

**INTEGRATION OF OPEN SPACES TOWARDS
ENSURING A SUSTAINABLE BUILT ENVIRONMENT
CASE APPLICATION: NEWTOWN, KOLKATA**

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ABSTRACT

In Current Scenario of Open Spaces and their integrated connection is sparse. People in neighbourhoods struggle to find continuous green spaces and lack of civic amenities in them. This thesis is an attempt to highlight such a neighbourhood and connect the green spaces in and around it. After researching about the Hierarchy of Open Spaces and how sustainability is achieved at different levels, this thesis attempts to select the best possible method and apply it in order to do the same in the chosen Case Application neighbourhood. Sustainability is achieved in the neighbourhood through applying overlapping sustainability goals and parameters found through survey.

CONTENTS

- 1.Introduction
- 2.Macro Level Approach Towards Open Spaces
- 3.Neighbourhood Level Approach Towards Open Spaces
- 4.Micro Level Approach Towards Open Spaces
- 5.Case Application Area
- 6.Aims
- 7.Goals and Objectives
- 8.Scope
- 9.Limitations
- 10.Parameters
- 11.Methodology
- 12.Case Application Area Analysis
- 13.Possible Points of Interception
- 14.Case Study Examples
- 15.Design Guidelines
- 16.Overall Initial Proposals
- 17.Design
- 18.References

INTRODUCTION

OPEN SPACES

Open space is a broad term that can be used to describe all land that does not contain buildings and structures. It can include public and private land. However when we discuss about open space in design and planning we basically use the term 'open space' as 'urban open space'. (*Terminology of Urban Open and Green Spaces; Mehdi, Afsi, Yusof*)

It is believed that the term open space was first applied in 1833 by a committee in a "public trail" in London. (Maruani and Amit-Cohen, 2007). Then another definition appears in "Metropolitan Open Space Act" made in London in Britain in 1877 and then in 1906, defined the open space as any land, less than 5% of which is occupied with buildings (Wang & Gao, 2012).

One broad definition could be argued that any area within the urban envelope not occupied by buildings constitutes open space. This lead to comparing different definition by other countries. For example the London Plan defined open space as: "All land use in London that is predominantly undeveloped other than by buildings or structures that are ancillary to the open space use. The definition covers the broad range of open space types within London, whether in public or private ownership and whether public access is unrestricted, partially restricted or restricted". In city of Melbourne, Australia, open space is defined as: "publicly owned land that is set aside primarily for recreation, nature conservation, passive outdoor enjoyment and public gatherings. This includes public parks, gardens, and reserves, waterways, publicly owned forecourts and squares". (*Terminology of Urban Open and Green Spaces; Mehdi, Afsi, Yusof*)

Another definition that emphasizes the greenery aspects indicates: It is usually publicly owned land that is set aside primarily for, nature conservation, agriculture, forest, green buffers, passive outdoor enjoyment, recreation, public gatherings, and. This includes public parks, publicly owned forecourts, gardens, waterways, reserves, and squares. This term includes any open area that is owned by an agency or organization dedicated to conservation and vacant lots and brownfields that can be redeveloped into recreation areas. On the other hand open space including not only land but also water bodies such as: lakes, canals, reservoirs and rivers which improves visual amenities beside opportunities for recreation and sport (Doyle, 2012; Patrick, 2008).



(Source: Urban Land Institute)



(Source:Savannah Park/Wikipedia)



(Source: Latz+Partner)



(Source:Cambridgema/CDD)

Open space is a necessary component of housing developments, but poor design of open space can lead to unused areas, undesirable behavior, strain on management, and other difficulties. In the following sections, we will attempt to outline methods of creating successful open spaces that are attractive, comfortable, and useful for a variety of residents, appropriate to the scale of the space. In particular, we support what we consider a sustainable version of recreational open space, which includes open space that:

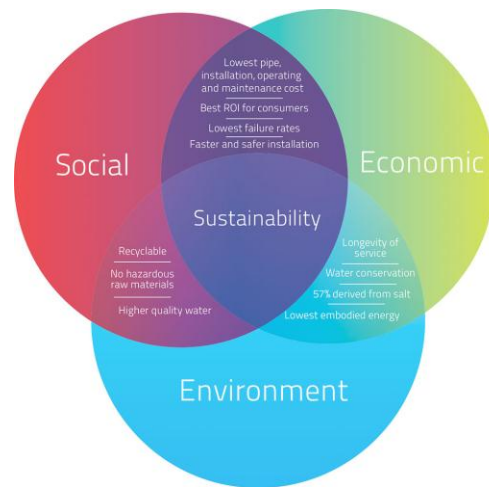
1. is reasonable to manage and upkeep;
2. adds to the value of the development;
3. is flexible in use and therefore adaptable;
4. fosters a sense of ownership so that residents become involved in maintaining the space;
5. and has a positive impact on the surrounding natural resource

Our quality of life significantly depends on open spaces. They offer facility provision for a wide range of social interactions and provide habitats for flora and fauna. A classification of spaces would be useful in preparing public open space policies and fulfilling structure plan.

The rapid growth of towns and cities in the nineteenth century led to calls for parks to be provided for the health of factory workers and consequently it benefited society as well. This could be seen as an early precedent to highlight the role of open spaces in supporting what we now call sustainable development. (Khalid Al-Hagla, 2014)

SUSTAINABILITY

The Brundtland definition states that "sustainable development is development that meets the needs of present without compromising the ability of future generations to meet their own needs(Brundtland Report,1987)



(Source:Think Pipe Think PVC)

SUSTAINABLE NEIGHBOURHOOD

There are different approaches that tackle the application of sustainability to neighbourhoods. Among these approaches, stands both social and ecological as two different but integrated perspectives. Regarding the social perspective, the overlapping area of both the terms 'neighborhood' and 'community' could be used to understand the definition that the Egan Review (2004) report 'Skills for Sustainable Communities', develops. It highlights sustainable communities as those which "meet the diverse needs of existing and future residents, their children and other users, contribute to a high quality of life and provide opportunity and choice. They achieve this in ways that make effective use of natural resources, enhance the environment, promote social cohesion and inclusion and strengthen economic prosperity". (Review, 2004:1)

It concludes that there are seven components of sustainable communities drawn from this definition; governance; transport and connectivity; services; environment; economy; housing and the built environment; sociology and culture.

From another stand point, Hugh Barton (1996) gives a different approach based on the 'Ecological Perspective'. He asserts that "One way of approaching the problem of sustainable design is to see each development as an organism or a mini ecosystem in its own right". (Barton et al, 1996) Regarding this point of view, a neighbourhood is an ecosystem in the sense that it provides the essential local habitat for humans, creating its own microclimatic conditions, and should provide as far as possible for their comfort and sustenance. (Khalid Al-Hagla, 2014)

It concludes that there are seven components of sustainable communities drawn from this definition; governance; transport and connectivity; services; environment; economy; housing and the built environment; sociology and culture.

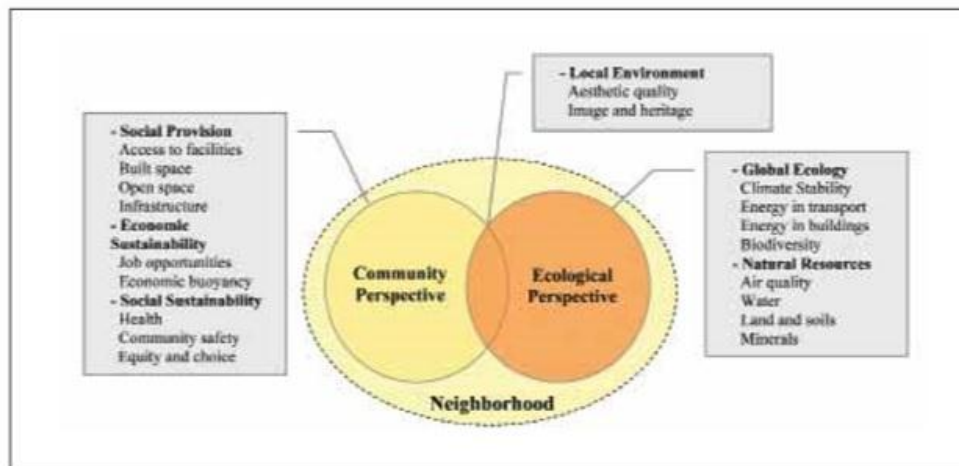
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(Source: Barton et al, 1996, Khalid Al-Hagla, 2009)

SUSTAINABILITY DIMENSIONS GOALS AND OBJECTIVES APPLIED TO A NEIGHBOURHOOD

The application of wide-scope conceptual sustainability dimensions to neighbourhoods needs them to be interpreted practically into goals and objectives. However, the following table sets the sustainability goals and objectives that have to be achieved at neighbourhood level. They are driven from the sustainability dimensions applied to the neighbourhoods.



(Source: Khalid Al-Hagla, 2009)



(Source: Attelborough Proposal JTP Architects)

MACRO LEVEL APPROACH TOWARDS OPENSACES

A COMPREHENSIVE PUBLIC OPEN SPACE CATEGORIZATION USING CLASSIFICATION SYSTEM FOR SUSTAINABLE DEVELOPMENT OF PUBLIC OPEN SPACES

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COMPREHENSIVE CATEGORIZATION OF OPEN SPACE BASED ON CLASSIFICATION METHOD

The classification method in classifying open spaces generally covers three approaches included

- i) the catchment hierarchy (who will use the open space),
- ii) function (the role of the open space) and
- iii) landscape/environmental character (what the open space looks like) .

CATCHMENT HIERARCHY

This term in some sources is simply so-called hierarchy. Hierarchy is basically determined by the:

- Geographical area being serviced(catchment)
- Size
- Level of use
- Significance

Typical size and how far a user might travel to visit the site. Catchment hierarchy reflect the distance people would be prepared to travel to use open spaces or the sphere of influence and origins of users.

FUNCTION

Each open space is assigned with a functional classification to reflect its primary use. It is used to define the purpose planned for a space. A functional classification, considering the primary purpose or use of the open space within the network. Primary use and expected activities identifies three primary types of open spaces]:

- Recreation spaces
- Sport spaces
- Nature spaces

LANDSCAPE/ENVIRONMENT SETTING

Each open space is assigned with a landscape/environmental classification that reflects its primary physical setting . A landscape setting type classification is proposed to assist with the differentiation of sites on the basis of experiences they offer and for planning, management and marketing purposes. These would be used where the setting type may not be evident from the functional classification. Landscape character is used to define the desirable landscape and/or vegetation type of a space.

METHODOLOGY

The study will engage with a qualitative approach, analysing literature and comparing different POS classification method that has been applied in several develop and developing countries. The study considers Malaysia's POS classification in three level which include the national, state and city level. It will also observe the shortcomings that exist in Malaysian POS classification as compare to other countries.

OPEN SPACE CLASSIFICATION IN OTHER COUNTRIES AND MALAYSIA

UNITED STATES

Michigan

| Classification |
|--|
| Mini-Parks |
| Neighbourhood Park |
| School-Park |
| Community Park |
| Large Urban Park |
| Natural Resource Areas |
| Greenways |
| Sports Complex |
| Special Use |
| *Private Park / Recreation Facility |

**Parks and recreation facilities that are privately owned yet contribute to the public park and recreation system.*

City Of Coon Rapids

| Classification |
|------------------------------------|
| Mini And Neighbourhood Park |
| Community Park |
| Youth Athletic Complex |
| Community Athletic Complex |
| Community Preserve |
| Protected Open Space |
| Special Use Park |
| Regional Park |
| School Site |

SINGAPORE

| Zoning | Example of Developments |
|---------------------|--|
| Open Space | <ol style="list-style-type: none"> 1. Wooded Area 2. Swamp Area 3. Natural Open Space 4. Public Promenades 5. Outdoor Pedestrian Malls 6. Landscaped Plazas |
| Park | <ol style="list-style-type: none"> 1. National Park 2. Regional Park 3. Community/Neighbourhood Park 4. Park Connectors 5. Zoological Gardens, Botanic Gardens, |
| Beach Area | Nil |
| Sports & Recreation | <ol style="list-style-type: none"> 1. Sports Complex/ Indoor Stadium 2. Swimming Complex 3. Golf Course 4. Golf Driving Range 5. Recreation Club 6. Campsite 7. Chalet 8. Marina 9. Water Sports Centre 10. Outward Bound School 11. Theme Park |

UK

London

| Open Space Category |
|------------------------|
| Regional |
| Metropolitan |
| District / Major Parks |
| Local Parks |
| Small Local Parks |
| Pocket Parks |
| Linear Open Spaces |

AUSTRALIA

City of Marion

| |
|-------------------------|
| User Catchment Level |
| Local Level Distributed |
| Neighbourhood Level |
| Precinct Level |
| Regional Level |
| State Level Land |

User Catchment levels and classifications, Open Space & Recreation Strategy 2006 – 2016, City of Marion, 2006

| |
|---|
| Functional Classifications |
| Recreation - Structured, Physically Active |
| Recreation -Unstructured, Physically Active |
| Recreation - Structured, Passive |
| Recreation - Unstructured, Passive |
| Physical Activity / Linkage |
| Cultural / Heritage |
| Tourism |
| Visual Amenity / Environmental |
| Unclassified |

Functional classifications, Open Space & Recreation Strategy 2006 – 2016, City of Marion, 2006

| |
|---|
| Landscape/Environmental Classifications |
| Formal / Landscaped |
| Turf / Lawn |
| Watercourse |
| Natural Area |
| Undeveloped Area |
| Wetland |
| Drainage / Stormwater |
| Buffer |
| Hard Surface |
| Coastal |
| Unclassified |

Landscape/Environmental classifications, Open Space & Recreation Strategy 2006 – 2016, City of Marion, 2006

Hume City Council

| Level of Hierarchy |
|--------------------|
| Neighbourhood |
| Sub-Regional |
| Regional |

Hierarchical classifications, Hume City Open Space Classification System, Hume City Council, 2003

| Function Name |
|--|
| Access Way / Linkage / Bicycle Or Walking Trail |
| Community Horticulture / Vegetable Growing / Farming |
| Conservation of Flora & Fauna |
| Crematoria / Remembrance Garden / Cemetery |
| *Cultural / Community Gathering / Event |
| Drainage / Storm Water Management |
| Environmental/Visual Amenity |
| Family/Social Recreation |
| Historic/Cultural Protection |
| Indoor Community Activity Centre |
| Outdoor Sports |
| Play Space |
| Relaxation / Contemplation / Urban Escape |
| Water Based Recreation |

Functional classifications, Hume City Open Space Classification System, Hume City Council, 200

| Landscape Character |
|---|
| Bushland |
| Creek/River Corridor |
| Formal Ornamental Garden |
| Lake |
| Lawn or Managed Turf |
| Narrow Grass Or Paved Corridor |
| Native Grassland |
| Open Grassy Area |
| Open Parkland |
| Outdoor Sports Facilities |
| Road Side Plantation / Tree Reserve |
| Rough Unmanicured Area |
| Vegetable Garden /Pasture / Agriculture |
| Wetland |

Landscape character classification, Hume City Open Space Classification System, Hume City Council, 2003

City Of Maroondah

| |
|---|
| Function |
| Play |
| Social Family / Recreation |
| Community Horticulture |
| Cemetery / Memorial / Remembrance |
| Ornamental / Botanic Garden |
| Access Way / Trail |
| Sport |
| Flora / Fauna Conservation |
| Drainage / Stormwater Management / Floodway |
| Visual Amenity |
| Community Facility Forecourt |
| No Identified Function |
| Conservation of Cultural Heritage |
| Relaxation / Contemplation / Escape |
| Lookout / Ridgeline Reserve |
| Water Based Recreation |
| School / Educational Institute |

| |
|---|
| Function |
| Play |
| Social Family / Recreation |
| Community Horticulture |
| Cemetery / Memorial / Remembrance |
| Ornamental / Botanic Garden |
| Access Way / Trail |
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| School / Educational Institute |

Contextual or catchment classification, An Open Space Strategy for the City of Maroondah, 2005

Functional classification, An Open Space Strategy for the City of Maroondah, 2005

| |
|--|
| Landscape Setting Types |
| Bushland / Forest |
| Exotic, Ornamental or Specimen Plantings |
| Open Grassland |
| Specialised Sports Surfaces (e.g. Synthetic or Enclosed) |
| Lawn or Managed Turf |
| Open Parkland |
| Creek Corridor |
| Lake / Waterbody |
| Rough Natural Area |
| Paved Area |
| Crop or Plantation |
| Tree Plantation |
| Wetland |
| House Built on Reserve |

Landscape classification, An Open Space Strategy for the City of Maroondah, 2005

City of Melbourne

| |
|------------------|
| Hierarchy |
| Capital City |
| State |
| Regional |
| Municipal |
| Neighbourhood |
| Local |
| Small Local |
| Small Local Link |

Hierarchy of open space, City of Melbourne Open Space Strategy Technical Report, 2012

| |
|----------------------------------|
| Character Classification |
| Botanical |
| Civic Space |
| Events |
| Formal |
| Heritage |
| Informal Use |
| Linear |
| Linking Space |
| Nature Conservation |
| Play |
| Railway Easement/Siding |
| Recreation |
| Restricted Sporting / Recreation |
| Seating / Viewing |
| Service Easement |
| Significant Road Reservation |
| Sporting |
| Square |
| Undeveloped |
| Urban Plaza |
| Water Feature |
| Waterway |

Open space character classification, City of Melbourne Open Space Strategy Technical Report, 2012

MALASIA

National Level: Department of Town and Country Planning, Malaysia

| Hierarchy | Size (ha.) | Population Catchment |
|---------------|------------|----------------------|
| National | Unlimited | National |
| Regional | 100 | Regional |
| Urban | 40 | > 50,000 |
| Local | 8 | 12,000 - 50,000 |
| Neighbourhood | 2 | 3,000 - 12,000 |
| Playing Field | 0 - 0.6 | 1,000 - 3,000 |
| Playground | 0 - 0.2 | 300 - 1,000 |
| Roof Garden | Varies | Target Group |

Catchment hierarchy classification, Hierarchy of Open Spaces, Town and Country Planning Department Peninsular Malaysia (2002)

State Level: State of Selangor

| Hierarchy | Size (ha.) | Service Distance |
|---------------|------------|------------------|
| Urban | 40-100 | Within 5km |
| Local | 8-40 | Within 3km |
| Neighbourhood | 2-8 | Within 1.5km |
| Playground | 0.6-2 | Within 1km |
| Playing Lot | 0.2-0.6 | Within 0.5km |

Catchment hierarchy classification, Guidelines on hierarchy of open space, Manual Planning Standard and Guidelines Selangor, 2nd ed., 2010.

City Level: Kuala Lumpur

| Hierarchy | Minimum Size | Population |
|--------------------|--------------|------------|
| District Park | 40 ha | 200,000 |
| Neighbourhood Park | 10 ha | 50,000 |
| Local Park | 2 ha | 20,000 |
| Local Play Area | 0.5 ha | 5,000 |
| Sport Complex | 2.5 ha | 50,000 |

Catchment hierarchy classification, Open Spaces, Recreational and Sports Facilities, Kuala Lumpur Structure Plan 2020, (2004)

ANALYSIS OF COMPARISON

The analysis of each city in several countries reveals that Australia comprehensive POS classification could inspired in development of a similar classification system for Malaysia. Therefore the POS classification provided by the cities of Australia could be adopted and adapted to affectively assist in proposing a comprehensive POS classification system for Malaysian context. In addition to Australia, the items used in the cities of the US, Singapore and London open space classification will also apply.

RESULT AND DISCUSSION

In following table a cumulative list of items in all three approaches included 'catchment hierarchy', 'function', and 'landscape/environmental character' proposed as a new 'comprehensive POS classification' for Malaysia .

| Hierarchy | Function | Landscape / Environmental Character |
|--------------------------------------|---|--|
| • National Open Space | • Bicycle Or Walking Trail / Linear Open Space / Access Way | • Bushland |
| • Regional Open Space | • Park Connectors / Greenways / Linking Space / Corridor Link | • Creek / River Corridor / Watercourse / Waterway |
| • Sub-Regional Open Space | • Community Garden / Urban Agriculture / Farming | • Lawn, Managed Turf |
| • State Level Open Space | • Nature Conservation | • Paved Area / Landscaped Piazzas |
| • Capital City / District Open Space | • Community Gathering / Event | • Open Grassland |
| • Urban Open Space | • Drainage / Stormwater Management / Floodway | • Rough Natural Area / Natural Open Space |
| • Municipal Open Space | • Visual / Landscape Amenity | • Vegetable Garden / Plantation, Agriculture |
| • Local Open Space | • Community Facilities, Social Recreation | • Sports Surfaces / Hard Surface, Facilities |
| • Neighbor-Hood Open Space | • Recreation - Structured, Passive | • Road Side Plantation / Significant Road Reservation / Wooded Area / Buffer |
| • Small Open Space (Pocket Park) | • Historic / Cultural Heritage | • Railway Easement / Siding |
| | • Sport / Athletic Facility / Playing Field | • Open Parkland |
| | • Play Space / Playground | • Lake, Wetland / Swamp Area / Waterbody |
| | • Informal Recreation / Recreation - Unstructured, Passive / Informal Use / Relaxation / Contemplation / Urban Escape | • Formal / Formal Ornamental Garden / Landscaped |
| | • Water Based Recreation / Water Feature | • Beach Area / Coastal |
| | • Ornamental, Botanic, Zoological Garden | • Undeveloped / Unclassified Area |
| | • Special Use / Unclassified | • Open Grassy Area |
| | • School, Educational / Institute Space | • House Built on Reserve |
| | • Cemetery / Memorial / Remembrance | |
| | • Tourism | |
| | • Roof Garden | |
| | • Private Open Space (Open To Public), Recreation Facility | |
| | • Youth Athletic Complex | |
| | • Community Preserve | |
| | • Wildlife Corridor | |
| | • Indoor Community / Activity Centre | |
| | • Informal Recreation Node | |
| | • Lookout Space / Seating / Viewing, Ridgeline Reserve | |
| | • Civic Space | |
| | • Restricted Sporting / Recreation -Unstructured, Physically Active / Recreation | |
| | • Service Easement | |
| | • Square | |
| | • Urban Plaza | |

CONCLUSION

This study presented three level of classification in Malaysia. The investigation in all three levels revealed that the open space classifications are mainly based on 'catchment hierarchy' approach. In other words, there is a lack of comprehensive open space classification in Malaysia. Therefore a comprehensive classification as a framework would be a useful tools for sustainable development and management of public open spaces.

NEIGHBOURHOOD LEVEL APPROACH TOWARDS OPEN SPACES

TOWARDS A SUSTAINABLE NEIGHBORHOOD: THE ROLE OF OPEN SPACES

Author: Khalid Al-Hagla

OPEN SPACE MORPHOLOGY OF NEIGHBOURHOODS

Open spaces in neighbourhoods are defined as ‘any unbuilt land within the boundary or designated envelope of a neighbourhood which provides, or has the potential to provide, environmental, social and/or economic benefits to communities, whether direct or indirect.’ (Campbell, 2001) They could be classified into: -

GREENSPACE: a sub-set of open space, consisting of any vegetated land or structure, water or geological feature within urban areas.



(Source: KSMU Documentary on Olmsted)



(Source: Arch 20)



(Source: dcla.net)

GREYSPACE: (sometimes referred to as “civic space”): a sub-set of open space, consisting of urban squares, market places and other paved or hard landscaped areas with a civic function.



(Source:Pinterest)



(Source:Herskhazen)



(Source:Gillespies)

Moreover seven distinct sub-sets of publicly accessible greenspace, could be realized each with a specific and distinct primary function (Campbell, 2001):

1. **PARKS AND PLAYGROUNDS:** areas of land, normally enclosed, designed, constructed, managed and maintained as a public park or garden. Their primary function is for informal activity or relaxation, social and community purposes.
2. **AMENITY GREENSPACE:** Managed and maintained landscaped areas with no designated specific use by people, but providing visual amenity or separating different buildings or land uses for environmental, visual or safety reasons.
3. **CHILDREN’S PLAY AREAS:** The primary function of these areas is to provide safe facilities for children to play, usually close to home and under informal supervision from nearby houses.

4. **SPORTS FACILITIES:** Designed, constructed, managed and maintained large and generally (although not always) flat areas of grassland or specially-designed artificial surfaces, used primarily for designated sports. The primary function of these areas is to accommodate practice, training and competition for recognized outdoor sports.

5. **GREEN CORRIDORS:** Routes linking different areas within a town or city as part of a designated and managed network and used for walking, cycling or horse riding or linking towns and cities to their surrounding countryside or country parks. The primary function of green corridors is to allow safe, environment-friendly movement within urban areas. Moreover, they support wildlife colonization and therefore habitat creation.

6. **NATURAL/SEMI-NATURAL GREEN SPACES:** Undeveloped land with little or only limited maintenance which have been planted with wild flowers or colonized by vegetation and wildlife. They also include woodland, railway embankments, river and canal banks and derelict land, which may in some cases be thought of as temporary natural greenspace. The primary function of natural greenspaces is to promote biodiversity and nature conservation.

7. **OTHER GREEN SPACES:** Essentially allotments, the yards of religious buildings and cemeteries.

There are also various types of Greyspace (civic space), including:

1. **CIVIC SQUARES AND PLAZAS:** Often containing statues or fountains and primarily paved, sometimes providing a setting for important public buildings.
2. **MARKET PLACES:** Usually with historic connotations.
3. **PEDESTRIAN STREETS:** Usually former roads which have been paved over and provided with seats and planters.
4. **PROMENADES AND SEA FRONTS:** Usually used for recreational activities. They have special value when located at historical areas.

THE ROLE OF OPEN SPACE IN ACHIEVING SUSTAINABLE NEIGHBOURHOOD

The role that is assigned to open spaces to play within the neighborhood structure, to achieve sustainability goals and objectives, is formulated in three key issues(Campbell, 2001, Ironside, 1999, Birkeland 2004) :

■ SPACE MANAGEMENT

This includes:

- encouraging sustainable lifestyles, for example by providing paths and cycle routes
- making maximum use of existing features and assets

- strengthening the sense of place
- incorporating local or recycled materials
- encouraging community participation and involvement
- reducing inputs of non-renewable resources during construction and subsequent maintenance
- eliminating or reducing the use of herbicides and resources that affect other ecosystems
- encouraging habitat creation and native planting
- managing resources carefully

■ SPACE FUNCTION(Circulation of People and Permeability)

While most modern development planning uses the road network as the key structural element, a sustainable design takes the circulation of people on foot and bike and the effectiveness of public transport as starting points (Barton, 1996). “Communities can support walking and cycling if they are developed with meaningful destinations in close proximity to each other, such as shopping, school and employment”. (National NeighborhoodCoalition,2005)

The objectives are to:

- reduce the level of car reliance,
- reduce the need to travel
- with the social benefits of increasing transport choice for all groups in the population
- enhancing local security and community

■ THE ROLE OF OBJECTS WITHIN SPACE(Sustainable Landscape)

Landscaping elements are the basic constituent of any open space’s structure. They have to be utilized to achieve sustainability goals at the micro level. Janis Birkeland (2004) draws a framework for sustainable landscaping elements as they should:

-Return to original sources of inspiration, whether nature or culture.
(Papnek, 1984).

-Respond to the site, designing in harmony with its distinctive character to enable the unfolding of the landscape's ecological potential over time.

- Minimize inputs of materials and energy and maximize outputs of renewable and reusable resources.

- Maximize resilience and dynamic stability in the landscape in such a way that each element fulfils several functions and each function is undertaken by several elements.

- Create 'place' as distinct from merely manipulating space, in such a way that the design maximizes the potential for user interaction with the environment.

- Make systems visible, which means making environmental processes apparent and celebrating them.

- Minimize maintenance and maintain to enable full expression of design, acknowledging that ongoing management is itself an aspect of design, to ensure the continuity of sustainable outcomes.

OPEN SPACE SUSTAINABILITY PARAMETERS

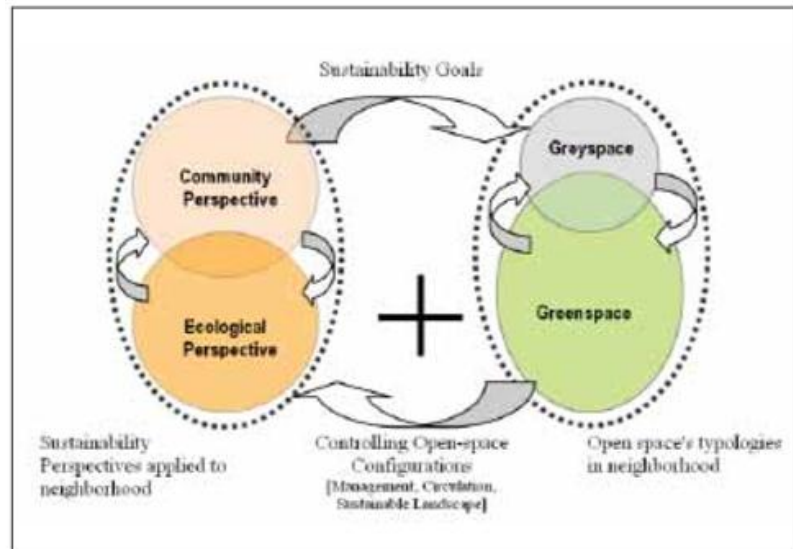
A proposal of a three dimensional matrix that consists of two main parts was given:-

1. A two dimensional matrix that investigates the relationship between the sustainability goals and objectives, and the different types of open spaces in a neighbourhood. This matrix indicates the roles and responsibilities that each of these types has to play –divided mainly into categories of 'greenspaces' and 'greyspaces'. This answers the question about 'What' are the goals and objectives that the open spaces in a neighbourhood have to achieve.
2. A two dimensional matrix that correlates the assigned sustainability parameters (checklist) –driven out of three main sustainability issues, management, circulation, and sustainable landscape– with the open

spaces categories of neighbourhoods, 'greenspaces' and 'greyspaces'. This answers the question of 'How' these goals and objectives could be achieved.

The overlapping answers of these two questions draw the dimensions of the developed three dimensional matrix. (Fig.7)

However this matrix could be used to develop a further checklist for evaluating the open spaces performance in neighbourhoods. This



(Source: Khalid Al-Hagla)

could be achieved in three consequent steps as follows [numerically indicated in Fig.8]. :-

- The first, is to determine which type of open space the study wants to investigate

- The second, is to determine the sustainability goals and objectives that are assigned to this type of open space and have to be achieved in the neighbourhood. [table 1]

- The third, is to develop a checklist of the sustainability parameters assigned to this type of open space. [table 2]

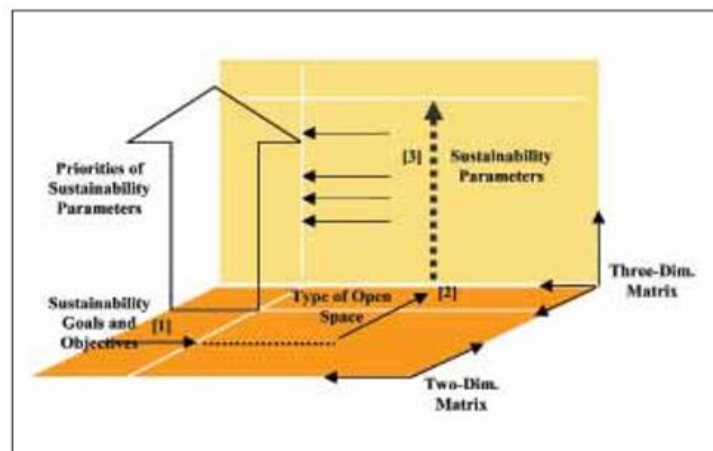


Figure 8: Three Dimension Matrix Correlates Types of Open Space to Sustainability Attributes (Source: Khalid Al-Hagla)

| Sustainability Parameters | | Green Space | | | | | | | | | | Grey Space | | | | | | | |
|---------------------------|--|--|--|-----------------------|-------------------|-----------------|----------------------------------|------------------------------|--------------|---------------|--------------------|---------------------------|---|---|---|---|---|---|---|
| | | Parks and gardens | Amenity greenspace | Children's play areas | Sports facilities | Green corridors | Natural/semi-natural greenspaces | Other functional greenspaces | Chic squares | Market places | Pedestrian streets | Promenades and sea fronts | | | | | | | |
| Space Management | <ul style="list-style-type: none"> encouraging sustainable lifestyles, for example by providing paths and cycle routes making maximum use of existing features and assets strengthening the sense of place incorporating local or recycled materials encouraging community participation and involvement reducing inputs of non-renewable resources during construction and maintenance eliminating or reducing the use of resources that affect other ecosystems encouraging habitat creation and native planting managing resources carefully | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| | Circulation | <ul style="list-style-type: none"> reduce the level of car reliance the effectiveness of public transport reduce the need to travel social benefits of increasing transport choice for all groups population enhancing local security and community | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| | | Quality Greenspace | <ul style="list-style-type: none"> Return to original sources of inspiration Respond to the site <ul style="list-style-type: none"> creating connections and themes within and across sites transforming site constraints into environmental opportunities minimizing negative environmental impacts maximizing positive impacts, off-site as well as internally Minimize inputs of materials and energy and maximize outputs of renewable and reusable resources Maximize resilience <ul style="list-style-type: none"> maximizing the diversity [landscape elements and the diversity of relationships] creating opportunities for the emergence of self-sustaining and self-regulating systems Create 'place' as distinct from merely manipulating space Make systems visible, which means making environmental processes apparent and celebrating them Minimize maintenance meet the varied recreation and leisure needs of users involve local communities | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

Table 1: Sustainability Matrix-A (correlating sustainable development with open space typologies (Source: Khalid Al-Hagla)

| Sustainability Goals | | Sustainability Objectives | | Green Space | | | | | | | | | | Grey Space | | | | |
|---------------------------------------|--------|--|---|-------------------|--------------------|-----------------------|-------------------|-----------------|----------------------------------|------------------------------|--------------|---------------|--------------------|---------------------------|---|---|---|---|
| | | | | Parks and gardens | Amenity greenspace | Children's play areas | Sports facilities | Green corridors | Natural/semi-natural greenspaces | Other functional greenspaces | Chic squares | Market places | Pedestrian streets | Promenades and sea fronts | | | | |
| Cutting greenhouse gas emissions | Energy | <ul style="list-style-type: none"> Reduce the need to travel Reduce car reliance Increase energy efficiency in buildings | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| | | <ul style="list-style-type: none"> Reduce demand for non-renewable resources Reuse and recycling of resources locally Local water sourcing, treatment and aquifer recharge Local low-input food production | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Enhancing local environmental quality | | <ul style="list-style-type: none"> Promote local distinctiveness and heritage Create an attractive public realm Enhance local habitat diversity | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | | <ul style="list-style-type: none"> Improve local air quality Promote an active life-style (especially walking) Encourage consumption of fresh fruit and vegetables | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Increasing street safety | | <ul style="list-style-type: none"> Reduce the chance of vehicle/pedestrian accidents Reduce the fear of violence | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | | <ul style="list-style-type: none"> Choice of transport mode for trips More facilities accessible locally | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Equity and social inclusion | | <ul style="list-style-type: none"> Choice of facilities within easy walking distance Viability of public transport | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | | <ul style="list-style-type: none"> Accessible jobs for those tied to the locality Reduce transport emissions | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Value of local community | | <ul style="list-style-type: none"> Facilitate accessible social networks Promote mental health | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | | <ul style="list-style-type: none"> Increase user/citizen control Management of decentralized systems | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

Table 2: Sustainability Matrix-B (correlating sustainable development with open space typologies (Source: Khalid Al-Hagla)

UTILIZING THE MATRIX IN EVALUATING OPEN SPACE SUSTAINABILITY PERFORMANCE

The study applies its findings to two different types of open spaces:

1. Beirut Pine ‘Horsh Beirut’ that is classified as a ‘Greenspace’ serving number of functions –parks and gardens, children playgrounds, and sports facilities.

2. The pedestrian open spaces at Byblos. They are classified as ‘Greyspaces’, however they function as: market places and pedestrian streets.

To determine the priorities of sustainability goals and objectives that have to be achieved through this multi functional greenspace, the paper assigns a relative weight equivalent to the type of influence that each space typology affects sustainability performance (2 to direct influence, 1 to indirect influence, and 0 to no influence). Reading table (3), and according to the shown relative scale, sustainability goals and objectives, could be re-arranged regarding their importance (indicated at the last column-right).

BEIRUT PINE ‘HORSH BEIRUT’

| | | Beirut Pine 'Horsh Beirut' | | | |
|--|--|----------------------------|-----------------------|-------------------|-------------------|
| Sustainability Goals | Sustainability Objectives | Parks and gardens | Children's play areas | Sports facilities | Assignment Weight |
| Cutting greenhouse gas emissions Energy | Reduce the need to travel | | ■ | ■ | 2 |
| | Reduce car reliance | | | | 0 |
| | Increase energy efficiency in buildings | | | | 0 |
| Closing local resource loops | Reduce demand for non-renewable resources | ■ | ■ | | 3 |
| | Reuse and recycling of resources locally | ■ | | | 1 |
| | Local water sourcing, treatment and aquifer recharge | ■ | | | 1 |
| | Local low-input food production | ■ | | | 1 |
| Enhancing local environmental quality | Promote local distinctiveness and heritage | ■ | ■ | | 3 |
| | Create an attractive public realm | ■ | ■ | ■ | 6 |
| | Enhance local habitat diversity | ■ | | | 2 |
| Creating a healthy environment | Improve local air quality | | ■ | ■ | 3 |
| | Promote an active life-style (especially walking) | ■ | ■ | ■ | 4 |
| | Encourage consumption of fresh fruit and vegetables | | | | 0 |
| Increasing street safety | Reduce the chance of vehicle/pedestrian accidents | | ■ | ■ | 3 |
| | Reduce the fear of violence | | | | 0 |
| Increasing accessibility and freedom of choice | Choice of transport mode for trips | | ■ | ■ | 4 |
| | More facilities accessible locally | | ■ | ■ | 4 |
| Equity and social inclusion | Choice of facilities within easy walking distance | | ■ | ■ | 3 |
| | Viability of public transport | | | | 0 |
| Local work opportunities | Accessible jobs for those tied to the locality | | ■ | | 1 |
| | Reduce transport emissions | ■ | | | 2 |
| Value of local community | Facilitate accessible social networks | ■ | ■ | ■ | 5 |
| | Promote mental health | ■ | ■ | ■ | 6 |
| Increasing local self-determination | Increase user/citizen control | | ■ | | 1 |
| | Management of decentralized systems | | | | 0 |

The matrix correlates different sustainability goals and objectives to the composite typology of the Beirut Pine ‘Horsh Beirut’ greenspace.

Table (3) shows that: for Beirut Pine ‘Horsh Beirut’ –in its composite greenspace typology-, the sustainability goals that have the first priority to be achieved are to: Enhance local environmental

quality and To increase the value of local community.



Figure 9: Different Activities Performed in the Beirut Pine 'Horsh Beirut', [park and gardens, children's play area, and sports Facilities] (Source: Khalid Al-Hagla)

Moreover, the sustainability objectives are: to create an attractive public realm, to promote mental health, and to facilitate accessible social networks.

Table (4) shows that: the most important sustainability indicators are as follows:

- Does the Beirut Pine 'Horsh Beirut'?
- Strengthening the sense of place?
- Encourage community participation and involvement?
- Meet the varied recreation and leisure needs of users?
- Reduce the need to travel?

| Sustainability Parameters | | Grey Space | | | | |
|--------------------------------|---|--|-----------------------|-------------------|-----------------|---|
| | | Parks and gardens | Children's play areas | Sports facilities | Assigned Weight | |
| Space Management | • encouraging sustainable lifestyles, for example by providing paths and cycle routes | ■ | | ■ | 2 | |
| | • making maximum use of existing features and assets | ■ | ■ | | 2 | |
| | • strengthening the sense of place | ■ | ■ | | 4 | |
| | • incorporating local or recycled materials | | ■ | | 1 | |
| | • encouraging community participation and involvement | | ■ | ■ | 4 | |
| | • reducing inputs of non-renewable resources during construction and maintenance | ■ | ■ | | 2 | |
| | • eliminating or reducing the use of resources that affect other ecosystems | ■ | ■ | | 2 | |
| | • encouraging habitat creation and native planting | ■ | | | 2 | |
| • managing resources carefully | ■ | | | 1 | | |
| Circulation | • reduce the level of car reliance | | | | 0 | |
| | • the effectiveness of public transport | | | | 0 | |
| | • reduce the need to travel | ■ | ■ | ■ | 3 | |
| | • social benefits of increasing transport choice for all groups population | | | | 0 | |
| | • enhancing local security and community | ■ | | ■ | 3 | |
| Quality Greenspace | • Return to original sources of inspiration | ■ | ■ | | 3 | |
| | Respond to the site | • creating connections and themes within and across sites | ■ | | | 1 |
| | | • transforming site constraints into environmental opportunities | ■ | | ■ | 2 |
| | | • minimizing negative environmental impacts | ■ | | | 1 |
| | | • maximizing positive impacts, off-site as well as internally | ■ | ■ | | 2 |
| | Maximize resilience | • Minimize inputs of materials and energy and maximize outputs of renewable and reusable resources | ■ | | | 1 |
| | | • maximizing the diversity [landscape elements and the diversity of relationships] | ■ | | | 2 |
| | | • creating opportunities for the emergence of self-sustaining and self-regulating systems | ■ | | | 1 |
| | | • Create 'place' as distinct from merely manipulating space | ■ | ■ | | 3 |
| | | • Make systems visible, which means making environmental processes apparent and celebrating them | ■ | | | 1 |
| | | • Minimize maintenance | ■ | ■ | | 2 |
| | | • meet the varied recreation and leisure needs of users | ■ | | ■ | 4 |
| • involve local communities | | | ■ | ■ | 4 | |

Table 4: Applying Sustainability Matrix to the Beirut Pine 'Horsh Beirut' Greenspace

- Enhance local security and community?
- Return to original sources of inspiration?
- Create 'place' as distinct from merely manipulating space?

PEDESTRIAN STREETS AND HISTORICAL MARKETPLACE BYBLOS



Table (5) shows that: for the pedestrian open spaces at Byblos, the sustainability goals that have the first priority to be achieved are to: enhancing local environmental quality, increasing both the value of local community and street safety. The sustainability objectives are to: Promote local distinctiveness and heritage, Facilitate accessible social networks,

Reduce car reliance, Create an attractive public realm, Reduce the fear of violence, and Promote an active life-style (especially walking).

| Sustainability Goals | Sustainability Objectives | Market spaces at Byblos | | |
|--|--|-------------------------|--------------------|-----------------|
| | | Market place | Pedestrian streets | Assigned Weight |
| Cutting greenhouse gas emissions Energy | • Reduce the need to travel | ■ | ■ | 2 |
| | • Reduce car reliance | ■ | ■ | 3 |
| Closing local resource loops | • Increase energy efficiency in buildings | | | 0 |
| | • Reduce demand for non-renewable resources | | ■ | 1 |
| | • Reuse and recycling of resources locally | | | 0 |
| | • Local water sourcing, treatment and aquifer recharge | | | 0 |
| Enhancing local environmental quality | • Local low-input food production | | | 0 |
| | • Promote local distinctiveness and heritage | ■ | ■ | 4 |
| | • Create an attractive public realm | ■ | ■ | 3 |
| Creating a healthy environment | • Enhance local habitat diversity | | ■ | 1 |
| | • Improve local air quality | | ■ | 1 |
| | • Promote an active life-style (especially walking) | ■ | ■ | 3 |
| Increasing street safety | • Encourage consumption of fresh fruit and vegetables | | | 0 |
| | • Reduce the chance of vehicle/pedestrian accidents | | ■ | 2 |
| Increasing accessibility and freedom of choice | • Reduce the fear of violence | ■ | ■ | 2 |
| | • Choice of transport mode for trips | | | 0 |
| Equity and social inclusion | • More facilities accessible locally | ■ | | 1 |
| | • Choice of facilities within easy walking distance | ■ | ■ | 2 |
| Local work opportunities | • Viability of public transport | | | 0 |
| | • Accessible jobs for those tied to the locality | ■ | | 1 |
| Value of local community | • Reduce transport emissions | | ■ | 2 |
| | • Facilitate accessible social networks | ■ | ■ | 4 |
| Increasing local self-determination | • Promote mental health | | ■ | 1 |
| | • Increase user/citizen control | | ■ | 2 |
| | • Management of decentralized systems | ■ | | 1 |

Table 5: Sustainability Goals, Byblos

The matrix correlates different sustainability goals and objectives to the composite typology of the Byblos greyspaces.

| Sustainability Strategies | | Market spaces at Byblos | | | |
|---|---|--|-----------------------|-----------------|---|
| | | Market places | Public realm elements | Assigned Weight | |
| Space Management | encouraging sustainable lifestyles, for example by providing paths and cycle routes | ■ | ■ | 2 | |
| | making maximum use of existing features and assets | ■ | ■ | 1 | |
| | strengthening the sense of place | □ | ■ | 3 | |
| | incorporating local or recycled materials | ■ | ■ | 2 | |
| | encouraging community participation and involvement | ■ | ■ | 1 | |
| | reducing inputs of non-renewable resources during construction and maintenance | ■ | ■ | 3 | |
| | eliminating or reducing the use of resources that affect other ecosystems | ■ | ■ | 0 | |
| | encouraging habitat creation and native planting | ■ | ■ | 1 | |
| | managing resources carefully | ■ | ■ | 0 | |
| | reduce the level of car reliance | ■ | ■ | 3 | |
| Circulation | the effectiveness of public transport | ■ | ■ | 0 | |
| | reduce the need to travel | ■ | ■ | 3 | |
| | social benefits of increasing transport choice for all groups population | ■ | ■ | 1 | |
| | enhancing local security and community | ■ | ■ | 4 | |
| Quality Greenspace | Return to original sources of inspiration | ■ | ■ | 3 | |
| | Respond to the site | creating connections and themes within and across sites | ■ | ■ | 0 |
| | | transforming site constraints into environmental opportunities | ■ | ■ | 2 |
| | | minimizing negative environmental impacts | ■ | ■ | 0 |
| | | maximizing positive impacts, off-site as well as internally | ■ | ■ | 0 |
| | Maximize resilience | Minimize inputs of materials and energy and maximize outputs of renewable and reusable resources | ■ | ■ | 2 |
| | | maximizing the diversity [landscape elements and the diversity of relationships] | ■ | ■ | 1 |
| | | creating opportunities for the emergence of self-sustaining and self-regulating systems | ■ | ■ | 0 |
| | | Create 'place' as distinct from merely manipulating space | ■ | ■ | 4 |
| | | Make systems visible, which means making environmental processes apparent and celebrating them | ■ | ■ | 0 |
| Minimize maintenance | | ■ | ■ | 4 | |
| meet the varied recreation and leisure needs of users | ■ | ■ | 0 | | |
| involve local communities | ■ | ■ | 0 | | |

Table 5: Sustainability Parameters, Byblos

The matrix correlates different sustainability 'Parameters' to the composite typology of the Byblos greyspaces.

Table (6) shows that: the most important sustainability indicators are as follows:

Do the greyspaces at Byblos?

- Enhance local security and community?
- Create 'place' as distinct from merely manipulating space?
- Return to original sources of inspiration?
- Strengthen the sense of

place?

- Reducing inputs of non-renewable resources during construction and maintenance?
- Reduce the level of car reliance and need to travel?

CONCLUSION

This paper proposed an approach based on the intersecting area of both social and ecological approaches to investigate the potential of open space to achieve sustainability goals and objectives in neighborhoods. Such an approach is chiefly based on the dual role that open spaces play in articulating the character of neighborhoods. They are the domain for different social interactions and shared community activities, and the field of micro-ecological features to express their personality. The application comes to determine the priorities of both sustainability goals and objectives, and sustainability parameters that have to be evaluated at each area.

MICRO LEVEL APPROACH TOWARDS OPEN SPACES

Vanke Vision: Sustainable Residential Development in Shanghai Urban Planning and Design Handbook Vol. 1. Research Seminar and Field Survey|February2006

Massachusetts Institute of Technology Department of Urban Studies and Planning City Design and Development Group

DIVISION OF OPEN SPACES IN TERMS OF SCALE

In terms of scale, open space is divided into :-

Urban Public Open Space

SIZE: 40 feet- 450 feet or 70-100 M (Maximum distance for being able to see facial expressions: 20-25 m)

Service area: 900 feet or 4- minute walk

LOCATION: Corner location, mid-block location, a widened sidewalk. Mixed use, closed to retail stores & restaurants. Connect to pedestrian system

USES AND ACTIVITIES: Almost all, group and individual use Main features: Central, equal access, variety of elements.

Community Public Open Space

SIZE: various

2 FACTORS THAT AFFECT THE DESIGN: the overall surrounding

housing density & income

USES AND ACTIVITIES: Smaller gatherings and play spaces, multi-purpose but for fewer uses

MAIN FEATURES: Supplements to public spaces, smaller, quieter, closer to home .

Semi-Private Open Space

SIZE: One house lot wide

LOCATION: Corner lots, mid-block lots, through-the-block lots

SITE SELECTION: four-block radius walking without major streets

USES AND ACTIVITIES: Gardens, visual enjoyment only, circulation

MAIN FEATURES: Near/between buildings, number and location of building entrances determines type and frequency of use. Often separated with fences or landscaping.

OVERVIEW OF OPEN SPACE DESIGN

In the following section we will analyze the design of open space according to different categories, including:

1. Use
2. Comfort
3. Visual Quality
4. Safety
5. Convenience/Access

USE

Parks can be designed to accommodate a number of uses. Use can be based on age and activities. Children of various age groups have different needs. Same goes for Teenagers, Adults and Senior Citizens. Attention to use can prevent conflicts between intended use and actual use, and between adjacent or overlapping uses.

COMFORT

Open space is enjoyed more and used more often when it is designed to be a comfortable place for people. Whether the space is to be used for exercise, seating and relaxation, gathering, or play, its design should take into account whether it is a comfortable space. This includes psychological as well as physical comfort. The aspects of Comfort are:-

1. Microclimate

Temperature, water, sun/shading, and wind are all aspects of microclimate that need to be taken into consideration when designing open space. At temperatures above 55 degrees Fahrenheit, the number of people walking, standing, and sitting outdoors in urban malls and plazas typically increases, but at temperatures above 75 degrees Fahrenheit, shading options should usually be included in order to keep stationary users comfortable.

2. Street Furniture/Seating

Types of Seating:

1. Street furniture benches
2. Tables and chairs
3. Large rocks
4. Low walls and planters
5. Bleachers
6. Steps

3. Boundaries

Designers of open space should not only consider the bodily comfort of users but also their psychological comfort. This includes understanding the

relationship of open space to its surroundings-buildings, streets, and sidewalks-as well as scale.

VISUAL QUALITY

The visual quality of open space is an extremely important part of design. While people do frequently use unattractive open spaces that meet a need or provide a use (such as specialized fields or playgrounds), open spaces that are visually appealing and provide a variety of things to explore and see will typically be more successful. Visual quality is impacted by-

- Surface Material
- Landscaping
- Public art
- Maintenance

SAFETY

Safety is a key consideration for designers of open space, as people will not spend time in a space where they feel threatened or insecure. Some of the key aspects of open spaces that influence an individual's feeling of safety include defensible space, visibility, management, and the consideration of physical hazards. Safety can be maintained by having:

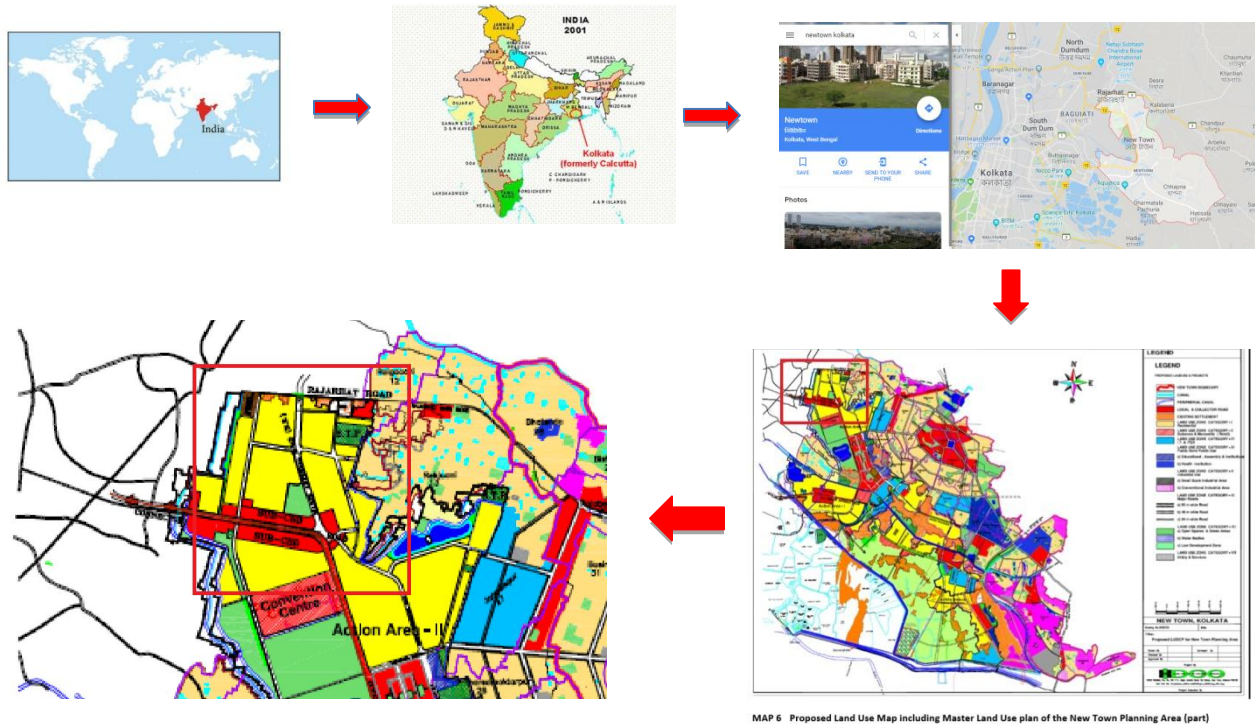
- Defensible Space
- Visibility
- Management
- Consideration Of Physical Hazards

CONVENIENCE/ACCESS

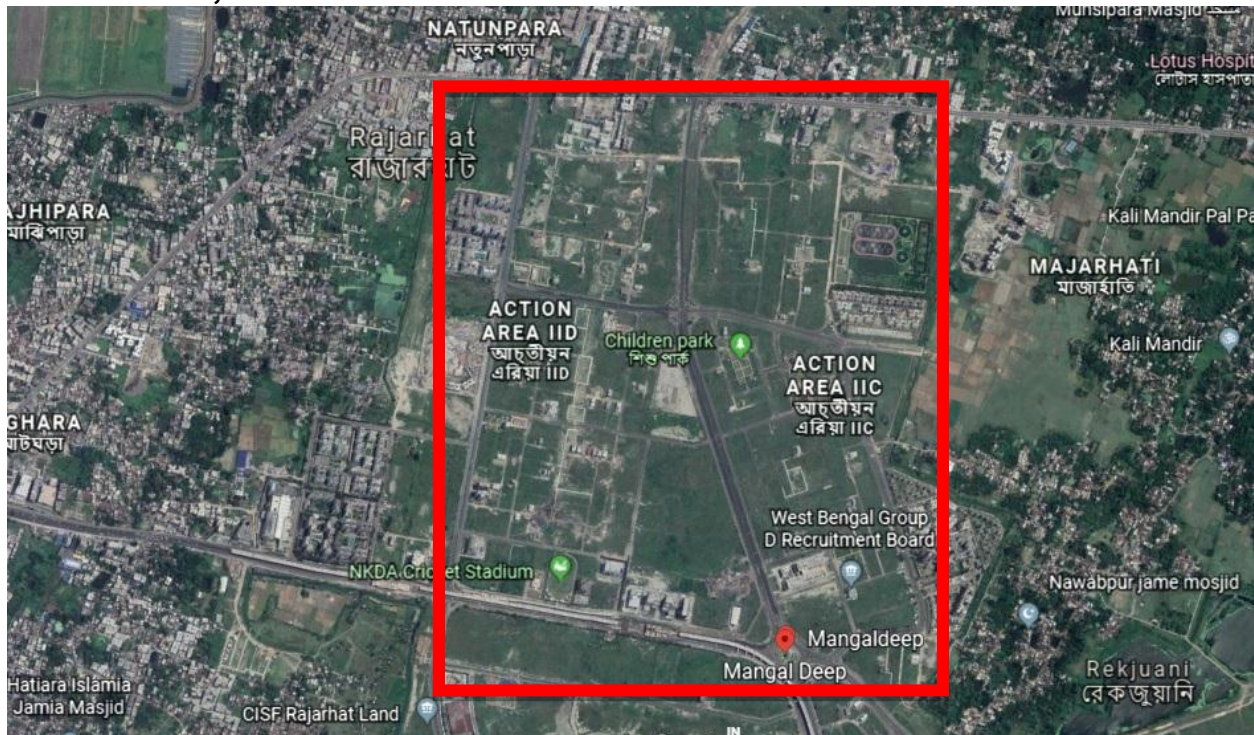
Why consider circulation and access?

- o Encourage use of public space
- o Location of open space within a neighbourhood or community or development
- o Location of uses within open space
- o Access to a variety of users, including disabled users

CASE APPLICATION



NEWTOWN, KOLKATA



NEWTOWN, is a fast growing planned satellite city in the neighbourhood of Kolkata (earlier, Calcutta), located partly in the North 24 parganas district

and South 24 Parganas district of the Indian State of West Bengal. This new information technology and the residential hub is being developed on the north eastern fringes of Kolkata. It consists of areas of two erstwhile villages Rajarhat and Bhangar, which is now a statutory planned development under the KMDA. The area mainly consists of huge acres of cultivable lands and waterbodies, which have been acquired and developed in a planned manner.

DEMOGRAPHICS- As of April 2018, the residential population of Newtown is estimated to be more than 1 million with 0.5 million additional floating population.

Why Newtown is an ideal Location for living in Kolkata?

- Affordable
- Excellent Transport and connectivity
- Superior Infrastructure
- Entertainment Facilities
- Green City Gold Certificate by IGBC



LOCATION-
Mangaldeep, Action Area
IIC, Newtown, Kolkata

CO-ORDINATES-
22°33'04"N 88°27'54"E

AREA ANALYSIS

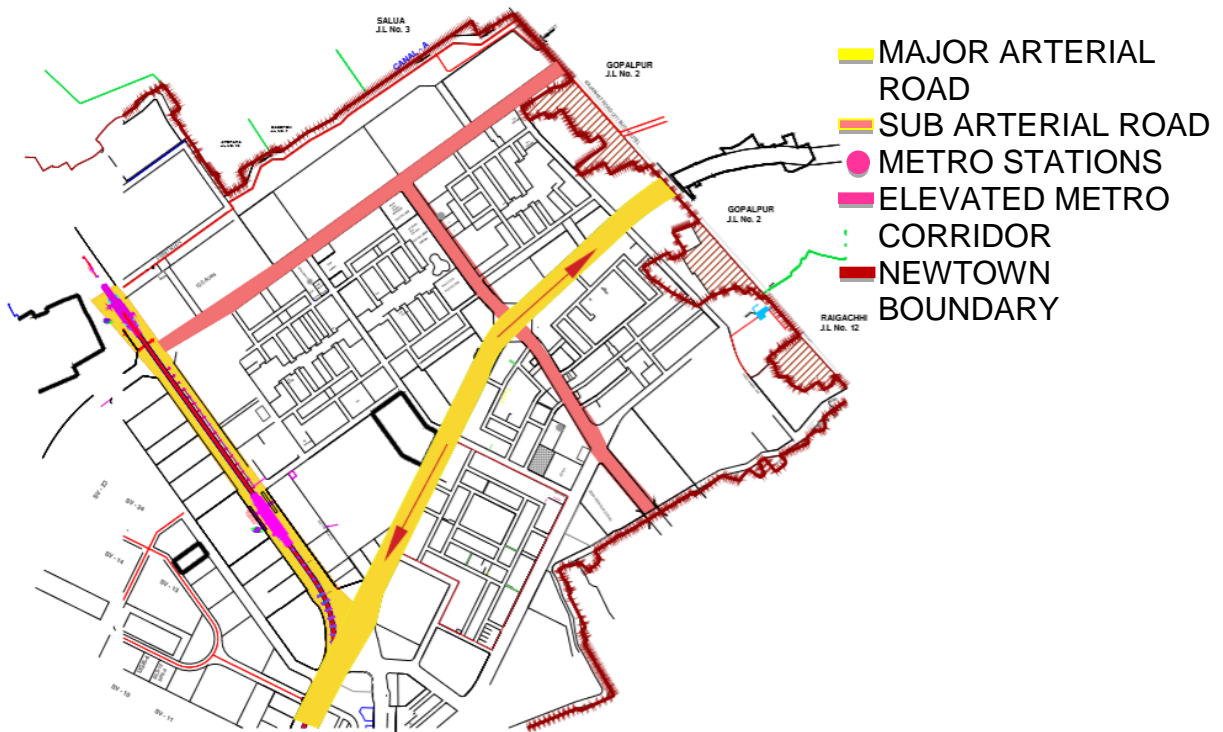


ACCESS AND CONNECTIONS

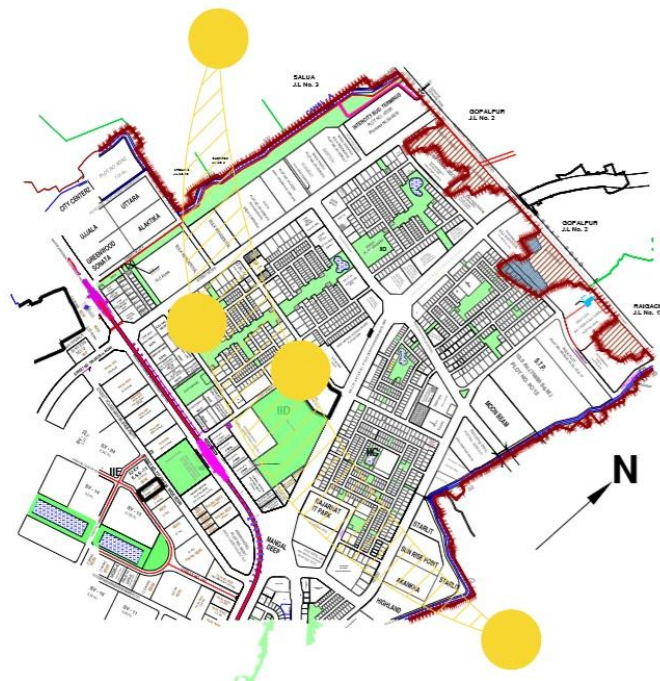
The area is located at the 6th intersection and situated on the end of Newtown. The site is well connected and accessible with Major Arterial roads passing through and the area and upcoming metro stations will increase the connectivity further. An interstate Bus terminus is located on one end of the area. The figure below shows the connections with yellow

INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT

roads depicting Major Arterial Roads and the Red ones being Sub-Arterial Roads



SUNPATH



CURRENT SITE CONDITIONS



(Source:Author)



(Source:Author)



(Source:Author)



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INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT

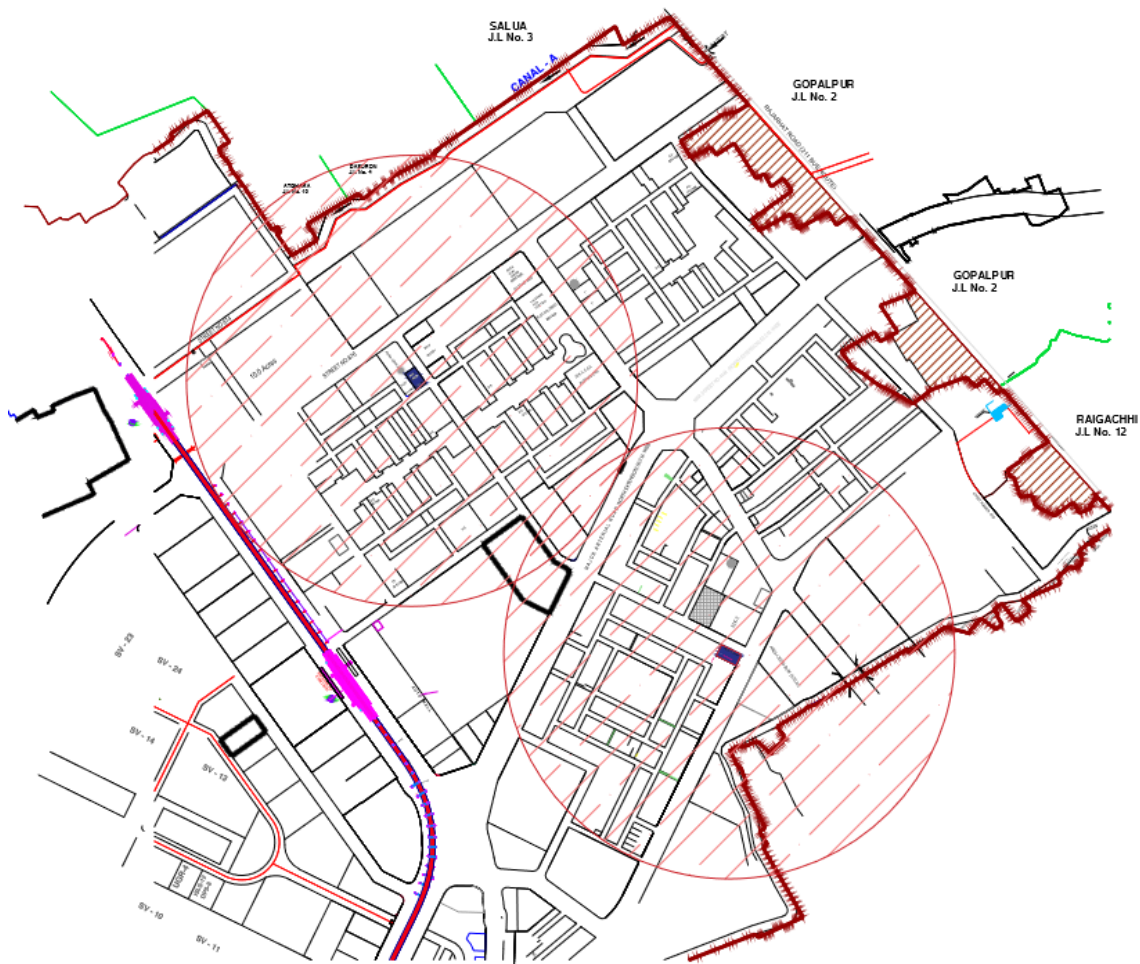


(Source:Author)



(Source:Author)

MARKET



CURRENT OPEN SPACE AXES



MORPHOLOGY OF OPEN SPACES IN THE AREA

GREEN SPACES:

- Parks and gardens
- Amenity Green Space
- Children's Play Area
- Sports Facilities
- Green Corridor
- Natural/ semi- natural greenspaces

GREY SPACES:

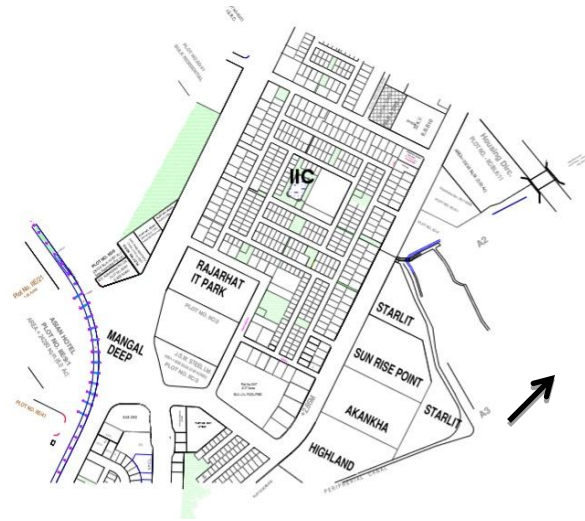
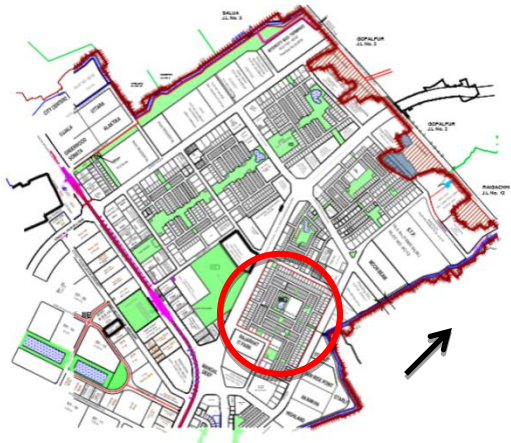
- Market Place
- Pedestrian Streets

This shows the area lacks Civic Squares and plazas and Promenades.

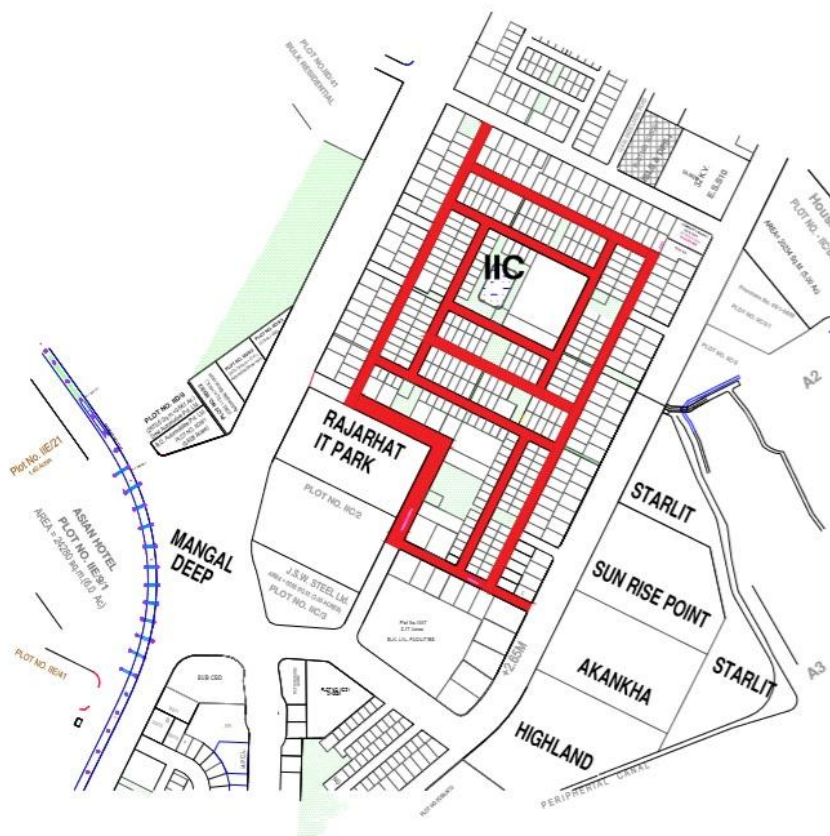
PROBLEMS

1. A Major Arterial road 59 m wide, divides the whole area in two parts thereby cutting of pedestrian circulation and connectivity of the area as a whole.
2. Vehicles passing at high speed create huge amount of Noise Pollution.
The MAR extension is going to serve as a National Highway Connector in the future, thereby will result in a significant increase in Traffic, Noise and Air Pollution
3. The area is further divided into 6 neighbourhoods, 3 on each side of the MAR Extension. The neighbourhoods on the Western side is well connected to each other with the help of an array of Green Spaces essentially serving as a Green Corridor. However, a lack of the same is noticed on the eastern side. The Inter connections of the whole area is also lost due to the MAR passing through this predominantly residential area.
4. The balance of green Space distribution is missing.
5. Predominantly the open spaces available are Green Spaces. The lack of grey spaces is evident. Pedestrian Walkways, Cycle tracks Civic Squares and Plazas are missing.
6. The whole area is serviced by two local markets. The Northern End lacks service as the Markets are out far stretched.

NEIGHBOURHOOD ANALYSIS



STREET ACCESS



SITE AREA- 38.64 Acres
TYPE- Residential Neighbourhood
NO OF PLOTS- 311 (G+4)
REQ OPEN SPACE AREA- 12.88 Acres
AVAILABLE OPEN SPACE AREA- 3.55 Acres

PROBLEMS

- Amount of Green and Open spaces account for 12% of the total site area which has to be 33%
- The Site is marked on one side by a Major Arterial road and a Collector Streets which goes on to join a Sub arterial road. Thus vehicles passes through this road in order to avoid traffic on the MAR.
- The Green Corridor is not defined and lacks major supervision due to smaller plots sizes.
- The plots are planned in such a manner that the internal roadways are very straight which helps in speeding up traffic and thus making it unsafe for the residents.
- The interconnectivity with the other neighbourhoods is lacking resulting in social isolation

APPLYING SUSTAINABILITY MATRIX TO NEIGHBOURHOOD

SUSTAINABILITY GOALS MATRIX

| SUSTAINABILITY GOALS | SUSTAINABILITY OBJECTIVES | GREEN SPACE | | | | | GREY SPACE | | | Assigned Weight |
|--|---|-------------|--------------------|-----------------------|-----------------|---------------|--------------------|---|---|-----------------|
| | | Parks | Amenity Greenspace | Children's Play Areas | Green Corridors | Market Places | Pedestrian Streets | | | |
| Cutting Green House Gas Emissions | Reduce need to travel | | 1 | | | | | 1 | | 3 |
| | Reduce car reliance | | | | | | | | | |
| | Reduce energy efficiency in buildings | | | | | | | | | |
| Closing Local Resource Loops | Reduce demand for non renewable resources | | | | | | | 1 | | 1 |
| | Reuse & recycling of local resources | | | | | | | | | |
| | Local Water Sourcing Treatment and Aquifer Recharge | | | | | | | | | |
| | Local Low Input food production | | | | | | | | | |
| Enhancing Local Environment | Promote local distinctiveness and resources | 2 | 1 | | | | | | | 4 |
| | Create attractive Public realm | 1 | | 2 | | | | | 2 | 6 |
| | Enhance Local Habitat Diversity | 1 | | | | | | | 1 | 3 |
| Creating a Healthy environment | Improve Local air quality | 1 | 1 | | | | | | | 5 |
| | Promote an active lifestyle especially walking | 1 | | 1 | | | | | | 5 |
| | Encourage consumption of fresh fruits and veg | 1 | | 1 | | | | | 1 | 5 |
| Increasing Street Safety | Reduce the chance of vehicles/pedestrian accidents | 1 | | 1 | | | | | | 6 |
| | Reduce fear of violence | 1 | | | | | | 2 | 1 | 5 |
| Increasing Accessibility and Freedom of Choice | Choice of Transport mode for trips | | | | | | | | | |
| | More facilities accessible locally | 1 | 1 | | | | | | | 3 |
| | Choice of facilities within easy walking distance | 1 | 1 | | | | | | | 3 |
| Equity and Social Inclusion | Viability of Public transport | | | | | | | | | |
| | Accessible jobs for those tied to the locality | 1 | 1 | | | | | | | 4 |
| Local Work Opportunities | Reduce transport emissions | | | | | | | | | |
| | Facilitate accessible social networks | 1 | 1 | | | | | | | 3 |
| Value of Local Community | Promote mental health | 1 | 1 | | | | | | 1 | 3 |
| | Increasing user/citizen control | 1 | 1 | | | | | | 1 | 3 |
| Increasing Local Self Determination | Management of Decentralized systems | 2 | | 1 | | | | | | 3 |

TABLE 1

SUSTAINABILITY PARAMETERS MATRIX

| TYPE | SUSTAINABILITY PARAMETERS | Parks | Amenity greenspace | Children's play areas | Green corridors | Market places | Pedestrian streets | Assigned Weight |
|--------------------|---|-------|--------------------|-----------------------|-----------------|---------------|--------------------|-----------------|
| Space Management | encouraging sustainable lifestyles, for example by providing paths and cycle making maximum use of existing features and assets | 2 | 1 | 1 | 1 | | | 5 |
| | strengthening the sense of place | | 1 | 1 | 1 | | 1 | 4 |
| | incorporating local or recycled materials | | | | | | | |
| | encouraging community participation and involvement | 1 | 1 | 1 | 1 | | | 4 |
| | reducing inputs of non-renewable resources during construction and subsequent maintenance | | | | | | | |
| | eliminating or reducing the use of herbicides and resources that affect other ecosystems | | | | | | | |
| | encouraging habitat creation and native planting | 1 | 1 | 1 | 1 | | | 4 |
| | managing resources carefully | | | | | | | |
| | Reduce the level of Car reliance | 1 | 1 | | | 1 | | 3 |
| | The effectiveness of public transport | | | | | | | |
| Circulation | Reduce the need to travel | 1 | 1 | 1 | 1 | | | 4 |
| | Social benefits for increasing transport choices for all group populations | | | | | | | |
| | Enhancing local security and community | 1 | 1 | 1 | 2 | 1 | 1 | 6 |
| Quality Greenspace | Return to original sources of inspiration, whether nature or culture | | | | | | | |
| | Respond to the site | 1 | 1 | 2 | 2 | | | 6 |
| | creating connections and themes transforming site constraints into environmental opportunities | | | | | | | |
| | minimizing negative environmental impacts | 1 | 1 | 1 | 1 | | | 4 |
| | maximizing positive impacts, off-site as well as internally | 1 | 1 | 1 | 2 | | 1 | 6 |
| | Minimize inputs of materials and energy and maximize outputs of renewable and reusable resources. | | | | | | | |
| | Maximize resilience | | | | | | | |
| | maximizing the diversity of landscape elements and the diversity of relationships | | | | | | | |
| | creating opportunities for the emergence of self-sustaining and self-regulating systems | 1 | | 2 | 1 | | | 3 |
| | emerge of self-sustaining and self-regulating systems | 1 | | 1 | 1 | | | 3 |
| Create 'place' | Make systems viable | 2 | | 2 | 2 | | | 6 |
| | Minimize maintenance and maintain to enable full expression of design | | | | | | | |
| | meet the varied recreation and leisure needs of users | 1 | 1 | 2 | 1 | | | 5 |
| | involve local communities | 1 | | 1 | 2 | | | 4 |

TABLE 2

Table 1 shows that: for given neighbourhood –the sustainability goals that have the first priority to be achieved are to: Enhance Local environmental quality and to increase street safety Moreover, the sustainability objectives are: to create an attractive public realm, reduce the chance of vehicles and pedestrian accidents and reduce fear of violence. The second priority to be taken into consideration is to Create a Healthy Environment with the sustainability objectives being improve local air quality and promote active lifestyle especially walking.

Table 2 shows that the most important sustainability indicators pose the following questions:

- Does the neighbourhood Enhance Local Security and community?
- Does it respond to the site by creating connections and themes and maximize positive impacts off-site as well?
- Does the neighbourhood make it's systems visible?

AIM

To create a Sustainable Open Spaces in and around a neighbourhood unit.

GOALS AND OBJECTIVES

- Create attractive Public realm
- Reduce the chance of vehicles/pedestrian accidents
- Improve Local air quality
- Promote an active lifestyle especially walking
- Reduce fear of violence

SCOPE

- To establish inter and intra connected of open spaces in the area.
- To provide noise buffers in the area.
- To increase street safety for pedestrians and establish cycle paths.
- To concentrate on greening of the neighbourhood.

LIMITATIONS

- Design will cater to Functional and Aesthetic requirements for Open Spaces.
- Detailed Structural Engineering may not be delved into.
- Economy will not be delved into.

PARAMETERS

- Enhancing local security and community
- Creating connections and themes
- Maximizing positive impacts, off-site as well as internally
- Make systems visible
- Encouraging sustainable lifestyles, for example by providing paths and cycle routes
- Meet the varied recreation and leisure needs of users

METHODOLOGY

STEP 1: Literature and Concept Study

STEP 2: Establishing the Relevance of the Thesis

STEP 3: Identifying the Parameters of the Thesis

STEP 4: Establishing Tentavi Scale of Application of Thesis

STEP 5: Case Study Examples: Study and analyze how the Parameters have been applied

STEP 6: Study and Analyze overall Case Application area

STEP 7: Selection of Scale of Site from overall Case Application Area

STEP 8: Giving Area and Site Level Proposals

STEP 9: Design process and Implementation

STEP 10: Future Scope

CASE STUDY EXAMPLES

- Hamburg Autobahn A7
- Highline, New York
- Chandigarh Leisure Valley

POSSIBLE POINTS OF INTERCEPTIONS



The red circles show us the possible points of Interception where connections can be introduced in the form of Elevated bridges, crossovers, etc.



The green circles show us the possible points of Interception where connections can be introduced inside the neighbourhood.

CASE STUDY EXAMPLES

HAMBURG AUTOBAHN A7

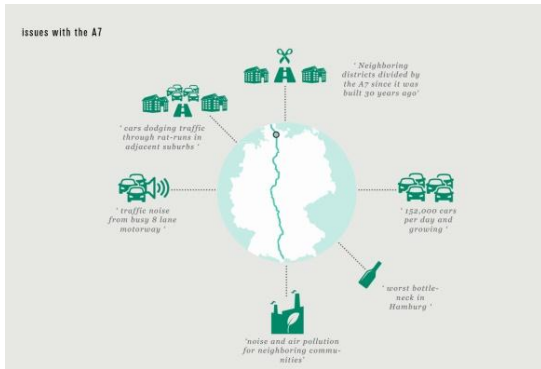


Source: Streets without cars, Wordpress)



Source: Streets without cars, Wordpress)

INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT



Source: Streets without cars, Wordpress)



Source: Streets without cars, Wordpress)



Source: Citymetric)



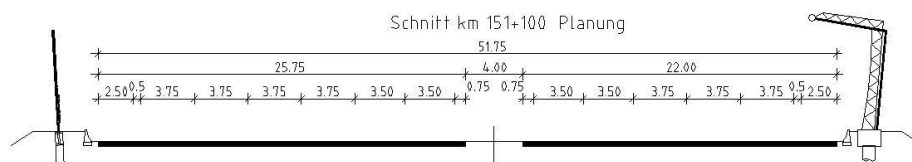
Source: Dossier Let-Wessen)



Source: Citymetric A7 Autobahn)

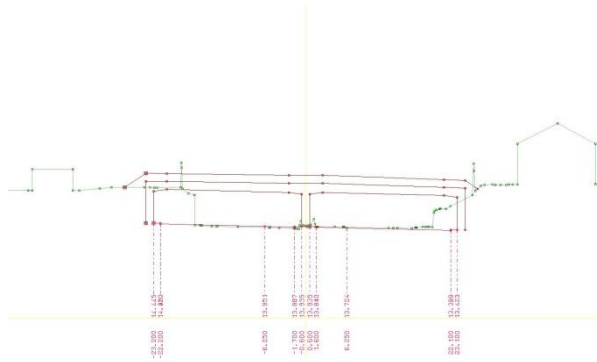


Source: Citymetric A7 Autobahn)



(Source: Card_1)

INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT



(Source: Card_1)



(Source: Card_1)



(Source: Hamburg.de)

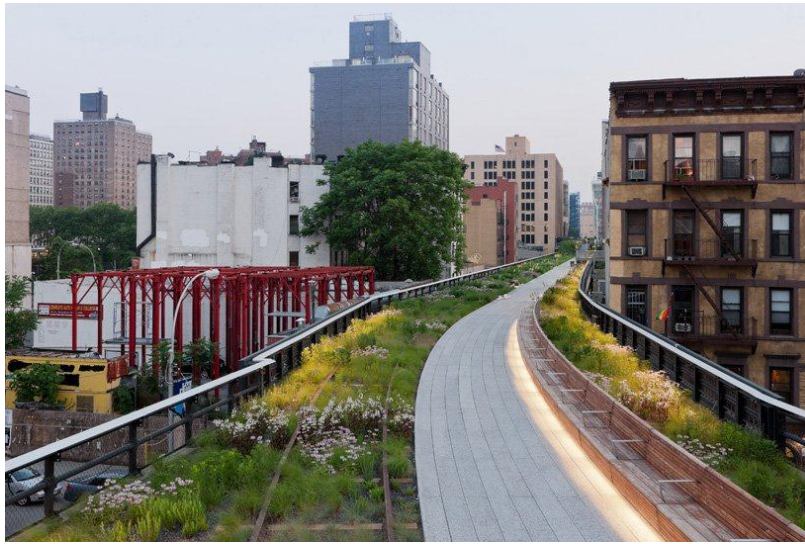


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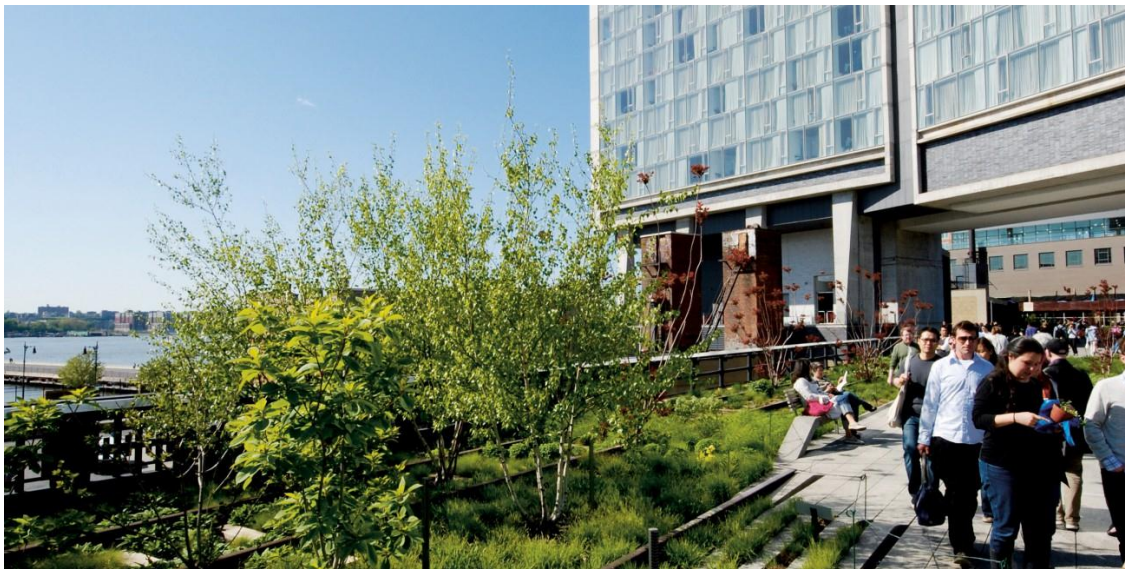
ANALYSIS

1. Stretch of Underground tunnel is 900 m long (Equivalent to site)
2. Tunnels act as noise buffers.
3. Space on the ground can be used as Green and Grey Spaces.
4. Emergency routes and services need to be worked out.
5. 6 ft-10ft caps can support the Ground level open space.

HIGHLINE NEW YORK



(Source: Places Journal)



(Source: Urban Green Blue Grids)

INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT



(Source: Researchgate)



(Source: Friends Of The Highline, Wordpress)

INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT



(Source:Sunset Boulevard)



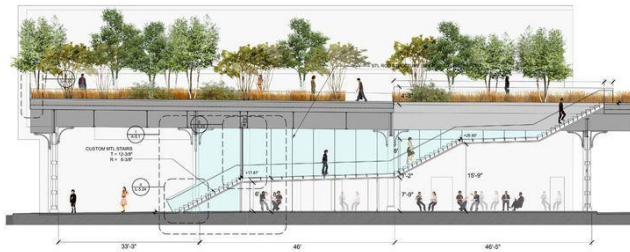
(Source:e-Architect)



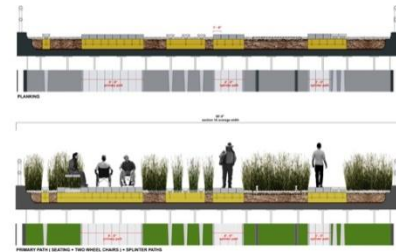
(Source:Great Museums)



(Source:Archdaily)

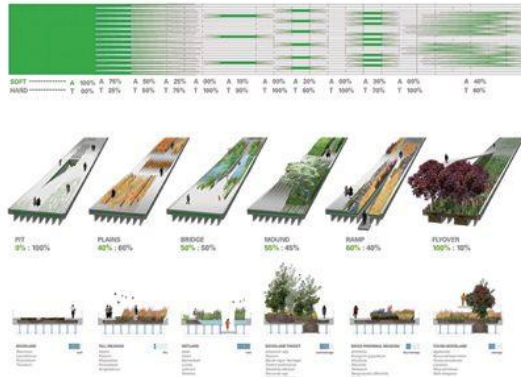


(Source:Friends Of The Highline, Wordpress)

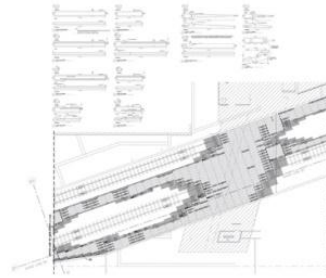


(Source:American Society Of Landscape Architects)

INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT



(Source: American Society Of Landscape Architects)



(Source: American Society Of Landscape Architects)



(Source: American Society Of Landscape Architects)

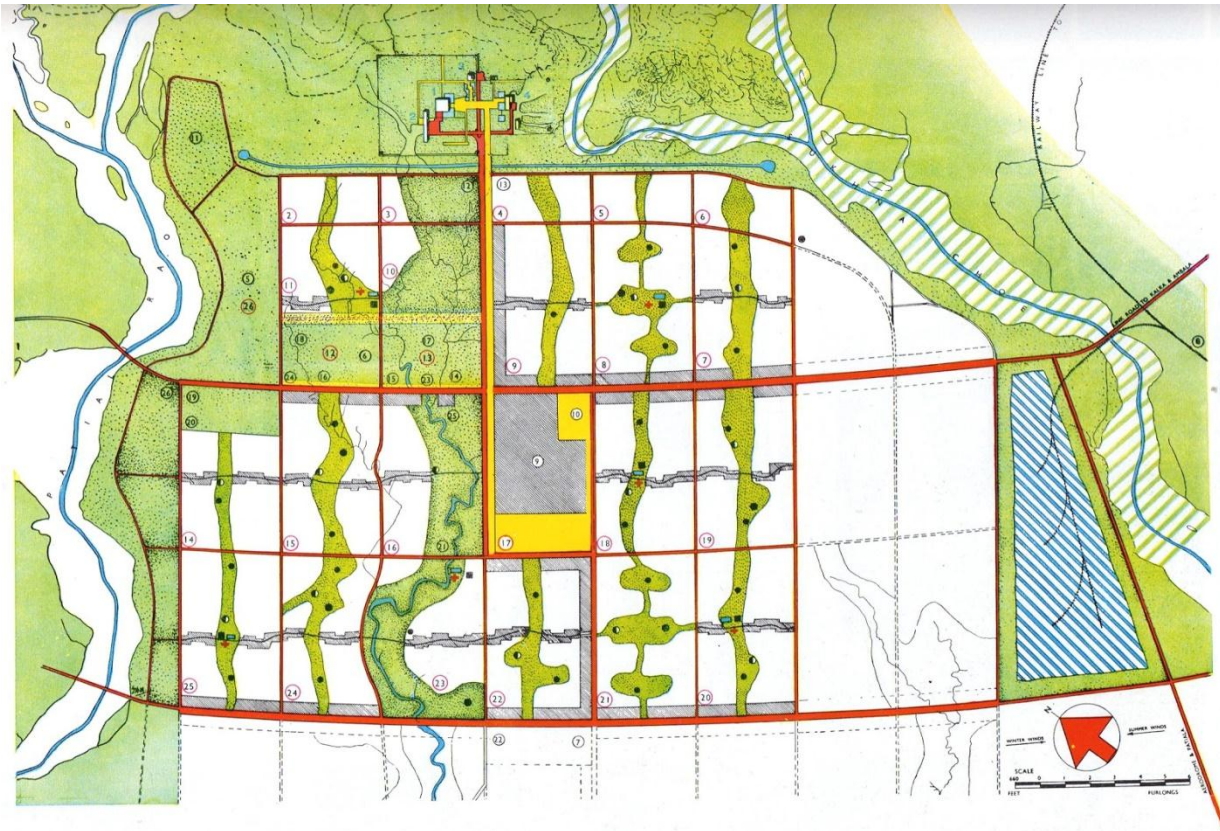


(Source: Pinterest)

ANALYSIS

1. Elevated corridors can serve the purpose of connecting spaces.
2. Access needs to be Barrier free and frequently placed.
3. Landscaping needs to be Vibrant and cater to various user Groups.

LEISURE VALLEY CHANDIGARH



Chandigarh, maggio 1952.
Piano urbanistico definitivo
della prima fase di
realizzazione che comprende
abitazioni e servizi per 150 000
abitanti e il Campidoglio

1 Parlamento
2 Segretariato

3 Campidoglio
4 Corte di giustizia
5 Università
6 Stadio
7 Mercati generali
8 Stazione ferroviaria
9 Centro commerciale
10 Municipio
11 Istituto di ingegneria

12 Residenza del Primo
Ministro
13 Residenza del Capo della
Magistratura
14 Biblioteca
15 Museo
16 Scuola di arti applicate
17 College statale maschile
18 College statale femminile

19 Istituto superiore e ospedale
odontoiatrico
20 Ospedale
21 Maternità
22 Sarai
23 Teatro
24 Istituto Politecnico
25 Croce Rossa
26 Boys Scouts

Vie principali (V2)
Vie secondarie (V3)
Strade locali (V5+V6)
Spazi aperti e parchi
Affari e commercio
Zona industriale
Aree pedonali

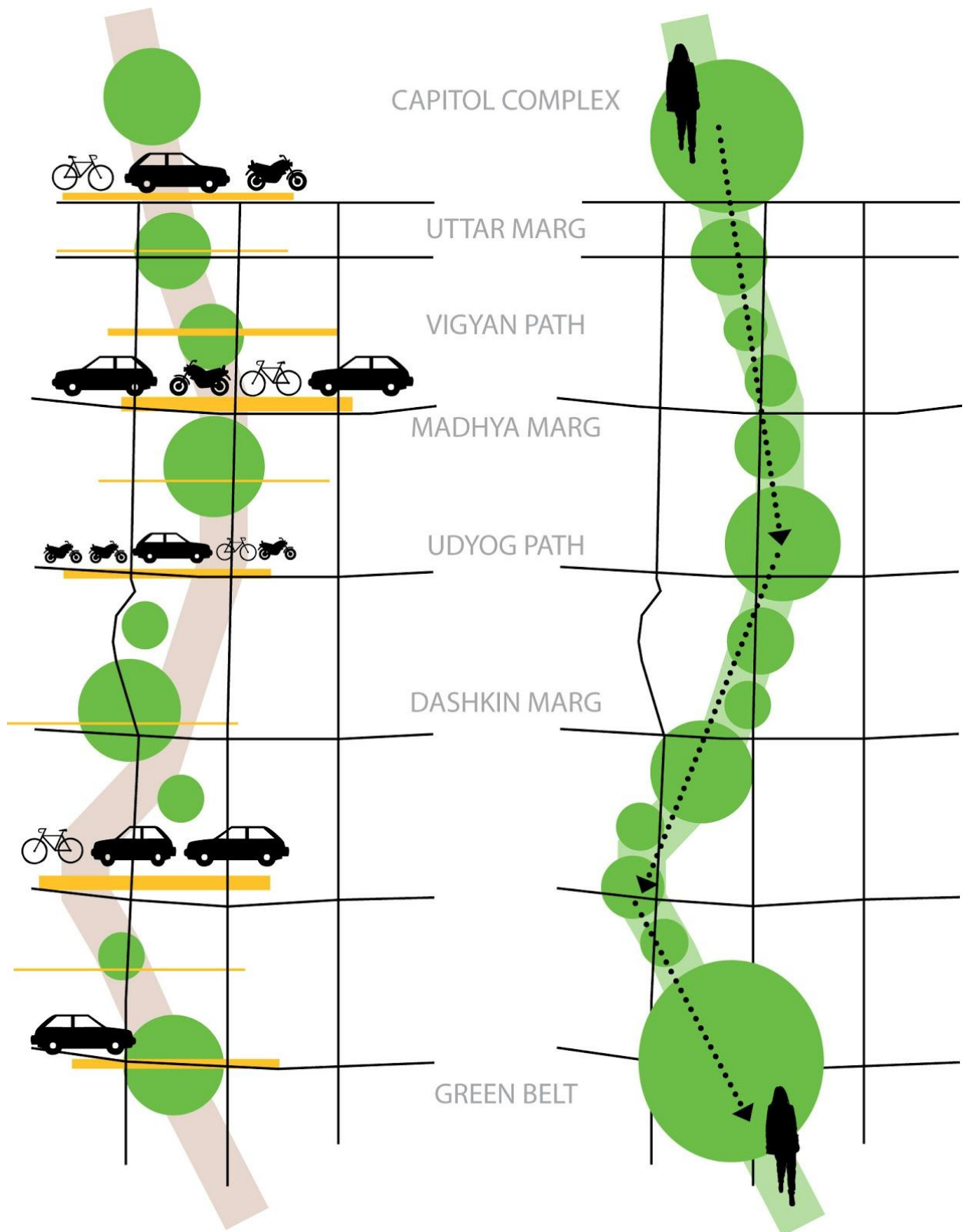
● Scuole elementari
● Scuole medie
● Scuole superiori
+ Centri sanitari
■ Centri comunitari
■ Piscine
○ Numeri dei settori
■ Spazi aperti interni

(Source: Research Images)



(Source: Apnitricity)

INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT



(Source:Chandigarh Urban Lab)

INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT



(Source:Justdial)



(Source:The Oscar Shorts)



(Source:Chandigarh Medical Tourism)



(Source:ChandigarhMetro)

ANALYSIS

1. Existing Ecological Features need to be utilised and enhanced.
2. Variation in landscape helps to create interest.
3. Routes need to be rerouted wherever possible.
4. Cycle Tracks and wide pedestrian roads along side helps to maintain and create boundaries in order to define spaces

DESIGN GUIDELINES

AREA LEVEL PROPOSALS

Area Marked In Yellow Is The Target Area

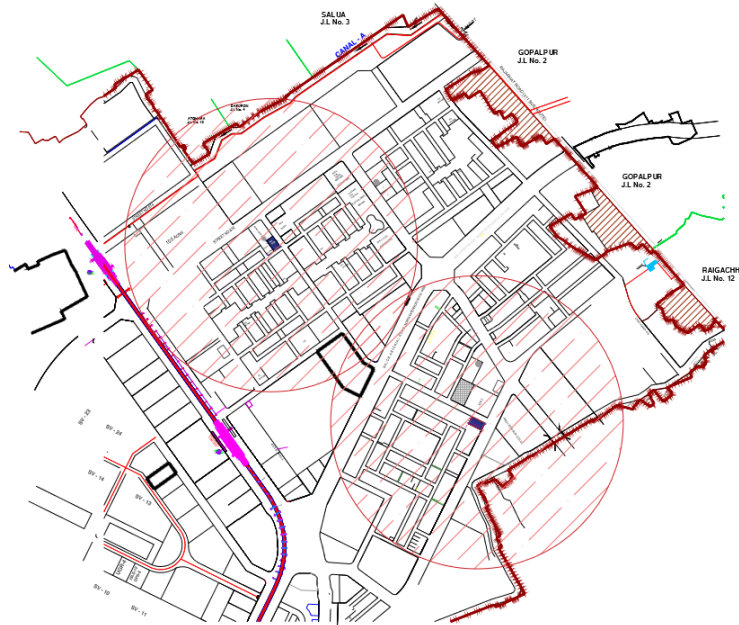


INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT

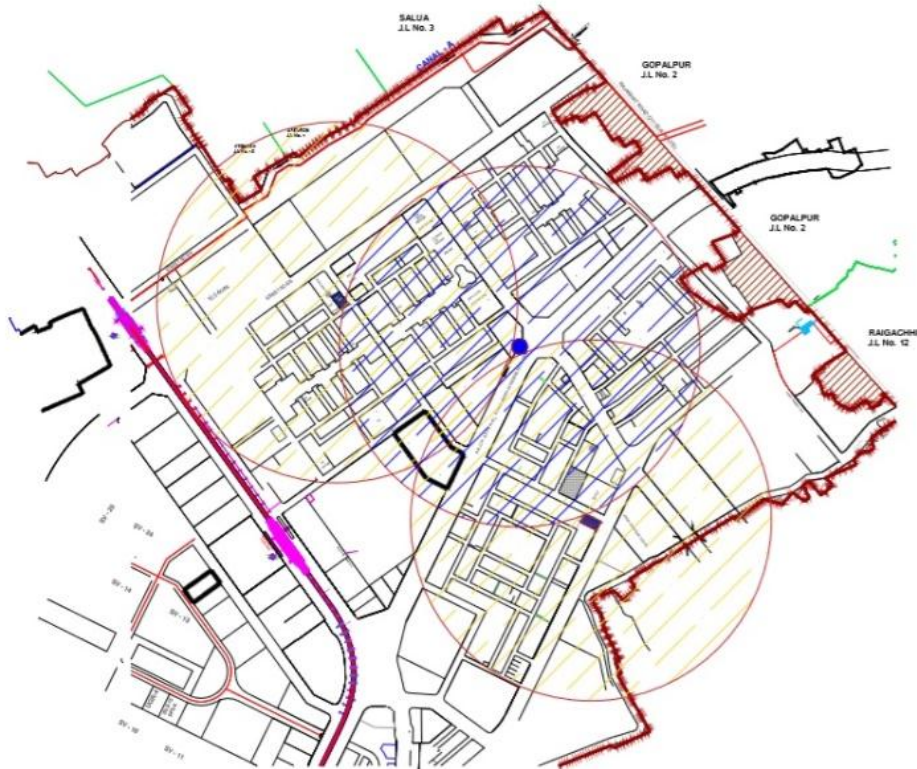


Establishing a Connection through Green and Grey Space In the Form of Ground Level Or Elevated corridor Or a mixture of Both

MARKET

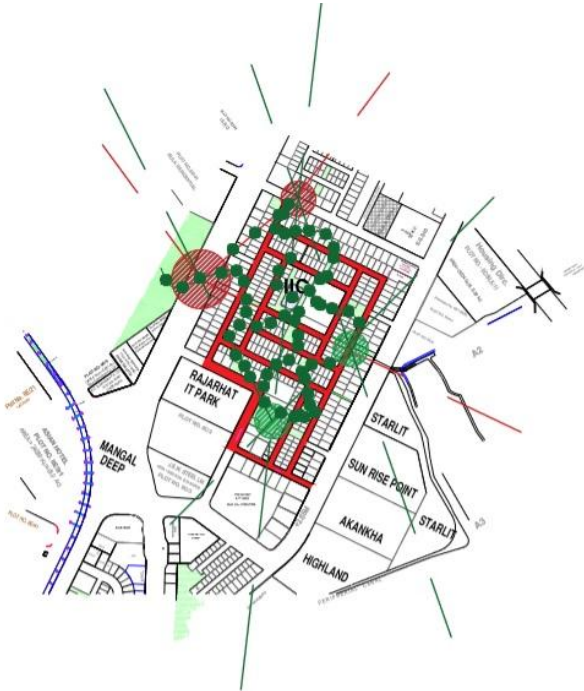
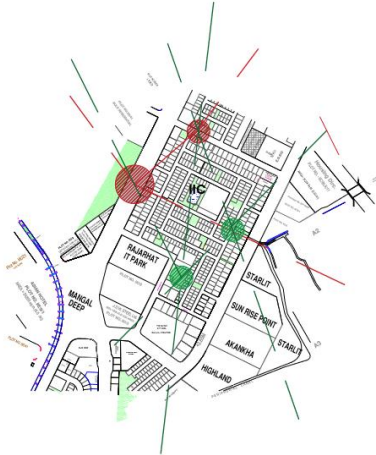


The two existing markets places in the area do not cater to Northern end of the area. The new Market place will help in covering the two remaining neighbourhoods north of the Sub-Arterial street.



NEIGHBOURHOOD

Creating 3 new axes along the existing greens and Area level axis by modifying it helps for a better understanding of the greens present in the neighbourhood. Thereby, working along the axes but in swinging curvilinear ways to create more open spaces. This helps in reducing the amount of straight roads inside the neighbourhood which will result in slowing down vehicles.



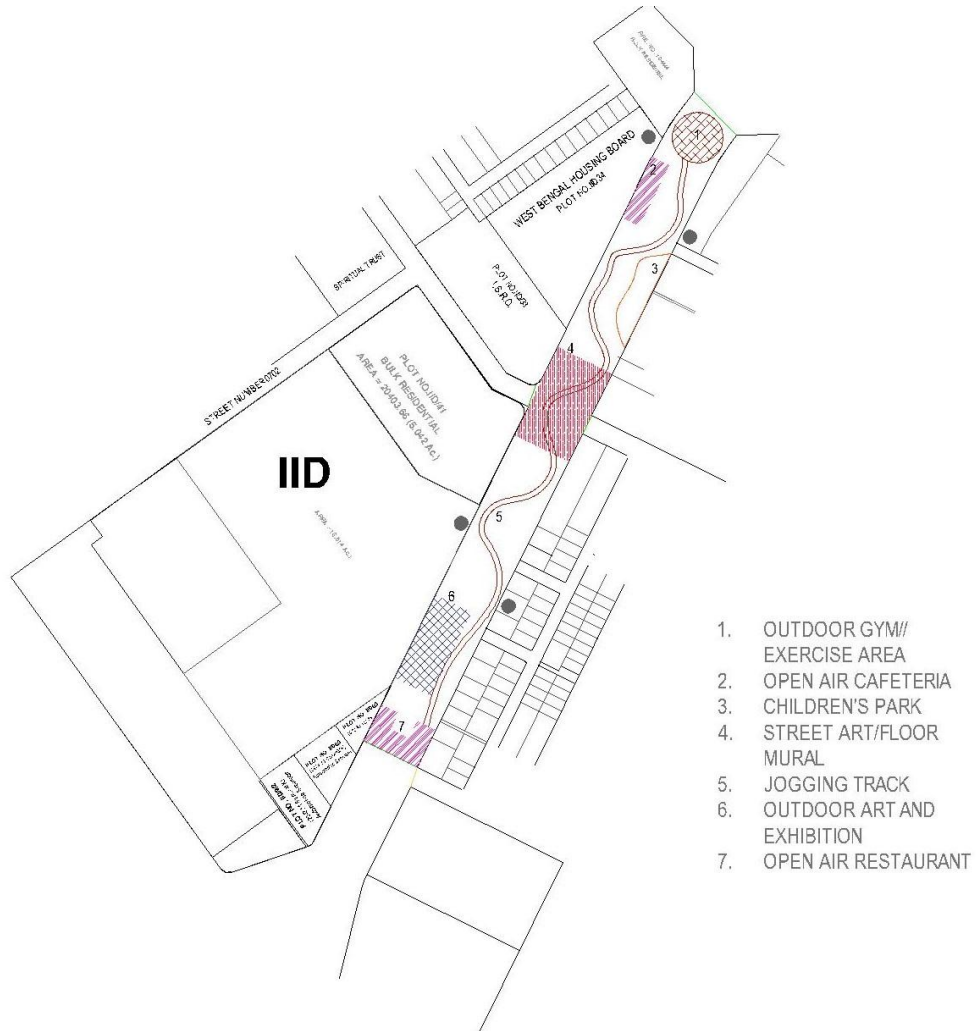
OVERALL INITIAL PROPOSAL



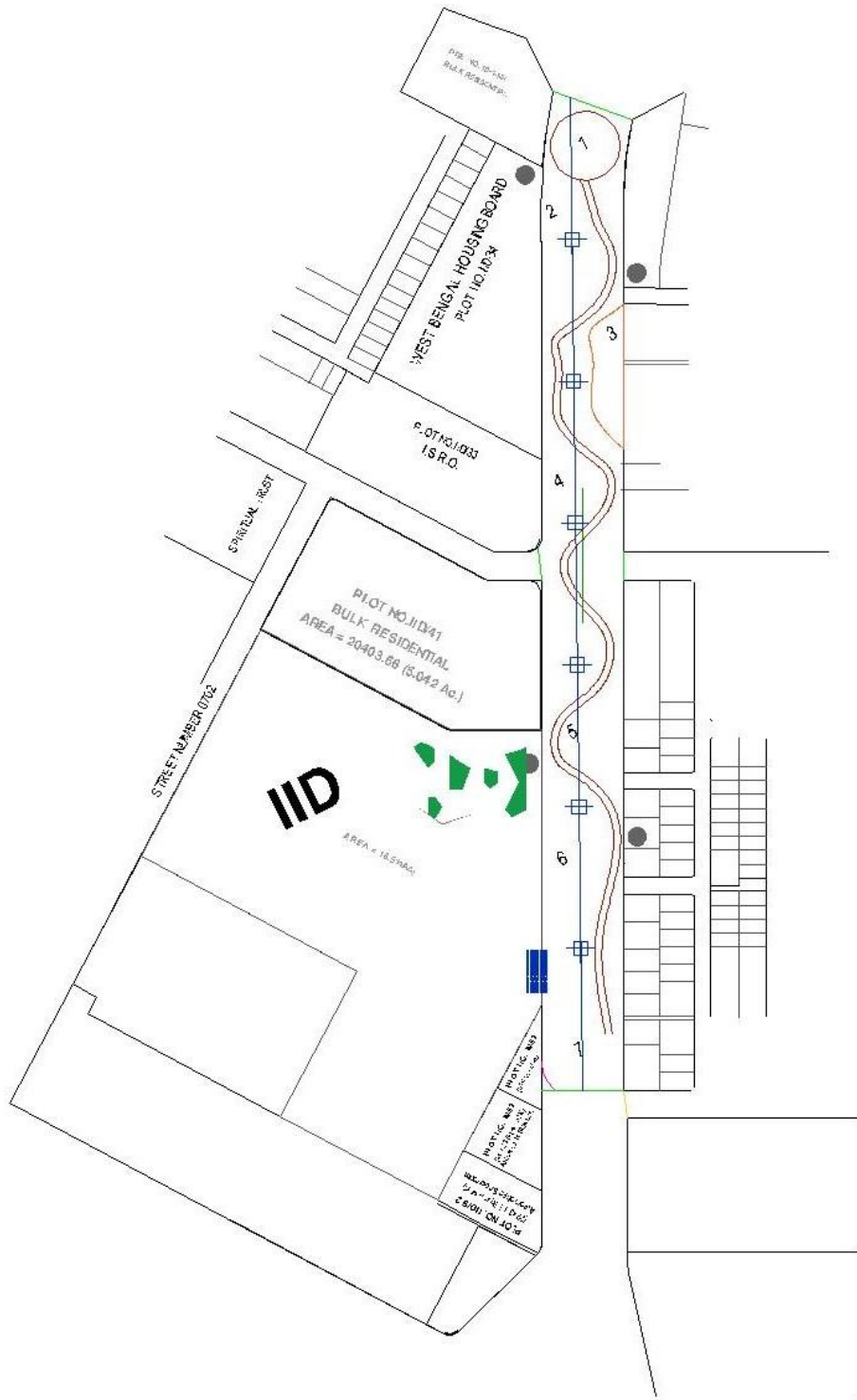
1. Introduce a Green-Grey Corridor through a Span of 850m.
2. Corridor with Civic Spaces, Seating arrangements, Kiosks, Cycle Tracks, and Greenery and Landscaping with either of the following arrangements-
 - a. Preferably at Ground Level MAR Extension to be sunk down underground;
 - b. Elevated Corridor with various access points;
 - c. Corridor Slightly raised to a height of 4-6 feet and MAR sunk down as well.
3. Creating Noise Buffer by Walls/Tunnels. Raised Tunnels and Walls to have Green Elements.
4. Create similar scope for future possible interceptions, hence connecting the overall area through linked Open Spaces.
5. Introducing a New Local Market Place.
6. Increase the overall amount of Open Space in the selected Neighbourhood by strengthening the Green Corridor through creation of new spaces and connection along the axes.
7. Shorten the amount of Straight roads inside the neighbourhood for making it more pedestrian friendly and safe.

DESIGN

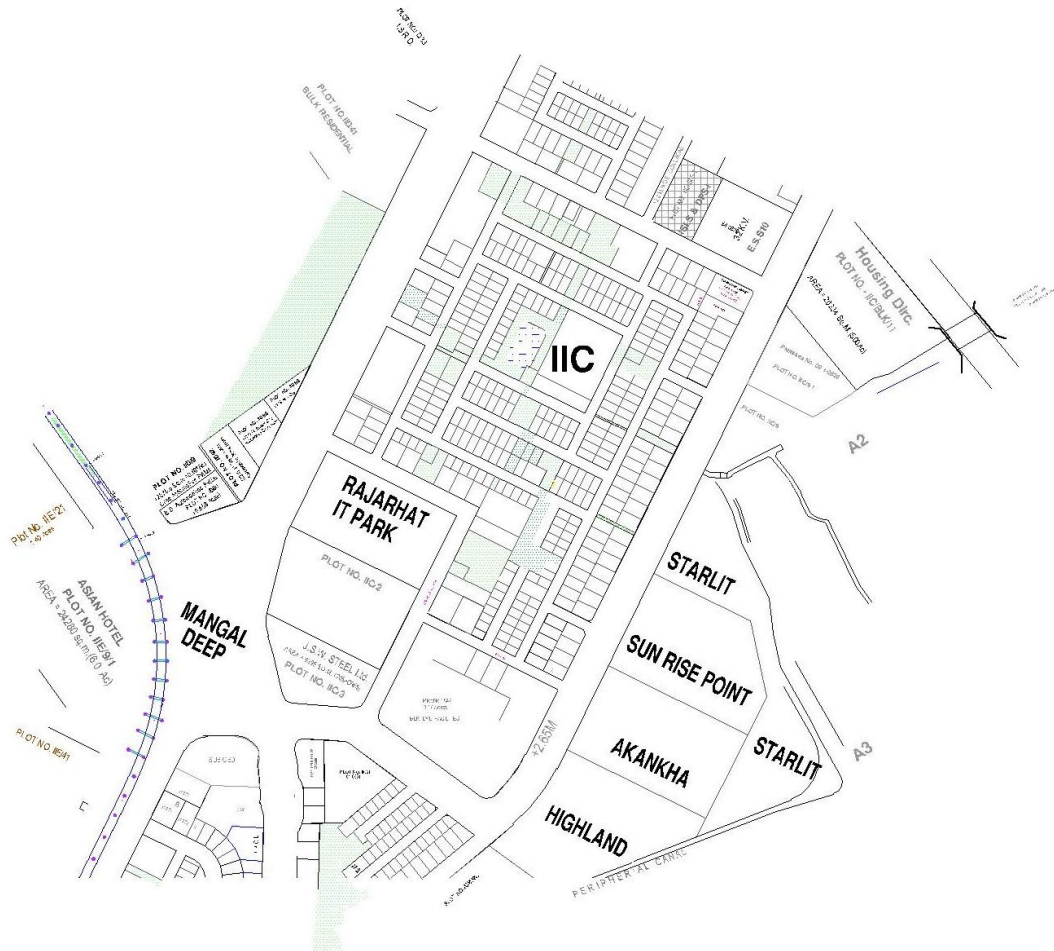
STAGE 1



INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT



INTEGRATION OF OPEN SPACES TOWARDS ENSURING A SUSTAINABLE BUILT ENVIRONMENT



REFERENCES

RESEARCH PAPERS CITED:

1. A COMPREHENSIVE PUBLIC OPEN SPACE CATEGORIZATION USING CLASSIFICATION SYSTEM FOR SUSTAINABLE DEVELOPMENT OF PUBLIC OPEN SPACES

(Authours: Ashkan Nochian1*, Osman Mohd Tahir1, Suhardi Maulan1 and Mehdi Rakhshanderoo Department of Landscape Architecture, Universiti Putra Malaysia, Serdang, Malaysia1*)

2. TOWARDS A SUSTAINABLE NEIGHBORHOOD: THE ROLE OF OPEN SPACES(Author: Khalid Al-Hagla)

3. Vanke Vision: Sustainable Residential Development in Shanghai Urban Planning and Design Handbook Vol. 1. Research Seminar and Field Survey|February2006(Massachusetts Institute of Technology Department of Urban Studies and Planning City Design and Development Group)

VARIOUS SOUCES:

<https://in.pinterest.com/pin/700450548273893446/>

<http://www.herskhazeen.com/the-block-a-sustainable-approach-for-public-landscape/>

<https://www.gillespies.co.uk/>

<https://in.pinterest.com/marlongrifaldo/plaza-design/?lp=true>

<https://www.google.com/url?sa=i&source=imgres&cd=&cad=rja&uact=8&ved=2ahUKEwj6-P-74fTgAhULeCsKHT1IAz4Qjxx6BAgBEAI&url=https%3A%2F%2Fwww.ksmu.org%2Fpost%2Fdocu-mentary-tells-story-landscape-design-pioneer-olmsted&psig=AOvVaw2Qf5bS140XmL2YZH5oEUd0&ust=1552210649054284>

<https://www.arch2o.com/urban-green-spaces-challenge-cities/>

<https://www.dcla.net/blog/create-a-hub-in-parks>

<https://landscapearchitecture.inloop.com/en/article/106362/parks-are-a-critical-solution-to-climate-change>

<https://www.nytimes.com/2008/03/16/arts/design/16shat.html>

<https://placesjournal.org/article/above-grade-on-the-high-line/>

<https://www.urbangreenbluegrids.com/projects/the-high-line-new-york/>

https://www.researchgate.net/figure/Highline-Park-Manhattan-New-York_fig3_271345821

<https://friendsofthehighline.wordpress.com/2008/12/16/designing-the-high-line-part-2-gansevoort-plaza-and-stair/>

<https://1111sunsetblvd.com/the-design-team-orig/field-bg/>

<https://archinect.com/news/article/150051094/harvard-gsd-awards-the-high-line-with-2017-veronica-rudge-green-prize-in-urban-design>

<https://www.e-architect.co.uk/new-york/high-line-park>

<http://greatmuseums.org/explore/more/elevated-thinking-the-high-line-in-new-york-city>

<https://www.alltrails.com/trail/us/new-york/high-line-park>

<https://www.asla.org/2010awards/173.html>

<https://www.architecturaldigest.com/gallery/best-nyc-architectural-landmarks-visit>

https://www.archdaily.com/24362/the-new-york-high-line-officially-open/2086125159_dsr-highline-09-06-5695

<https://in.pinterest.com/pin/564075922054670163/?lp=true>

<http://chandigarhurbanlab.org/connections-rethinking-leisure-valley/>

<http://apnitricity.com/places-to-visit/leisure-valley/>

https://www.justdial.com/Chandigarh/Leisure-Valley-Chandigarh-Sector-1/0172PX172-X172-170315161508-M2N4_BZDET/photos

<http://theoscarshorts.com/most-beautiful-garden-in-india/most-beautiful-garden-in-india-botanical-garden-ooty-top-10-beautiful-amazing-gardens-of-india/>

<http://chandigarhmedicaltourism.com/medical-packages/tour-and-travels/leisure-valley/>

<https://www.slideshare.net/gridworks2/chandigarh-11952896>

<http://www.noel-murphy.com/journal/category/chandigarh/>

<https://chandigarhmetro.com/chandigarh-open-hand-monument-thrown-open-to-public/>

<http://www.merachandigarh.com/tourist-attractions/leisure-valley/>

<https://www.citymetric.com/politics/it-fair-cities-get-more-government-funding-rural-areas-4510>

https://www.freenet.de/auto/magazin/dossier-leitwesen_175440_4714768.html

<http://annualreport2014.uli.org/program-highlights/uli-awards-competition-and-honors/uli-open-space-award/>

https://www.google.com/imgres?imgurl=https%3A%2F%2Fwww.cheshireeast.gov.uk%2Fimages%2FSpatial-Planning%2Fen-ldf-congospacpic.jpg&imgrefurl=https%3A%2F%2Fwww.cheshireeast.gov.uk%2Fplanning%2Fspatial_planning%2Fresearch_and_evidence%2Fopen_spaces_assessment_2012.aspx&docid=I5FWtZkw6StFM&tbnid=g52RaLPvAdmhwM%3A&vet=10ahUKEwiNxef3xPvgAhVCXn0KHaYDB80QMwhuKAQwBA..i&w=250&h=179&bih=635&biw=1366&q=open%20spaces&ved=0ahUKEwiNxef3xPvgAhVCXn0KHaYDB80QMwhuKAQwBA&iact=mr&uact=8

https://www.cheshireeast.gov.uk/planning/spatial_planning/research_and_evidence/open_spaces_assessment_2012.aspx

<https://www.cambridgema.gov/CDD/parks/osplanning>

<https://www.latzundpartner.de/en/projekte/freianlagen/>

<https://www.jtp.co.uk/news-and-events/news/attleborough-set-to-evolve-with-jtps-proposals-for-a-sustainable-extension>

<https://www.cnu.org/publicsquare/2017/10/31/25-great-ideas-new-urbanism>