evolved structure is the prime constraint on the future evolution of a system. Since, the two nodes constituting the duality at question in this research hold historic significance, extracting their most integrating segments and examining them against the historic descriptions of the urban centres helps assess for a structural record of this duality in their evolved state.

2.5   Historical spatial perspective

Having established centrality as a spatial phenomenon and discussed the potential of syntactic analysis of spatial configurations to objectively extract patterns of centrality, a need for historic descriptions of urban centres is realised as they allow for a comparative spatio-functional assessment of the current patterns of centres. Thus, enabling to respond to the question–if the dual phenomenon from the past still operates in the current spatial structure of the twin cities' region. An assessment for change and continuity in the historic descriptions can be seen as an attempt to trace if there is a latent spatial memory of the dual phenomenon conditioning the current functioning of the city. The concept of spatial memory is analogous to Griffith's conceptualisation of spatial history, where his approach indicated "how the historical texture of space might provide a context for understanding the simultaneity of change and continuity in an urbanising society" (Griffiths, 2005, p. 667). His works develops on the premise that "the spatial qualities of British cities associated with the industrial revolution are rarely considered separately" (Griffiths, 2005, p. 655), the current relationship between the popular twin cities' phenomenon and the city of Hyderabad is similar to such an inseparable association and therefore suggesting the aid that can be provided by "historicised interpretation of configurational descriptions" (Griffiths and von Lünen, 2016, p. 80). From Shah Alam's work of 1962, the commercial structure of the twin cities is of relevance, considering the resolution of his work in describing socio-economic processes at the scale of streets. Specific descriptions from his work are referenced in the analysis section however, his discussion on the trends and patterns in commercial centres from the twin cities' region is briefly outlined here.

At the city level, he broadly states, "In the Twin Cities business streets decrease in importance from the city's centre to its periphery. The tapering-off of business streets

from strong continuous development in the centre to weak and isolated clusters towards the margins is illustrated in Figure 7. On these business streets, beaded along lines of traffic, shopping nucleations of varying grade have emerged. Business is intensified at traffic intersections." (Alam, 1962, p. 176). This description suggests an intuitional and implicit understanding of attraction inequalities within the spatial configuration. However, the possibility of providing objective spatial descriptions by space syntax methods holds potential to shed a newer light to these descriptions.

Relevant to descriptions on the Twin Cities, he notes (refer Figure 8a and Figure 8c), "Hyderabad and Secunderabad have their separate CBD's which are, however, closely interlinked " (Alam, 1962, p. 181). He also notes (refer Figure 8b), "with the growth and expansion of Hyderabad and the change in axis of growth, the principal retail business district has changed locations twice during the course of its history" (Alam, 1962, p. 181). This identification of shifting centres, stands as another testimony for Hillier's argument of the phenomenon of centrality being a spatially-led dynamic process (Hillier, 1999b).
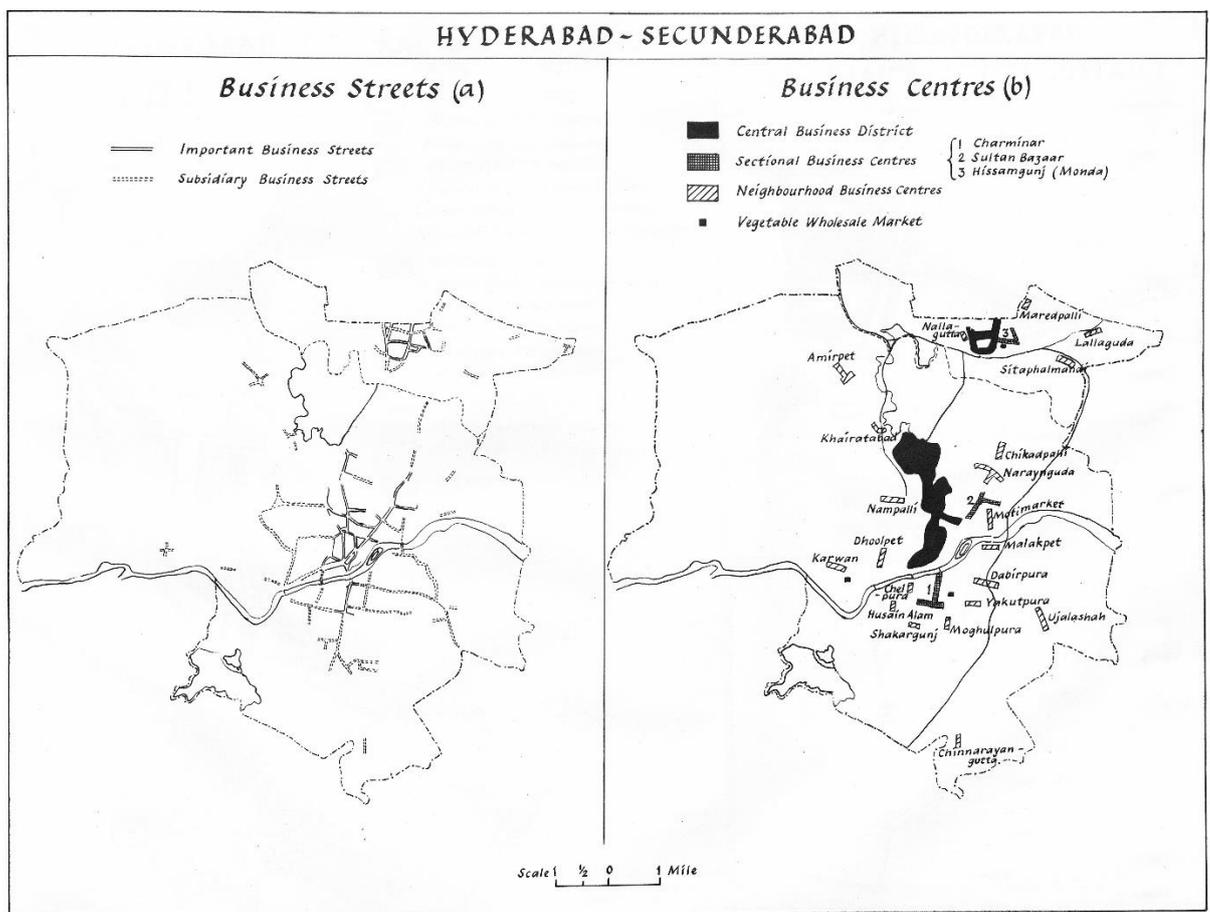
Figure 7: Business Streets and CBD's from 1962. Source: (Alam, 1962, Figure 44)
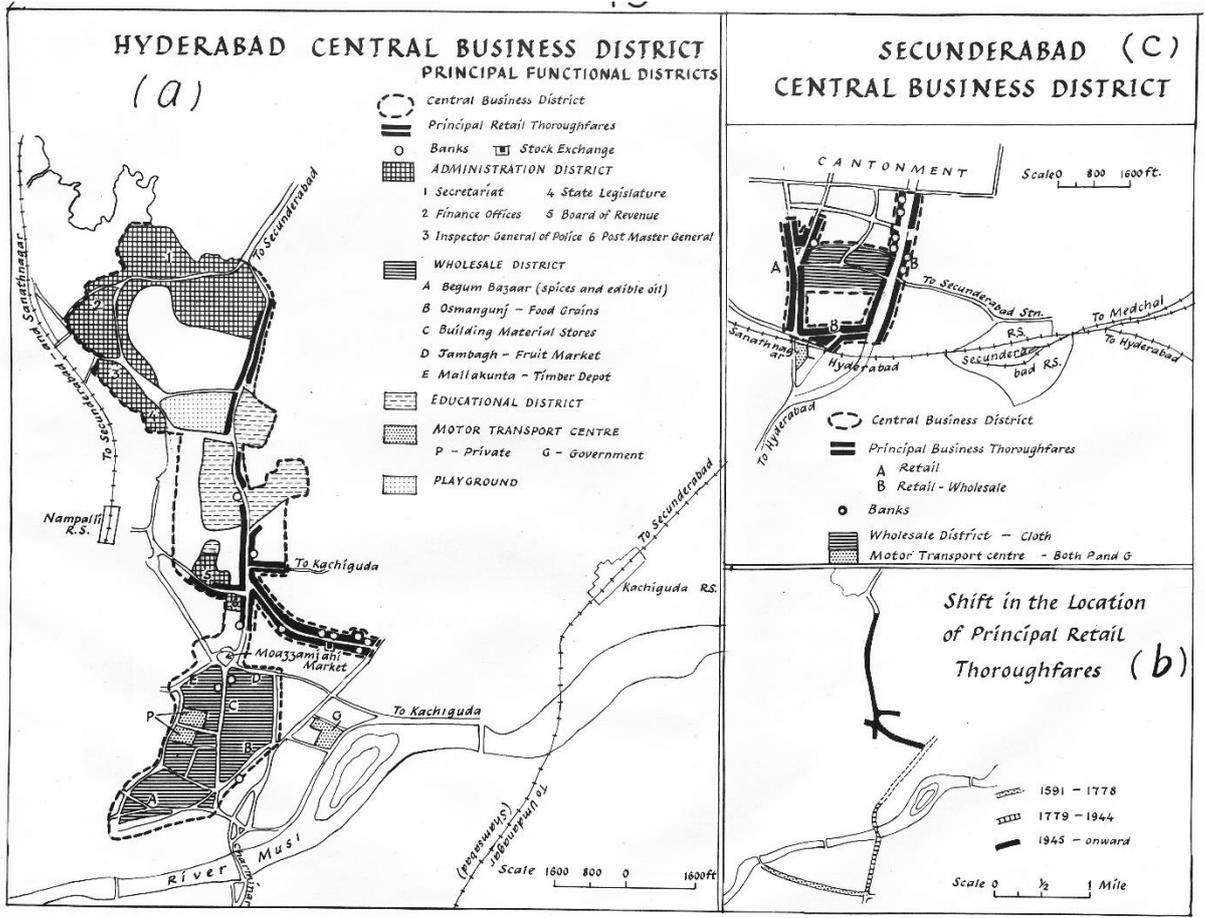
Figure 8: Central Business Districts from Hyderabad and Secunderabad; and shift in retail thoroughfares from 1962. Source: (Alam, 1962, Figure 45)

3. METHODOLOGY

The analysis to examine the duality is carried out in two steps. One, at a city-wide scale assessing the centres within the twin cities area against other centres of the city, and two, at the scale of individual twins to assess change and continuity from historical urban descriptions of the principal retail thoroughfares and CBDs to their current spatial and functional disposition. The contemporary segment model used for the following steps of analysis is a simplified network of the road centreline model sourced from Geofabrik OSM database (http://download.geofabrik.de/asia/india.html).

3.1   Analysis of the Twins in relation to the city

The objective assessment of areas across the city is done using the crowd sourced data from the Geofabrik OSM database that defines the whereabouts of the city's vicinities. This data consists of a single parameter which is the name of the vicinity assigned to points at the location of their respective vicinities. The degree to which vicinities perform as destinations is graduated by assigning each data point with the highest to-movement potential of the segments within a catchment of 800m from the data point. This distance for catchment is chosen as, apart from being the lowest radius of analysis, it also avoided assigning the same value to multiple data points. However, only the top 30% value segments are used at each radius of analysis to extract the data points that cover the spatial network constituting the integration core.

The spatial network is thus analysed for normalised angular integration (NAIN) at the following radii: 800m, 1.6km, 2.1km, 4km, 8km and 16km, to encompass movement potentials ranging from pedestrian level to regional level. Through this analysis the focus is to objectively identify areas that are central, and not, on the basis of their to-movement potential within the twin cities' zone across scales. However, the line-charts attached as appendix in section 9.1 show NAIN values of all the vicinities central across the city from the top 30% value segments. The emergent patterns of centres across the scales will be examined for a simultaneity in centrality of the two historic nodes to assess if the city is binodal–complying with its twin cities' definition.

Following this, is the analysis of the spatial configuration of each twin individually by plotting NAIN values from 1.6km radius of analysis against 16km to quantify the

degree of correspondence between the local and global structures of spatial accessibility. This local-global correspondence of integration serves as another parameter to statistically assess the duality.

3.2   Analysis of the Twins themselves

The analysis carries forward to examine for duality at the scale of the twins in two steps. First step is to study the spatial relationship between the two nodes to see if their historic spatial linkage is still central or not. Second step is the spatio-functional assessment of the two nodes as individual spatial systems to trace the extent to which they still operate as they did from when the city was binodal. The binodal state of reference of the city is taken from 1962. This is based on the urban descriptions of the city from Shah Alam (1962), which present the two nodes as being the most significant; and also, the mention of urban phenomena from other locations of the city as being secondary and dependent on the twins reinforces a binodal state of the city from then.

Firstly, the morphologies of historical significance whose current spatial potentials will be examined in detail are identified. Identification of these morphologies of historical significance is based on the appearance of their description in Shah Alam's work of 1962. The selection is restricted to important streets, markets and bazaars, recreational spaces and railway stations within the twin cities' area; which also continue to function under these labels in the current phase of the city.

For the first step of analysis, the extent to which the street from the twin cities' region performs as spatial linkages, with their through-movement potential, between the twins is assessed using the 1.4 and 1.3 structures of normalised angular choice (NACH) at the radius of 16km and 800m. This is done to derive initial descriptions of the spatial structure in which the two nodes are embedded and to help further examine their functions individually.

In the second step, the derived descriptions of the streets are then compared with the historical descriptions of these spatial linkages from 1962 to assess for change and continuity in their spatial pattern, to trace for spatial memory of the twin relation– starting from a purely spatial perspective. This assessment into the spatial history of the twins will then be traced back to their contemporary phase by the functional assessment

of the above comparative study of historic roads reading their current functions from Google Maps. This assessment will be done in conjunction with the study of their specific embedding in the centrality patterns of spatial accessibility (to-movement potential). The centrality patterns will be derived at the level of building blocks from the two nodes–the blocks as mapped from the Google Maps' areas of interest (AOI) data. This is done by assigning them with normalised angular integration (NAIN) values of the street segment they open to, which allows to describe the spatial potential of these morphologies to serve as centres and differentiate them as attraction inequalities. From the patterns of centrality in AOI, morphologies with highest to-movement potential are identified. In other words, morphologies which play a central role in attracting movement purely as a function of their placement in the spatial configuration. The functions of these morphologies are then compared from now and 1962 to trace for the spatial memory from a spatio-functional perspective. This second step is carried out on each twin separately.

4. RESULTS: City scale

The following analysis responds to the city-wide question– to what extent is the duality manifested in the spatial structure of the city. Thus, testing if the city is still binodal or whether there are emergent centres and hence poly-nodal.

4.1   Spatial Network Analysis: spatial potential of centres as destinations

At radius 16km (Figure 9), the top decile of centres emerges outside the twin cities' region of city in two locations: L. B. Nagar to the south-east and Kukatpally to the north-west. The twin cities' zone captures a mix of centres from the second and third deciles of integration (Figure 10), circumscribed by centres from the third decile linking the Twin Cities area to the centres with higher order NAIN values. The location of the historic centres of the city coincide with the second decile of integration values, highlighting the continuing centrality of some of the centres in the Twin Cities area, namely: Patny centre from Secunderabad and Nampally, Abids, Kacheguda, Chaderghat and Goshamahal from the Old Hyderabad.

At radius 8km (Figure 11), a receding trend in the to-movement potential away from the Twin Cities area is observed. However, within the Twin Cities region, a contrast within the two nodes is noted (Figure 12). The spatial network of Secunderabad continues to contribute to the integration core with third decile NAIN values, and enabling Patny centre area to emerge as a centre at this scale too, while it is only Chaderghat that persists from the southern twin. Thus, Secunderabad being more central than Hyderabad as a destination at this radius, despite their parallel continuation of centrality as historic centres in the top second decile of NAIN at radius 16km. This contrast is suggestive of Secunderabad being favoured by the nature of growth of the city in maintaining a higher spatial accessibility over Old Hyderabad.
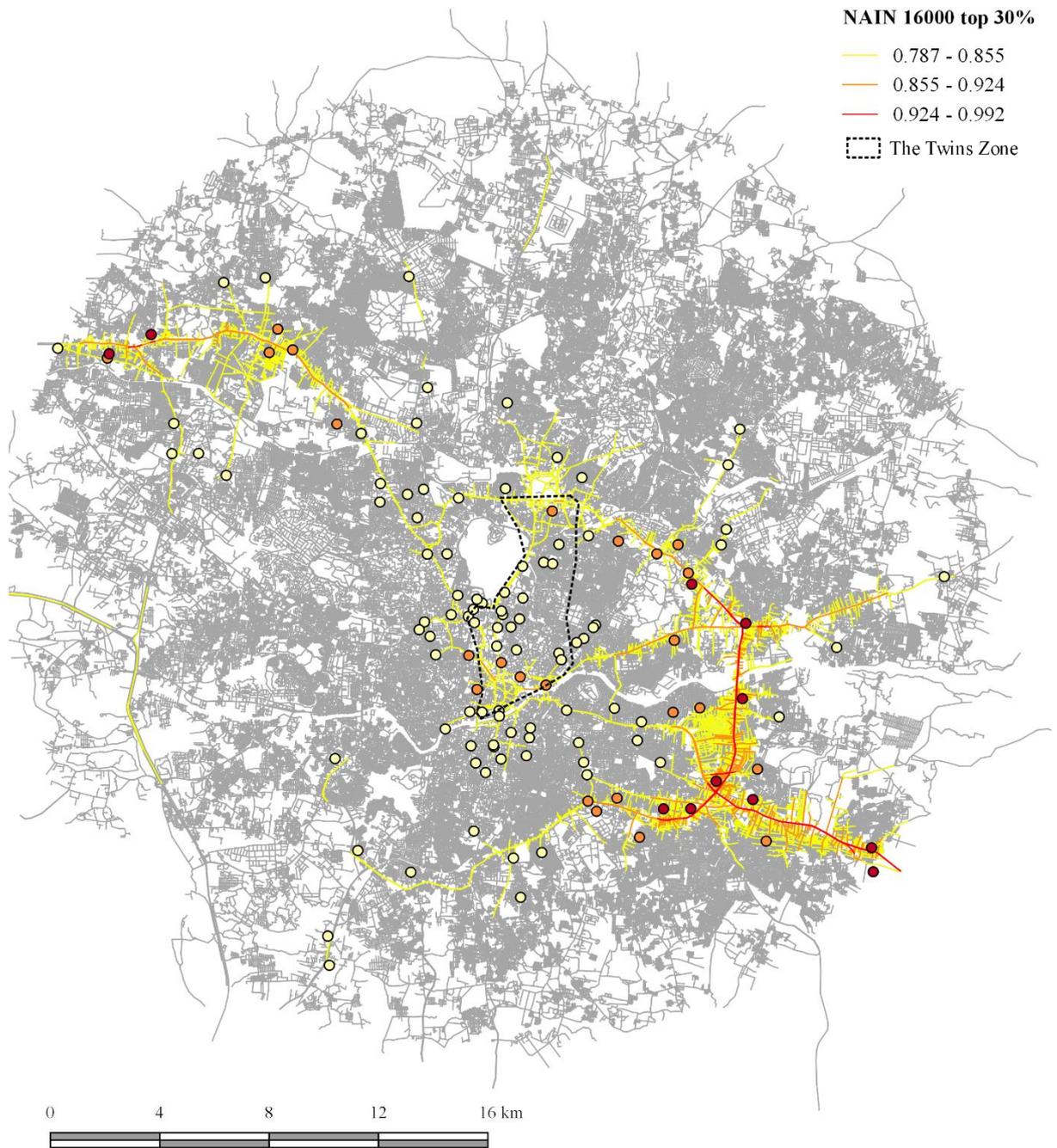
Figure 9: Angular segment analysis for **NAIN at 16km** radius showing the top 30% value segments, along with places classified into three ranks based on NAIN values in their 800m catchment. Source: Author.
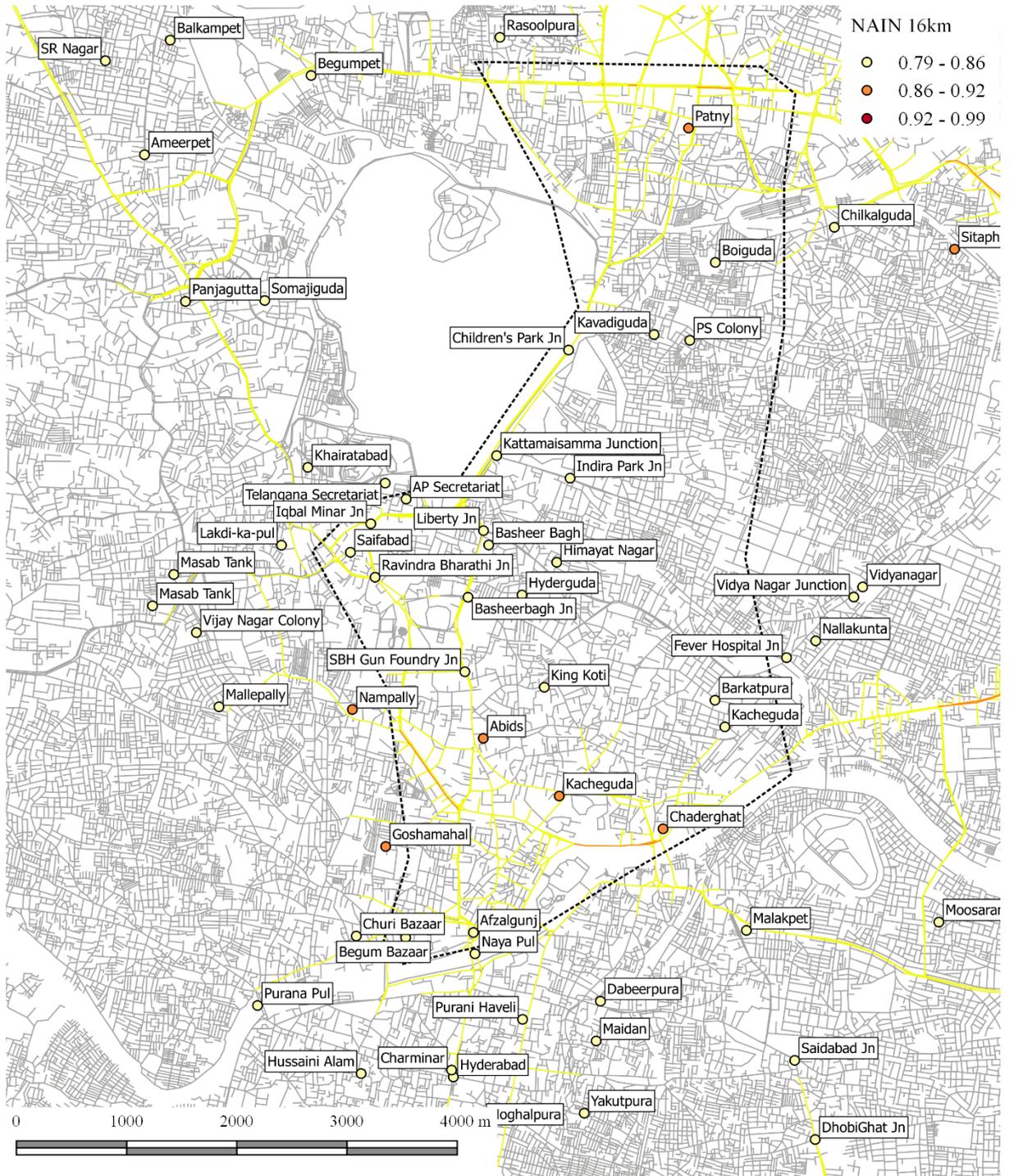
Figure 10: Places with top 30% of NAIN values at 16km radius within the Twin Cities Area.
Source: Author.
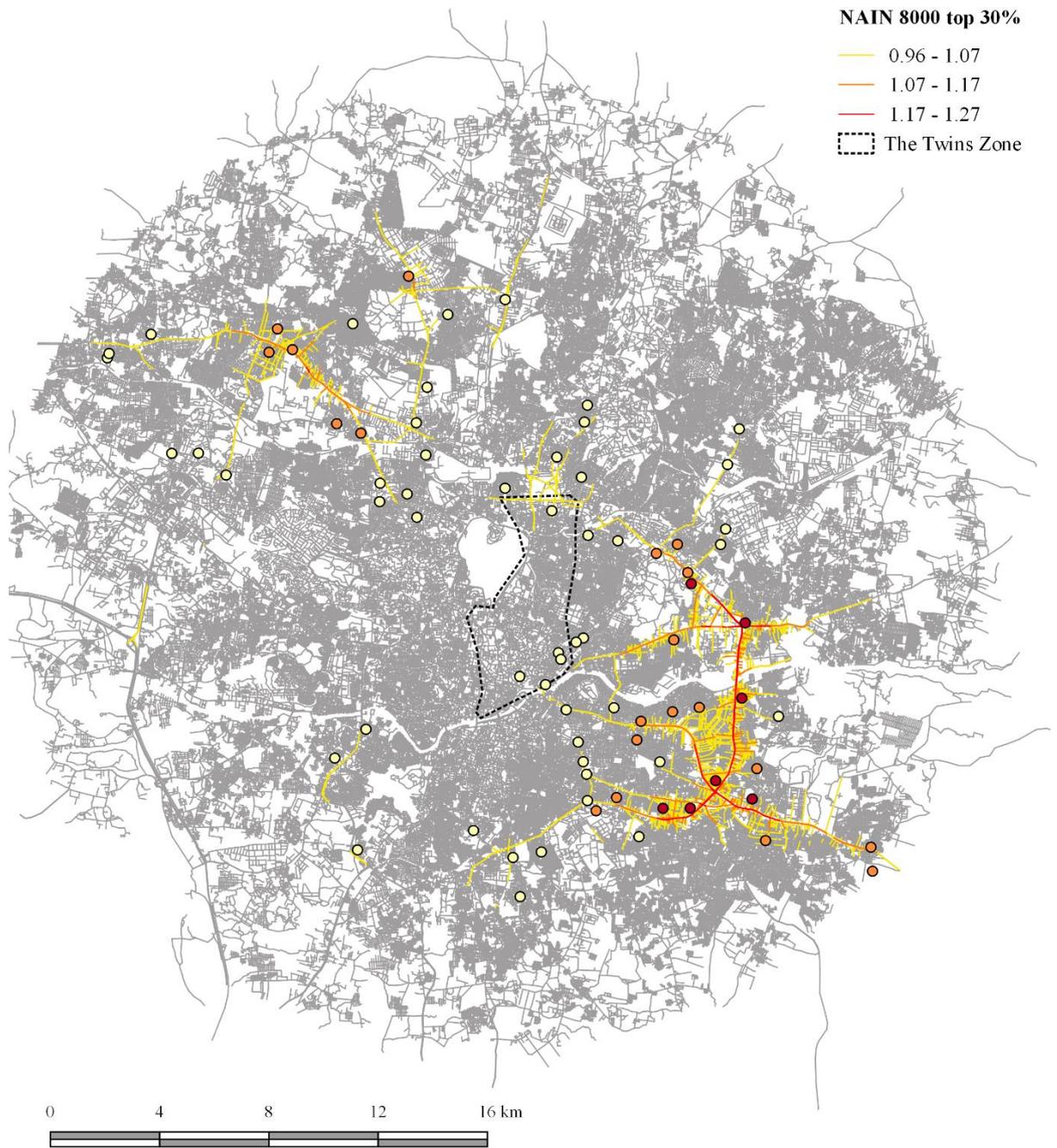
Figure 11: Angular segment analysis for NAIN at 8km radius showing the top 30% value segments, along with places classified into three ranks based on NAIN values in their 800m catchment. Source: Author.
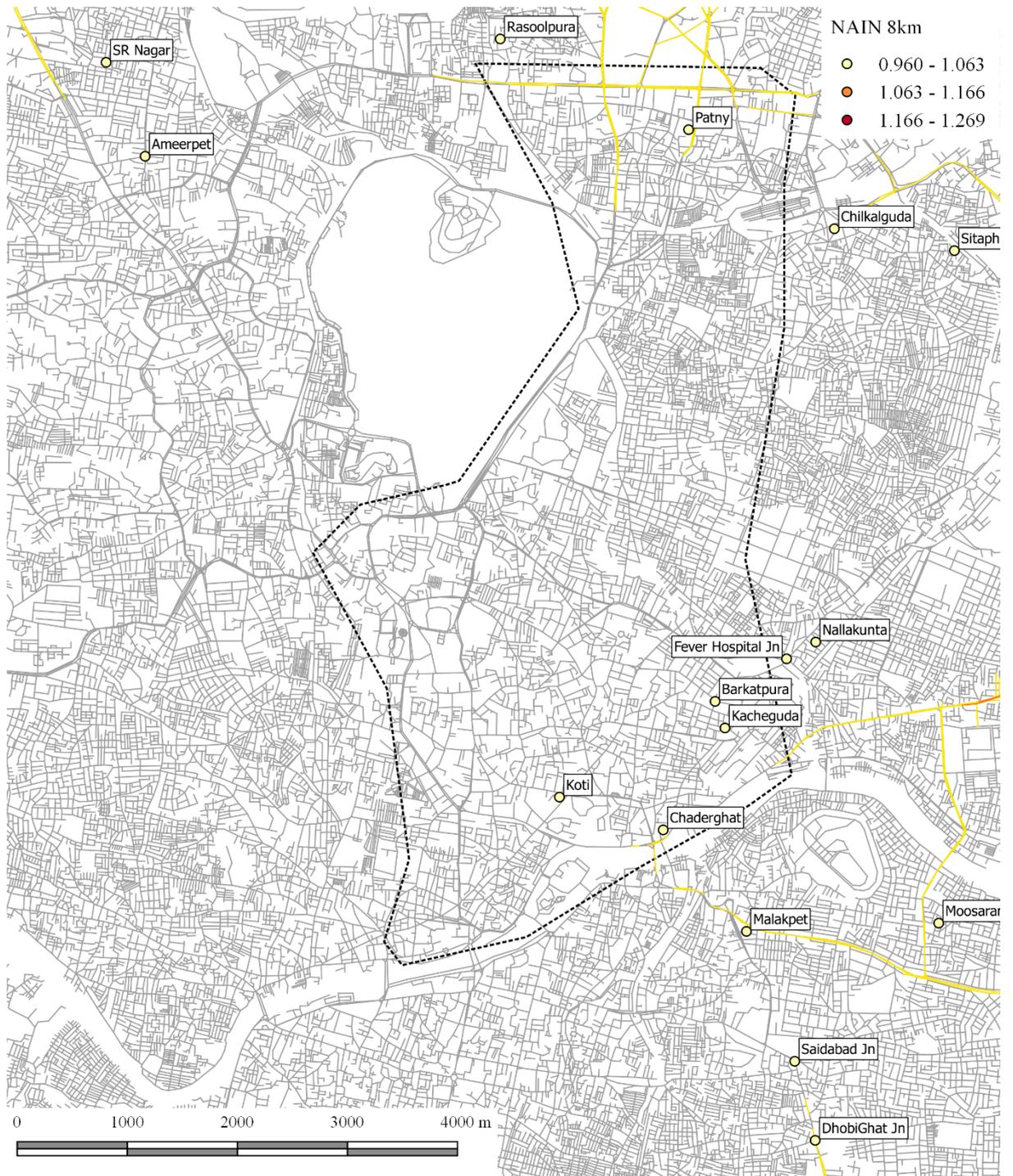
Figure 12: Places with top 30% of NAIN values at 8km radius within the Twin Cities Area.
Source: Author.

At radius 4km, viewing the city as a whole (Figure 13), two patterns of centrality are found. The south-east region of L. B. Nagar supersedes other regions of the city with centres of maximum to-movement potential, while new clusters of centres from the top second decile emerge scattered across the city. The twin cities region being one such cluster. Upon focussing on the Twin Cities region, a vivid north-south differentiation is observed (Figure 14), with centres from the second decile composing the northern twin of Secunderabad and centres from the third decile dispersed over the southern twin. Basing on the historical description by Shah Alam (1962) that the sales level of the retail district from old Hyderabad were much above than that of Secunderabad– the above-noted contrast is suggestive of an inversion in that difference caused by growth of the city with its associated developments in retail and commercial characteristics. Two other noteworthy observations arise at this radius of analysis. First is the emergence of vicinities in the area between the twins as centres. Since the centrality of a vicinity is assigned by the highest spatial accessibility of the segments in their 800m catchment, these vicinities though being residential colonies emerge as centres due to their proximity to high streets. Second is the spread of centrality from top third decile, from the southern twin of Old Hyderabad across the river to the historical walled city to the south of the river.

At radius 2.1km (Figure 15), the top decile of NAIN values is distributed in three regions: L. B. Nagar to the southeast, Kukatpally to the northwest and Secunderabad in the centre. Thus, representing the twin cities region–Secunderabad emerges as one of the major city-wide local centres. Hence, within the twin cities' zone (Figure 16), a tripartite classification of centres is noted for the first time. Patny Centre, Secunderabad from the top decile followed by the centres to its immediate south from Gandhi Nagar and Himayat Nagar area in the second decile, and the centres from the southern twin in the third decile of NAIN values. A correspondence between this north-south hierarchy in centrality at radius 2.1km and the gradation in the mix of land use (Figure 17) can be noted. Patny Centre, Secunderabad being majorly multi-use (mixed use), Gandhi Nagar and Himayat Nagar being residential but with high streets as seen in the analysis at radius 4km and the southern twin of Old Hyderabad being a mix of multi-use and public and semi-public spaces. Upon continuing to read the pattern of centrality panning further south from the southern bank of the river, an increase in the NAIN values from previous scales of analysis is noted in the locations from the once walled city around Charminar. Hence the change from yellow to orange rank of these centres,

with change in radius from 4km to 2.1km respectively. This particular trend in centrality resonates with the fact of the city moving out of the walled quarter to the northern banks of the river; and suggests how this transition is ingrained in the spatial configuration.
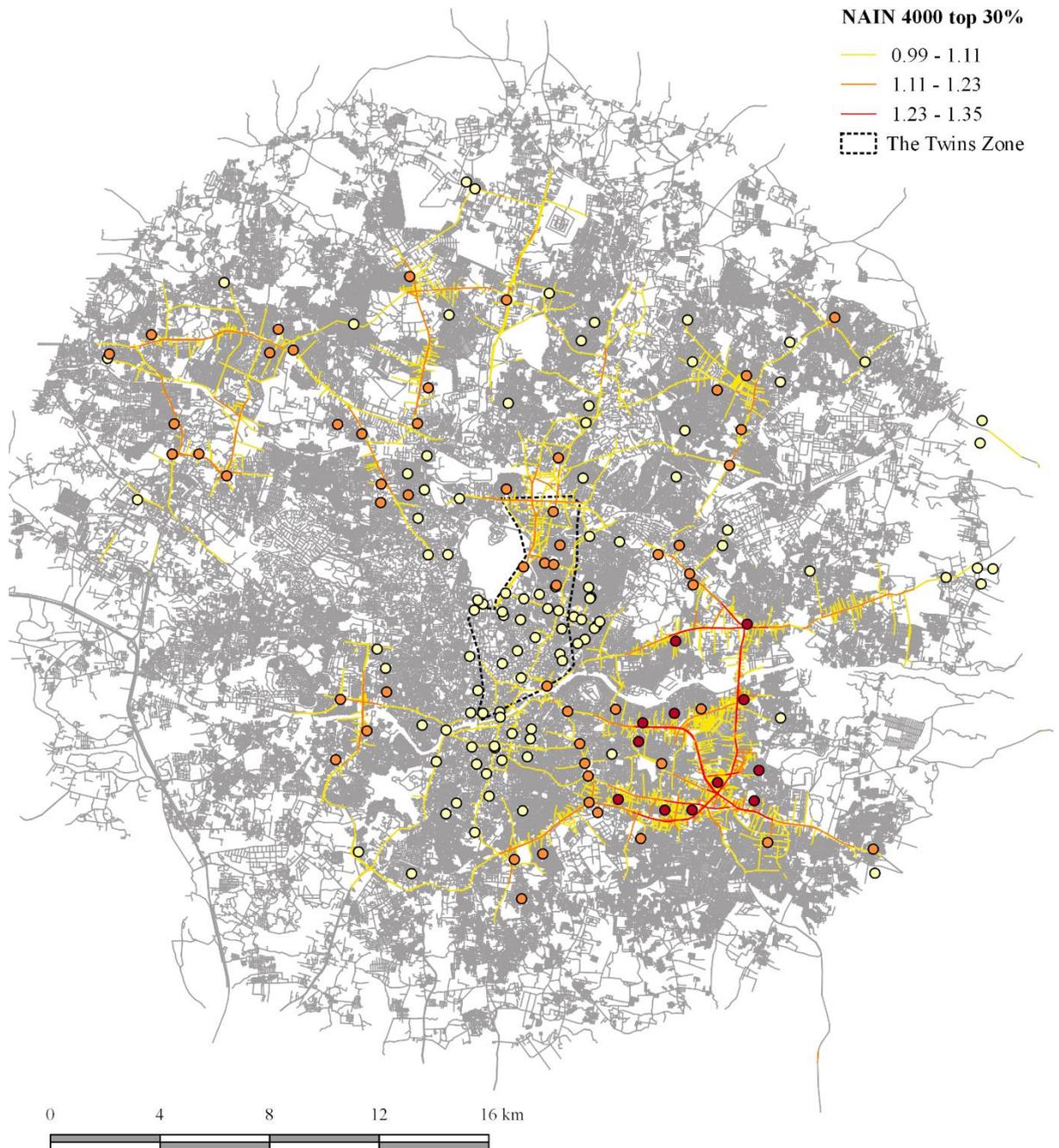
Figure 13: Angular segment analysis for NAIN at 4km radius showing the top 30% value segments, along with places classified into three ranks based on NAIN values in their 800m catchment. Source: Author.
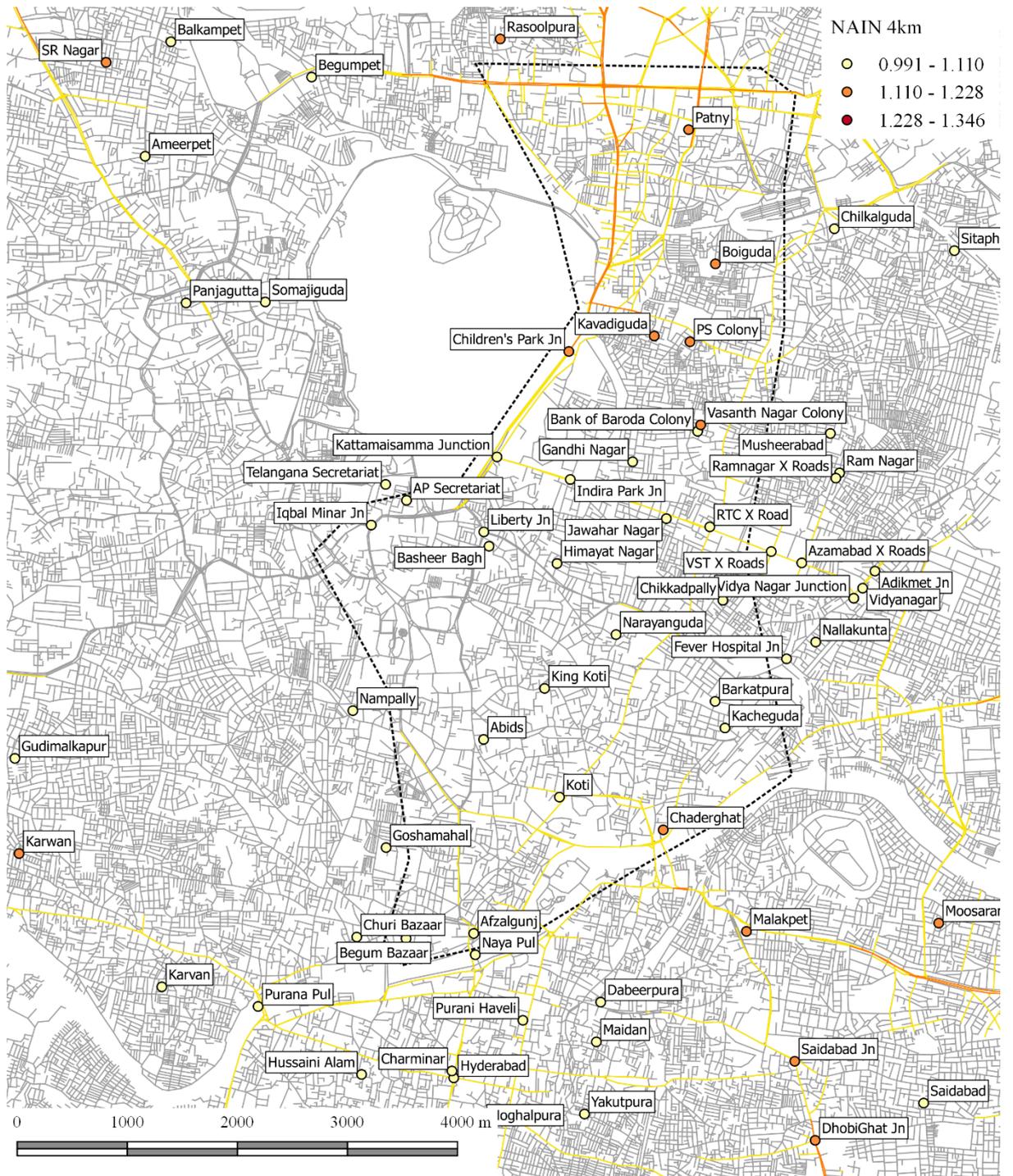
Figure 14: Places with top 30% of NAIN values at 4km radius within the Twin Cities Area.
Source: Author.

NAIN 2100 top 30%

Diss_Hyd_NAIN_2100

— 1.11 - 1.25
— 1.25 - 1.38
— 1.38 - 1.52
⬚ The Twins Zone

0   4   8   12   16 km
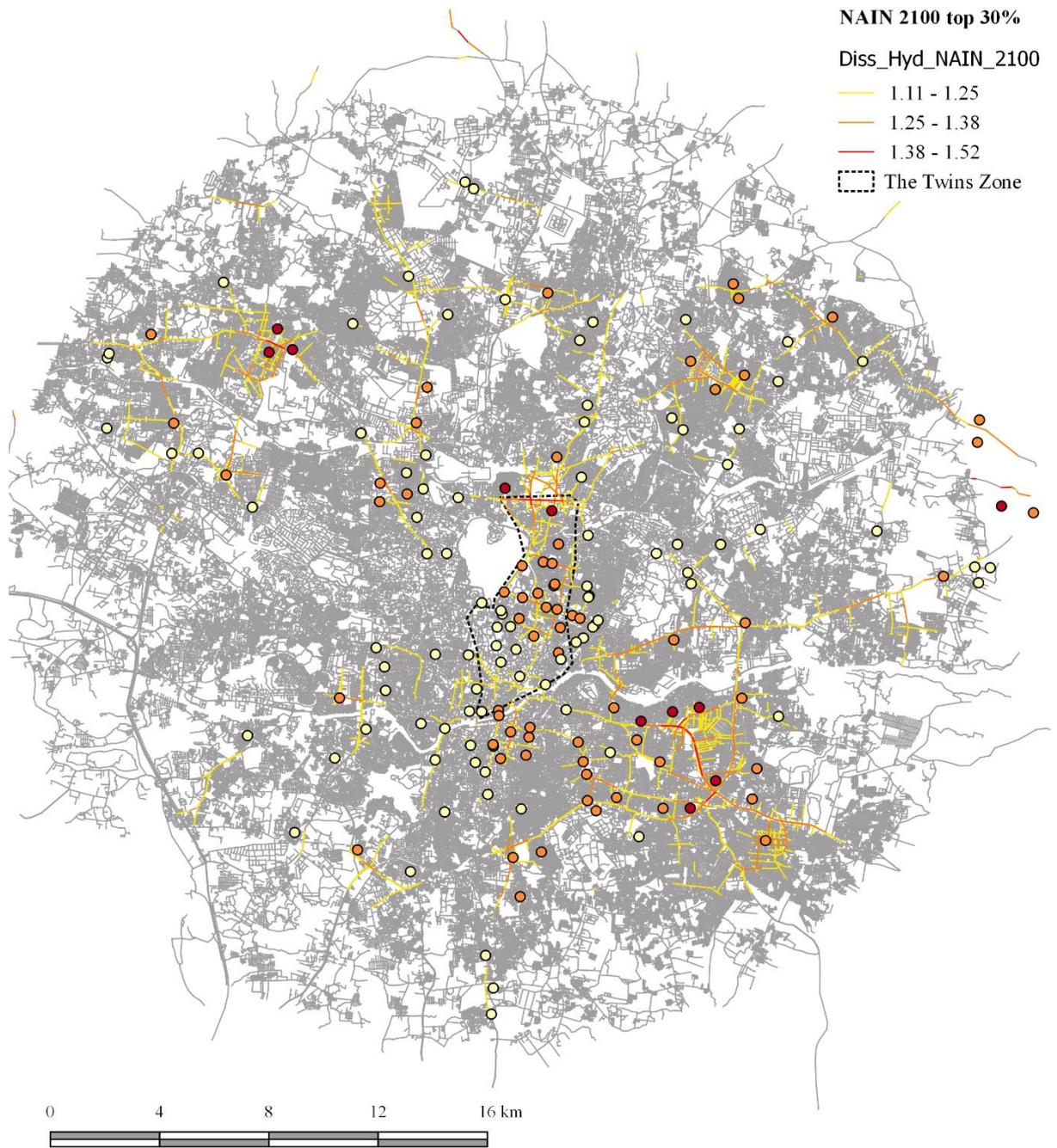
Figure 15: Angular segment analysis for NAIN at 2.1km radius showing the top 30% value segments, along with places classified into three ranks based on NAIN values in their 800m catchment. Source: Author.
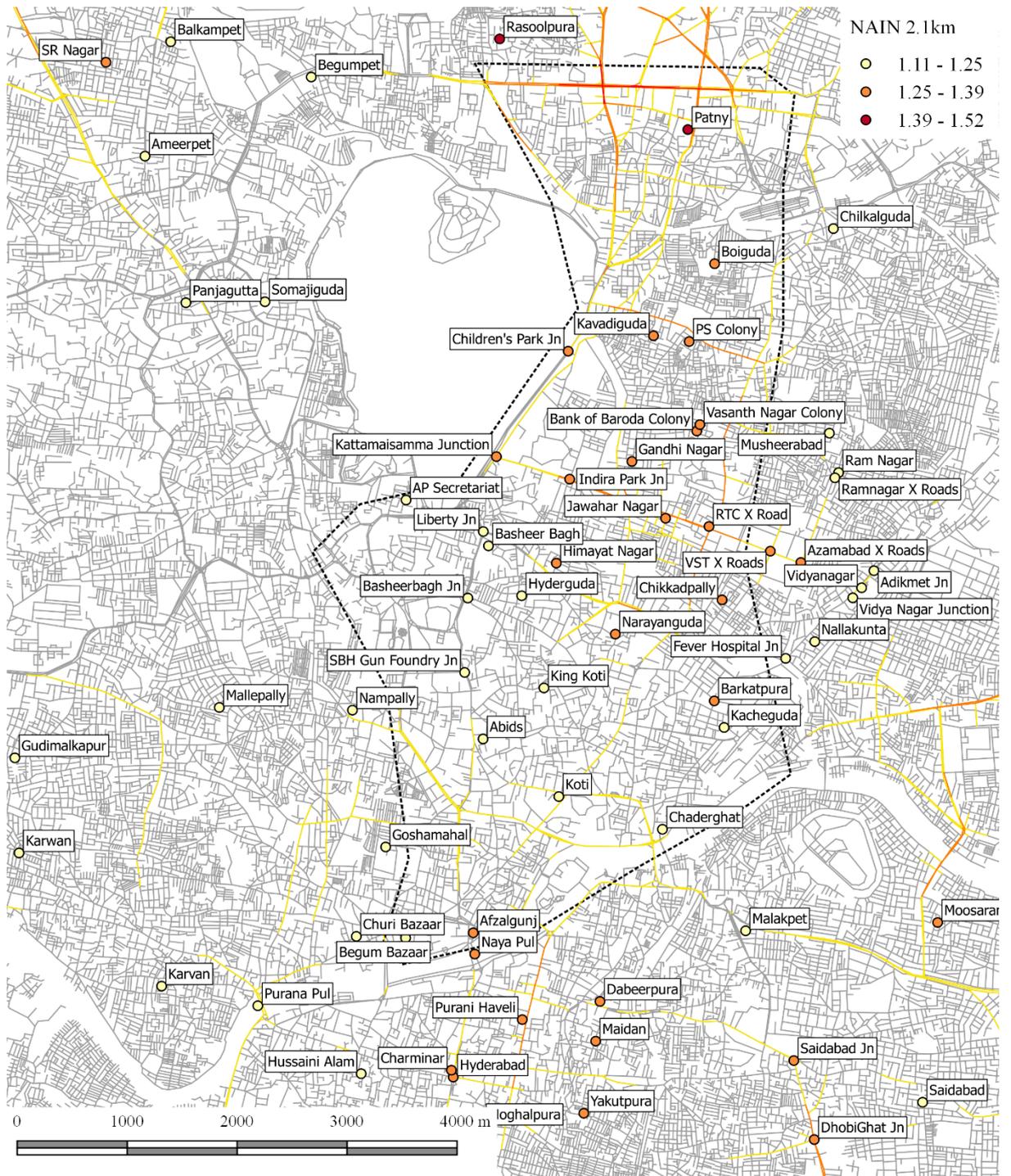
Figure 16: Places with top 30% of NAIN values at 2.1km radius within the Twin Cities Area.
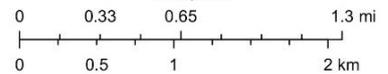
Figure 17: Current land use of the twin cities' region. Source mentioned in the image.

At radius 1.6km (Figure 18), similar city-wide patterns as from analysis at radius 2.1km are observed. However, upon observing centrality at the resolution of individual vicinities, a directionality in the pull or greater attracting power of centres than that of from analysis at radius 2.1km is noted (Figure 19). Afzalgunj previously noted in the second decile at 2.1km drops to the third decile. As a distilling effect, a closer clustering of the second decile centres into the once walled city region to the south of the river is observed, thus the spatially-led process of centrality being synchronous with the historicity of this cluster. Similar drop from second to third decile is observed in the region between the twins at the centres of Barkatpura and Kattamaisamma, thus increasing the centrality in a relational sense of the others centres lying in between the twins. However, it isn't the reinforcing of a historical connotation here but a gradation in the concentration of commercial activities that is indicated by the process of centrality.

At radius 800m (Figure 20), vicinities constituting the top decile emerge in distinct regions suggesting their prevalence as local centres at the pedestrian level. None of which fall within the Twin Cities area (Figure 21). However, it is composed of centres from the second decile which fall in the region of Narayanguda and RTC X Roads between the two twins. The surge in to-movement potential of the central region between the twins is indicative of the growth of this region with contemporary micro-economic transactions in the form of cinema halls, provisional stores, coaching centres and retail lining along the length of the RTC X Roads, compared to the twins which have been operating predominantly as wholesale business districts.
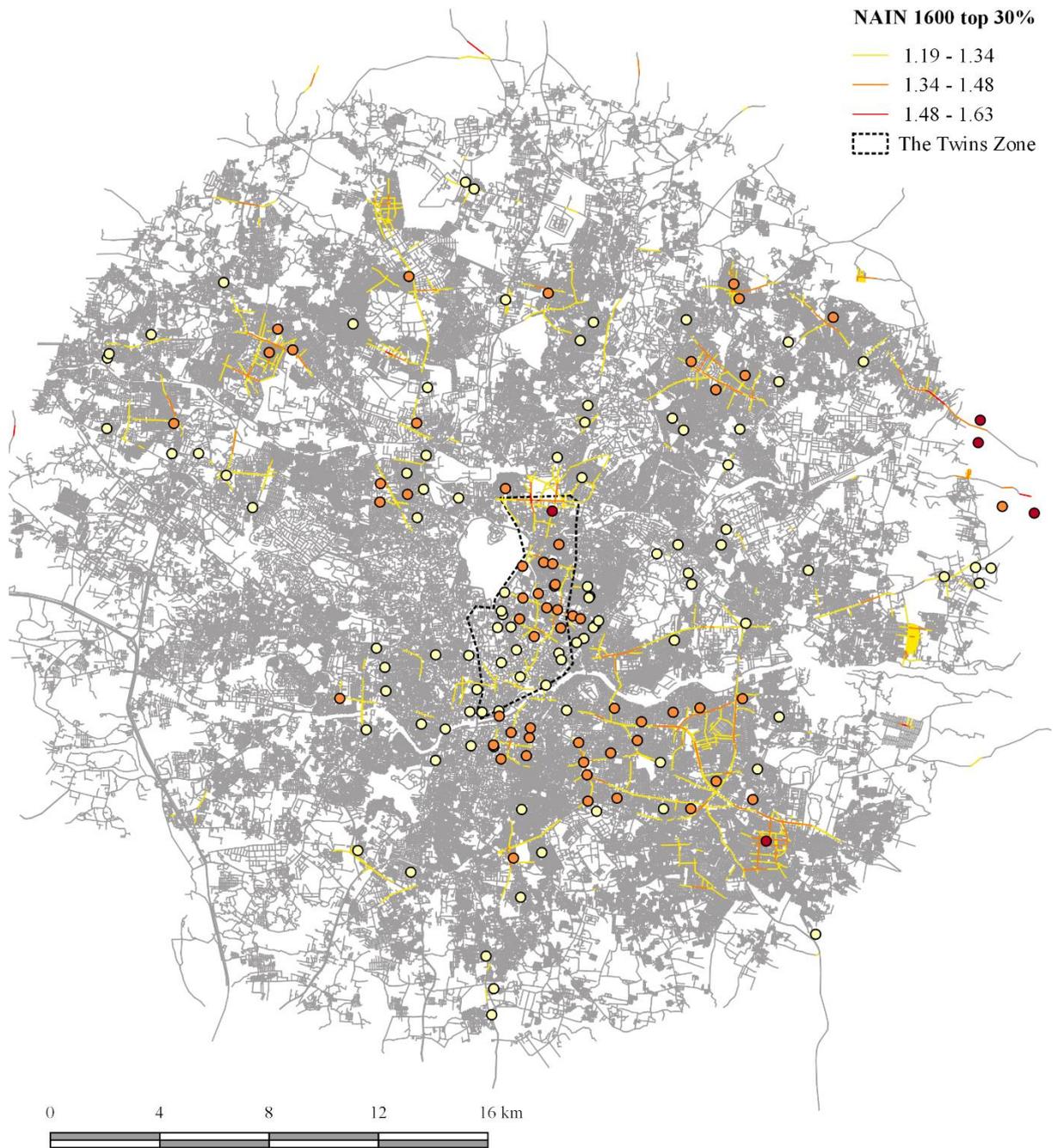
Figure 18: Angular segment analysis for NAIN at 1.6km radius showing the top 30% value segments, along with places classified into three ranks based on NAIN values in their 800m catchment. Source: Author.
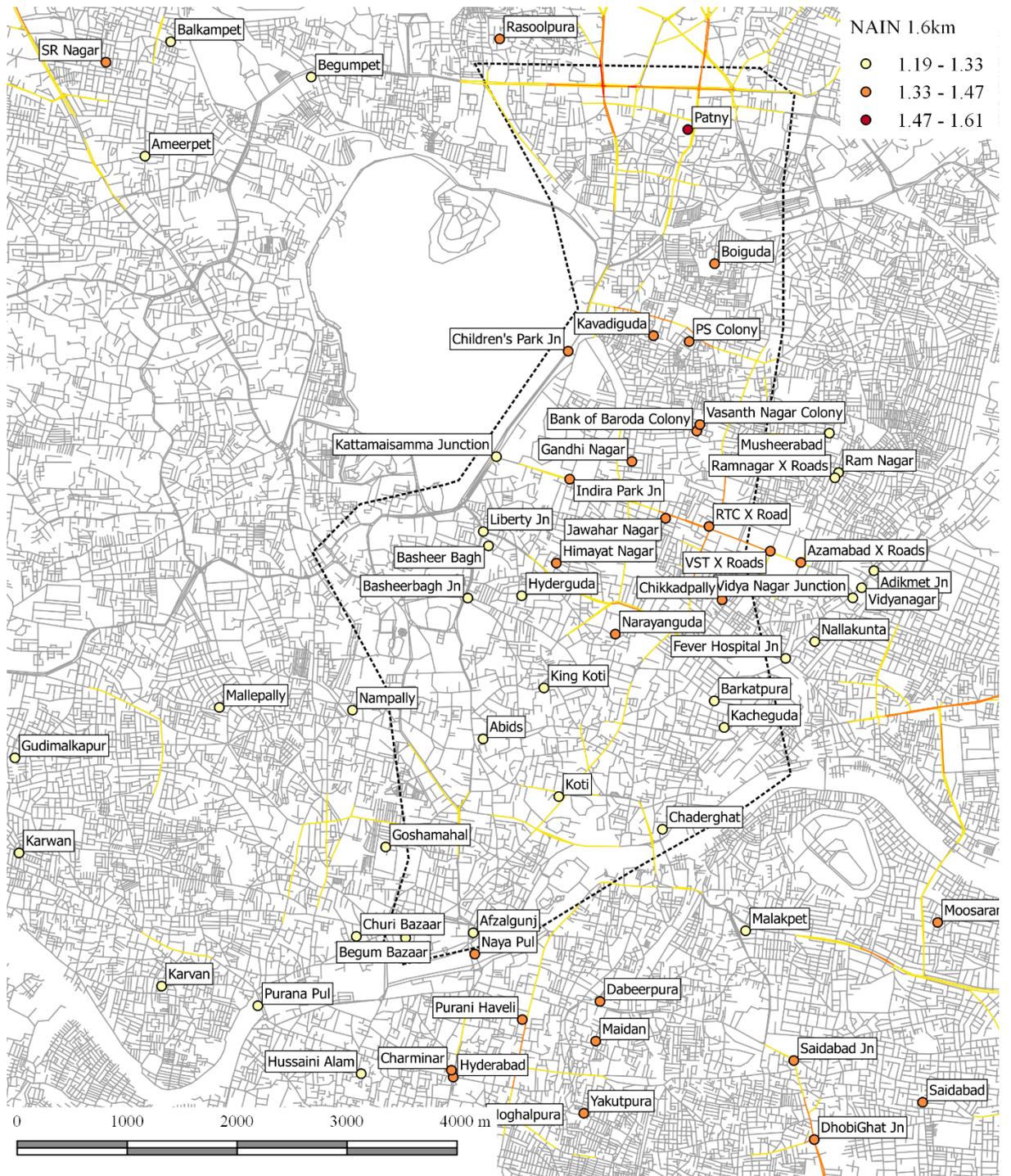
Figure 19: Places with top 30% of NAIN values at 1.6km radius within the Twin Cities Area.
Source: Author
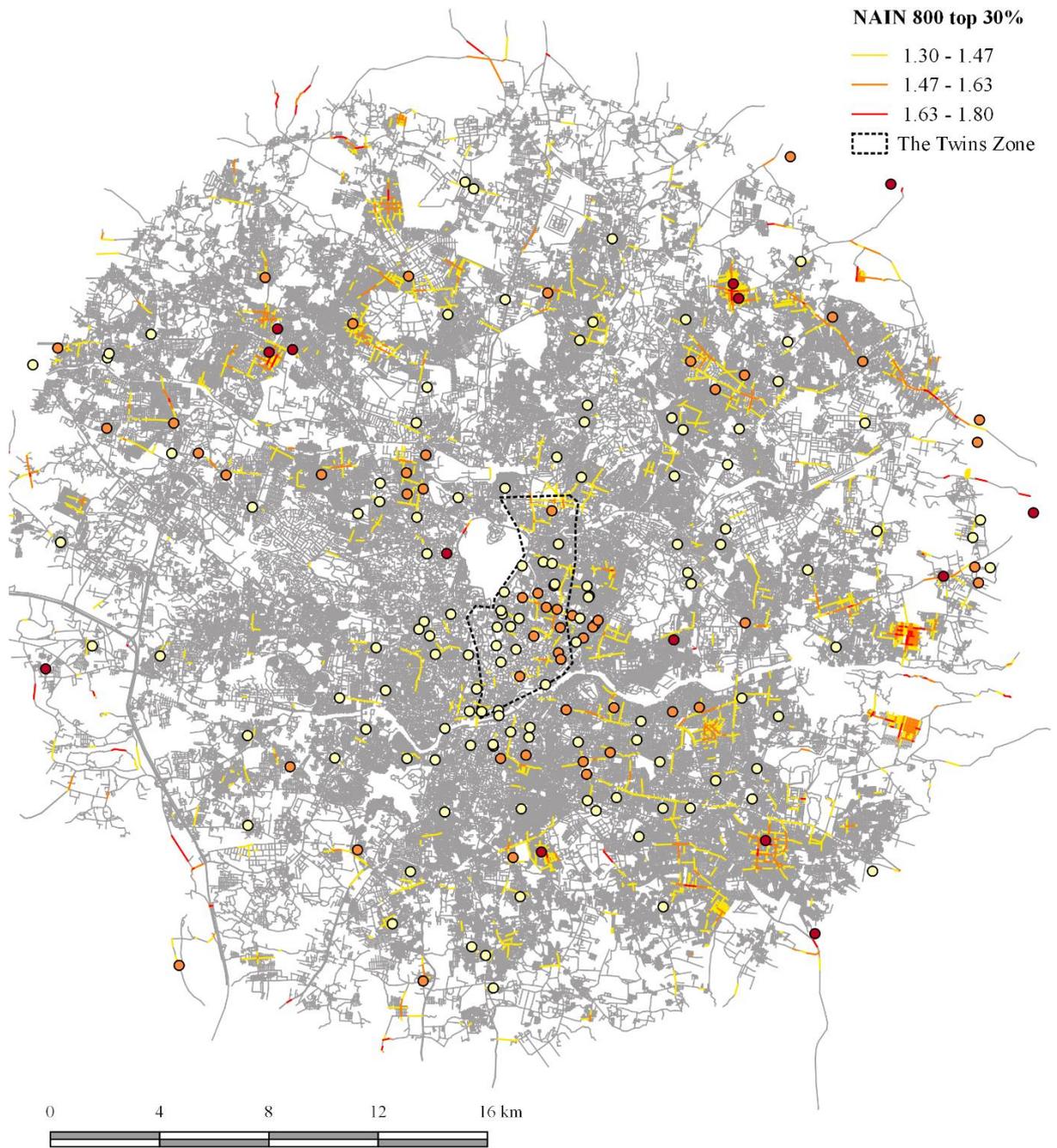
Figure 20: Angular segment analysis for NAIN at 800m radius showing the top 30% value segments, along with places classified into three ranks based on NAIN values in their 800m catchment. Source: Author
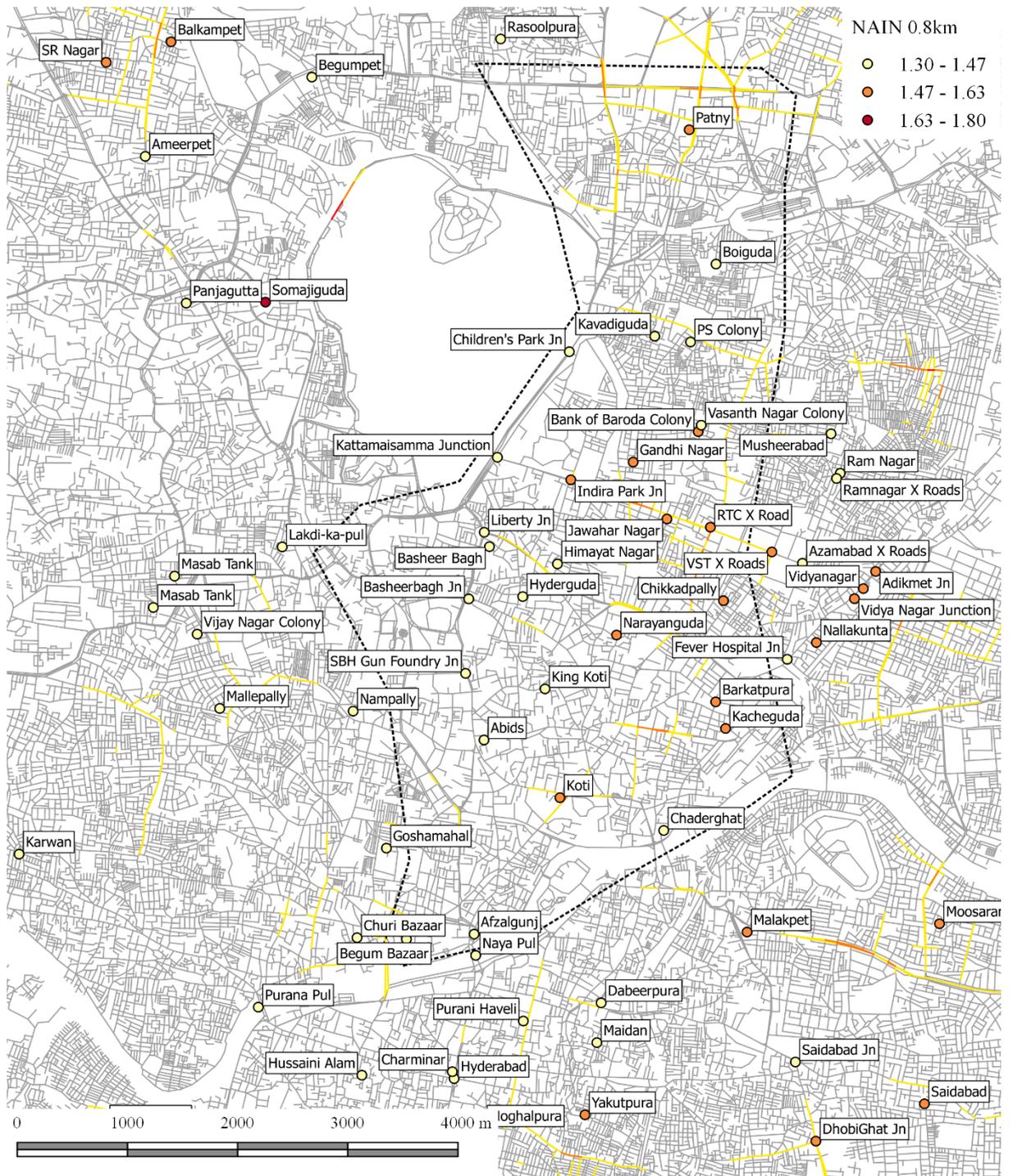
Figure 21: Places with top 30% of NAIN values at 800m radius within the Twin Cities Area. Source: Author

Table2 summarises the above emergent patterns by showing how many of the vicinities, including the historic centres, from the two twins are spatially accessible at the top 10%, 20% and 30% values of NAIN. At a first glance, different variations within the two nodes can be noted at different scales, and containing them under the

title of twin cities can thus be inferred as an over-simplification. This calls for contemporary descriptions of the historical twin cities phenomenon. An attempt to describe is made in Section 6 synthesising the results from the analyses taking the space-first approach; and also highlights urban processes happening differently from a duality.

Simultaneity in spatial accessibility of Secunderabad and Old Hyderabad can be noted only at the regional scale of 16km in the second decile. A predominant function of both these nodes as wholesale retail districts comes forth a possible interpretation of this pattern. The black cells across the scales, symbolise other areas outside the twin cities' region occupying that respective decile of spatial accessibility to constitute the integration core of the city. This study thus, objectively suggests how the city has appropriated the two nodes to various degrees for various purposes at each scale.

	Top 10%	Top 20%	Top 30%	Total
16km				
Secunderabad	■	1	■	1
in-between twins	■	■	9	9
Old Hyderabad	■	5	12	17
8km				
	■	■	1	1
	■	■	2	2
	■	■	2	2
4km				
	■	1	■	1
	■	5	10	15
	■	1	13	14
2.1km				
	1	■	■	1
	■	15	1	16
	■	1	11	12
1.6km				
	1	■	■	1
	■	13	3	16
	■	■	11	11
800m				
	■	1	■	1
	■	8	7	15
	■	2	10	12

Table 2: The pattern of emergence of centres from the Twin Cities region in the top three deciles of NAIN across different radii.
Source: Author

There is no significant correlation between the to-movement potential of segments at a local scale with that of at a global scale, when the whole city is considered as one spatial system (Figure 22). However, upon selecting the spatial network of the individual twins and analysing for the same, presents latent correlations. The performance of the spatial configuration of Secunderabad in attracting to-movement that pervades from the local scale of 1.6km to a global scale of 16km is much greater, with an r-squared value of 0.73 (Figure 23), than that of Hyderabad with an r-squared value of 0.43 (Figure 24). Thus, a further nuance on variations within the duality. This difference, statistically, reinforces the previous finding of how the growth of the city has favoured the spatial network of Secunderabad in maintaining high spatial accessibility across the radii of analysis. The syntactic analysis of the spatial configuration of the twin cities from a historical snapshot of 1914 is appended in section 9.2 to further comment on the relation between growth of the city and centrality patterns. However, upon performing the same statistical test to the spatial network of the relatively newer area between the twins (Figure 25), the r-squared value is equal to that of Old Hyderabad. The higher local-global correspondence of the historical twin of Secunderabad than that of the newly developed area between the twins, suggests the existence of other factors influencing the performance of the spatial network apart from growth of the city. Tracing back to the land use (Figure 17) as used in reading the tripartite classification of the centres within the twin cities area at radius 2.1km of NAIN analysis, aids in understanding this variation in local-global correspondence. Predominantly multi-use of Secunderabad thus suggests a high synergy between land use and local-global correspondence of the spatial network, and the lower local-global correspondence of the other two areas is synonymous to their mixed usage: Old Hyderabad with its mix of multi-use and public space and the area between the twins with a residential and multi-use mix.
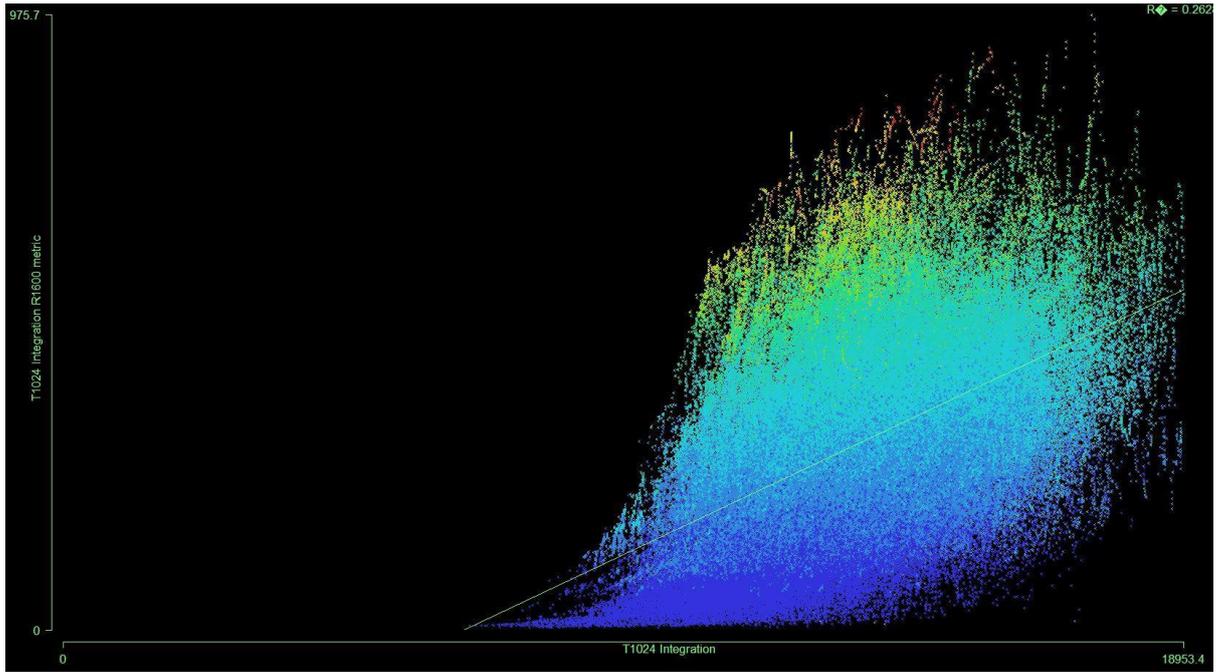
Figure 22: Scatter plot of angular integration at 1.6km against angular integration at 16km.
Source: Author
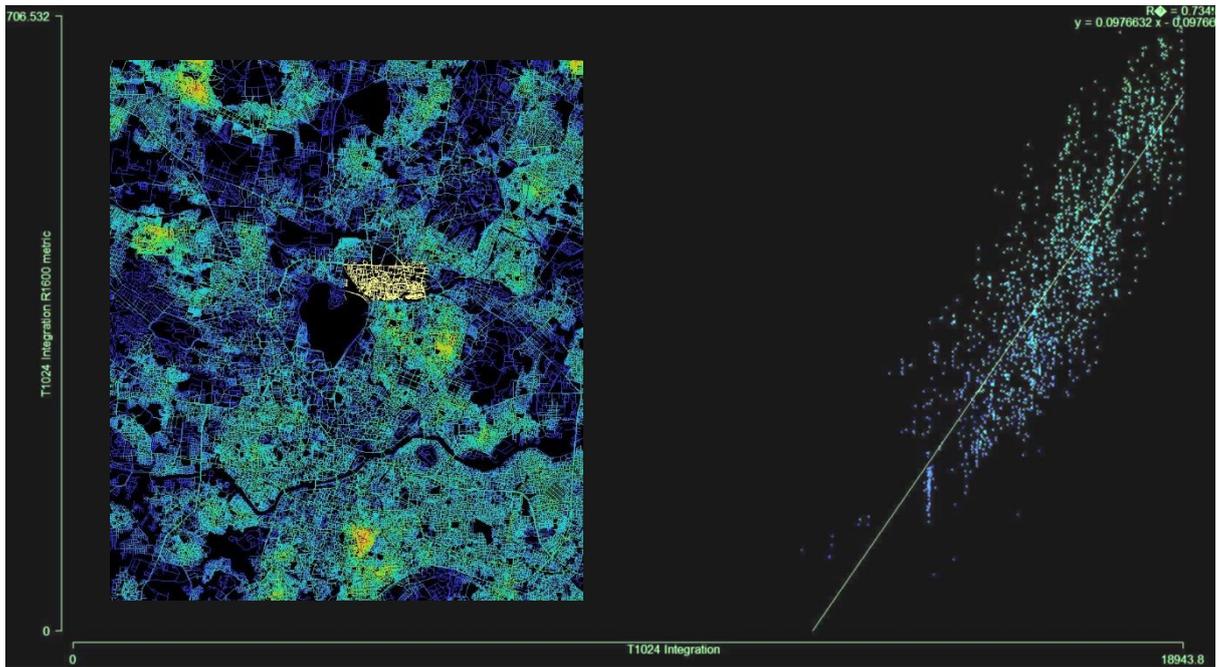
Figure 23: Above scatter plot for segments from Secunderabad. Source: Author
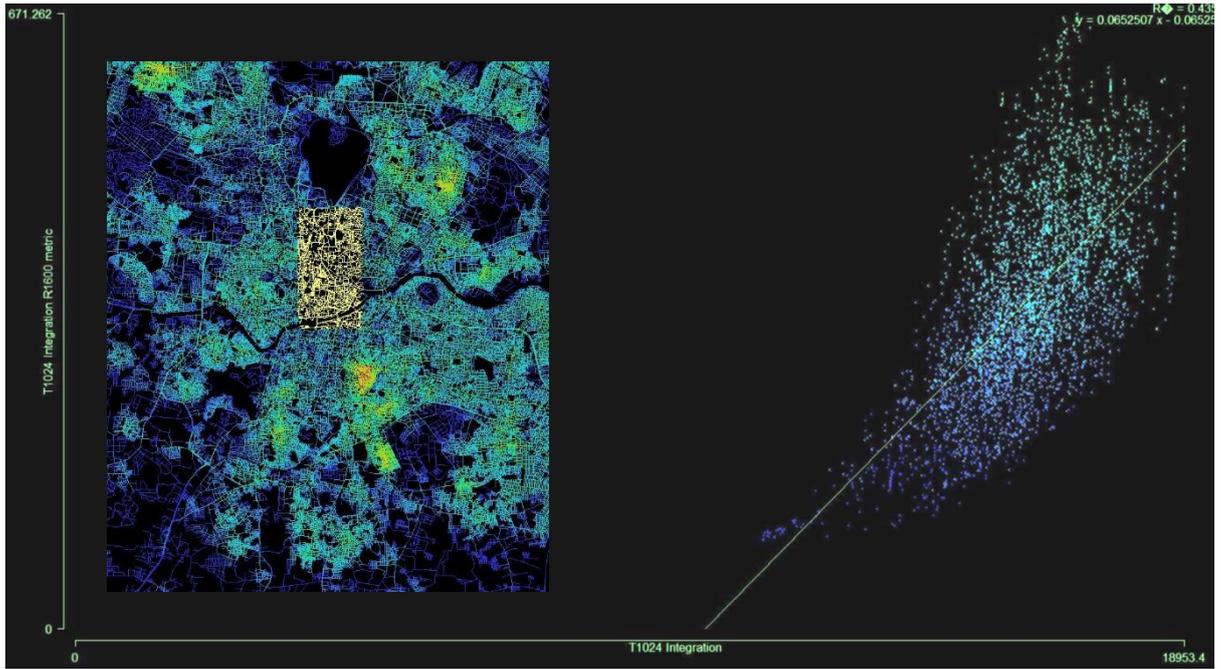
Figure 24: Above scatter plot for segments from Hyderabad. Source: Author
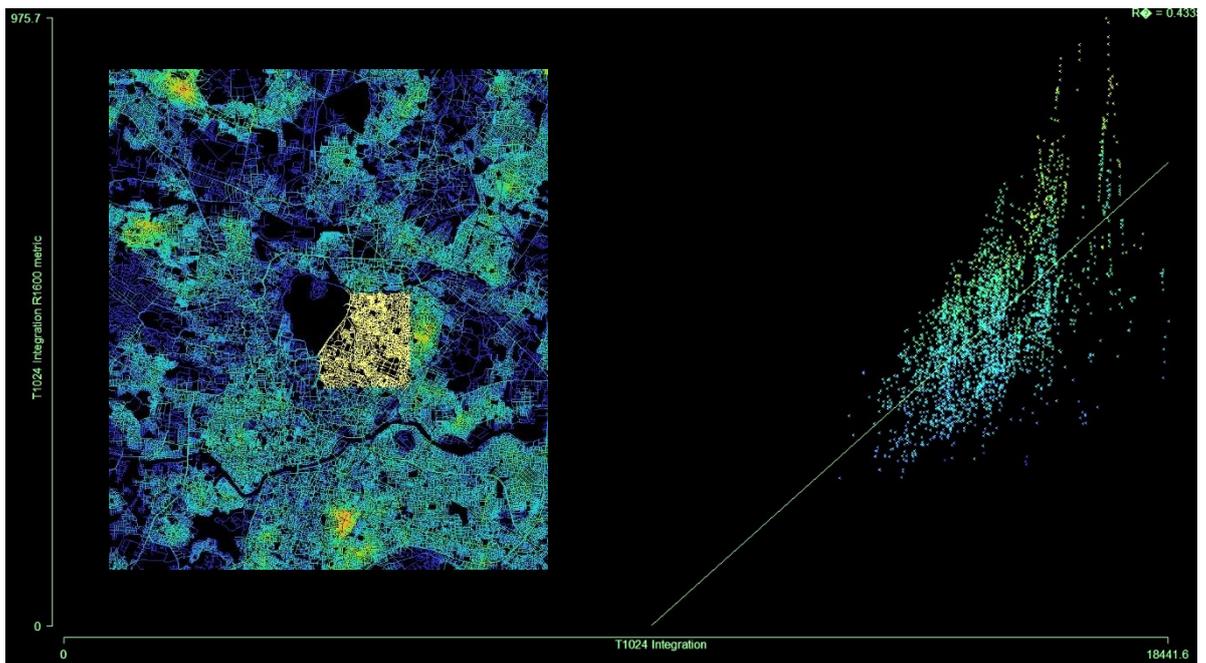
Figure 25: Above scatter plot for segments from the area between the twins. Source: Author

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5. RESULTS: The Twins scale

The previous section analysed the process of centrality across the city observing patterns within the two nodes, to examine for a duality. The following analysis focusses on the two nodes as individual spatial systems and the relation between them, to trace if they still posit a duality to the current city. This is carried out by the spatio-functional assessment of these two nodes for continuity and change from when the city was binodal; and hence an attempt to trace for a spatial memory of dualistic functioning of the current spatial structure. As described in the methodology, the binodal state of reference of the city is taken from 1962.

Following is the list of morphologies within the twin cities' region. These are introduced to familiarise with the areas which will be studied in detail and help read the analytical descriptions in conjunction with the figures.

From Secunderabad (Figure 26):

1. Mahatma Gandhi Road (MG Road)
2. General Bazaar
3. Rashtrapathi Road (RP Road)
4. Station Road
5. Secunderabad Railway Station
6. Tank Bund Road (North)

From Hyderabad (Figure 27):

1. Tank Bund Road (South)
2. Basheerbagh Road
3. Public Gardens
4. L. B. Stadium
5. Abids Road
6. Nampally Road
7. Nampally Railway Station
8. Moazzam Jahi Market
9. Jambagh Fruit Market
10. Osmangunj Road
11. Begum Bazaar
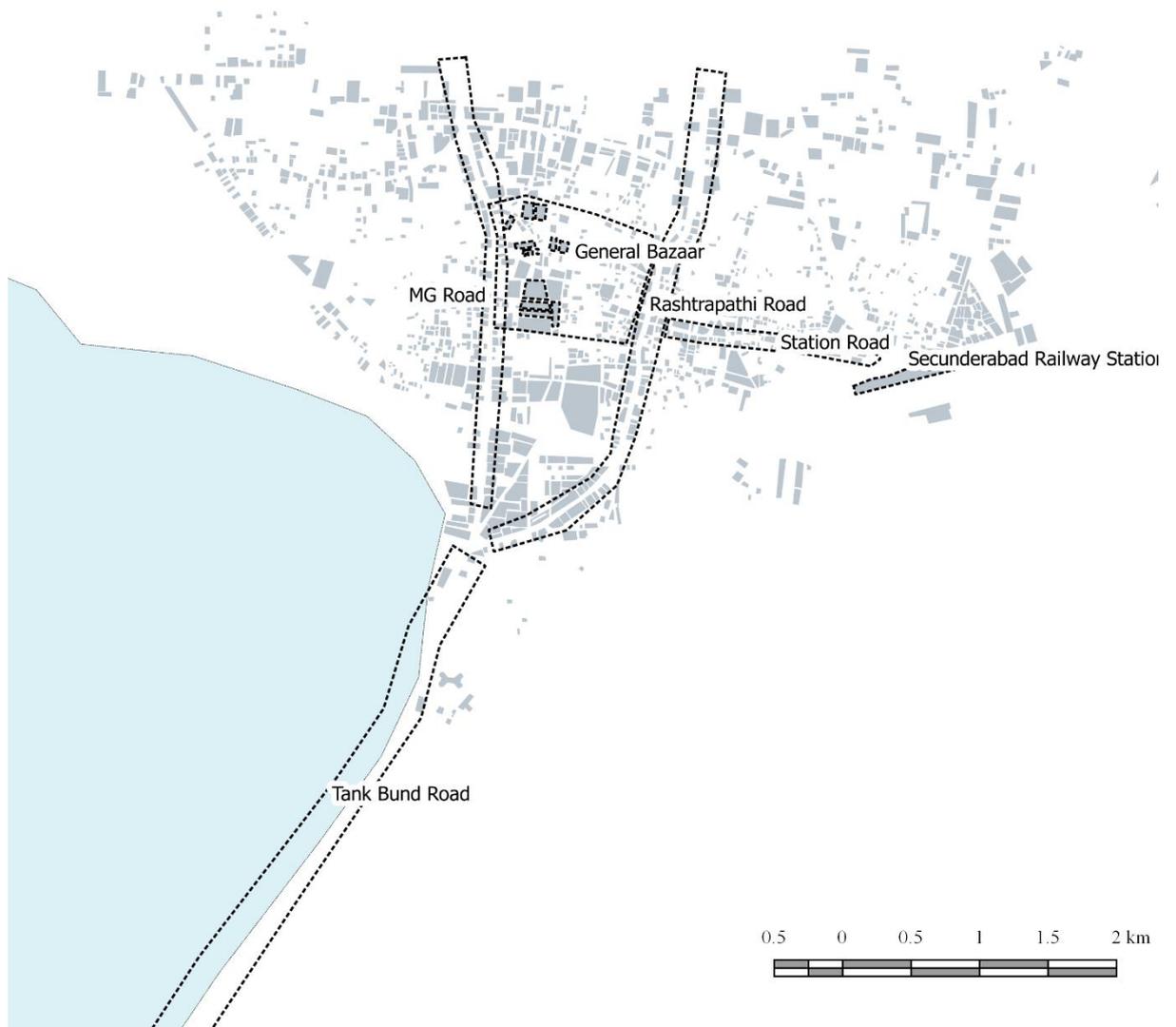
Figure 26: Morphologies of historical significance from Secunderabad outlined on the Areas of Interest (AOI) map. Source: Author.

Figure 27: Morphologies of historical significance from Old Hyderabad outlined on the Areas of Interest (AOI) map. Source: Author

5.1 Pervasive Centrality of the roads within the Twins

Variations in the through-movement potential of the streets, from the above list of morphologies, in the current spatial network are described from the 1.4 and 1.3 structures of normalised angular choice (NACH) at the local scale of 800m and global scale of 16km (Figure 28). A description of these patterns across the scales, enables commenting on the potential of these streets to perform as spatial linkages between areas; with street segments in the 1.4 structure being more central linkages than those from the 1.3. These different thresholds, as identified and argued by Hillier, also correspond with the emergence of different kinds of functions (Hillier et al., 2012). Thus, arriving at objective spatial descriptions of the linkages between the twins pervading from local to global scales. These shall serve as precedents for the assessment of change and continuity in the spatial structure from each of the two nodes to contribute to a duality; as will be done in section 5.2.

In Secunderabad, both the historic streets, MG Road and RP road, emerge in the global structure however, the full length of the former gets picked by the 1.4 structure while only the northern part of the latter by the 1.3 structure. This difference is suggestive of a difference in the nature and grouping of functions along MG road and RP road. The foreground network along MG Road extends southward, dropping from 1.4 (continuous red line) to 1.3 (dotted red line), to connect with the southern twin of Hyderabad. This drop in the centrality of the historic road linking the twins is noted at the elevated section of Tank Bund Road abutting the lake, thus suggestive of a local infrastructural project of constructing an embankment with a road above effecting a global link between the twins. At the local scale of 800m, the station road gets picked by the 1.3 structure starting from the middle of MG road extending eastward to terminate with segments in the 1.4 structure near the Secunderabad railway station. This increase in the NACH value on approaching the station and the concentration of 1.4 segments around it, suggests the area around the station to perform as a local urban centre.

A relatively recent road which has no mention in the map from 1962 calls for attention, linking Secunderabad along the east -west axis. It is the SP Road to the north of MG Road and RP Road, picked up the 1.4 structure at the global radius of 16km. It extends westward to cross the lake and branches from 1.4 structure to a 1.3 structure before it connects back to the 1.4 structure in the north-west direction.
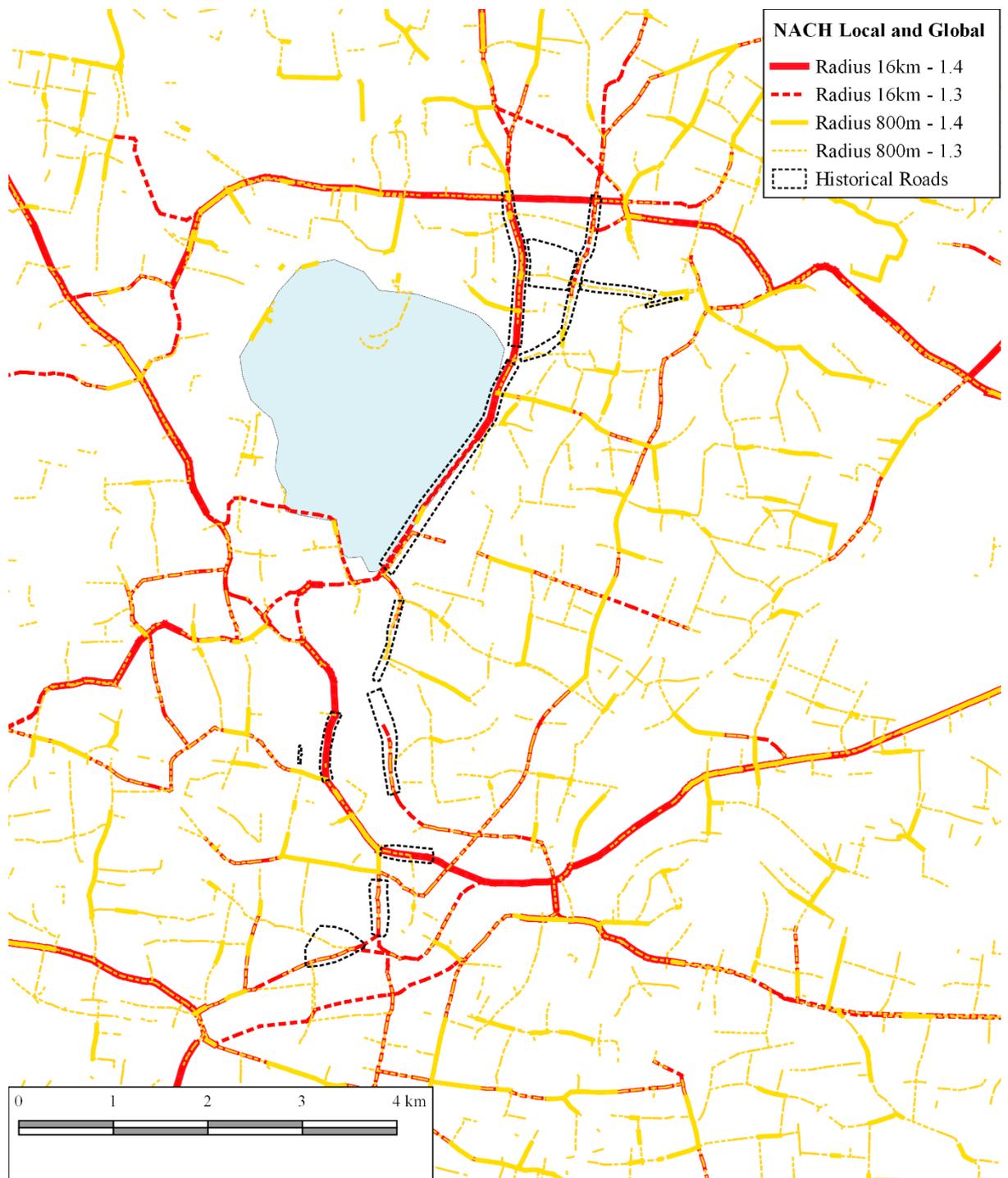
Figure 28: 1.4 and 1.3 structures from local scale of 800m and global scale of 16km showing the pervasiveness of through-movement centrality in the spatial network along the historic roads. Source: Author.

The southern part of the Tank Bund Road that links Hyderabad to Secunderabad falls in the 1.3 structure at the global scale. After branching into the Basheerbagh Road to its south, the 1.3 network changes from global scale to local scale of 800m. Upon traversing further south along Basheerbagh Road, Abids Road emerges in the 1.3 structure at the global scale following a lacuna between these two roads in the network of foreground structures. This southward sequential change: from global 1.3 segments, to local 1.3 segments, to an absence of a spatially central link, to the emergence of global 1.3 segments at Abids Road again, suggests a fracture in the spatial link between the twins.

On the other hand, Nampally Road on the western flank of Hyderabad marks the beginning of the 1.4 structure at the global scale and stretches southwards. Before arriving at the Moazzam Jahi Market Junction, it performs a dual role in the 1.4 structure at both local and global scales. Towards east from this junction: at the global scale, the 1.4 network extends continually along the river from which a 1.3 tributary returns to Abids road as noted above; while at the local scale the 1.4 network falls to 1.3 and branches at the end of the Jambagh Fruit Market. And to the south from Moazzam Jahi Market Junction, the local linkage from Nampally Road branches its 1.4 structure into the Osmangunj Road while the global foreground network branches its 1.3 structure. This global foreground network from the 1.3 structure extends south west from the end of Osmangunj Road to pass through Begum Bazaar. Even at the local scale of 800m, Begum Bazaar is connected by the 1.3 structure despite being a local market.

Thus, this analysis of pervasive centrality, highlights specific patterns and discontinuities in the through- movement centrality structure linking the twins. As will be discussed in the next section, a correspondence of these discontinuities with the urban descriptions of these historic roads would imply a continuing spatial memory of a dualistic functioning in their current spatial structure; and a non-correspondence would imply a change of the same.

5.2   Centrality Patterns in the Twins: through– and to– movement

This section carries on the analysis to assess, if there is any correspondence between the above patterns and discontinuities in the foreground network from the two nodes and the historical urban descriptions of these roads from the twins from a binodal state of the city. The assessment is carried on Figure 29 which shows the central NACH structures from local and global scale overlaid on the map of principal retail thoroughfares and CBDs from the twins from 1962. The principal retail thoroughfares are shown by thick black bands on the historical maps.

5.2.1 Secunderabad

The disposition of principal retail thoroughfares from 1962 (Figure 30) suggests a south to north trajectory of growth of the spatial network of Secunderabad, starting as a single lateral thoroughfare from the south to branch on either ends extending northward. This aligns with the historic trend of city-wide expansion happening from the southern twin of Hyderabad. However, upon overlaying the pervasive centrality pattern of spatial linkages on the map from 1962, a contrasting trend of north to south is noted in the NACH values at the global scale of 16km, shown in red. The east-west road of SP road (no mention from 1962) falls in the 1.4 structure, and of the two longitudinal roads branching southward from this, MG Road to the west coincides with the 1.4 structure while only the northern part of RP Road lies in the 1.3 structure. Despite the inversion from south-to-north to north-to-south pattern in growth, both these historical principal retail thoroughfares are now globally central spatial linkages, however the difference in their thresholds and extents is suggestive of other implications of this pattern. The overlap of the global centrality of the northern half of RP Road with its functional mix of zonal offices of banks and large shopping malls along this half suggests a spatio-functional correspondence.
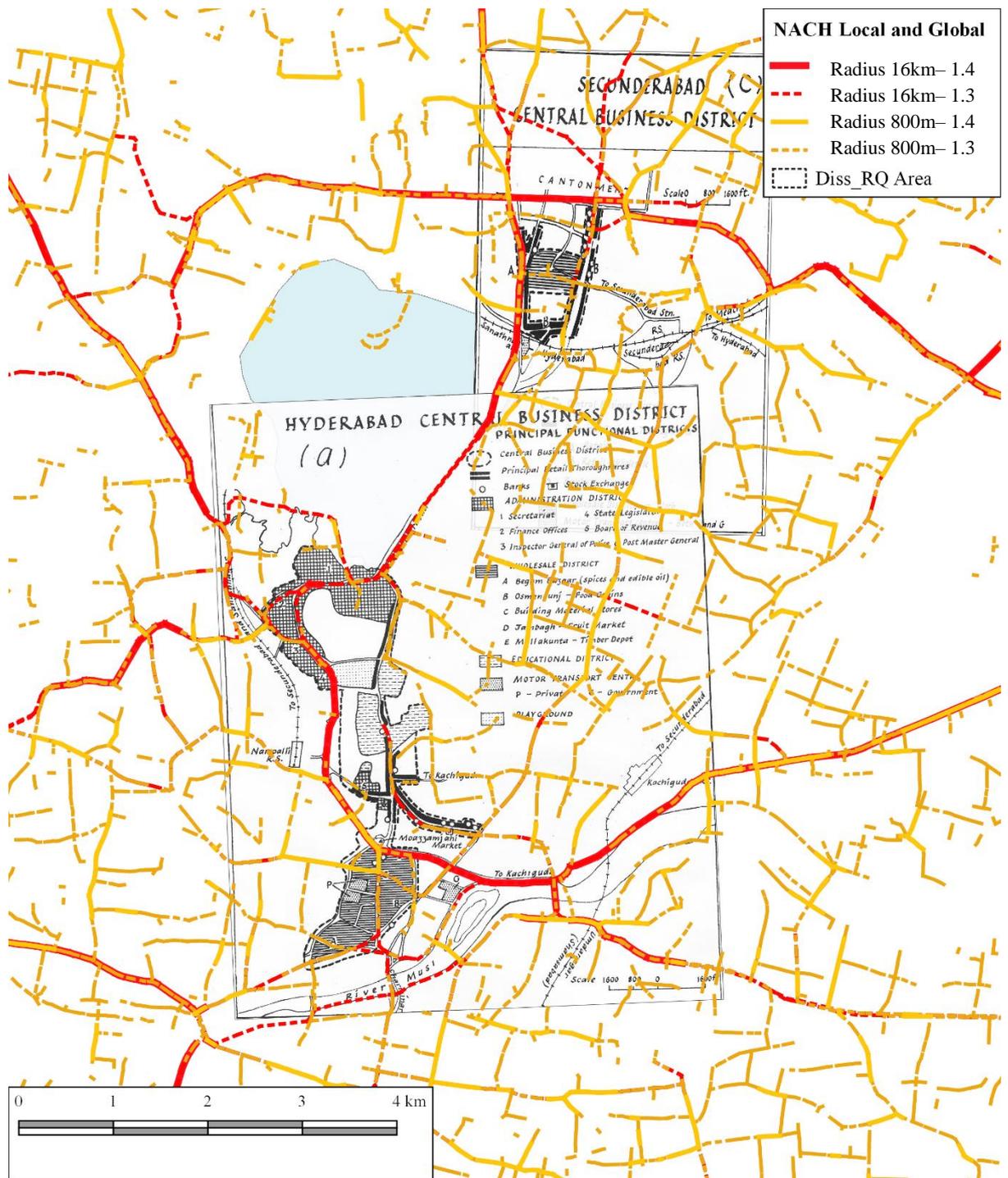
Figure 29: Foreground structures overlaid over the historical descriptions from 1962 (Alam, 1962) on the central business districts from the twins. Source: Author

The local 1.3 structure, shown in orange, captures the local grid weaving the morphologies of MG road, RP road, Station road, General Bazaar and the Secunderabad Railway Station, into the urban fabric. However, the local 1.3 structure stops at the south of MG road, but from RP road it continues southward to connect with the spatial network between the twins. When read in conjunction with global through-movement potential, in red, MG road is central at both scales, while RP road is central only at the local scale. This point coincides with the point where MG road connects with the Tank Bund Road and stops being fronted by local functions and servers purely as a connecting road at global scale, while the centrality of RP road branches south to continue as local neighbourhood high-streets. Concerning duality, this presents the difference in the spatial characteristics of these two roads to serve as north-south linkages between the twins. MG road merges into the tank bund road that connects the twins globally in the 1.3 structure as a single main road, while RP road extends south with deforming into local grids connecting linking neighbourhoods before arriving at the southern twin.

The centrality patterns in the to-movement potential of the areas of interest (AOI) across the scales are thus described. All the blocks along MG road peak in to-movement potential at a global scale of 8km and the scale of 4km (Figure 31 and Figure 32). However, at local radii of analysis, from 2.1km to 800m (from Figure 33, Figure 34 and Figure 35), their to-movement potential gradually decreases with areas on the norther part with higher centrality than the ones on the south. This decrease in centrality corresponds with the scale of functions from north to south; with hospitals, shopping malls, educational institutions and office buildings to the north, to individual retail outlets and food joints to the south.

The AOIs on the northern half of RP road hold greater to-movement potential than the southern half, across the scales. A suggestive correspondence of this pattern is the proliferation of Old banks (marked as white dots in the historic map in Figure 30) on the northern part while its local cooperative banks clustered along the southern half. Even within the northern half, the to-movement potential gets increasingly concentrated in the north most areas, as the radius of analysis decreases. Thus, a reversal from a south-to-north trend of growth from 1962 to a north-to-south fading of centrality can thus be noted in terms of the spatial accessibility, and the scale of functions, of blocks as well.
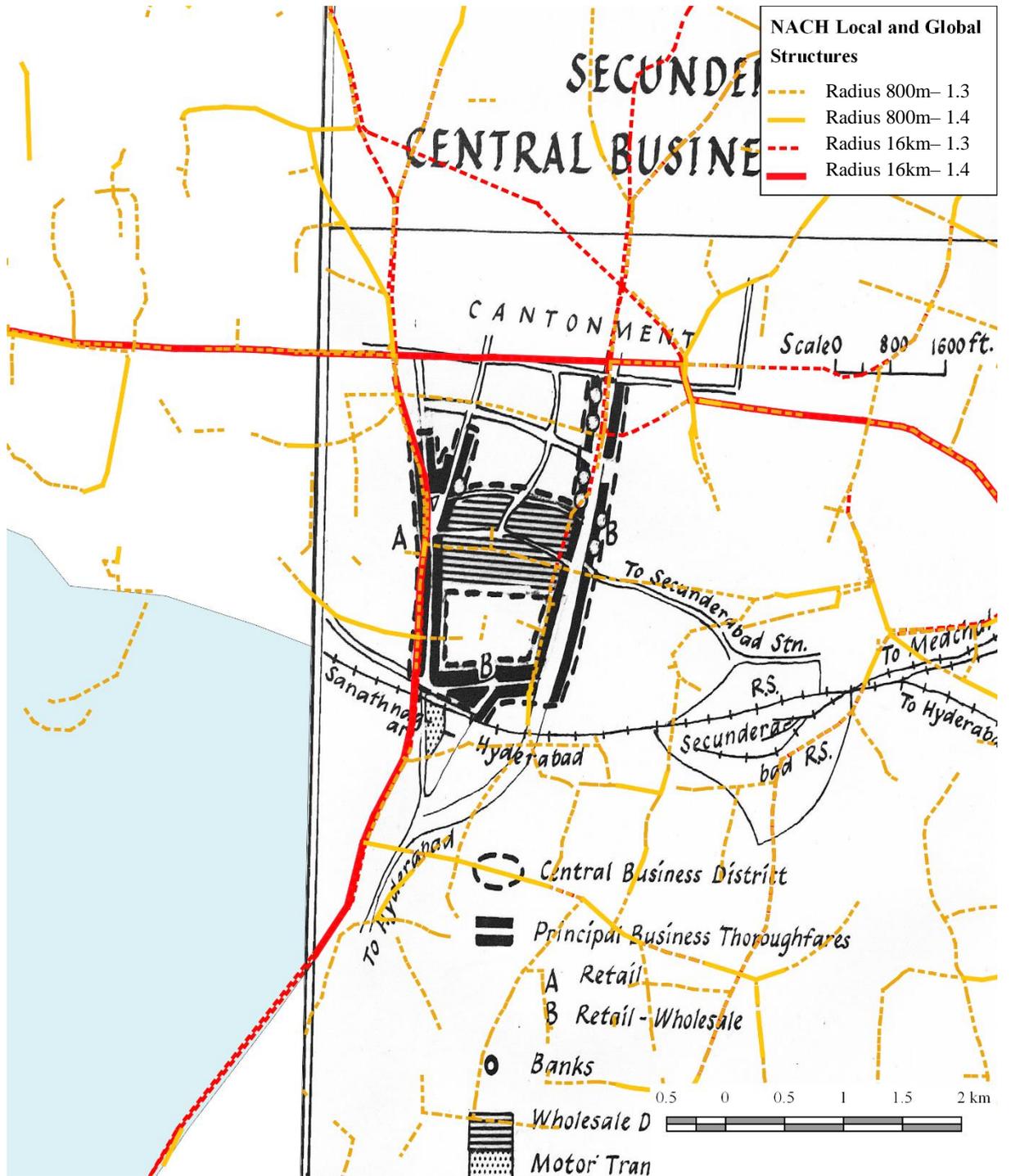
Figure 30: Foreground structures overlaid over the historical descriptions from 1962 (Alam, 1962) on the central business district of Secunderabad. Source: Author
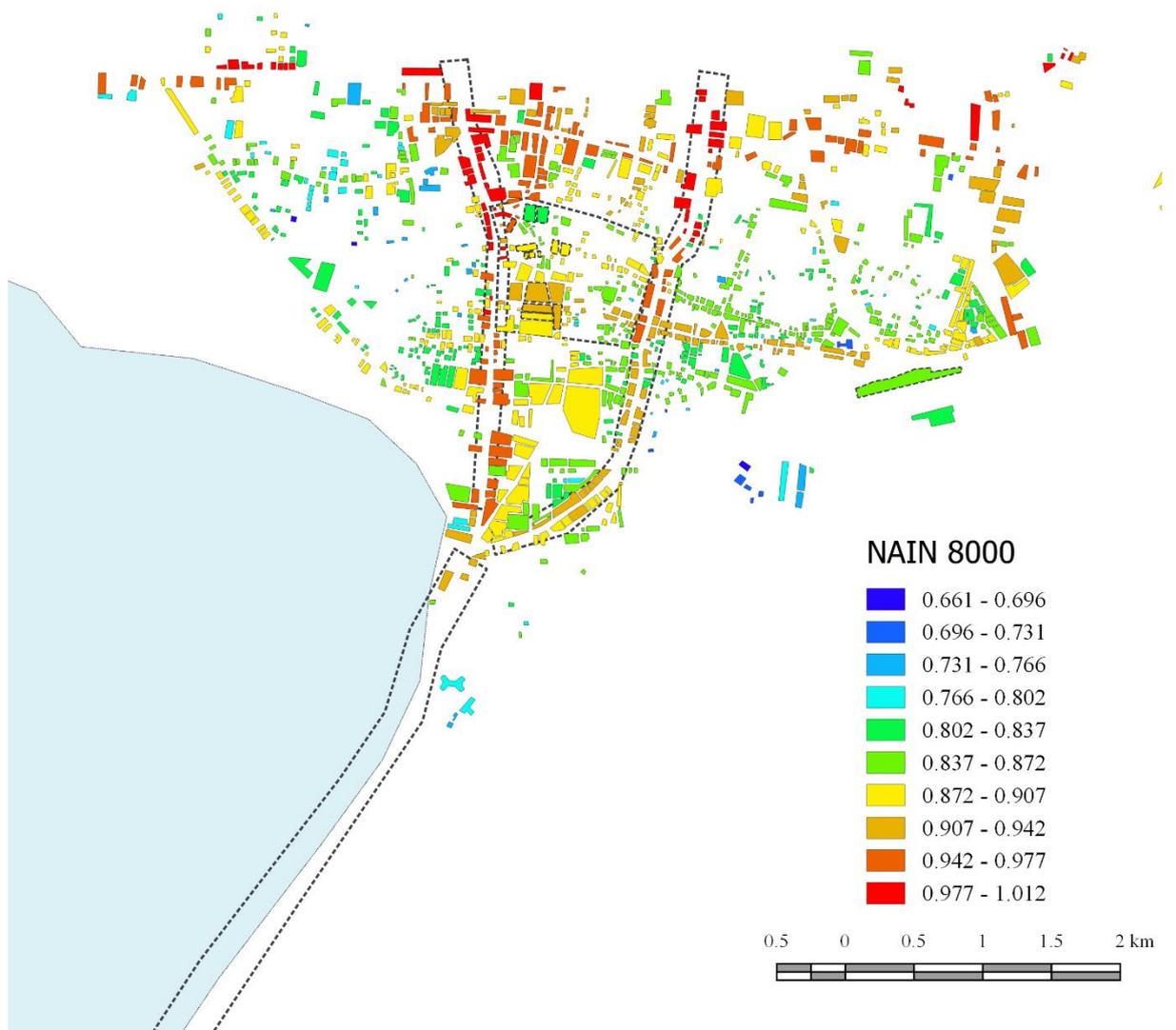
Figure 31: Pattern of closeness centrality in the AOI from Secunderabad, assigned with NAIN values at 8km of the street they open onto. Source: Author
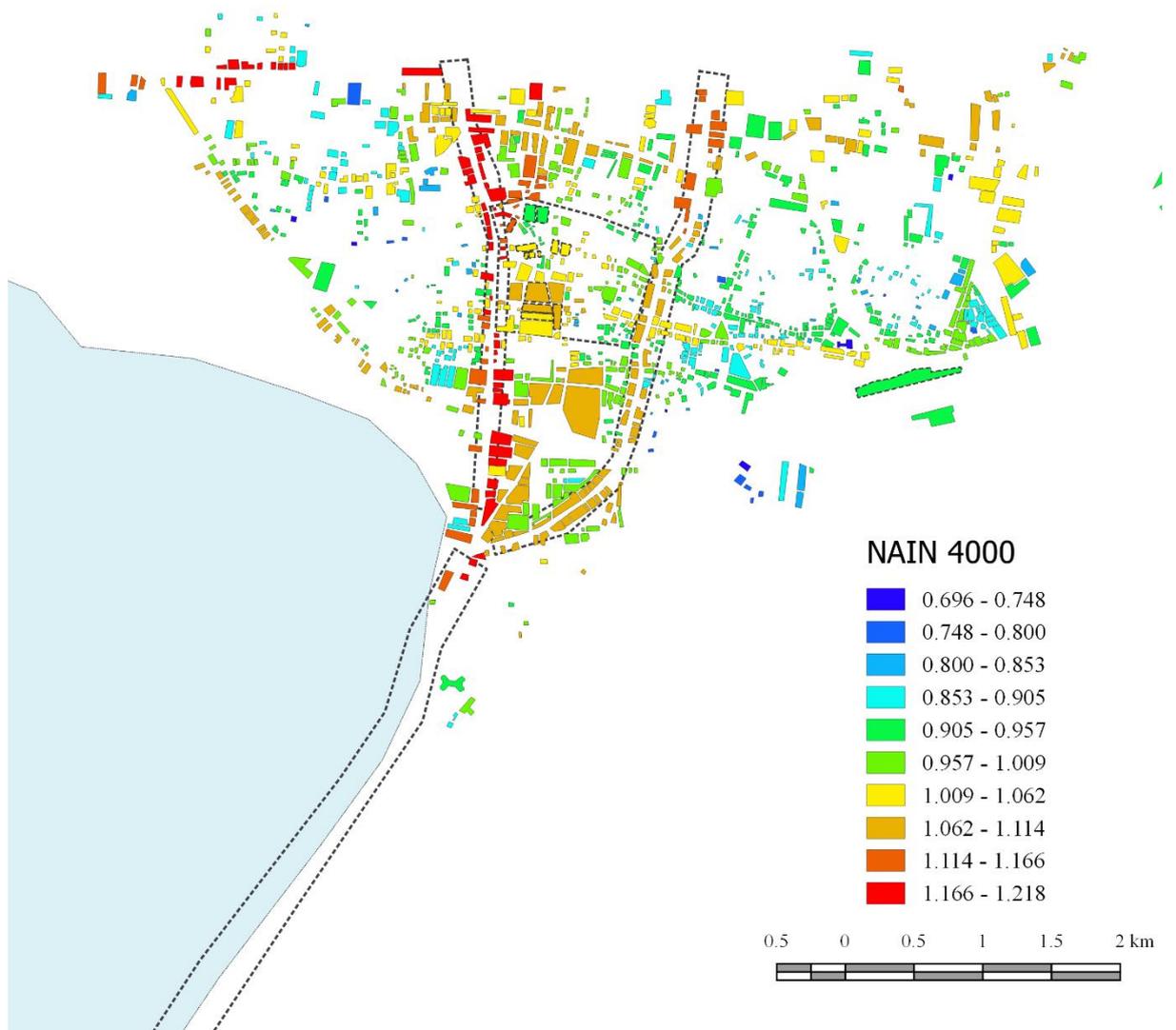
Figure 32: Pattern of closeness centrality in the AOI from Secunderabad, assigned with NAIN values at 4km of the street they open onto. Source: Author
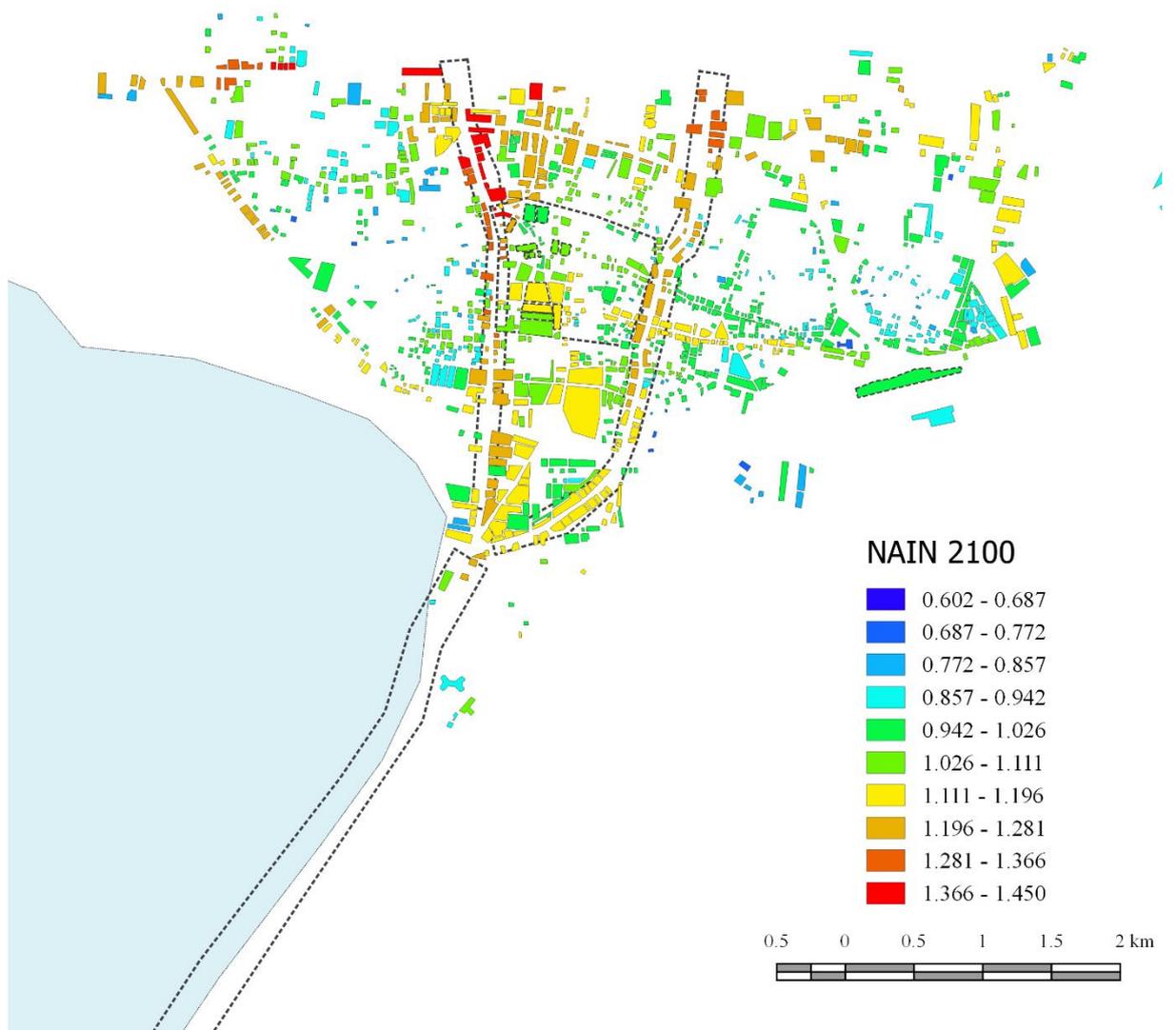
Figure 33: Pattern of closeness centrality in the AOI from Secunderabad, assigned with NAIN values at 2.1km of the street they open onto. Source: Author
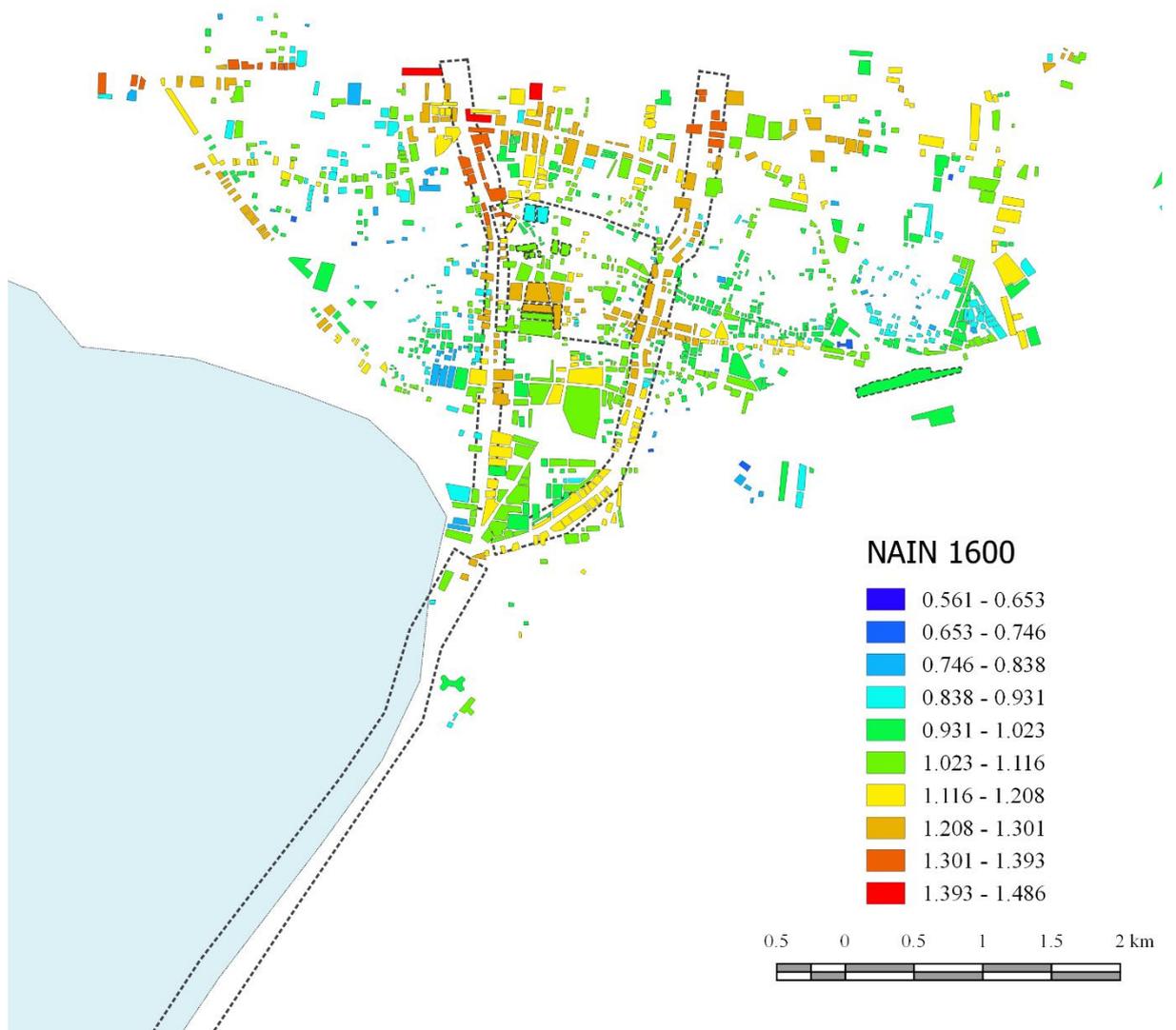
Figure 34: Pattern of closeness centrality in the AOI from Secunderabad, assigned with NAIN values at 1.6km of the street they open onto. Source: Author
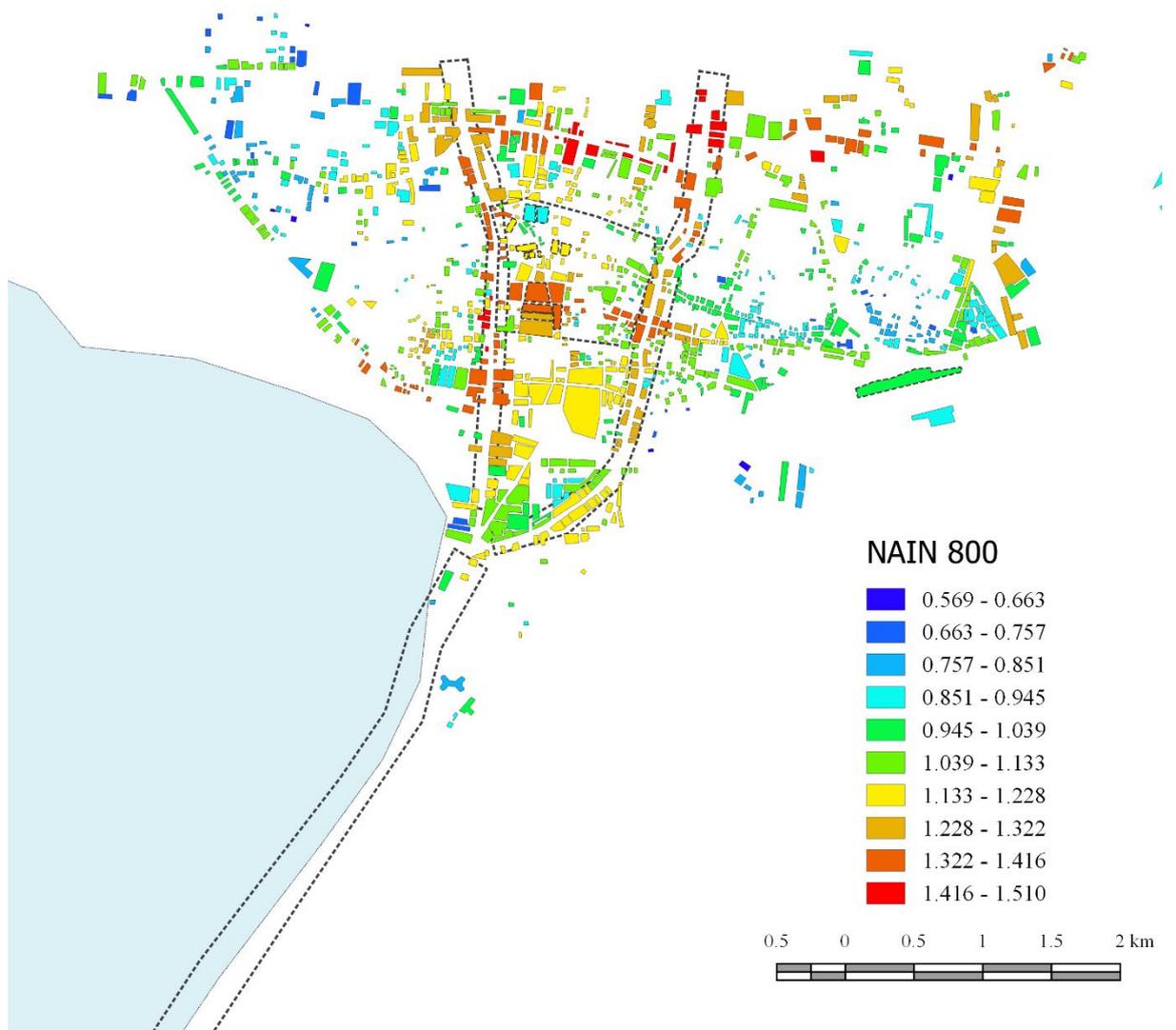
Figure 35: Pattern of closeness centrality in the AOI from Secunderabad, assigned with NAIN values at 800m of the street they open onto. Source: Author

5.2.2 Old Hyderabad

At the global scale, a vivid east-to-west shift in centrality in through- movement potential of the main roads as compared to their role as principal retail thoroughfares from 1962 is observed (Figure 36). The eastern flank along the historical retail thoroughfare of the Abids Road has a NACH value of 1.28, whereas the western link along the Nampally Road, which lied outside the dashed line demarcating the CBD from 1962, has a NACH value of 1.41. Similar to the case of MG road in Secunderabad, Nampally Road performs majorly as a connecting link at the global scale. However, unlike MG Road, it is not a case where the historical principal retail thoroughfare continues as a major connector at the global scale. The1.4 structure at the global scale terminates at the intersection marked as A on Figure 36, and branches its 1.3 structure out to the north. This drop in the centrality of the network connecting the two twins suggests a weak spatial relation between the two twins at a global scale. Hence, its upon selecting the 1.3 threshold for the NACH structure at the global scale (dotted red line from Figure 36) that the major historical retail thoroughfare on the Abids Road (black bands from Figure 36) extends northernly to connect to Secunderabad through the Tank Bund Road. Thus, suggesting the transformation of a previously important global link between the twins into a less central or a secondary connection now, in terms of its through-movement centrality; global with reference to the expanse of the city from 1962.

(From Figure 37 to Figure 41) Amongst the principal retail thoroughfares from 1962, Basheerbagh Road has the least spatial accessibility across the scales despite being in immediate connection with the southern end of the Tank Bund Road by the local 1.3 structure. Abids Road exhibits a consistent variation across the scales, with the areas on its southern end exhibiting high spatial accessibility than the ones on its north. The high centrality of this area corresponds with the existence of shopping complexes, and hence an instance of continuity in the spatial memory as a principal retail district from 1962– during a binodal state of the city.
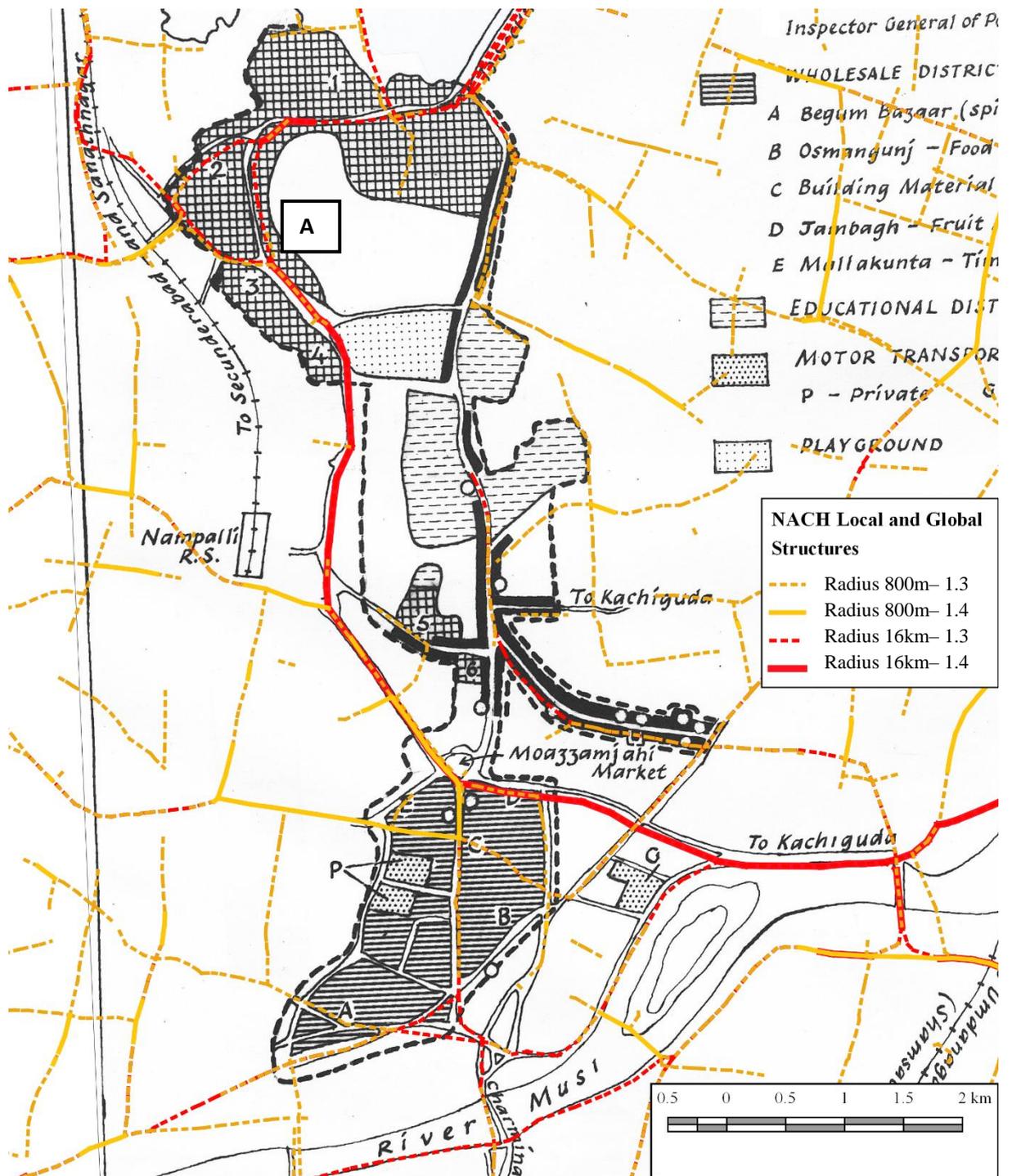
**Figure 36:** Foreground structures overlaid over the historical map from 1962 (Alam, 1962) on the central business district of Old Hyderabad. Source: Author

A southward shift in centrality of to- movement potential (spatial accessibility) is observed as the radius of analysis reduces from 8km to 2.1km. This shift in centrality aligns with the location of historical epicentre to the south of this region next to the river, from which the city grew. Also in this bracket of radii of analysis, Osmangunj road exhibits high to-movement potential until 2.1km but drops as the radius decreases, for its major purpose was to link the local wholesale market of Begum Bazaar to the Moazzam Jahi market junction (Alam, 1962); but not to serve as a local centre itself. The Jambagh Fruit Market and Moazzam Jahi Market exhibit similar pattern as the Osmangunj Road (can be noted from the change in their rank from red to yellow from Figure 37 to Figure 41), losing their role as a destination as the radius of analysis approaches the local scales. This pattern of higher centrality at global scale over local scale corresponds with their nature of functioning as wholesale markets serving at the scale of the city but not as local retail centres. Begum Bazaar exhibits a similar trend too however, it emerges as a centre at 800m radius again. At radius 800m, the eastward extensions to the relatively newer areas of Narayanguda and Hyderguda from the Basheerbagh Road exhibit high centrality aligning with their function as contemporary retail high streets.

Thus, instances of both change and continuity in the spatial memory of a duality are noted in the spatial structure of Old Hyderabad. At the global scale of through-movement, a shift in centrality from the historic Abids Road to Nampally Road in the current spatial network is noted. However, upon the analysis for spatial accessibility, trends of continuity from the historical descriptions are noted at different scales of analysis. The historic retail centre of Abids continues being central to attracting movement across the scales. On gradually reducing the scale of analysis, the centrality shifts southwards coinciding with the historic centres and bazaars. This regional scale shift in through-movement centrality accompanied with the continuity in spatial accessibility at local scale suggests that the growth of the city's network has shadowed the spatial possibilities of the spatial structure of Old Hyderabad from its binodal time.
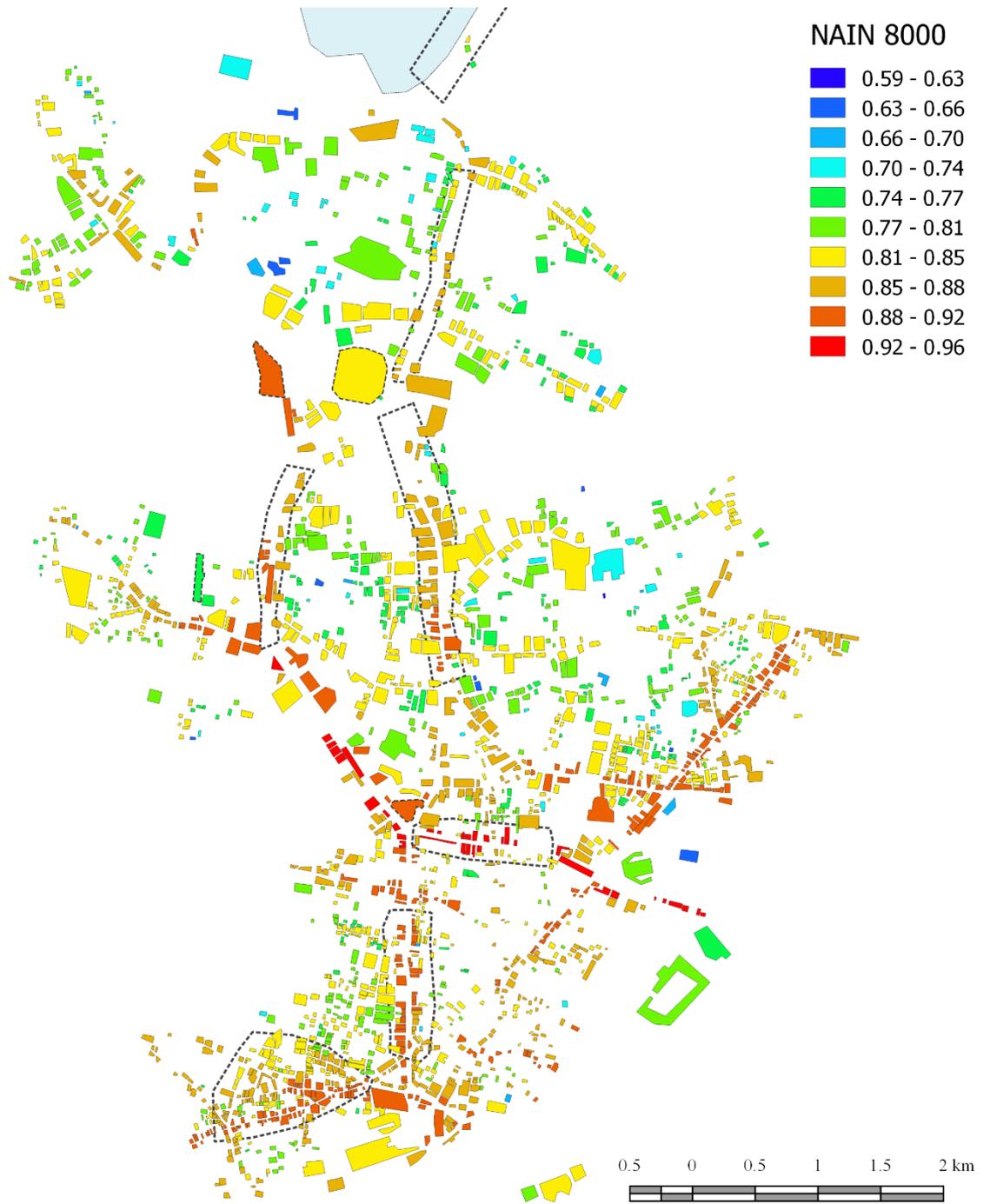
Figure 37: Pattern of closeness centrality in the AOI from Old Hyderabad, assigned with NAIN values at 8km of the street they open onto.

NAIN 4000

- 0.569 - 0.622
- 0.622 - 0.674
- 0.674 - 0.727
- 0.727 - 0.780
- 0.780 - 0.833
- 0.833 - 0.885
- 0.885 - 0.938
- 0.938 - 0.991
- 0.991 - 1.043
- 1.043 - 1.096
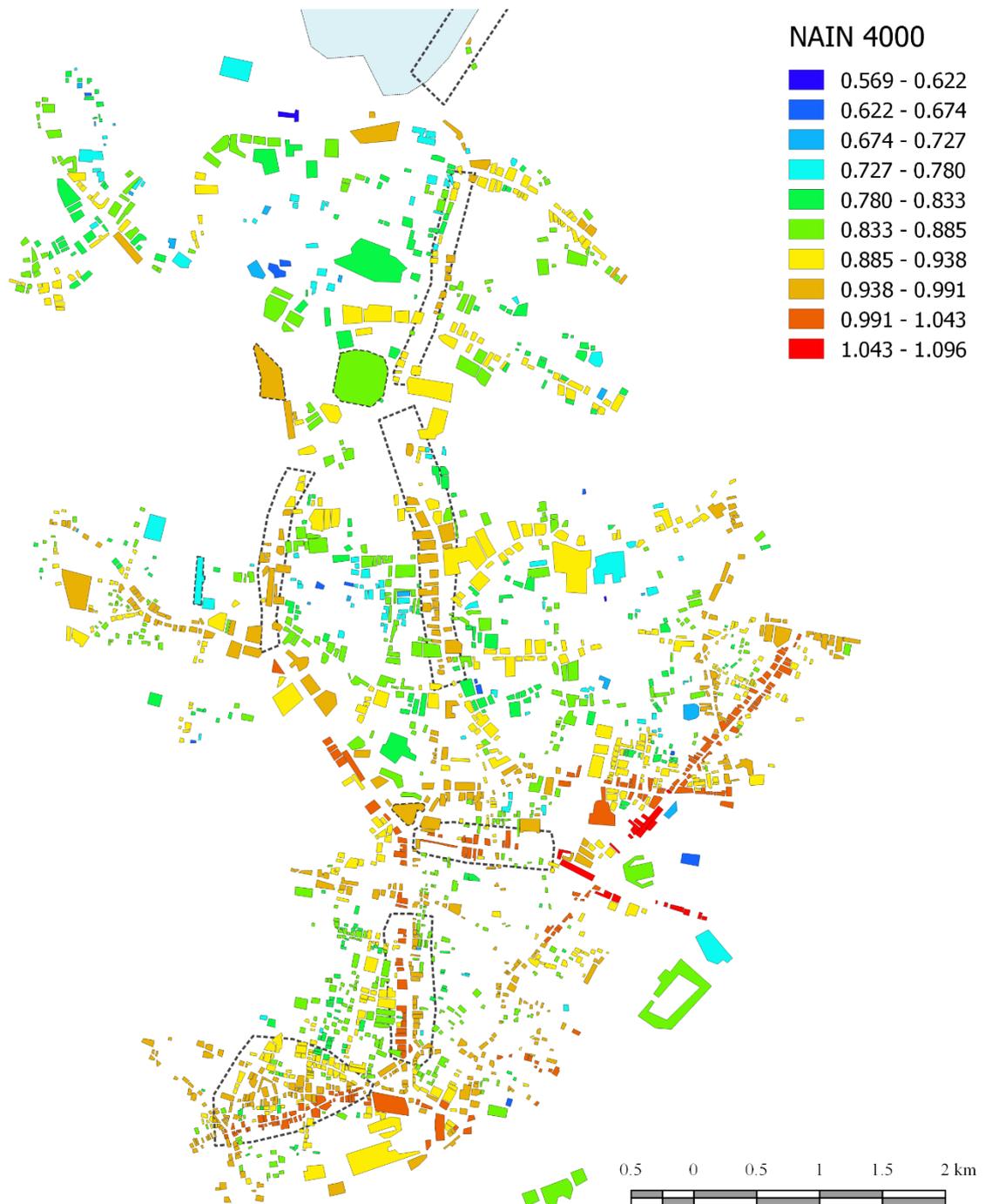
Figure 38: Pattern of closeness centrality in the AOI from Old Hyderabad, assigned with NAIN values at 4km of the street they open onto.
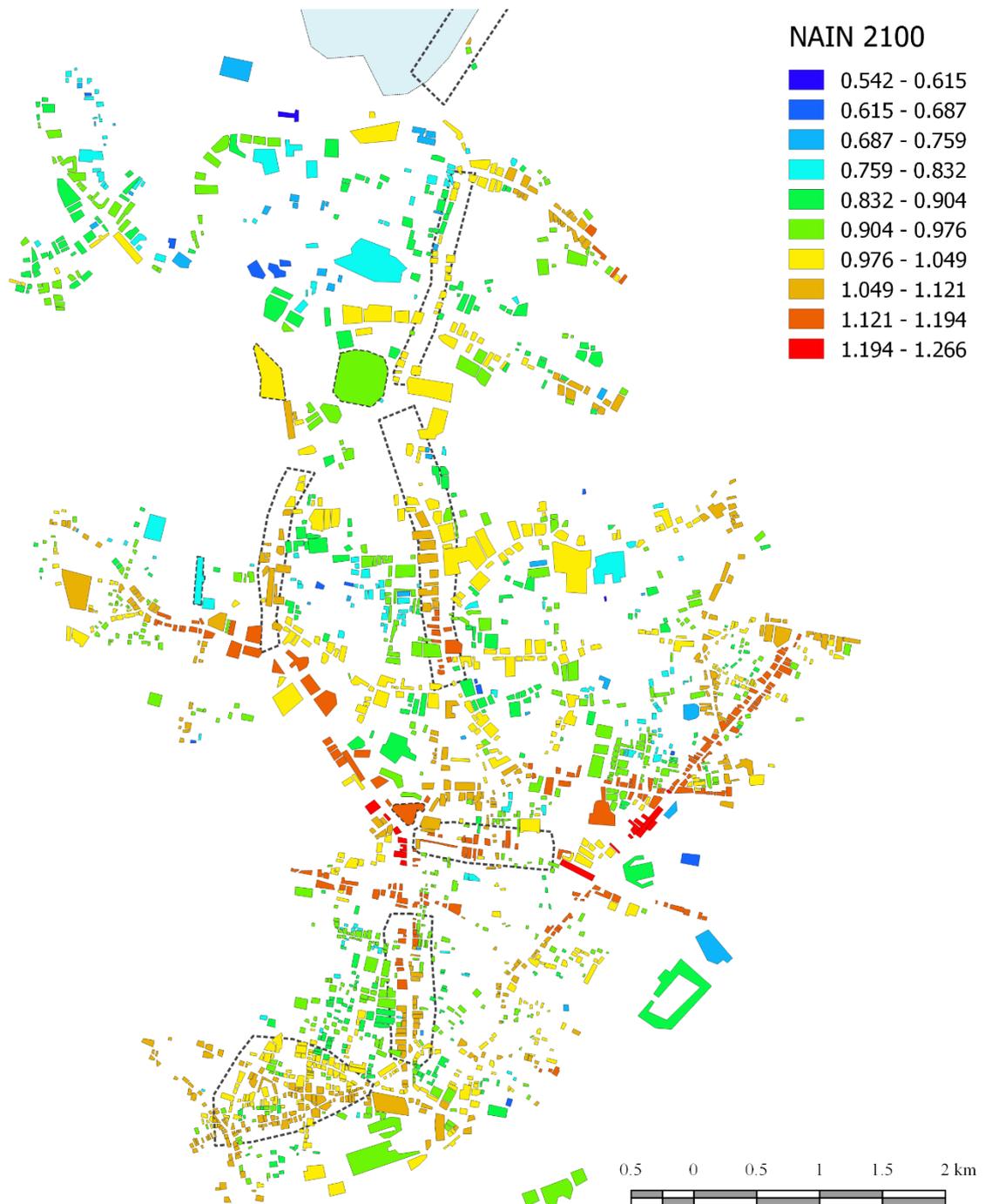
Figure 39: Pattern of closeness centrality in the AOI from Old Hyderabad, assigned with NAIN values at 2.1km of the street they open onto.

NAIN 1600

- 0.517 - 0.606
- 0.606 - 0.695
- 0.695 - 0.784
- 0.784 - 0.873
- 0.873 - 0.962
- 0.962 - 1.051
- 1.051 - 1.140
- 1.140 - 1.229
- 1.229 - 1.318
- 1.318 - 1.408
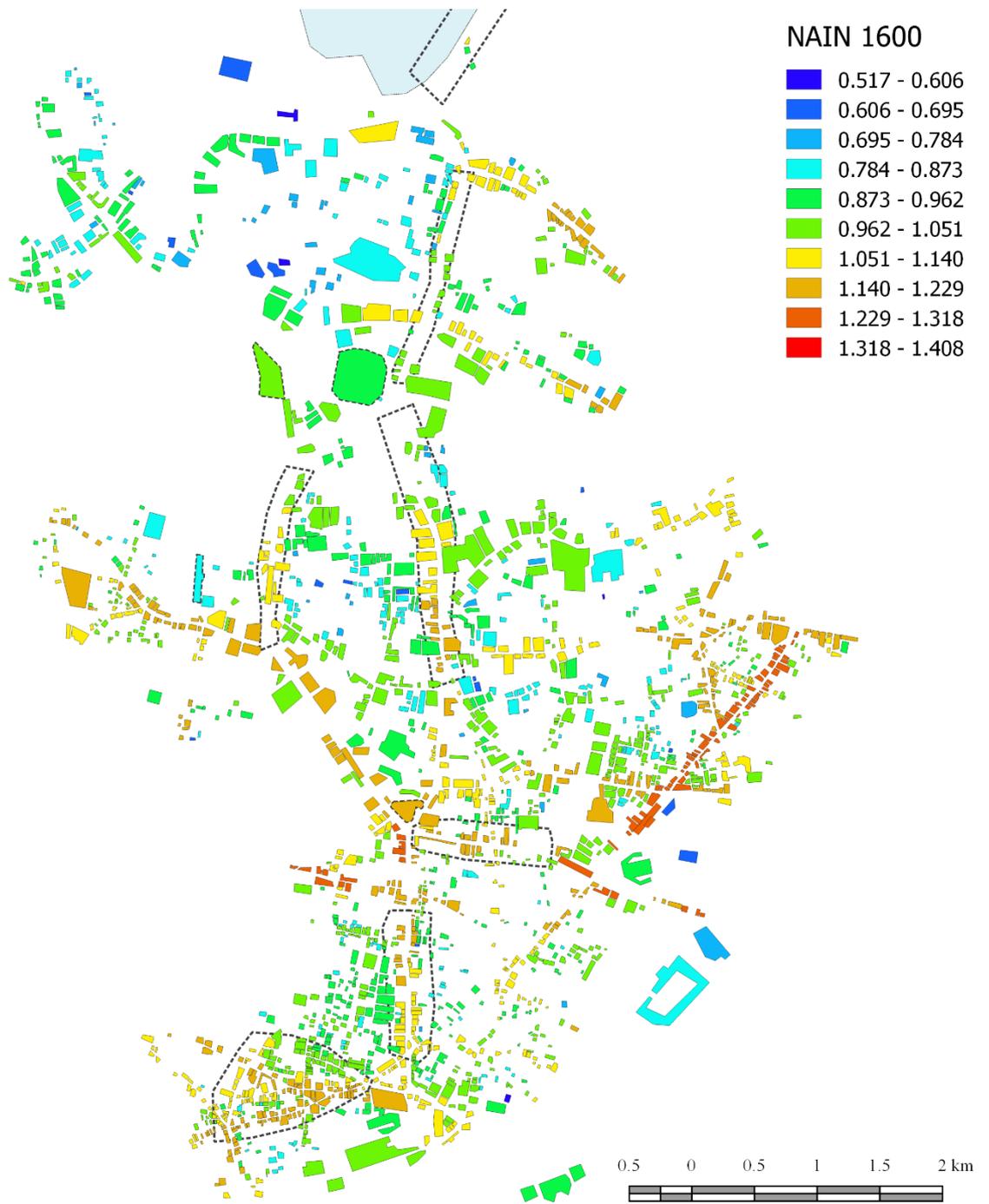
Figure 40: Pattern of closeness centrality in the AOI from Old Hyderabad, assigned with NAIN values at 1.6km of the street they open onto. Source: Author

NAIN 800

- 0.454 - 0.559
- 0.559 - 0.665
- 0.665 - 0.770
- 0.770 - 0.876
- 0.876 - 0.981
- 0.981 - 1.087
- 1.087 - 1.192
- 1.192 - 1.298
- 1.298 - 1.403
- 1.403 - 1.509
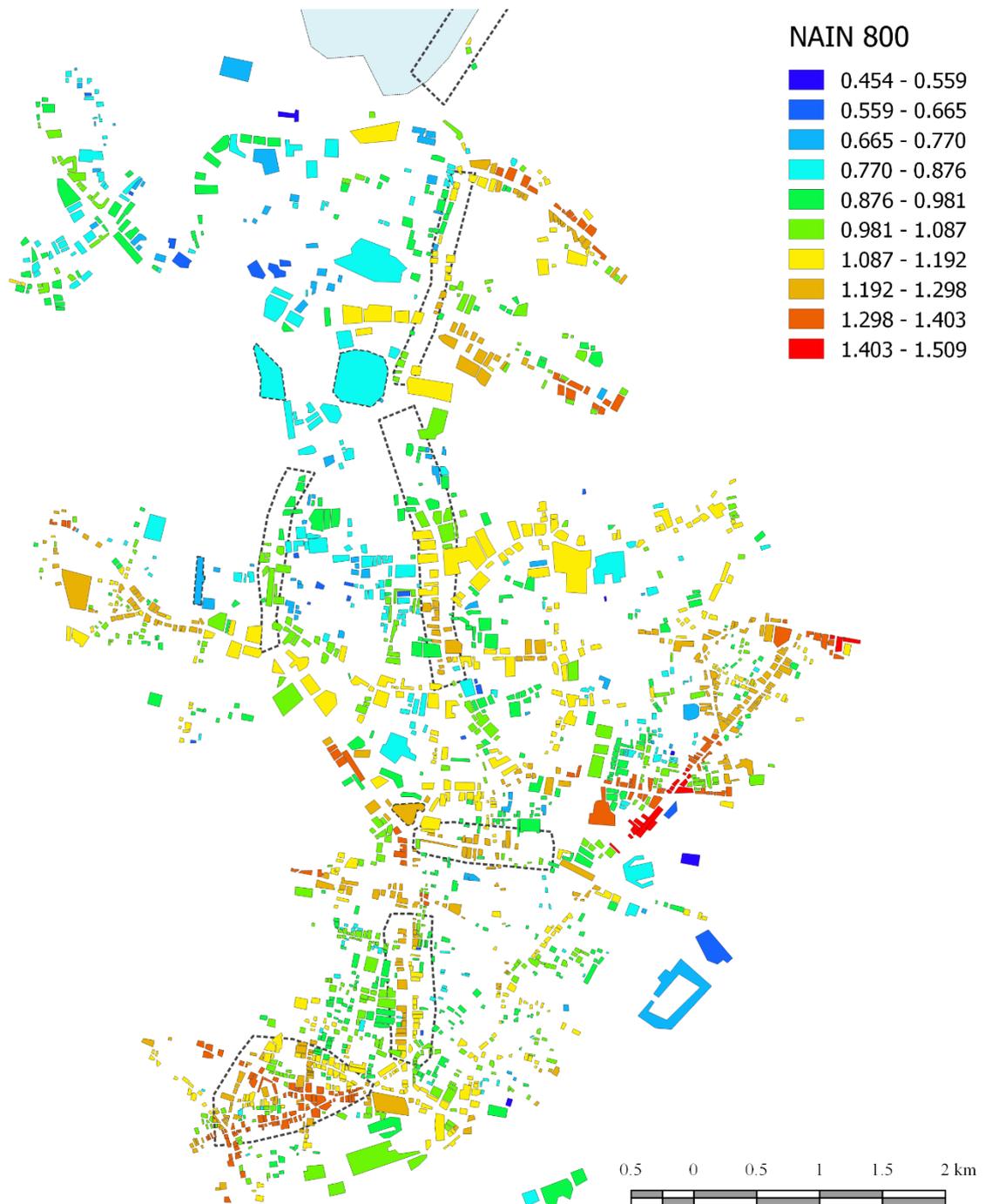
Figure 41: Pattern of closeness centrality in the AOI from Old Hyderabad, assigned with NAIN values at 800m of the street they open onto. Source: Author

6. SYNTHESIS: The Twin Cities Phenomenon

The above analytical sections are summarised before the discussions from this section.

From the city-wide study of spatial accessibility patterns, concerning duality of the two nodes in the current spatial structure of the city– while different patterns of centrality were noted at different scales of analysis, simultaneous centrality of these two nodes was observed only at the global scale of 16km, that too, in the second decile of NAIN values. Thus, the centrality of the two historic nodes is manifested in different ways at different scales; and they are binodal only at the global scale.

At the scale of the twins, the focus of the analysis was to understand the twin cities' region as an urban object and a social artefact in the contemporary context. Thus, the aim was to study the spatial relation between the twins and the spatio-functional assessment of each of the twins, to examine for continuity and change in the spatial memory of a duality. The role of streets as spatial links between the two nodes was found to be globally less central than as linkages within the nodes. The discontinuities in the global NACH structure from the southern twin suggests a spatial disconnect between the two nodes and hence, can be regarded as a fracture in the spatial link between the twins. Concerning change and continuity in the spatial memory of each of the twins– In Secunderabad, the spatial links central in attracting through- movement flows have continued to be the same from the dualistic functioning of the twin cities' region. However, the patterns of centrality within them have changed. A reversal from south-to-north to north-to-south fading of centrality in spatial accessibility from 1962 is noted, which corresponds with the decrease in the scale of functions from north to south. In Old Hyderabad, a new spatial link has emerged highly central to through-movement flows. The Nampally road which was outside the CBD from 1962, is now more central in facilitating through-movement flows than the historical retail thoroughfares at the global scale as a property of the current spatial configuration. However, upon the analysis for spatial accessibility (to- movement potential), trends of continuity from the historical descriptions are noted at different scales of analysis. And the historical retail thoroughfare along Abids Road featured high spatial accessibility across the scales, coinciding with its current function as a retail district.

In this section, the results from the above two scales of analysis are synthesised together using others concepts of urban form, as will be introduced and deduced, to see

what the results imply and mean to each other from different perspectives. The aim of this synthesis is to the define the duality or the twin cities' phenomenon in the contemporary context; and to bring to light other characteristics of, and urban processes under play in, the city of Hyderabad.

The historic centres continue to feature as central to flows of movement at the regional scale of accessibility, namely: Patny centre from Secunderabad and Nampally, Abids, Kacheguda, Chaderghat and Goshamahal from the Old Hyderabad (Figure 10) at radius 16km. This suggests a structural record of the twin relation from its historical mode still persisting in the current spatial structure of the city of Hyderabad. However, the low centrality of the roads linking the two nodes at global scale in terms of through-movement potential despite the high global centrality of areas within the two nodes to attract movement flows, suggests the twin cities' region as an urban object composed of two disconnected polar ends at the global scale. Since other parts of the city, outside the twin cities' region and in between the two historic nodes, are found to be central to movement flows to degrees higher than the twin cities' region across the scales of accessibility (refer to city-wide trends in appended in section 9.1), it is not enough to speak of duality implicit in the twin cities' definition.

Another urban process that happens differently from a duality is observed at the scale of the twin cities' region. It is the contrast between the twins from the analysis of spatial accessibility at radius 8km; where the urban grid from Secunderabad features to be central in the top third decile of normalised angular integration (NAIN) while no segment from the urban grid of Old Hyderabad is featured. Upon examining the current urban grid of Secunderabad against its historical one (Figure 42), it can be suggested that this contrast may have stemmed from large-scale land uses that interrupt the growth of the city. In Secunderabad, such land uses have been outside its central district, as can be seen in the historical map from Figure 42, while in Old Hyderabad they are already configured into the central district Figure 43. Two processes associated with the growth of the urban grid from its historical state are identified: grid intensification, where the existing grid is fragmented further and grid sustenance, where the existing grid continues without any alterations. In Old Hyderabad it is the sustained grid that is being intensified, while they are distinct in Secunderabad and the city has grown around the sustained grid (as can be seen from the satellite image in Figure 42). Thus, the urban grid from Secunderabad shows a greater structural inertia to the forces

of growth of the city, and configurationally continuing with high accessibility at the regional scale. The sustained grid in Secunderabad encompasses the protected large-scale land-use of the parade grounds, which was historically used for military demonstrations.
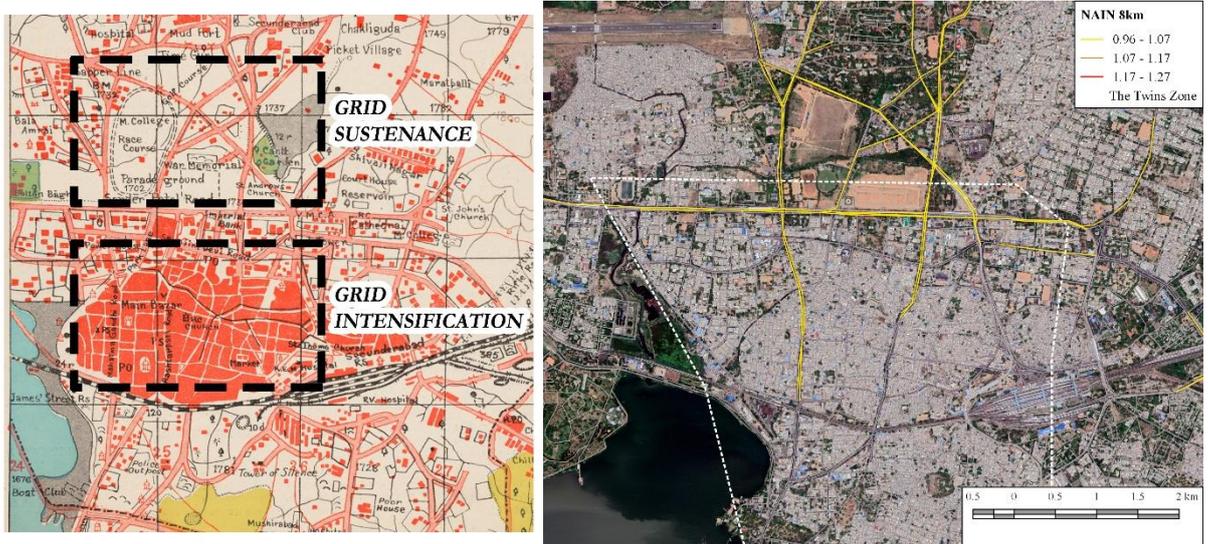
Figure 42: The spatial network of Secunderabad from (left), source: http://hdl.handle.net/1721.3/27202 ; Current satellite image of Secunderabad (courtesy: Google Maps) with the integration core at 8km radius overlaid on it (right).
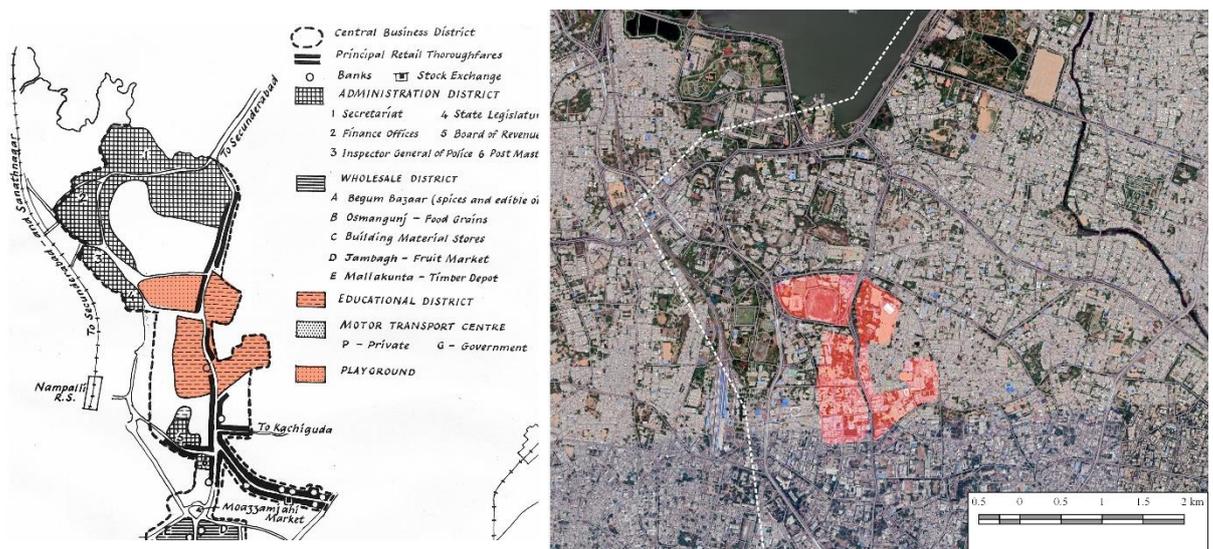
Figure 43: Highlighted in colour are large-scale land uses; in Old Hyderabad continuing from 1962 (left); Current satellite image of old Hyderabad (right).

Hillier's concept of spatial seeds provides another perspective in which the individual twins can be studied for the process of formation of centres in the current state of the city. Thus, also helping trace for a spatial memory of the duality in the current trend of formation of centres.

Hillier suggests that there is a generic process of centre formation and argues that, "every centre has a centre. It starts with a spatial seed, usually an intersection, but it can be a segment…some centres start because they are the focus of a local intensified grid – a local case – others because they are at an important intersection – a global case. Both local and global properties are relevant to how centres form and evolve" (Hillier, 2009, p. K01:6). Describing the spatial attributes of the seed of a centre, he notes that they have both destination and route values, which is their respective values for to-movement and through- movement potentials at both local and global scales. He further argues that these spatial values of the seed for the centre will establish a fading distance from the seed which defines the distance from the seed up to which e.g. shops will be viable. The latest spatial variable of normalised angular choice (NACH) (Hillier et al., 2012) which combines to- movement and through- movement (Hillier, 2016) thus enables combined reading of both the spatial values of the seeds of the centre. The NACH structures across the scales in their highest possible threshold, 1.4 for Hyderabad, help identify the spatial seeds. Some spatial seeds are latent in the already evolved linear centres, while some exist in their seed stage as segments or intersections. Figure 44 shows spatial seeds and evolved linear centres from Secunderabad from local (800m), intermediate (2km) and global (16km) scales.

Concerning the growth and formation of centres, Hillier argues– "The centre will grow beyond the fading distance established by the initial seed to the degree that further seeds appear in the fading distance, which reinforce the original seed. Again these (centres) can be local or global, and stronger or weaker" (Hillier, 2009, p. K01:6). Now, upon studying the identified spatial seeds from Secunderabad, two characteristics of its centres are noted. One is that the east-west SP Road to the north of MG Road has evolved into a continuous linear centre across all the scales. This pattern of spatial potential is synchronous with the degree of functional importance of these areas, with major retail, banks and hospitals along this centre. However, along MG road the global linear centre (shown in red in Figure 44) stops at the Tank Bund Road and the fading of centrality phenomenon starts. This suggests the propensity of the spatial network of

Secunderabad to grow centres along the east-west direction over the north-south direction which links with the other twin.

Figure 44: Spatial seeds from the 1.4 structure of NACH at 16km, 2km and 800m.
Source: Author.

Second characteristic is the disposition of spatial seeds at the local scale. Specific to the spatial network along the Station road, bound in the black rectangle in Figure 44, two spatial seeds from the local scale of 800m are found one at the intersection of Station Road and MG Road to the west and one at the Secunderabad Railway Station to the east; and between them is another spatial seed but from the intermediate scale of 2km. The location of these seeds corresponds with the historic functions from 1962 (refer Figure 30), namely; the principal retail thoroughfare along MG Road, General Bazaar in the middle and Secunderabad Railway Station. They continue as distinct seeds with their corresponding fields of spatial potential fading with distance, but have not evolved into a linear centre as seen along the SP Road at the global scale. It can thus be suggested that this particular configuration of spatial seeds at local scale has been, continuing historically and, providing for the functions in their fading distance with their spatial potential. Hence, an instance of continuity in the spatial memory of a duality in their current mode at the local scale – also suggests a high structural inertia of the spatial network of Secunderabad to the growth of the city.

However, in Old Hyderabad, the emergence of spatial seeds and evolved linear centres across the local and global scales happen at locations different from the historic centres; as can be seen in the shift of the linear centre at global scale to a newer location (shown by the red line in Figure 45) along Nampally Road from the historical principal retail thoroughfare (shown by the black band in Figure 45). This viewing of the growth of centres on the current spatial structure also suggests, a continuity in the pattern of centrality in the spatial configuration and the spatial memory associated with the twin relation in Secunderabad, and a forgetting of this relation in Old Hyderabad. Thereby, giving the Twin Cities phenomenon a historical status upon viewing the nature of spatial growth of its current centres; and thus, the need for contemporary descriptions on the urban form of the city.

The patterns of spatial accessibility from Old Hyderabad and the corresponding instances of change and continuity in the spatial memory are hidden from this analysis of spatial seeds and the process of growth of centres by the spatial value of NACH. This is because the NACH values of the segments from Old Hyderabad were under 1.3, while the spatial seeds were derived from segments with higher order spatial values i.e. from 1.4 and above. The synthesis of patterns of spatial accessibility from Old

Hyderabad are thus appended in section .3 considering its weaker spatial propensity to grow suggested by it being left behind by the objective study of spatial seeds.
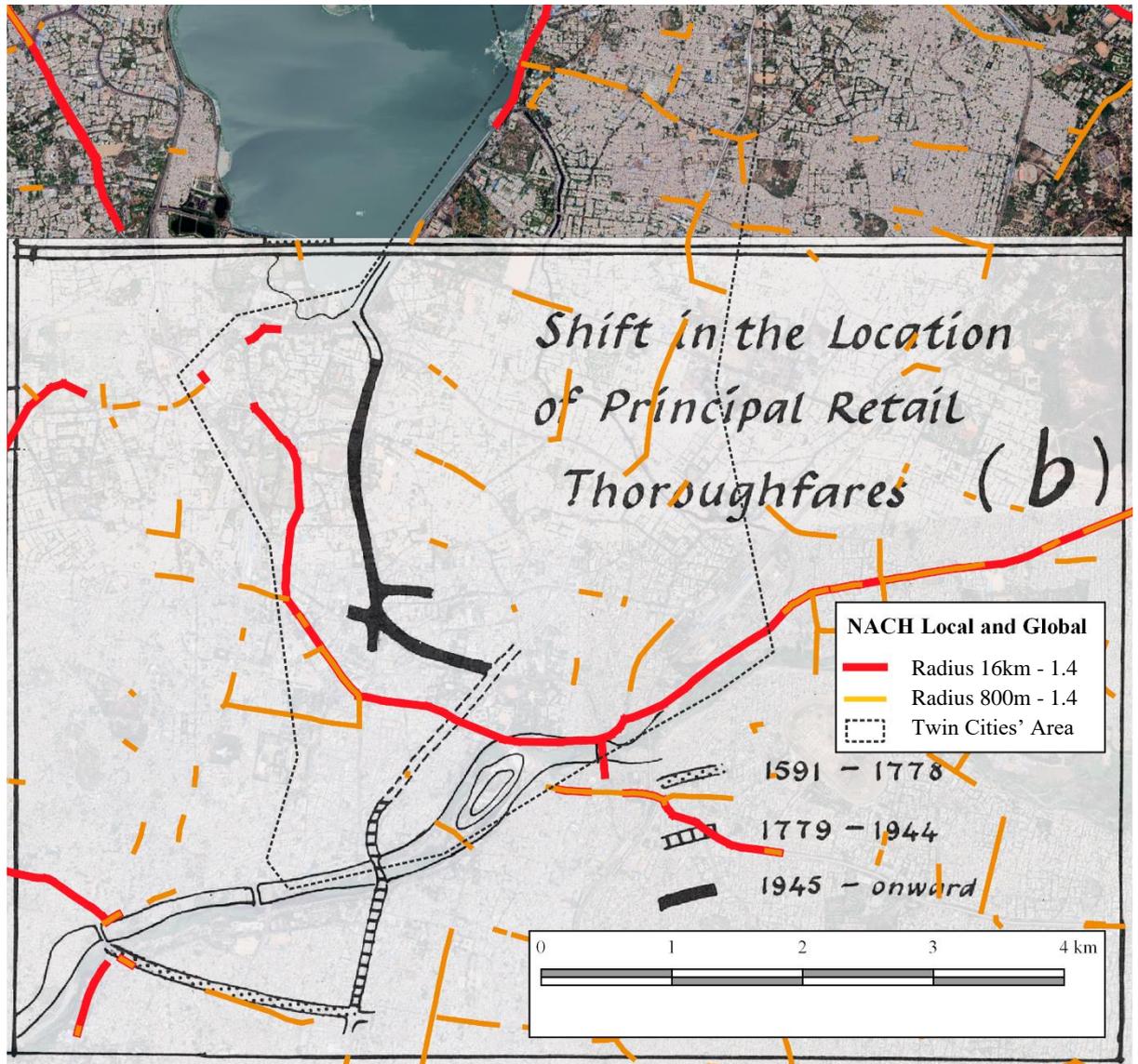
Figure 45: The current foreground network of 1.4 structure of NACH at local (800m) and global scale (16km) overlaid on the map (Alam, 1962) showing shift in the location of principal retail thoroughfares from 1591 to 1962. Source: Author.

7. CONCLUSION

From the analysis of the vicinities across the city of Hyderabad, differentiating them on the basis of their spatial accessibility, it can be concluded that the city of Hyderabad is not binodal in its spatial structure as its popular title of Twin Cities suggests. However, this is not to discount its historical significance as a spatial fact that performed under definitive and deeply interlaced socio-political and economic forces; for a continuity in the spatial potential of the historic centres to attract movement is observed at the regional scale of accessibility.

Shah Alam, in his conclusion, notes:

"Today the two settlements are so closely linked with each other that to appreciate their functions and ecological structure one cannot be alienated from the other, but each must be thought of as contributing to greater community- the rise of the modern metropolis." (Alam, 1962, p. 30)

To add to his commentary from that day, from this research to trace for any continuity in the spatial memory of a duality in the historical twin cities zone it is found that though the morphological remnants persist and continue to operate, the specific relations between themselves and to the city on the whole have been altered and appropriated by the modern metropolis fragmenting the twin cities' zone. Thus, referring to the current city of Hyderabad as Twin Cities of Hyderabad in urban research, drafting city-plans and policies and conceptualizing designs would remain incomplete and potentially misleading as an understanding, if not done so as to mention a purely historic fact. The twin cities reference of the city can thus be argued to be nothing more than a legend. Hence, necessitating a greater specificity in the urban descriptions of the city of the Hyderabad and calling for newer descriptions. As identified by the late geographer John Brush in 1968 as growing interstitial and peripheral areas– there are emergent centres that demand for the diversification of the popular twin city definition.

Now, having explored "the autonomous potential of space to form patterns" (Hillier and Vaughan, 2007, p. 207) and how these patterns relate to the functional clustering of city centres– this research presents fertile conditions for studies to analyse spatial cultures across the city to provide with design-level insights compared to the current scale of findings which highlight urban processes at a policy-making and planning level.

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9. Appendix

9.1 Line graphs of NAIN of vicinities across the radii of analysis
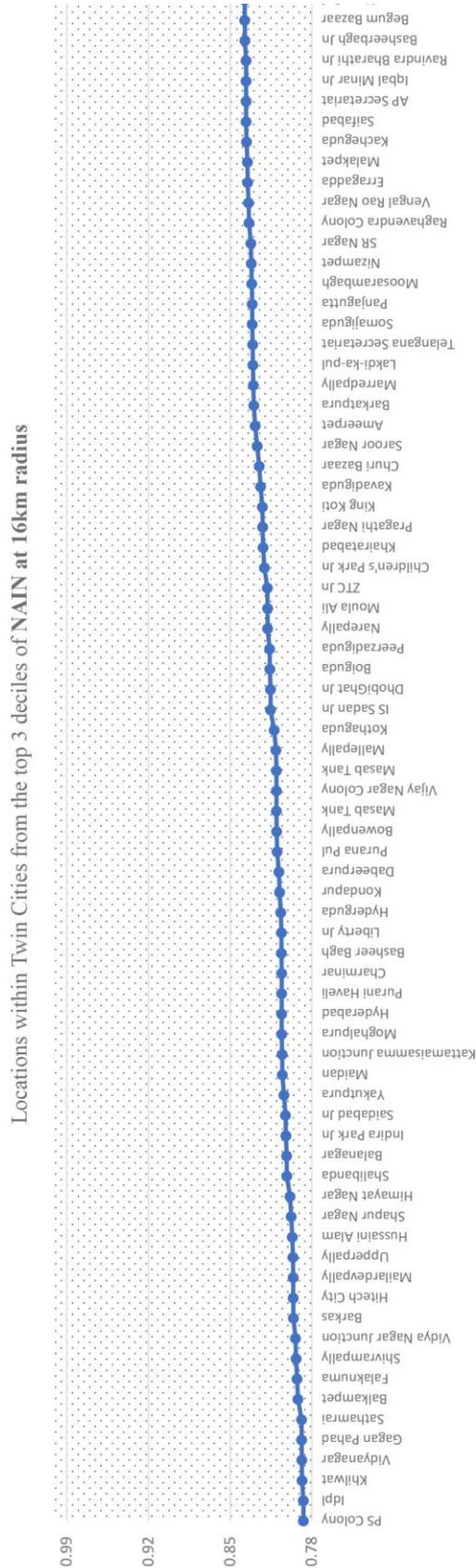
● Secunderabad Centres

○ Hyderabad Centres

The following line graphs show the vicinities across the city in top 3 deciles of normalised angular integration (NAIN) at different scales. The specific potential of the locations from the twin cities' region to attract movement flows and the competing emergent centres from other parts of the city can be noted. © author

Locations within Twin Cities from the top 3 deciles of NAIN at 8km radius

Locations within Twin Cities from the top 3 deciles of NAIN at 4km radius

Rasoolpura
Attapur
Kothapet
Miyapur
Children's Park Jn
Kavadiguda
Shapur Nagar
Kondapur
Hitech City
Balanagar
Hafiz Baba Nagar
Habsiguda
Dhobighat Jn
IS Sadan Jn
Habsiguda x Roads
Kothaguda
Jillelaguda
Kapra
Chandrayangutta
PS Colony
Langar Hauz
Karwan
Bolguda
Raghavendra Colony
Vanasthalipuram
Saroor Nagar
Moosarambagh
Erragadda
Tarnaka Flyover;APSRTC...
Tarnaka
Bharath Nagar
Moosapet
Saidabad Jn
Gunrock Enclave
Dammaiguda
ZTC Jn
Satavahana Nagar
KPHB Colony
Vengal Rao Nagar
Jeedimetla
Barkas
Moula Ali
SR Nagar
Hayathnagar
AS Rao Nagar
Upperpally
Kukatpally
Malakpet
Chaderghat
Madinaguda
Vasanth Nagar Colony
Narepally
Trimulgherry
Kushaiguda
Begumpet
Karvan
Sainikpuri
Bank of Baroda Colony
Kattamaisamma Junction
Indira Park Jn
Naya Pul
Charminar
Purani Haveli
Dabeerpura
Maidan
Hyderabad
Yakutpura
Moghalpura
Jawahar Nagar
RTC X Road
Afzalgunj
Koti
Alwal
Marredpally
VST X Roads
Chikkadpally
Gandhi Nagar

Bairamalguda
Chintalkunta
Nagole
LB Nagar
Chaitanyapuri
Dilsukh Nagar
Karmanghat
Gaddiannaram
Uppal
Ramanthapur
Mansoorabad
Champapet
Idpl
DMRL X Roads
Patny
Kanchan Bagh
Rasoolpura
Attapur

Locations within Twin Cities from the top 3 deciles of **NAIN** at **2.1km radius**

Locations within Twin Cities from the top 3 deciles of NAIN at 1.6km radius

Kukatpally
Jawahar Nagar
RTC X Road
VST X Roads
Chikkadpally
Chintalkunta
Singapore Township
Sainikpuri
Raghavendra Colony
Saidabad Jn
DhobiGhat Jn
IS Sadan Jn
Gandhi Nagar
Nagole
Chaitanyapuri
Bank of Baroda Colony
Azamabad X Roads
Kothapet
Manjira Nagar Colony
Vasanth Nagar Colony
Charminar
Yakutpura
Purani Haveli
Maidan
Hyderabad
Moghalpura
Dammaiguda
AS Rao Nagar
Kapra
Dilsukh Nagar
Jawahar Nagar
Balaji Nagar
Moosarambagh
Narayanguda
Himayat Nagar
Dabeerpura
Shapur Nagar
Bairamalguda
PS Colony
Children's Park Jn
Kavadiguda
Champapet
Chandyangutta
LB Nagar
Boiguda
Naya Pul
DMRL X Roads
Vengal Rao Nagar
Erragadda
SR Nagar
Saidabad
Indira Park Jn
Gaddiannaram
Balanagar
Langar Hauz
Uppal
Karwan
Attapur
Doolapally
Gangastan
Hitech City
Narepally
Mansoorabad
Barkas
Yapral
Saroor Nagar
Ramanthapur
Koti
Afzalgunj
Marredpally
Miyapur
Idpl
Jeedimetla
Nallakunta
Hafiz Baba Nagar
Hyderguda
Masjid Banda

Vanasthalipuram
Patny
Rampally
Ismail Khan Guda
Satavahana Nagar
KPHB Colony
Rasoolpura
Kukatpally

Locations within Twin Cities from the top 3 deciles of **NAIN** at 800m radius

Left panel — vertical axis values: 1.784, 1.624, 1.464, 1.304

Left panel labels (bottom to top):
Al-Jabri Colony, Gowlidoddi, Miyapur, Uppuguda, Sri Kalki Heights, Nawab Saheb Kunta, Panjagutta, Ram Nagar, Ramnagar X Roads, Mansoorabad, Begumpet, Nacharam, ZTC Jn, Upperpally, Abids, Mehdipatnam, Hussaini Alam, Children's Park Jn, Narsingi, Saket, Madinaguda, Trimulgherry, Secunderabad, Kattamaisamma Junction, SBH Gun Foundry Jn, Gaddiannaram, Anamagal Hayathnagar, Peerzadiguda, Mustafa Hills, Quba Colony, Rasoolpura, Jillelaguda, Bahadurpura, Attapur, Lingampally, Chintalkunta, Kishan Bagh, King Koti, Azamabad X Roads, Nacharam Jn, Madhapur, Hydershah Guda, Masab Tank, Masab Tank, Jeedimetla, Shanti Nagar, Maidan, Dabeerpura, Erragadda, Basheer Bagh, Hyderguda, Basheerbagh Jn, Liberty Jn, Purana Pul, Saroor Nagar, Habsiguda, Habsiguda x Roads, Lakdi-ka-pul, Vijay Nagar Colony, Katedan, Purani Haveli, Nampally, Bolarum, Pocharam, Hyderabad, Charminar, Chellapally, Kokapet, Chaderghat, Balanagar, Goshamahal, Afzalgunj, Naya Pul, LB Nagar

Right panel labels (bottom to top):
Naya Pul, LB Nagar, Tarnaka, Kothaguda, Mallepally, Begum Bazaar, Churi Bazaar, Fever Hospital Jn, Saidabad Jn, Almasguda, Neredmet, Boduppal, Malkajgiri, Bolguda, Dilsukh Nagar, Karwan, Kavadiguda, Subprabhat Colony, Kushaiguda, Venkatapuram, Bairamalguda, Himayat Nagar, PS Colony, Moula Ali, Musheerabad, Chengicherla, Barkas, DMRL X Roads, Kanchan Bagh, Nagole, Gangastan, Yousufguda, Karmanghat, Vasanth Nagar Colony, Marredpally, Gunrock Enclave, Vengal Rao Nagar, Yapral, Qutbullapur, Doolapally, Langer Hauz, Anna Nagar, Safilguda, Alwal, Idpl, Mallardevpally, Champapet, Kismatpur, Ameerpet, Bandlaguda, Pragathi Nagar, Masjid Banda, Antaipalle, Chandanagar, IS Sadan Jn, DhobiGhat Jn, Saidabad, Moghalpura, Officer's Colony, Jalpally, Narayanguda, Koti, Bank of Baroda Colony, Malakpet, Chaitanyapuri, Yakutpura, SR Nagar, Balkampet, AS Rao Nagar, Dammaiguda, Fateh Nagar, Barkatpura, Kacheguda, Uppal, Vidyanagar, Vidya Nagar Junction, Mallepally

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Somajiguda
S.LN Colony
KPHB Colony
Kukatpally
Gandipet
Injapur
Ramanthapur
Jawahar Nagar
Balaji Nagar
Dharmavaram
Vanasthalipuram
Hafiz Baba Nagar
Satavahana Nagar
Narepally
Borabanda
Kothwalguda
Rampally
Ismail Khan Guda
Manjira Nagar Colony
Nagaram
Shivrampally
Jawahar Nagar
RTC X Road
VST X Roads
Chikkadpally
Kapra
Shapur Nagar
Sainikpuri
Raghavendra Colony
Patny
Kothapet
Jagadgirigutta
Chandyangutta
Venkatadri Township
Swarnagiri Colony
Sanath Nagar
Moosarambagh
Kondapur
Hitech City
Indira Park Jn
Gandhi Nagar
Adikmet Jn
Nallakunta
Vidya Nagar Junction

9.2   On centrality from historic syntactic descriptions

From the statistical analysis from section 4.1 it was found that Secunderabad has a greater correspondence between local and regional-scale integration than Old Hyderabad. Notably higher values of spatial accessibility were also found in Secunderabad over Old Hyderabad at all scales. However, this a description of the current spatial structure of the city. Syntactic analysis of the historical spatial configuration of the twin cities is used to present spatial accessibility pattern from then to bring to light the dynamism of centrality patterns (Hillier, 1999b). Hillier's argument knit together– growth of settlements, changes in pattern of global integration and shifts in the focus of centrality.

The analysis of the spatial configuration translated from a cartograph of a historical snapshot of the Twin Cities from 1914 presents the southern twin of Hyderabad with greater to-movement potential and thus more centralized than Secunderabad as a destination (Figure 46). Thus, a complete reversal from the current spatial structure with Secunderabad being more spatially accessible. This is evident from the map itself considering the extents of the footprints of the settlement. However, it is this information being contained in the spatial configuration of the settlement brought to light by syntactic analysis that is of interest. Thus, it also validates the method used to assess the duality using the patterns of integration and analysing their shifts across scales. Hillier further clarifies on the role of space in creating centres in cities by noting: "This is not to discount the obvious fact that it is economic and political factors that eventually determine urban development, only that these factors work within the constraints and limits set by the fact that centrality is a spatially led process." (Hillier, 1999b, p. 108).
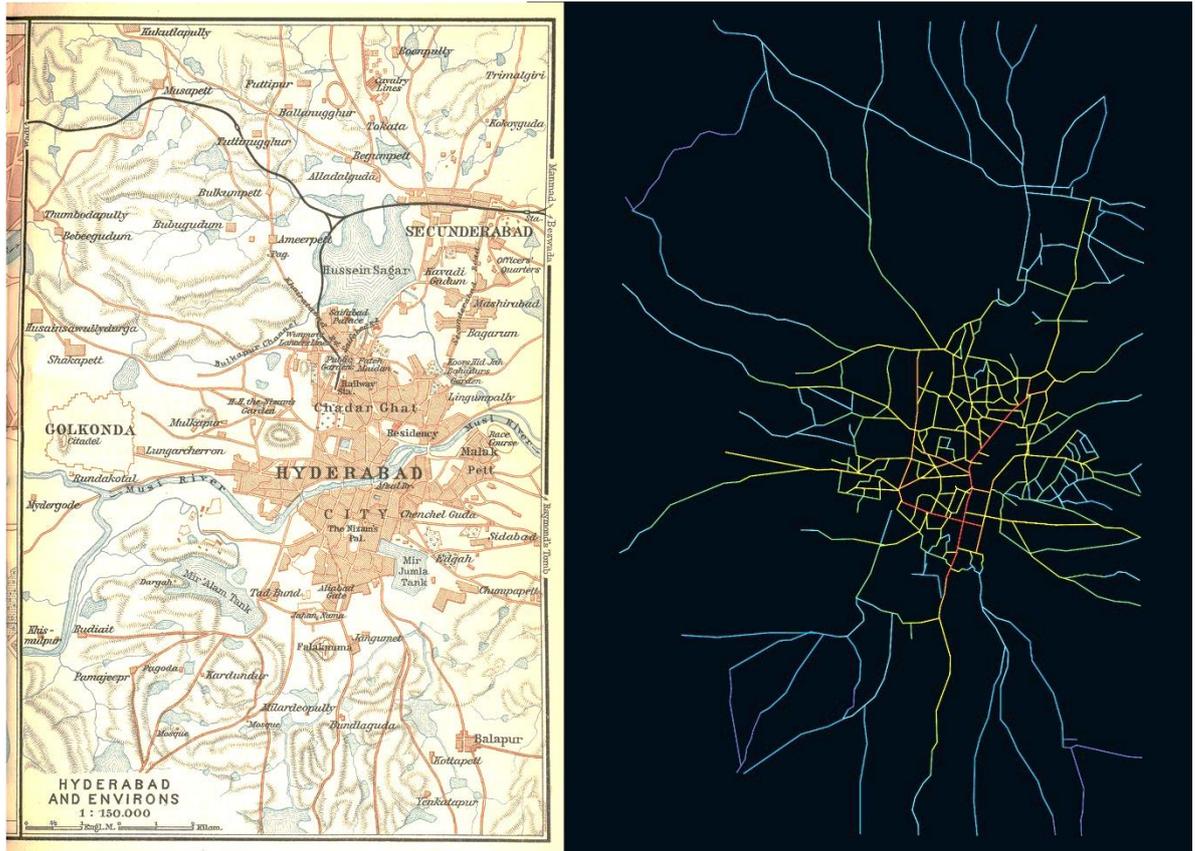
Figure 46: Historic map of the twin cities from 1914, used by permission of the University of Texas Libraries, The University of Texas at Austin. (left); Translated into segment model analysed for global integration (right), source: author.

9.3   Historic centres from Old Hyderabad

The patterns of spatial accessibility from Old Hyderabad corresponded with the spatial descriptions from 1962 and thus suggested a continuity in the spatial memory of duality in its spatial network. These patterns will be synthesised around intersections, considering the local and global 1.3 structures in conjunction with the spatial and functional characteristics of the areas of interest around them. Since these patterns were seen to correspond with the historical descriptions from 1962, and since the city grew from south near the river to north, distance from the river – which also corresponds with the mention of these junctions in Shah Alam's work of 1962.

The Abids junction (marked as A in Figure 47 and Figure 48), a historically important commercial intersection, demonstrates its importance with high spatial accessibility under all radii of analysis, which also corresponds with its current function as a busy retail district. However, it coincides with the 1.3 structure of through- movement at both local and global scales. This suggests that the attracting effect of the urban grid operates at a greater degree than its pervasive centrality in the NACH structure of the city.

Moazzam Jahi market Junction (marked as B in Figure 47 and Figure 48), which served as a gateway to the wholesale business district to the south in 1962 for the twin cities (refer to Figure 36), now emerges as global centre at the intersection of major routes. The global 1.4 structure coming from the Nampally Road that passes through it can be seen to be to concentric to the 1.3 structure across Abids with no connections between them. This is indicative of how the city has grown to stratify the Old Hyderabad into a two-faced entity. This process has also made, Jambagh Fruit Market, once a local centre, to have a higher spatial accessibility at global scales than at local scales.

The Afzalgunj junction (marked as C in Figure 47 and Figure 48), that links Begum Bazaar on its west to the Moazzam Jahi Market to its north, emerging in the 1.3 structure at global scale and being at the same rank as Abids road, is noteworthy. As it calls for attention to its historic role as the centre adjacent to the north of the river connecting to the southern walled city. Its higher spatial accessibility at the global scale further reinforces its commercial character, comparable to that of Abids.

These are other specific processes where historic centres have been transformed by the growth of the city, though as seen from the analysis of spatial seeds; these historic centres of Old Hyderabad are dominated by the ones along Nampally Road in terms of their spatial potential to grow.
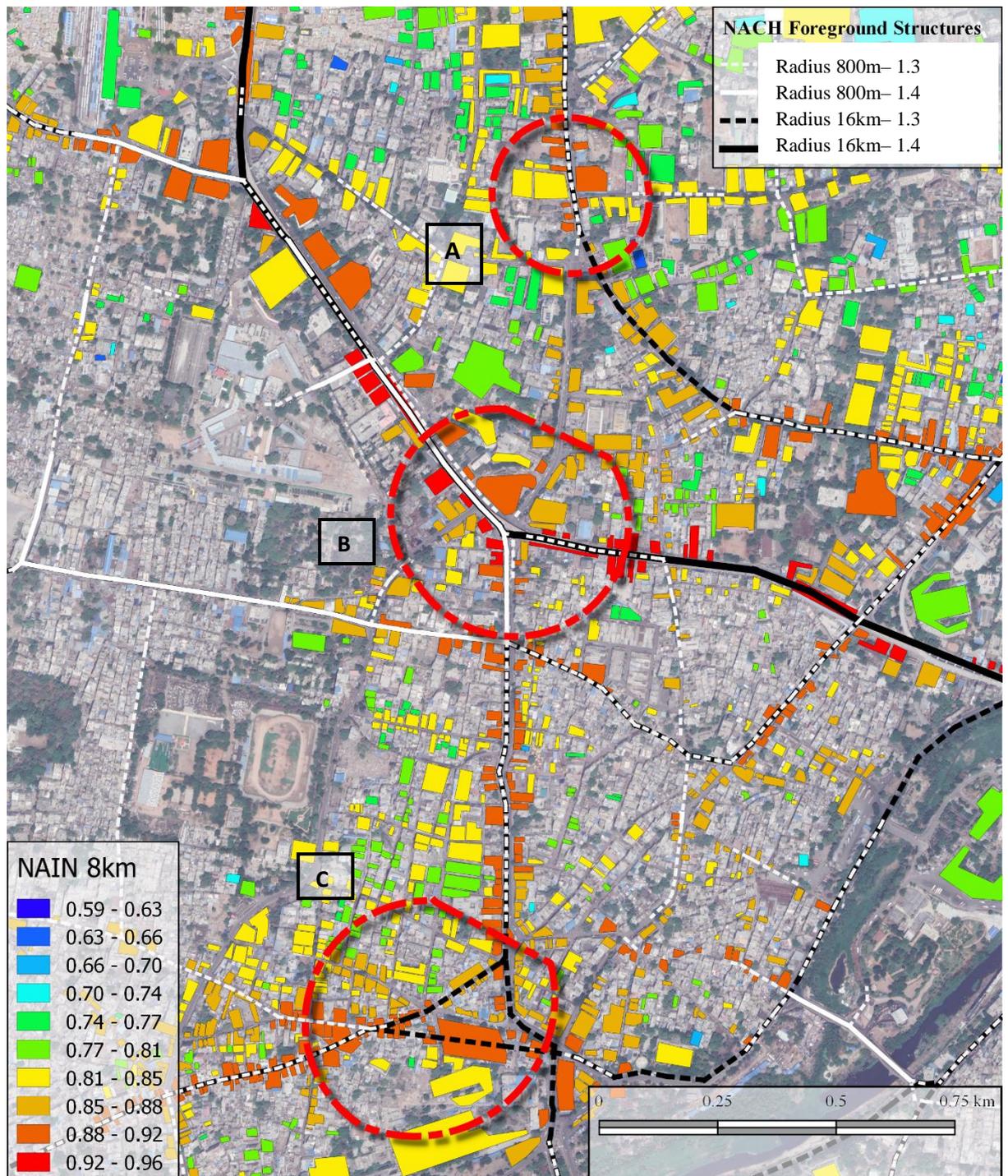

Figure 47: Major junctions from Old Hyderabad with, the foreground structures from local and global NACH values and the AOI with their NAIN values from 8km radius of analysis
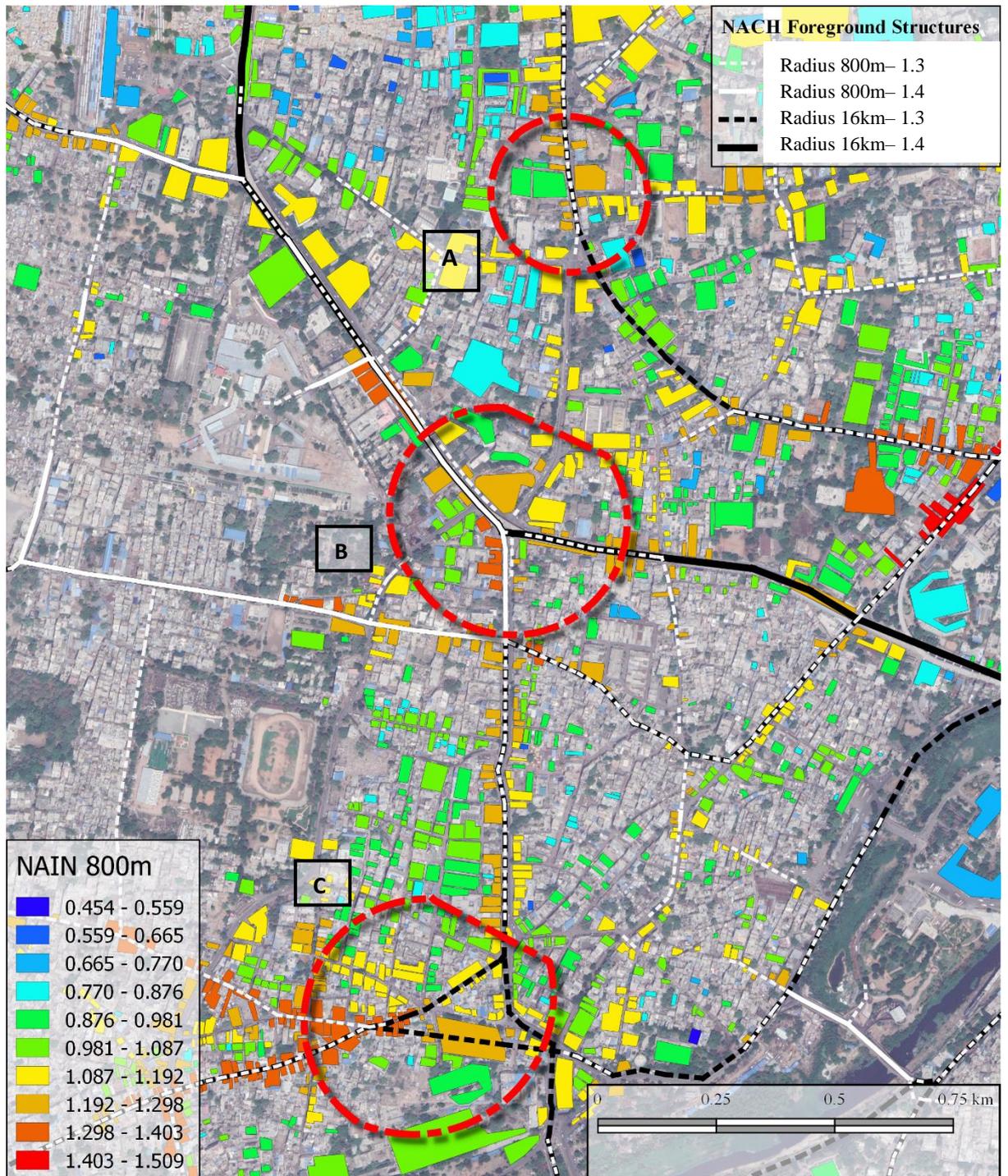
Figure 48: Major junctions from Old Hyderabad with, the foreground structures from local and global NACH values and the AOI with their NAIN values from 800m radius of analysis