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Guidelines for Urban Regeneration in India through Parameters of Landscape Transformation

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Guidelines for Urban Regeneration through Parameters of Landscape Transformation

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1. Abstract

This paper is a study of the residential urban regeneration programs in the city of Delhi. This research aims to prepare a landscape-driven holistic vision for urban regeneration by examining and evaluating elements of landscape planning through quantitative parameters such as mobility, building heights and other built-form regulations, blue-green networks, and qualitative aspects of open spaces such as identity.

In Delhi, the government has initiated an urban regeneration program called the General Pool Residential Accommodation (GPRA[4]) that uses existing residential plots for re-densification. An undertaking of such magnitude warranted a nuanced policy intervention for urban re-generation. However, it was found that the current research gap lay in a deficit of parameters to study the existing planning norms of redevelopment through the lens of landscape urban values.

The paper[5] begins by surveying, analysing, and assessing the prevailing redevelopment patterns of completed, under-construction, and future GPRA redevelopment projects. At the same time, case studies of landscape-driven evaluations of previous GPRA projects were analysed to establish benchmarks of landscape parameters. Based on this assessment, a set of "Efficiency Factors" were derived pertaining to each quantitative parameter and an "Assessment Index" was generated for qualitative parameters. The paper concludes with a catalogue of benchmarking criteria to be used as a guiding framework for future resilient and sustainable urban regeneration interventions in India.

2. Introduction

The National Capital Region of Delhi is the second largest metropolitan area in the world and, arguably, the fastest growing[6] in the world. It is a historic world city with unparalleled cultural

[4] GPRA- General Pool Residential Accommodation; MPD- Master Plan of Delhi; DDA- Delhi Development Authority; DUAC- Delhi Urban Arts Commission; MoHUA- Ministry of Housing and Urban Affairs, Government of India; MCD- Municipal Corporation of Delhi; AAI- Airport Authority of India; ASI- Archaeological Survey of India: MLCP- Multi Level Car Park

[5] A study of the GPRA Colonies (Delhi Urban Arts Commission 2020) was also taken up by DUAC from 2019-2020 which was led by Samir Mathur[1] as the Principal Investigator during his tenure at DUAC. The subsequent work was carried out by the authors of this report from 2021-22.

[6] For Delhi, Landsat Data shows that the built-up area in the city increased by 417 ha during 1998-2003 and 6,633 ha during 2003-2011 (Sharma and Joshi 2013). The population in Delhi increased from 400,000 in 1901 to 18,686,902 in 2016. It was projected to increase further by 40 per cent by the year 2020 (Tiwari, et al. 2018). The projections have

wealth. Over a short span of 75 years since India's independence from Colonial rule in 1947, Delhi has evolved swiftly to become a "world-class" (Ghertner 2015) metropolis of over 16 million people. This population is expected to grow further to 26.5 million by 2036 (National Commission on Population 2020).

The planning and city building process in Delhi took place over three phases- "the imperial Mughal, the imperial British, and post-independence" (Nath 1993). The first Master Plan for Delhi aimed at decentralization of the city, guiding development in new areas, and creating iconic public and private buildings in the city (Delhi Development Authority 1962).

Research has highlighted a shortcoming in city and state level policies on a master plan scale. This has resulted in a lack of policies that address parameters of landscape architecture such as "percentage of green space, patch density of green space, cohesion of green space, degree of greenery" (Pramanik and Punia 2019).

This paper focusses on the re-densification policy for GPRA (also called 'Colonies'), a scheme for residential housing for all Central Government employees who are entitled for allotment of accommodation. There are approximately 70 such land parcels located within significant areas around the city core. A requirement of 75,000 residential units is projected. There is a shortfall of 22,000 units. These need to be accommodated within the same land parcels. Re-densification was thus justified, as it would provide 26,000 units.

The goal of this study was to analyse urban regeneration through the lens of landscape based parameters; and was prompted by protests from citizens concerned by the loss of mature trees in the city core in redevelopment schemes proposed. Redevelopment proposals[7] for GPRA projects often necessitate the need for large parking infrastructure (in the form of basements) based on regulations[8] (as per Master Plan for Delhi 2021, Unified Building Bye Laws 2016 etc.) to accommodate the requisite vehicular parking numbers. The need to remove the existing trees is thus built into the current parking norms. Tree cutting, or tree transplantation often leads to the loss of mature and native tree species and thus loss of large range of biodiversity. Other restrictions include building height controls mandated by AAI (Airport Authority of India), that limit the top elevation of built form, thus ruling out the possibility of enhanced heights that may require smaller footprints (termed as low ground coverage) possible and thus reduce the need for tree cutting. In addition, the redevelopments are often seen in isolation and designed as gated islands cutting the

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been realised despite the pandemic. The urban area in Delhi increased from 26.89% in 2001 to 39.97% in 2015, and the vegetation cover reduced from 71.93% in 2001 to 60% in 2015 (Tiwari, et al. 2018).

[7] The demand and availability status of GPRA colonies stated in 2018-19 MoHUA Annual Report (Delhi Urban Arts Commission 2020) implies that the total shortage of Dwelling Units is 22,276, of which the major shortage is for Type II and Type III Dwelling Units.

[8] A background study was taken up to understand the norms that govern Site Planning and Built forms in the city. These included a study of the Master Plan of Delhi (MPD) 2021 and 2041 (Delhi Development Authority 2021) for social infrastructure and Green area standards, Unified Building Bye-Laws for Delhi (UBBL) (Delhi Development Authority 2015) for Building regulations and Fire Safety norms, UBBL (Delhi Development Authority 2015) and Urban Greening Guidelines, 2014 (Town and Country Planning Organisation 2014) for Environmental conditions for Buildings and construction, AMASR Act for Heritage regulations, and AAI guidelines for height regulations in Delhi.

right of way for general public and preventing the application of walkability from the nearest transit hubs (Baviskar 2003). This negates the very ideal of Transit Oriented Development (TOD) that is a key feature of MPD 2041 (Delhi Development Authority 2021).

A study of 7 approved redevelopment proposal also revealed an increase in road surface areas. This is contrary to conventional sustainable policies that suggest an increase of green cover versus an increase in hard surfaces to reduce heat island effect. Moreover, the redevelopment proposals do not follow norms relating to comprehensive urban landscape design and sustainability or user satisfaction. They also fail to bring a sense of identity to the precinct as a whole. The creation of meaningful open spaces to derive the maximum benefit out of city infrastructure (including social and recreational infrastructure) led to the review of the current practice of isolated developments, and re-evaluate the criteria/ benchmarks for such isolated developments and treat the seemingly separate plots as a unified masterplan.

3. Methodology

The objective of the study was to create a set of guidelines to facilitate planning the GPRA redevelopments as a comprehensive sub-set of the city fabric.

The identified boundary of the delineated macro-study area (6 miles by 3 miles or 10 km by 5 km) was situated between the Inner and Outer Ring Roads of Delhi. It encompassed 15 GPRA Redevelopment projects out of which 7 have been approved for redevelopment and 8 were identified as potential sites for future re-densification and demonstration of the results of this study. Prevailing redevelopment pattern analysis for integration to city mobility, social infrastructure in proximity, regulatory frameworks for building height restrictions and heritage structures (related to maximising density), green and blue networks were identified and finally a density mapping (related to site carrying capacity as defined in the MPD) were carried out. Inferences were collated from the macro-level study. The justification for a need of an alternative approach for urban re-generation of GPRA colonies was made.

Assessment and derivation formulation process is under three heads i.e. Data Collection, Issues Identification and Assessment & Derivation.

Demonstrations of the application of regulatory factors (Social infrastructure, Fire norms, green area ratios, tree count, heritage and height) and non-regulatory principles (TCF, EDF, RCF, PRF, PDF and CIF) for quantitative factors, as well as qualitative factors (comfort, identity, sustainability, user satisfaction quotient) have been collectively used.

The findings of this study were collated. These include identification of issues often overlooked by planners and designers. Derivation of the efficiency factors was used in identifying the feasible planning and design norms. Formulation of an assessment index for confirming objectively the liveability standards can be applied to check the efficiency of the site planning for each parcel and to arrive at feasible densities for each of the 7 study areas.

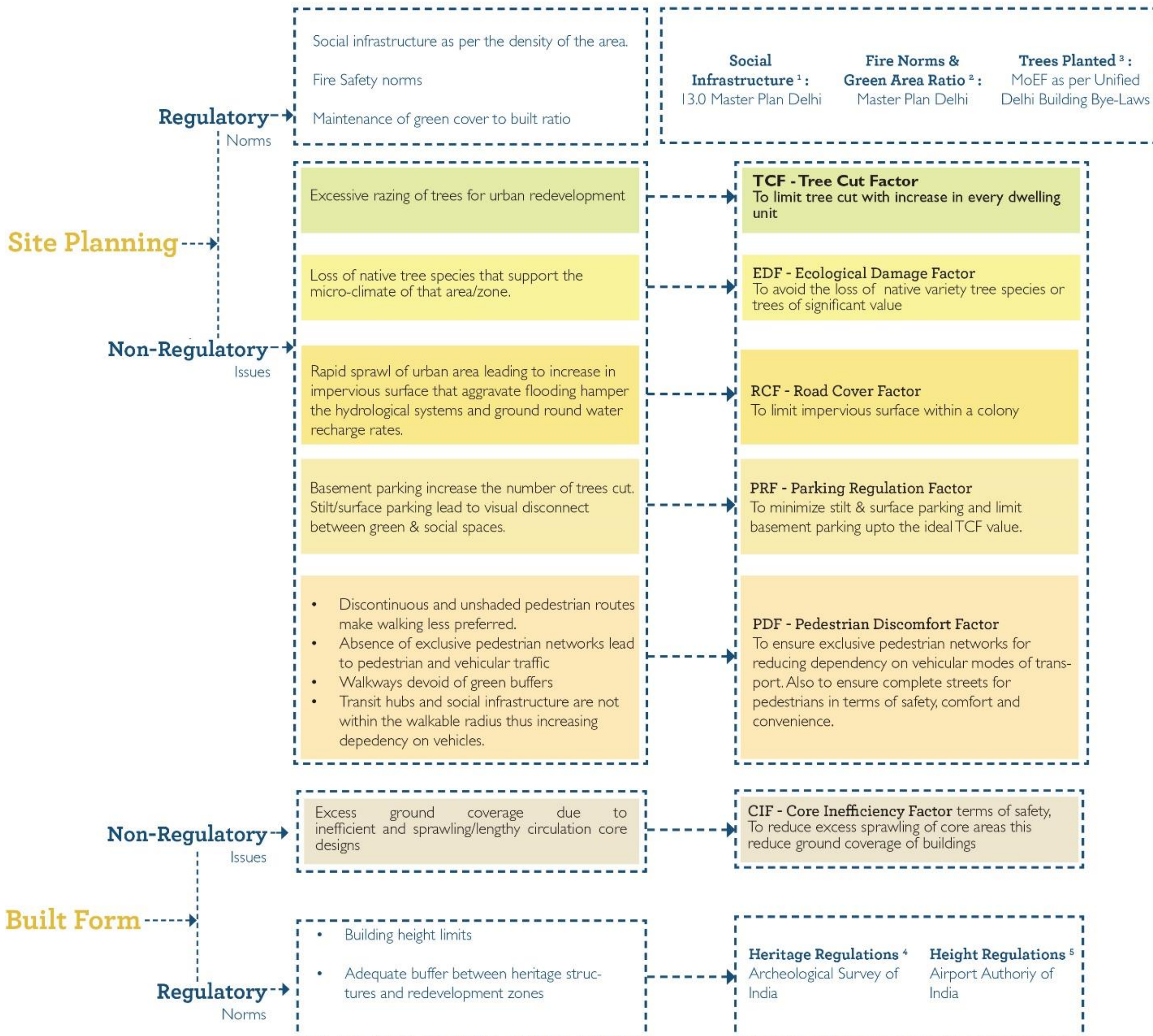

Figure 1- Summary of the structure of the paper outlining the research methodology (Delhi Urban Arts Commission 2020)

4. Assessment and Derivation based upon Methodology Development

First, data for design proposals of 7 GPRA colonies under the process of redevelopment in 2020 were studied to establish quantitative Parameters based on a comparative analysis to understand the before and after redevelopment scenarios. Second, the design proposals of 7 GPRA colonies were assessed to identify the issues, and each issue is then addressed by formulating its corresponding efficiency factor. Third, the relative parameters values corresponding to each factor, are compared and assessed for all GPRA schemes for which data is available to determine an ideal value.

Data collection and Data Index

Proposals submitted to DUAC for 8 GPRA redevelopment colonies received up to year 2020, as well as a survey of the built and landscape character of 18 more sites for demonstration are the primary data sources. These were sorted and analysed by creating a Data Index.

This Data Index for GPRA Colonies included information on the existing Site Area in hectares; existing Dwelling unit count (DU's), Density expressed in DU's per Hectare area, Average Height permitted by the aviation authorities in meters; Location, numbers, sizes and types of trees, as well as existing Tree Density.

The 8 proposals were examined for proposed DU's; Achieved Density (DU's/Hectare); maximum Height Achieved (M); Achieved Floor Area Ratio (FAR); and details of trees to be cut.

A comparison of these 8 sites led to conclusions relating to issues such as Retained Tree Density; Increased Densities (DU's/Ha.); Tree Cut (%) and remarks specific to each proposal.

Efficiency Factors- Assessment and Derivation

For the derivation of ideal values for each factor, a 3-step process was followed spanning across all 7 case studies. This formulation process was broadly under three heads i.e. Identification of Relative Parameters, Assessment of Relative Parameters, and Derivation of an Ideal Value. Based on the detailed study of the 7 approved GPRA redevelopment proposals and MPD norms that govern site planning and built forms in the city, six 'Efficiency Factors' were established; i.e., Tree Cut Factor (TCF), Ecological Damage Factor (EDF), Road Cover Factor (RCF), Parking Regulation Factor (PRF), and Pedestrian Discomfort Factor (PDF).

Tree Cut Factor (TCF)

Redevelopment project sites, with the presence of full-grown trees, allows two approaches. One, to clear the site and build. The second is to do the development responsibly considering the ecological value of every tree. The second approach has been quantified through this factor, which allows redevelopment in a controlled way and helps in reducing the large-scale tree cutting. The relative quantitative parameters applicable were 'Number of Existing Trees', 'Number of Trees Cut', and 'Increased Number of Dwelling Units'. The numeric values of these identified parameters for each colony were analysed to understand their co-relation.

The relationship between the parameters was further quantified in two parts: Ratio of 'Number of Trees Cut' to 'Total Number of Existing Trees' and Ratio of 'Number of Trees Cut' to 'Increased Number of Dwelling Units'. As both the ratios hold equal importance, an average is calculated to obtain a unique value. The quantified values of the two ratios for each colony are compared and analysed. It was concluded that a lower increase in DU density will lead to a higher retention of tree density, and that dwelling units' numbers were increased at the cost of cutting existing trees.

The ideal value of Tree Cut Factor has been derived to be less than or equal to 0.20, with a condition that the value of each ratio should be less than or equal to 0.20. Different strategies (not in the scope of this report) can be worked upon by the planners to achieve the ideal value of this quantified factor. The achievement of an ideal value will lead to a balanced design which will in turn ensure preservation of the green cover.

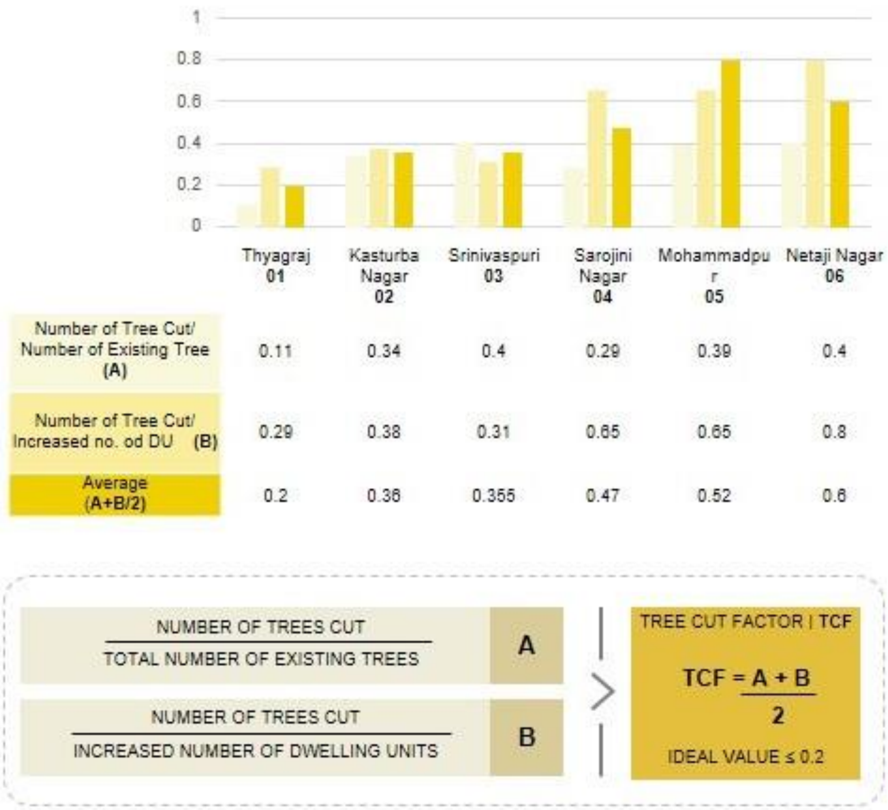

Figure 2- Summary of data collected and analysed to derive the TCF for each proposal (Delhi Urban Arts Commission 2020).

Tree Ecology Damage Factor (EDF)

Trees strengthen the distinctive character of a place and help in maintaining a healthy biodiversity. Fully grown native trees have a higher ecological value as they are well-adapted to the local environmental conditions and provide habitat to other species of wildlife. While deciding on the tree cutting strategy for any re-development, thought should be given to decide on the ecological value of trees being cut, as cutting trees with higher ecological value will lead to the loss of biodiversity. Thus, EDF evaluates the ecological value of trees cut on two parameters i.e. ‘Age of Trees’ and ‘Native Tree Species’, to assess the impact on the surrounding environment.

The relative quantitative parameters identified are ‘Calliper Value of the Tree’ cut (this value estimates the tree age), and the ‘Number of Native Trees’ cut.

The relation between the above parameters is quantified in two parts; (A) Ratio of ‘Number of Native Trees Cut’ to ‘Total Number of Trees Cut’, and (B) Ratio of ‘Number of Trees Cut with calliper ≥ 300 mm’ to ‘Total Number of Trees Cut’.

As both the ratios hold equal importance, average has been calculated to obtain a unique value. It is inferred that the percentage of tree cutting and their estimated ecology damage value, both should be considered separately to assess the overall impact on the surroundings. These values need to be minimum for the preservation of biodiversity.

The ideal value of Tree Ecology Damage Factor is estimated to be less than or equal to 0.2, with a condition that the value of each ratio i.e. 'A' as well as 'B' should be less than or equal to 0.20

Road Cover Factor (RCF)

Urban redevelopment often results in the increase of impervious surfaces, that increase the storm water run-off volumes and in turn pollute the natural waterways, by carrying all the pollutants along its way and eventually contaminate the lakes and rivers; or those that increase the heat island effect (thermal gradient difference between developed and undeveloped areas), which in turn, impact the microclimate.

Relative quantitative parameters identified are 'Site Area' and 'Road Surface Area' measured in square meters. The co-relation between the parameters have been quantified as the ratio of the 'Road Surface Area' to the 'Site Area'. This results in a unique value that evaluates the extent of road surface area at a particular site. The ideal value of Road Cover Factor is derived to be less than or equal to 0.20.

Parking Regulation Factor (PRF)

Strategically planned parking can reduce parking issues that hamper the quality of spaces within a residential area. Minimising stilt parking can reduce the circulation required around each block allowing better visual connect between the outdoor spaces at the ground level, minimising surface parking allows the scope to increase social interactive spaces. Optimizing basement parking can help reduce the number of tree cut. MLCP's (Multi level car parking structures) should be encouraged so that the vehicular circulation is restricted and pedestrian activities within residential zone are not hampered.

The relative quantitative parameters identified are 'Basement Parking Capacity', 'Stilt Parking Capacity', 'Surface Parking Capacity', and 'MLCP's Capacity'.

First, the co-relation of 'Basement Parking Capacity' and its consequence of tree-cutting is analysed. 'Basement Parking Capacity' was found to be directly proportional to the 'Basement Extent Area', the numeric value of the later is considered for assessment. Second, the numeric values of the four identified parameters, in terms of ratios 'Parking Capacity in stilts, basements and MLCP's' to 'Total Parking Capacity', have been analysed to understand their co-relation.

It was concluded that the Basement Extent / Basement Parking capacity is directly proportional to trees cut. Therefore increased basement extent led to more number of trees cut. The parking strategy could be in conjunction with the ideal value of Tree Cut Factor (TCF), and 'Stilt & Surface Parking' should be minimum in order to reduce the circulation area. Thus, it is suggested that MLCPs' use in planning is encouraged.

The ideal value of Parking Regulation Factor is estimated to be less than or equal to 0.20

Pedestrian Discomfort Factor (PDF)

In order to render a residential zone pedestrian friendly, the following issues were identified: discontinuous and unshaded pedestrian routes make walking less preferred than driving, absence of exclusive pedestrian networks lead to conflicts of the pedestrian and vehicular traffic. Walkways devoid of green buffers, and transit hubs and social infrastructure not within the walkable radius increase the dependency on vehicles.

The relative parameters identified are 'Pedestrian Discontinuity', 'Unshaded Walkways', 'Walkway devoid of Greens', 'Un-signalized Pedestrian Crossings', and 'Average Walking distance' to nearest transit hubs.

To quantify the above parameters and derive a unique ideal value for PDF, a score method was formulated. Score values were decided objectively based upon the plan area calculations. If the condition is not met, then the score is to be 0.0; if the condition is somewhat met, then the score is 0.4; and if the condition is met in the total, then the score is to be 0.8

The ideal average value of Pedestrian Discomfort Factor was thus derived to be less than or equal to 0.20.

Core Inefficiency Factor (CIF)

Building core must be designed efficiently for controlling excessive ground coverage. To achieve this, large circulation cores should be avoided in the building planning by minimising the circulation spaces. The relative parameters identified were 'Dwelling Units Area per floor' (Built-up Area of the Dwelling Unit including Balconies area), and' Core Area per floor' (Built-up Area including Stair Case, Service Shafts/Core, Lifts and Circulation Area).

The ideal value of Core Inefficiency Factor is derived to be less than or equal to 0.20 for all Type Units.

Qualitative Parameters and Assessment Index

The qualitative parameters intend to inform the study of aspects that need to be addressed to achieve quality of life in a project. These qualitative parameters use interpretive and theoretical frameworks that inform the 'Efficiency Factors'. These parameters consist of factors related to the psychological perception of the environment with respect to the physical characteristics of that environment. Qualitative parameters are general and descriptive but more complex as they involve aspects of social, environmental, economic and aesthetic design.

To assess the efficiency of the redevelopment proposals, an 'Assessment Index' was formulated which assessed liveability standards in terms of qualitative parameters such as comfort, satisfaction quotient, identity and sustainability, in relation to their respective quantitative parameters they are evaluated as a measurable quantity (refer Fig. 3). This index was based on *The Global Liveability Index 2021* (The Economist Intelligence Unit 2021), and *The World Happiness Report 2019*

(Helliwell, Layard and Sachs 2019) and 2022 (J. Helliwell, et al. 2022). The Assessment Index is used as a scoring system for the 7 GPRA projects that were identified for demonstration.

Development Proposal Demonstration

In order to achieve the ideal values for 'Efficiency Factors' and 'Assessment Index', the following strategies were demonstrated. This was done for 8 new sites and it was suggested for a further 10 redevelopment sites. Figure 02 shows the application to one of the sites redevelopment proposal.

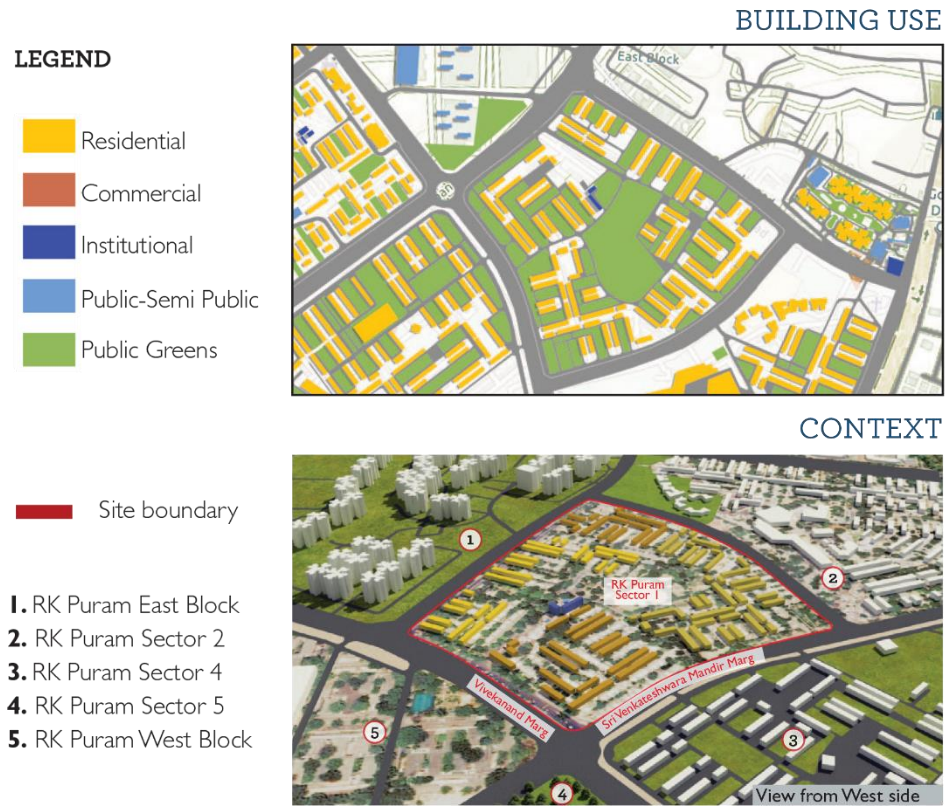

Figure 3- The proposal for RK Puram Sector 1 was developed using the ideal values for 'Efficiency Factors' to achieve 'Feasible Densities' (Delhi Urban Arts Commission 2020).

The demonstrations indicated:

1. Small isolated green pockets were replaced with consolidated greens to accommodate recreational activities and social spaces.
2. Multi-Level Car Parking were placed towards the periphery to allow shorter length of access for vehicular traffic, and to maintain an exclusive pedestrian zones towards the centre of every site.
3. Social Infrastructure, such as existing schools and commercial buildings in the site, were shifted to peripheral locations to facilitate easy access and increase serenity of the residential areas.
4. Towers were placed on the site with minimal road network to increase the green footprint within the site.

5. Conclusion

Urban regeneration is a challenging process as it needs to enhance the landscape character and blend the functional requirements with planning and design innovations that need to be assessed objectively. These objective parameters are used to derive a scoring system for the GPRA projects, and hopefully other urban landscape regeneration projects across the country.

At a macro level, an integrated, comprehensive and strategic planning approach is required for the re-distribution of the densities within the city to facilitate better mobility by locating increased densities along the major transit routes while incorporating existing social infrastructure in the planning. The increase of density needs to be strategically decided, and, the redevelopment should be considered holistically and not in isolation as plotted developments.

A comprehensive application of the Assessment Index across all 7 GPRA redevelopment proposals enabled the envisioning of a landscape planning that was efficient, sustainable, integrated, and holistic with feasible densities.

Figure 4- Comparison of the built form before and after the application of 'Efficiency Factors' indicating 'Feasible Densities' for one of the selected case studies (Delhi Urban Arts Commission 2020).

This study

(a) Suggests *landscape parameters for urban re-generation* strategies for city master planning,

(b) Demonstrates the impact of feasible landscape-based development parameters and derived '*Efficiency Factors'* for the design of redevelopment proposals, and

(c) Proposes a holistic '*Assessment Index*' that may be used as a rating system to ascertain the inclusion of sustainability parameters in redevelopment projects across India.

It may be noted that the findings would require further research for understanding a possibility of larger applicability.

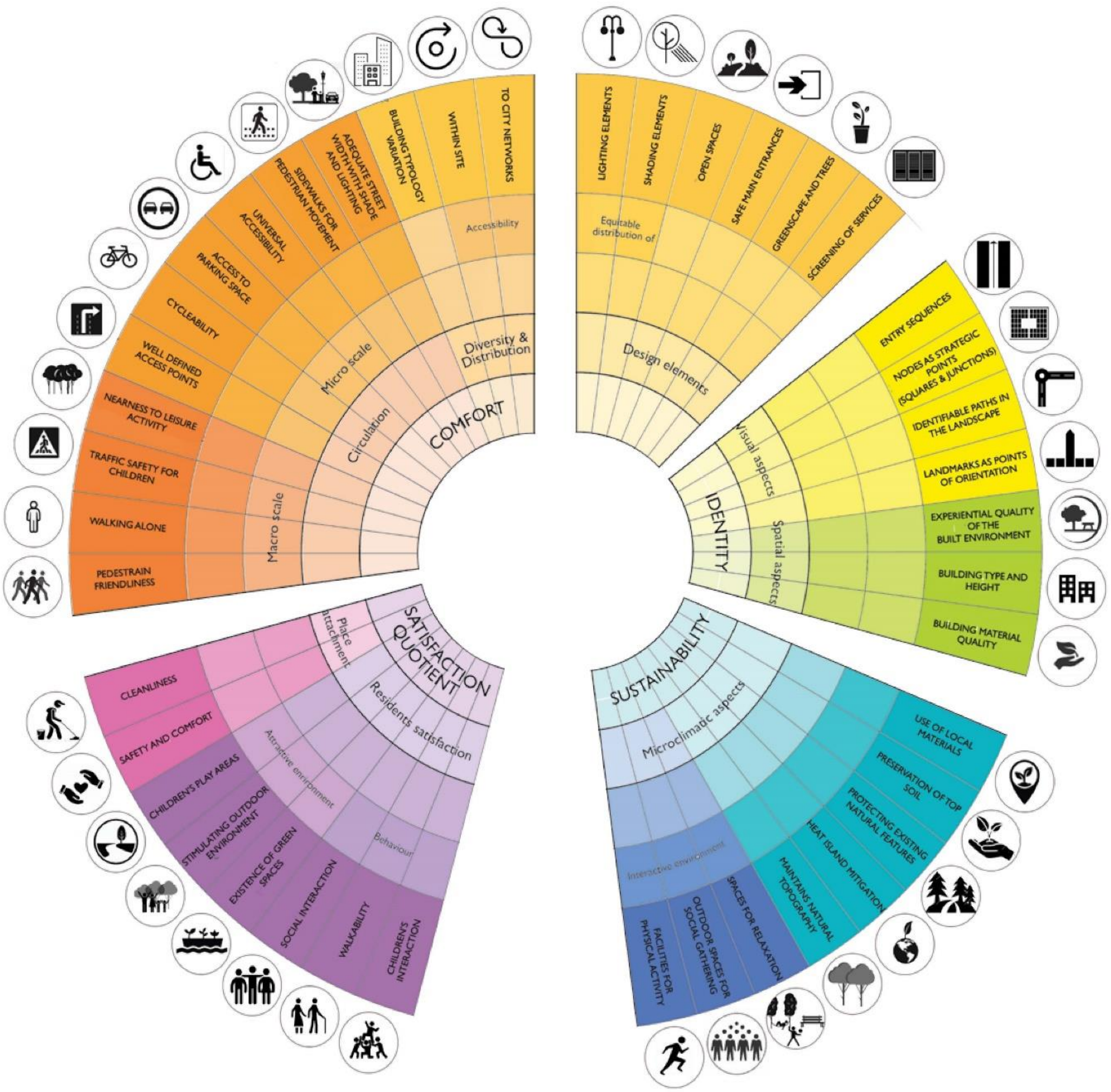

Figure 5- All redevelopment proposals were analysed against an 'Assessment Index'. It was observed that when the proposal incorporated the ideal values of 'Efficiency Factors', a higher 'Assessment Index' score was achieved (Delhi Urban Arts Commission 2020).

Our endeavour is to envision inclusive, sustainable, and functional spaces balancing the ecological and the built fabric, and ensure that they co-exist in harmony. As demonstrated in this study, efficient planning coupled with sustainable design and engineering is required at the planning, design, construction and maintenance stages in our cities to improve the quality of open spaces.

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