



## Exploring the City's Natural Systems to Create Walkable and Cyclable Networks: Case of Delhi

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**ABSTRACT:** This paper critically analyses the multiple facets of urban ecology i.e the built settlements, streets networks, open spaces, greens and water systems and focuses on the potential of city's natural systems to act as physical connector in terms of creating pedestrian accessibility. This scenario is faced by innumerable cities in India, this paper interrogates into the case of Delhi and provides new perspectives to explore natural networks. Rapid unplanned urbanization has taken over the right of the people to walk, the city and its streets have been taken over by vehicles. Due to traffic loads the pedestrians suffer frequent road fatalities. Delhi pedestrians constituted 455 of total 1,820 road accidents (Delhi Police, 2009). The paper explores the city's open space structure to define alternate movement domains. It demonstrates how existing natural and man-made constructs can be organized together to create a 'movement corridor'. These connections allow pedestrians and cyclists the right to move without being compromised by vehicles in the road space. Movement Corridors within the city have the potential to create interconnected zonal and local system trails that make Delhi a pedestrian friendly city. The plan includes the utilization of the city green lungs (city greens), linking forests and parks to the city and spatial corridors around precincts to allow for movement of people and non-motorized vehicles. This provides for safe and convenient connections to parks, natural systems and recreational facilities and links with residential areas, civic institutions and business. The paper concludes in purview of improved accessibility that influences standards of social justice and equity. It also results in an increase in the city's land value. It also provide a means to thread diverse city patterns together.

### I. CONTEXT

The city provides layers of opportunities to create a sheltered realm where pedestrians, cyclists and people using non-motorized vehicles can move in a safe manner. It also provides access to opportunities that are currently unavailable. These urban realms can be linked

utilizing nullahs, greens, parks, arterial roads and neighbourhoods. The city is further divided into zones.

To explore and define a potential of opportunities, the study has been designed to focus on a limited area: Zone F in South Delhi. Although, the strategy illustrated can be applied across other zones too.



Fig 1. Road Map of Delhi showing Zone F  
, Source: Author, Movement Corridors, DUAC Report



Fig 2. Zone F in context of city's nullah systems, Source: Author, Movement Corridors, DUAC Report



Fig 3. Zone F in context of city's greens,, Source: Author, Movement Corridors, DUAC Report

### A. Context within the City

**Road Network.** Zone F is linked to other parts of Delhi by major city roads. The Inner ring road located to the North, Mehrauli Badarpur road located to the South, Mathura road to the east and Delhi- Gurgaon expressway to the west, form major connections with other parts of the city. The outer ring road passing through Zone F is a major connector accommodating heavy traffic movements.

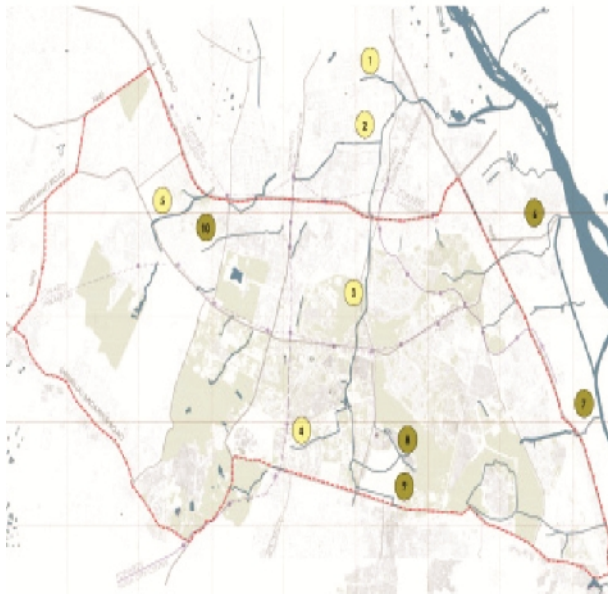


Fig 4. Map showing nullah network in Zone F, Source: Author, Movement Corridors, DUAC Report

### B. Zone F

The opportunity areas within Zone F include links to city greens, nullah systems, arterial roads, connecting neighbouring precincts and amenities.

**Nullahs in Zone F.** Zone F has a vast network of nullahs traversing through it i.e. Chirag Dilli, R.K. Puram nullah and Pushp Vihar nullah which drain into Barapullah nullah located in Central Delhi.

Thus, it forms a continuous network of nullahs and basins which can be utilized to form uninterrupted network of trails within the zones and to other parts of Delhi.

**Greens and Open spaces.** Zone F contains large pockets of various levels of greens, which also form a natural continuous organic pattern. These green / open pockets have the potential to be connected via internal trails and form a network for movement within the zone.

**Institutional and Commercial Areas.** *Institutional:* Institutions like IIT, JNU, AIIMS etc. form a large part

**Nullah Systems.** The system of Nullahs distributed across the city follows its natural topographic features. In Zone F it connects the Aravalli's in the south to the Yamuna river basin.

**City's Greens.** Zone F includes numerous city level forests like Sanjay Van, Aravalli Bio-diversity park, Jahanpanah forest, etc. These form parts of metropolitan green expanses like forests, district parks, planned greens and avenues plantations.



Fig 5. Map showing greens in Zone F, Source: Author, Movement Corridors, DUAC Report

of Zone F. A part of these large institutional areas can form continuous trails either along their edges or through them owing to their location and accessibility to the green belts.

**Commercial :** Zone F contains major CBD's of Delhi like Nehru place, Saket district centre, Bhikaji Cama place. Movement in and around these commercial centres is very intense and requires more accessibility by different travel modes including walking, cycling etc. to make it more pedestrian friendly.

**Monument Zones in Zone F.** Zone F includes numerous monuments scattered throughout the Zone. These have immense cultural and historic value and have the potential to revive city's historic potential. In spite of a large number of monuments that lie in this zone the heritage potential has not been explored to optimum value. As they are engulfed in dense settlements.



Fig 6. Map showing institutional and commercial network in Zone F ,

Source: Author, Movement Corridors, DUAC Report



Fig 7. Map showing monuments in Zone F, Source: Author, Movement

Corridors, DUAC Report

## II. INFERENCES AND CONCLUSION

### A. Nullah systems

The Chirag Dilli Nullah basin, Kushak Nullah basin and R.K Puram Nullah basin are the larger nullah systems that transverse Zone F. These nullahs form continuous patterns that exist as a drainage system throughout the city and eventually drain into the river. Hence, they can be explored to develop pedestrian connections. Nullahs in Zone F, create within the city a North - South linkage. Access to the nullahs which encourage local links to the city wide green belts.

### B. Green systems

Continuous stretches of green and vacant pockets could transform into unobstructed and alternative movement paths between important destinations in Zone F. Green pockets are distributed evenly across Zone F (A green stretch seems to be available every 2 km across the linear axis and every 1 km across the perpendicular axis). Greens and nullahs co-exist as a part of large environmental system. Connections between them provide the potential to link large tracts across Zone F to city wide green belts.

### C. Transport network : Roads and metro

Zone F, with the advent of the metro phase 3,4 would have four interchange stations at INA, Lajpat Nagar,

Chirag Dilli and Kalkaji. This will further add to the intensity of existing movement systems. In addition to existing movement systems which are already saturated it is envisaged to consider alternate networks. A potential to create linkages that provide ease of access to transit node exists. These will support 'last - mile' connectivity to areas within neighborhoods.

### D. Amenities

The walking paths/linkages would aim to connect and provide easy access to amenities like commercial, recreational, socio - cultural, sports complexes ,work centres, schools and colleges. Opportunities to create movement corridors that link with existing amenities are feasible.

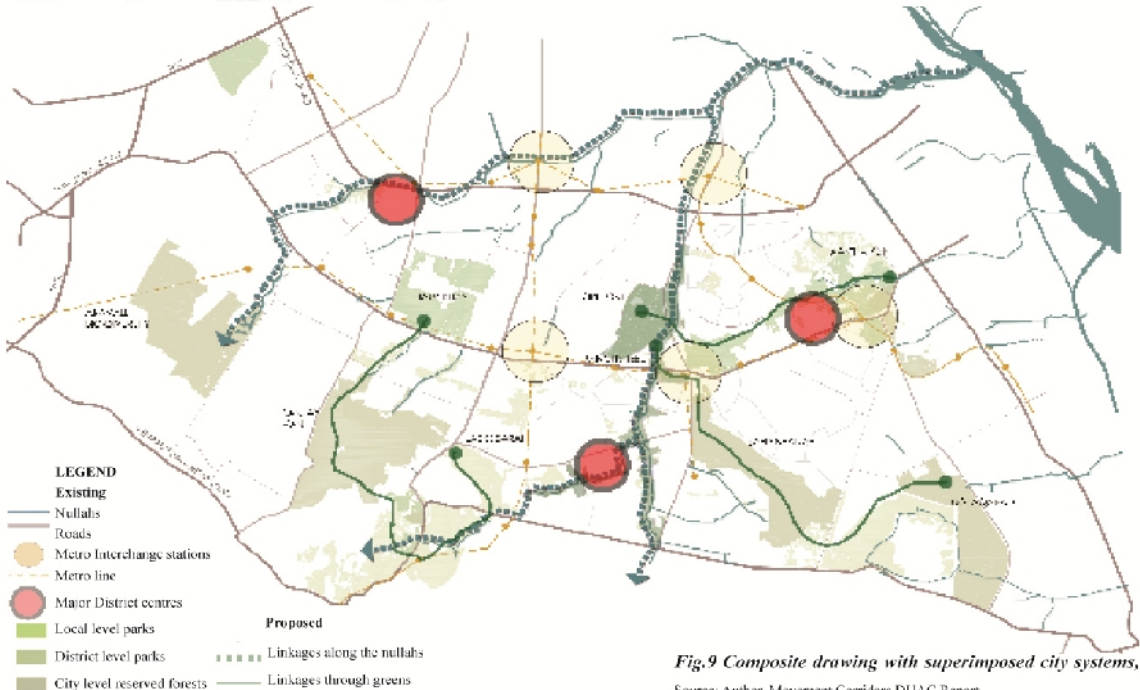
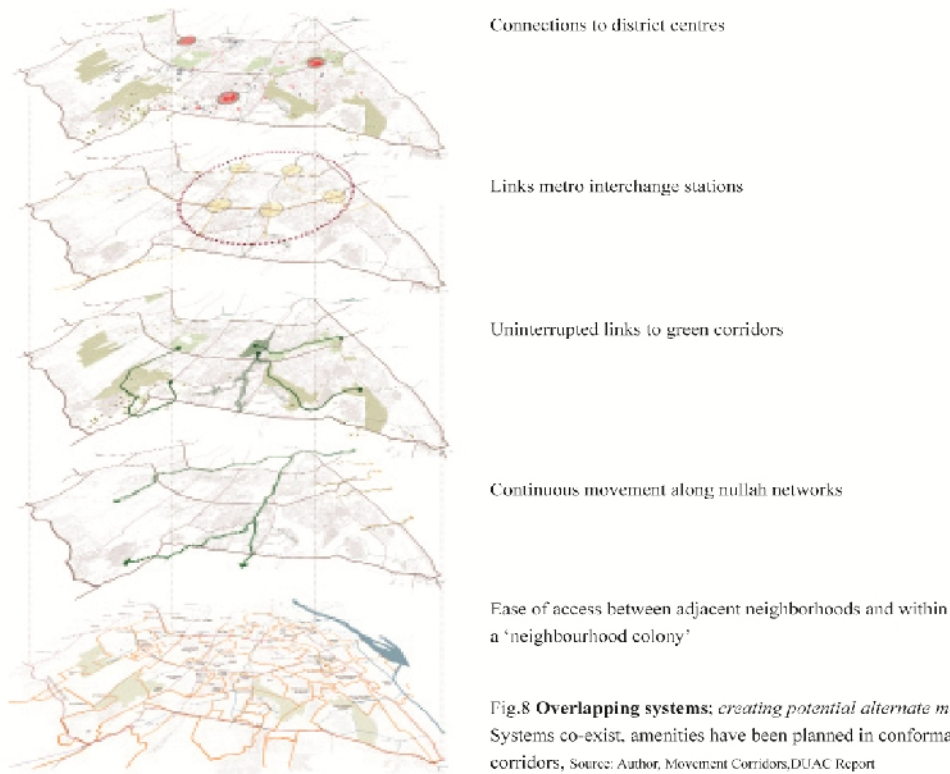
### E. Neighborhood opportunities

The walking paths/linkages would aim to provide ease of access/ connectivity between the neighboring places. A potential for linkages envisage last - mile connectivity within various neighborhoods.

### E. Built heritage pattern

The linkages proposed to connect the numerous monuments scattered throughout the zone. Potential accessibility to explore the heritage potential of the zone exists.





### III. AIMS OF THE STUDY

AIM 1 : Creating North - South linkages along existing nullah systems

AIM 2 : Creating an East - west linkage connecting

existing greens and connecting the missing links.

AIM 3 : Creating pedestrian and Non-Motorized Vehicle trail connections to transit hubs which enable movement to work centres.

AIM 4 : Creating last mile path connectivity between adjacent neighbourhoods and within colonies.

AIM 5 : Connecting neighbourhoods

AIM 6 : Easy access to monuments

#### IV. PROPOSAL

The proposal aims to establish a continuous link across the natural systems, ie the Chirag Delhi nullah, R.K.Puram nullah and the Barapullah nullah.

Connecting them across to the large green areas, such as Jahapanah forest, Hauz -Khas forest, Aravalli Bio-Diversity park, Sanjay Van and other prominent green pockets such as Aastha Kunj, Siri Fort greens, Panchsheel forest and the Qutab greens.

##### A. Linkage hierarchy

A hierarchy of trails has been established to create connections at different levels:

##### LINKAGE 5

(LINKAGE TO SPECIFIC AMENITIES)

Providing last mile connectivity

(Within neighborhoods)

##### LINKAGE 4

INTERNAL LINKAGES (Within precinct)

Along colony roads

Along greens (Local Parks)

##### LINKAGE 3

(CONNECTIONS BETWEEN CITY PRECINCTS)

Commercial area

Social, Cultural, Institutional & amenities

Heritage sites

Transport Hubs

##### LINKAGE 2

(ALONG CITY ARTERIALS AND MAJOR ROADS)

Connecting precincts

Intermediate connections between neighborhoods

##### LINKAGE 1

(CITY WIDE LINKAGES)

Nullah at a regional level

Greens at a regional level

L5

L4

L3

L2

L1

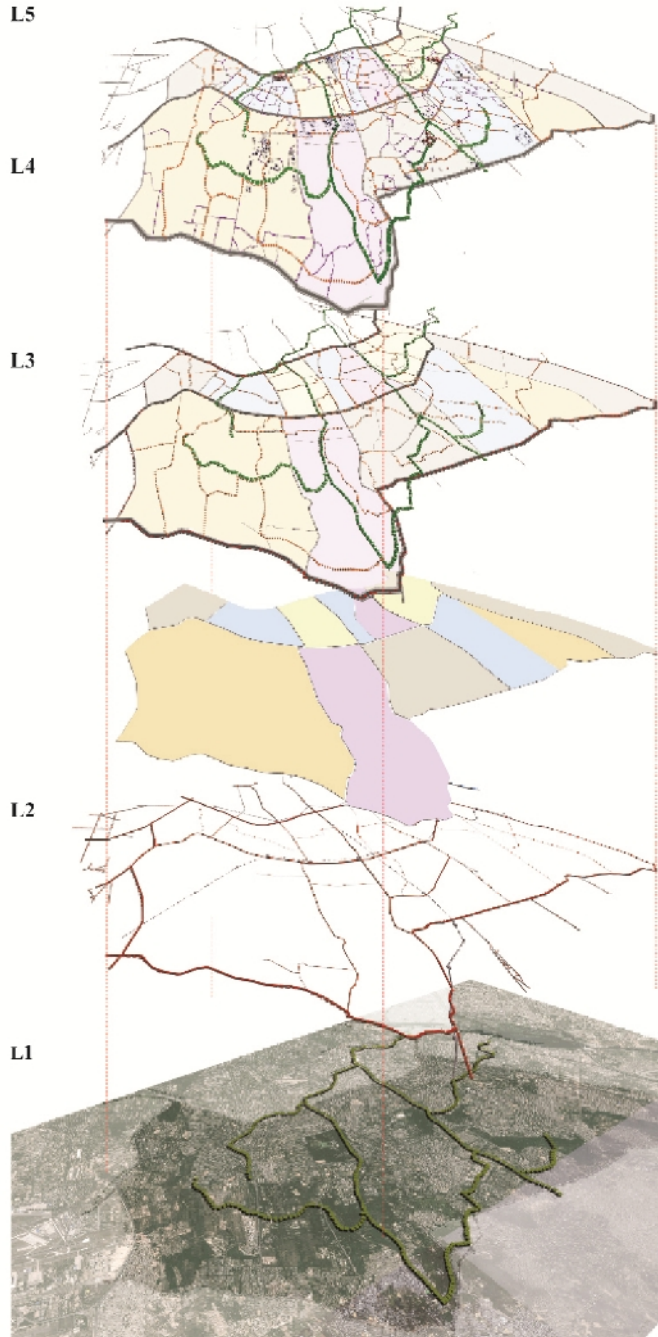


Fig.10 Map showing Hierarchy of trails,  
Source: Author, Movement Corridors, DUAC Report

**LINKAGE 1 (L1)****City wide linkages**

A continuous linkage has been established along nullah basins, various city level greens and road network. Connected lengths of trails make longer trips possible, increasing usefulness for commuting and recreation. This linkage connects

various amenities like CBD's, monuments and heritage sites, water bodies etc. which can be accessed by pedestrian pathways and cycle tracks. Linkage 1 is a connecting linkage providing bicycle and pedestrian network through the city and all the subsequent scales connect to it. The linkage width varies from 1.5 - 5mts.



Fig.11 Defining the network - creating a continuous pedestrian system, Source: Author, Movement Corridors, DUAC Report

**LINKAGE 2 (L2)****Along arterials and major roads**

The zone is further defined by the structure of existing road patterns to distribute it into workable sub-zones in order to develop walk able networks along this pattern of roads. Linkage 2 aims to equip streets with bicycle and pedestrian friendly

facilities, street furniture and signages. The ward boundaries are further overlapped on the precinct map as consideration for implementation at later stages. These ward boundaries (Source: MCD) have been overlapped on zonal maps. The road width varies from 45 - 60 mts.

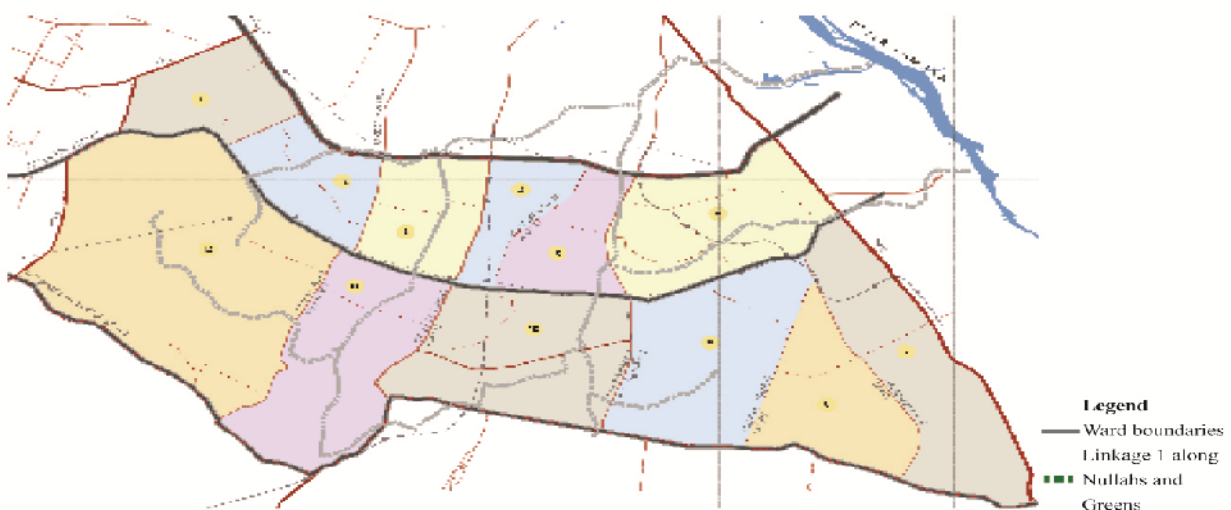


Fig.13 Identifying the Precincts defined by roads, Source: Author, Movement Corridors, DUAC Report



**LINKAGE 3 (L3)****Linkage between city precincts**

The adjacent precincts are connected by linkages along the various roads (i.e. Secondary and collector roads). These linkages connect precincts with each another and enable ease of movement from one precinct to another.

Precinct map showing the connections created to workplaces, institutions i.e schools, colleges and major commercial areas, the major destinations that are accessed within the zone. The road width varies from 6-18 mts.

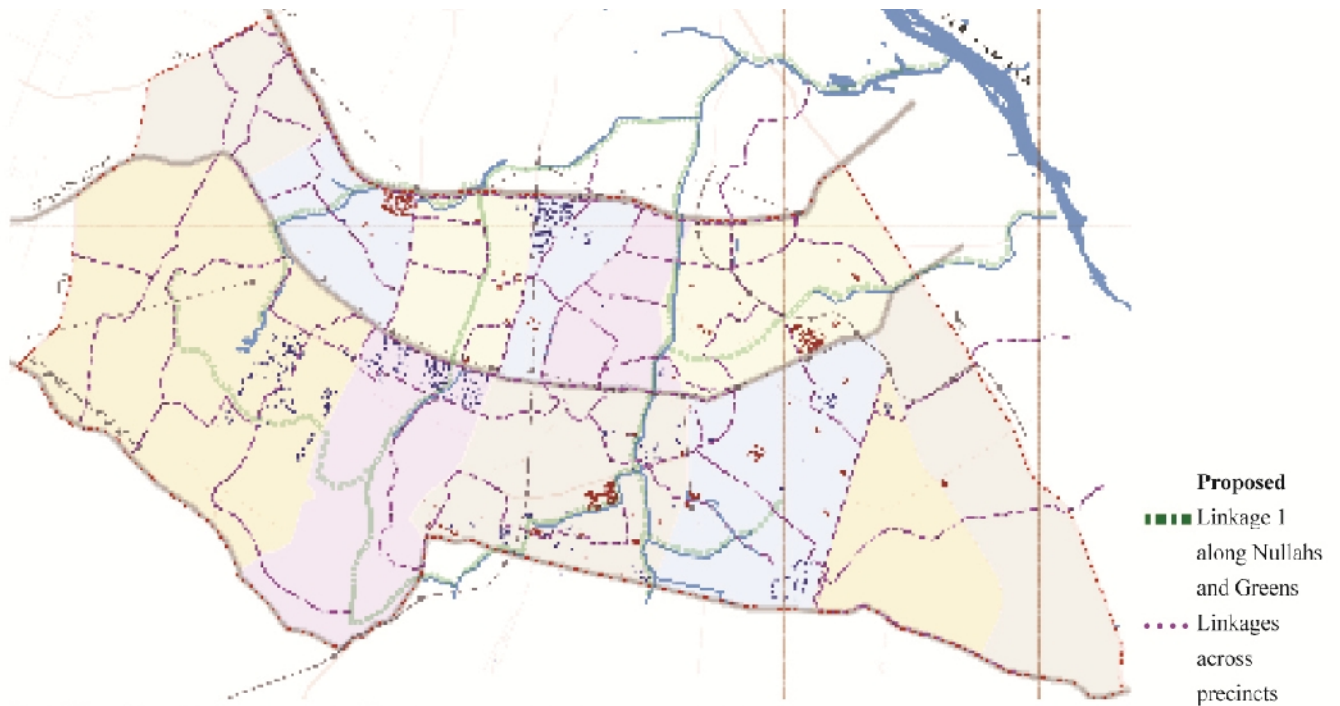


Fig.14 Identifying the Precincts defined by roads, Source: Author, Movement Corridors, DUAC Report

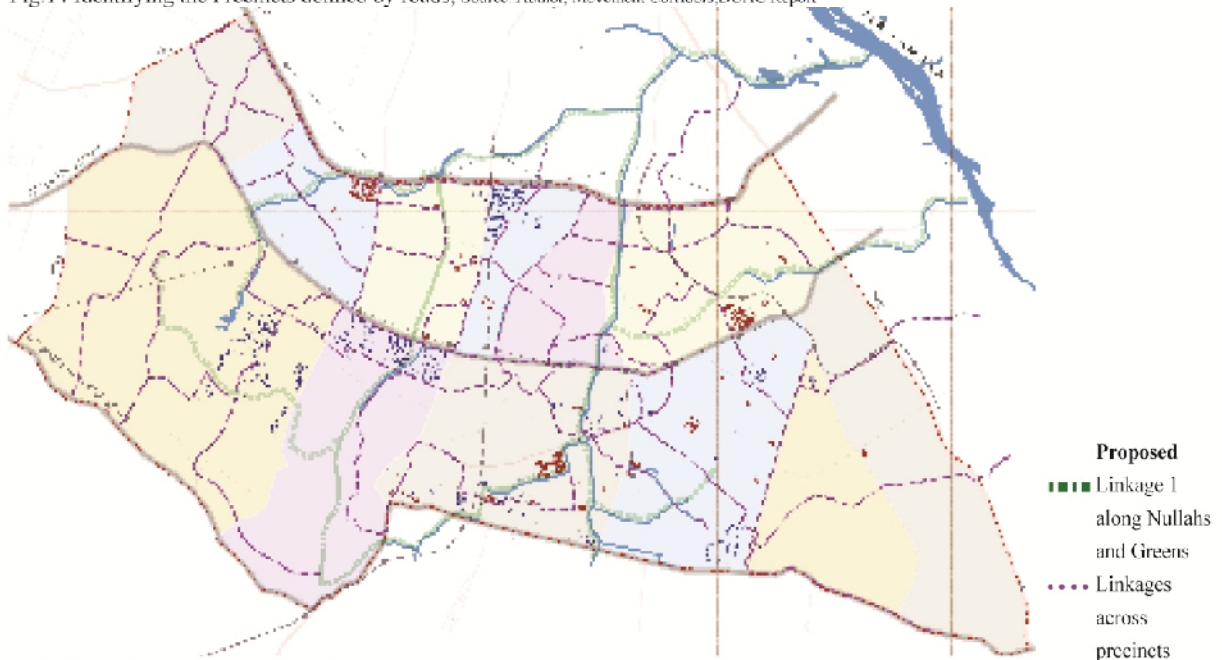


Fig.14 Identifying the Precincts defined by roads, Source: Author, Movement Corridors, DUAC Report

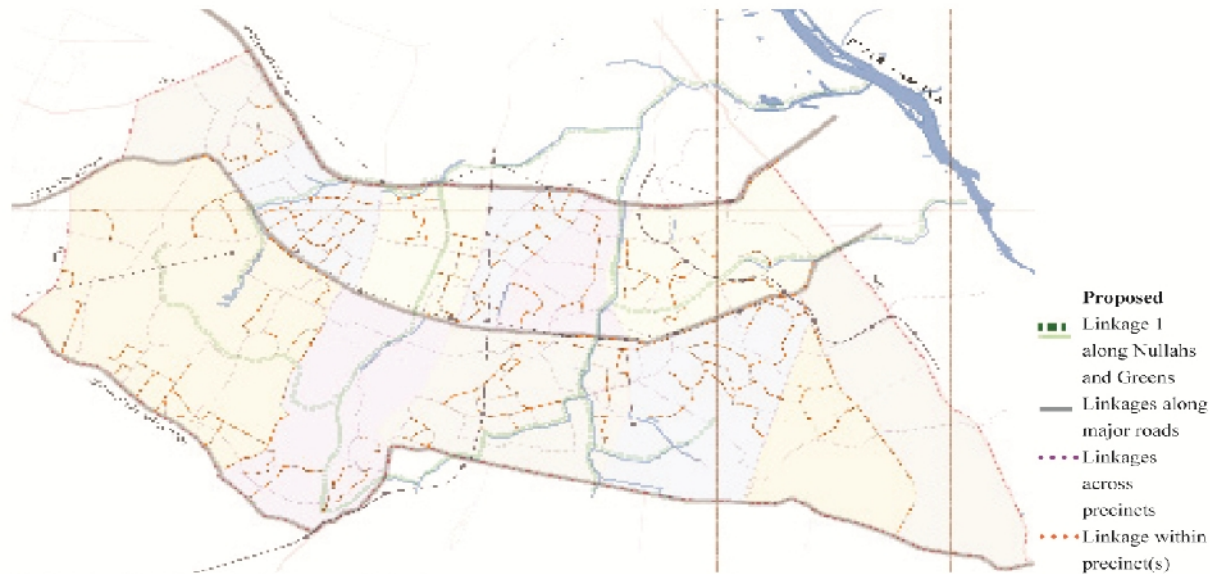
**LINKAGE 4 (L4)****Connecting neighbourhoods located within precincts**

Fig.15. Identifying the network between neighboring precincts, Source: Author, Movement Corridors, DUAC Report

The proposed network creates sub-networks within each precinct that allow pedestrian access to all amenities enclosed within such as commercial area (major marketplaces and neighbourhood level shopping area), schools and colleges. This linkage to be created along collector roads, road width varies from 24-30 mts.

**LINKAGE 5 (L5)****Last mile connectivity (With detail of Illustration area)**

Linkage 5 provides last-mile-connectivity. It creates access to amenities or connectivity to specific neighbourhoods, enabling walking instead of vehicular modes of travel. This would discourage the use of motorbikes or cars for a distance of 1-2km which adds to pollution and congestion on the road. These roads would create access to neighborhood level facilities. It is made possible by creating by upgrading sidewalks and creating alternate movement trails. Road width varies from 9 - 18mts.

The illustration area is located in North Central part of Zone F. It is defined by inner Ring Road to its North, outer Ring Road to the South, Africa Avenue to the West and Joseph Broz Tito Marg to its East.

**B. Illustration Area Conditions****Linkage 1: Trails along natural systems**

Large continuous stretches of greens and nullahs provide an opportunity to explore linkages through and along them respectively. These linkages which are unmarked, overgrown and encroached can be explored

by proposing pedestrian and cycling walkways.

**Linkage 2: Trail intersection with road**

Linkages along the road enable large volumes of pedestrian traffic to move at their own pace.

Features such as segregated cycle tracks, traffic calming elements contribute to a safer movement corridor. These dedicated corridors make streets more active, safe and vibrant.

**Linkage 3: Trail intersection with amenities**

Wider sidewalks along amenities (like commercial street fronts) provide room for seating, landscape and pedestrian movement in large volumes. These sidewalks enable pedestrians to walk at chosen pace, socialize or just stand and enjoy the surroundings.

**Linkage 4: Trail intersection with commercial, institutional and residential areas: Localized connections**

In order for a residential street to be adapted for a wider variety of uses, it may require traffic calming elements which can be combined with other elements like trees for shading, street furniture etc. to have safe and pleasant walking experience. These linkages offer last mile connectivity to the users.

**Linkage 5: Transition areas**

These edges are transition areas i.e the areas where the linkage changes its character due to the location, topography and street width. These are potential areas where various features like traffic calming, change in surface treatment or change in character of street need to be adapted for a variety of uses and users.



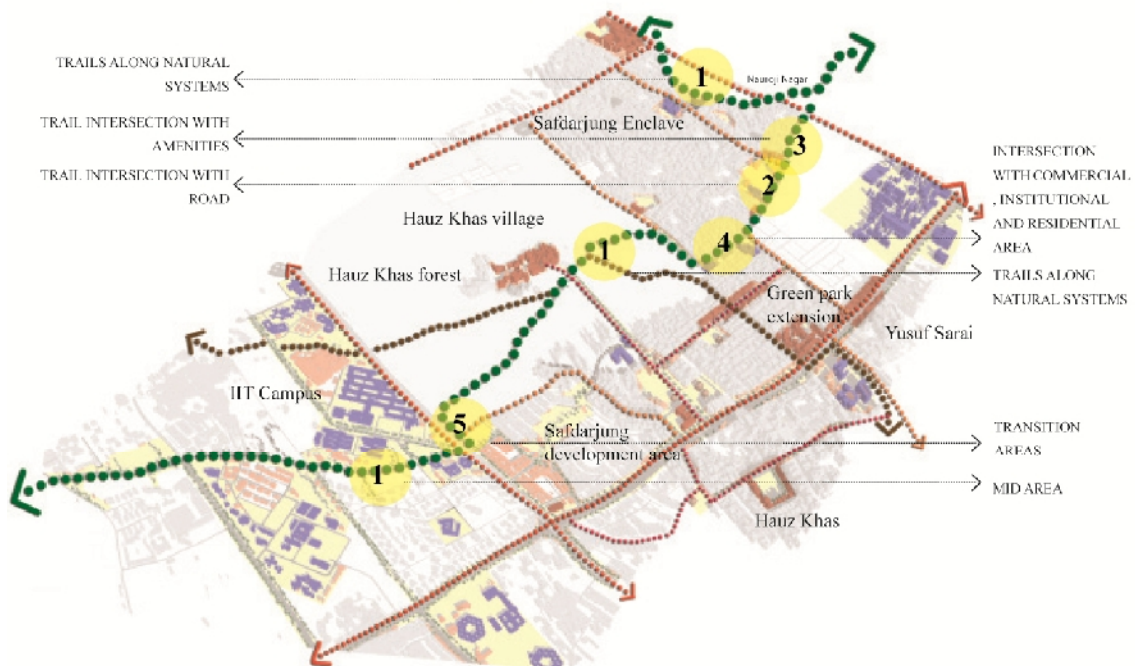
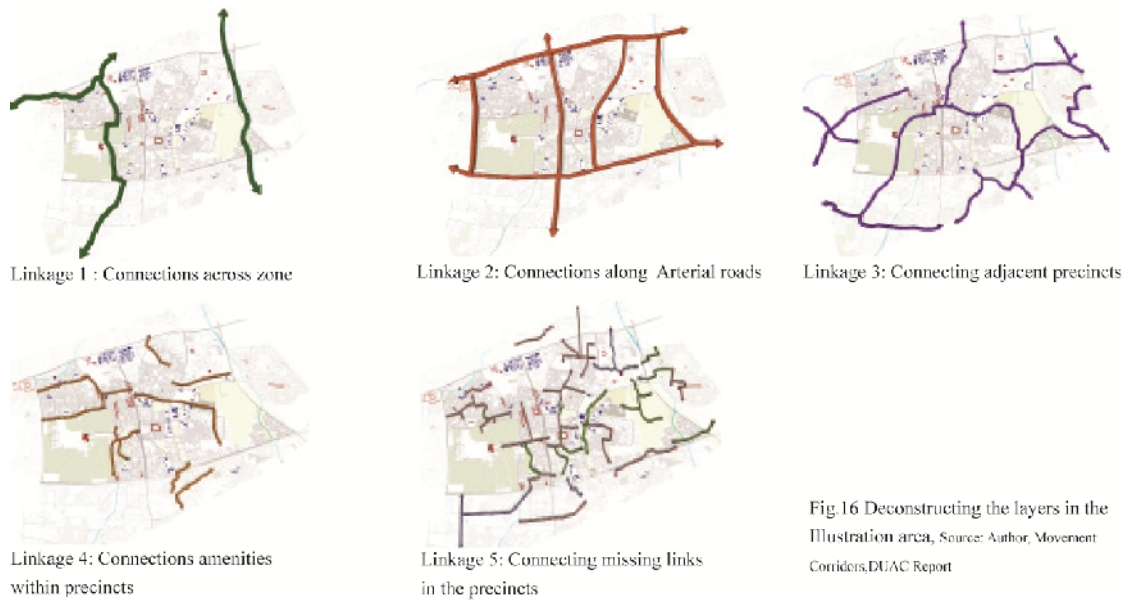
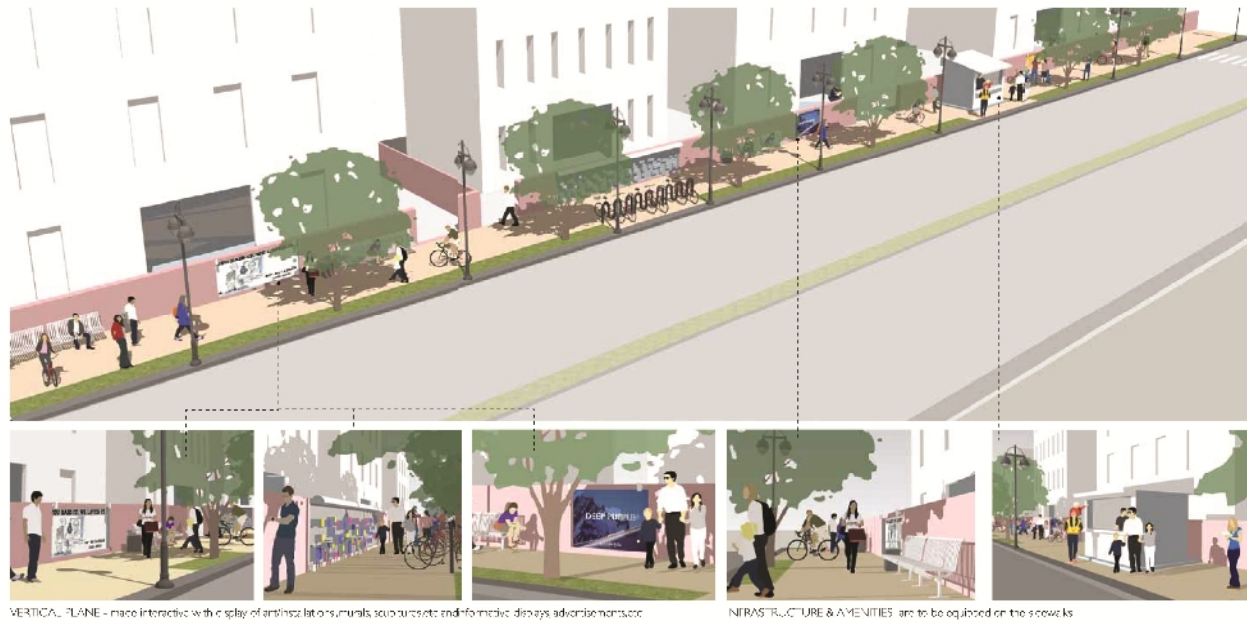


Fig.17. Illustration Area depicting Linkages 1-5, Source: Author, Movement Corridors, DUAC Report





**Fig. 18.** View showing typical sidewalk condition, Source: Author, Movement Corridors, DUAC Report.



## V. CONCLUSION

As demonstrated it is possible to link different parts of the city via natural features such as natural drains (nullahs) and large greens to provide a continuous and a seamless connection. This linkage would enable North-South and East-West movement and also ensure last mile connectivity. A similar approach can be applied to the entire city of Delhi, where the potential of natural features can be utilized to create 'Alternate Movement Corridors' for pedestrians and cyclists which would decongest our road network and help establish new

connections. These can be later explored and made interesting by including facilities (social, recreational etc.) to make the movement comfortable, safe and interesting.

## REFERENCES

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- [3]. Projects, DUAC, New Delhi (Author: Vanita Verma, et n all).