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Formulation of Imageability Standards and Design Codes for an Urban Area; Chennai.

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ABSTRACT
The appearance of an object in the environmental image depends on its "distinction from the other things……as a separable entity", which makes it easier to identify the object according to its spatial or pattern in relation to other objects. It is understood that by creating a distinction of the different elements as a separable entity, it makes it easier to identify the element and the city's parts can be recognized and organized into a coherent pattern, aiding way-finding, thus enhancing the imageability of any city. Order, unity, balance, symmetry, scale, proportion, rhythm, contrast, and harmony are among the important tools used to define good building architecture, and these concepts can be used to analyse the aesthetic qualities of an urban environment, though they are not used in precisely the same way for large scale urban development. This research paper tries to fill the gap and identify a list of parameters to measure imageability and suggest the ways it can be formulated for an urban area taking the case of Chennai City. The case study analysis method is used to for the formulation of standards for the selected paprameters of Imageability and developed design codes to the context of Chennai City. Similar method can be adopted and developed for other climatic regions in the global secenario.

KEY WORDS: Imageability, Parameters, Case Study, Standards, Design Codes, Chennai

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I. INTRODUCTION

Imageability, the term coined by Lynch Kevin (1960), "is the quality of a physical object, which gives an observer a strong and vivid image. … It might also be called legibility." **Images have been described as the** "points of contact between people and their environment" thus linking them to behavior (Downs and David Stea 2005)**.**

The skeleton, an image which appears, is a particularly useful analogue for the idea of a city. For the skeleton links the city to history. It is the history which is limited to a pure knowledge of the past, without which, to determine the future is difficult. Thus, the skeleton, which may at one level be compared to the urban plan, while a general structure of parts, is also a material of artefact in itself: a collective artefact (Rossi Aldo 1982). The concentration of one particular visual quality (the apparent clarity or legibility of the cityscape) is grasped visually as a related pattern of recognizable symbols.

Lynch Kevin (1960) has identified five important elements of imageability- paths, landmarks, nodes, districts and edges. It is understood that the uniqueness of the design of these elements helps in enhancing the imageability. The meaning of the elements helps to make things noticeable and can be shared by groups. Associations of different elements are generally unimportant; the location of physical elements is more important than their appearance, and paths are the most important element.

When these imageability elements are looked into, it is understood that paths are often treated as edges and tend to be major edge elements, which means that the classifications used by various studies need to be discovered (Rapoport Amos 1969). Districts are defined as large areas into which one enters, and which are distinguishable from the surrounding area, but this definition can also be subjective and variable. Nodes are equivalent to small districts, and distinguished by their importance, so that their definition involves many parameters. Different elements may be used at different scales and the different categories brought together into cognitive wholes, so that a market square is not just a district area but also a node, a meeting point of paths defined by edges and landmarks (John Douglas Porteous 1977).Thus, these elements are likely to vary in different groups, so that associations, unimportant in one place may be important elsewhere. Also, it appears that landmarks are selected differently by various people (Rapoport Amos1969).

The most important cue from which people choose to make a place more distinguishable, and which leads to strong imageability is the physical difference. In this, the vision is measured by parameters, such as the type of objects, space quality, light and shade, greenery, visual aspects of perceived density, new vs. old, order

vs. variety, well maintained and badly maintained, scale and urban grain, road pattern, topography and location. These are also included in the list of imageability parameters to evaluate the image of the city.

1. Adequate outdoor space
2. Trees
3. Clean air
4. Physical quality
5. Harmony with nature
6. Amount of greenery
7. Nature of building Elements
8. Signs
9. Noise level
10. Degree of enclosure
11. Character of space
12. Nature of enclosing elements
13. Transportation and Parking
14. Access to parks
15. Safety and Comfort
16. treet Length and Proportion
17. Paving and Street Furniture
18. Nature of ground floor abutting the street
19. Building height
20. Building use
21. Colour
22. Materials
23. Fenestrations
24. Appearance & Elevation
25. Type of housing units
26. Density
27. Style of dwelling
28. Variety
29. Total massing
30. Levels of complexity
31. Orientation

This paper deals with the formulation of standards for the different quantitative imageability parameters listed above. The different case studies were analysed to understand the formulation of the standards for different parameters of imageability adopted there in context. This helps in identifying the important parameters of Imageability along with the method of formulation of standards for the same. This guides in formulating the standards for the different identified quantitative imageability parameters in general, and in specific for the study area, Chennai city. The identified parameters are street wall height; which gives us the enclosure ratio, building height, building use, building facades, building materials, building signs, street facades and some special features like street furniture, pavement design, parking etc.

In continuation of identifying the imageability parameters under different characteristics of the urban area, they are further grouped into two. A list of quantitative parameters and qualitative parameters. This researchpaper is limited to evaluate the identified quantitative parameters from the list, and these are taken into consideration for enhancing the imageability for the study area, Chennai city

II. THE DIFFERENT IMAGEABILITY PARAMETERS - CASE STUDY METHOD

The cities identified for the case study were Downtown Halifax, Halifax Regional Municipality, High Land Square Business District, Akron, Ohio, Lough borough Town centre, Nottingham City and Islington, London. The different Imageability parameter addressed in each city with the method of formulation of standards for the same is shown in detail in Table 1. The conclusions derived from these case studies were used to formulate the standards for the various imageability parameters in general.

Table 1. The Different Imageability Parameter Addressed in Each City With the Method of Formulation of Standards and the Guideline Principles

A. City/ Area: Downtown Halifax, Halifax Regional Municipality **Guide line Principles are:**

1. Street Wall Height (M)

To ensure a comfortable human-scaled street enclosure, street walls should be no less than 35' and generally no greater than a height **proportional (1:1)** to the width of the street as measured from one building face to the opposite building face. Along heritage streetscapes, the maximum street wall height should be consistent with the prevailing heights of the heritage buildings. Along the Waterfront, fronting building walls are not to exceed 40' to maintain a low-rise interface. Street wall placements are categorized according to setback standards. All retail frontages should be encouraged to reinforce the 'main street' qualities associated with the historic downtown, including:

- ✓ Narrow shop fronts, high levels of transparency and frequent entries.
- ✓ Protecting pedestrians from the elements with awnings will be encouraged.
- ✓ Patios and other spill-out activity will be permitted and encouraged.

A "street wall" is formed when buildings consistently line or front onto a street with consistent setbacks. The following qualitative design aspects of the street wall should be considered:

- ✓ Design of the Street wall
- ✓ Building Orientation and Placement
- ✓ Retail Uses
- ✓ Residential Uses
- ✓ Sloping Conditions
- ✓ Materials
- ✓ Entrances
- ✓ Roof Line

2. Building Height (M)

The most important part of the design of a building is the first three to four storeys, as that part of the building and the established street wall affect the pedestrian experience.

3. Special Features

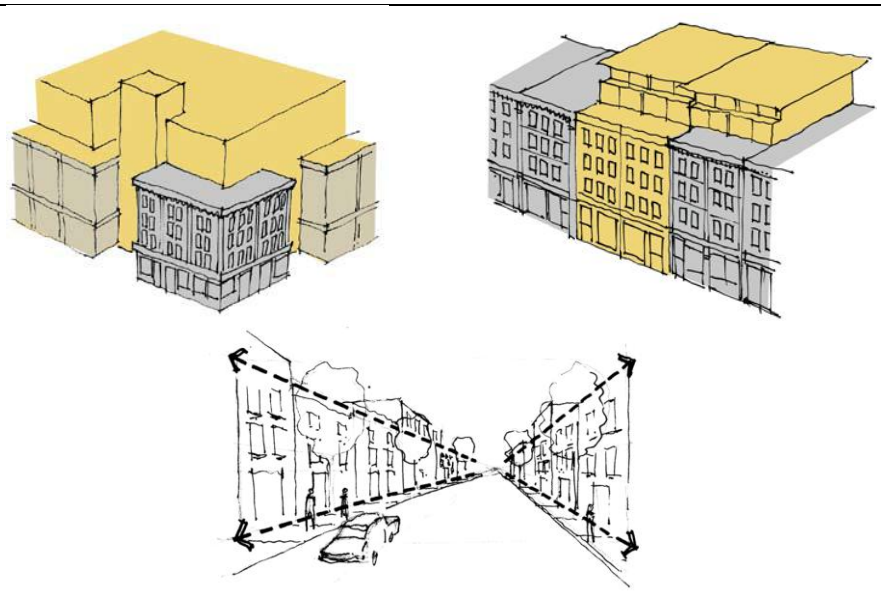
The articulation of a building is often what gives it a human scale and a sense of quality, through attention to detail. Articulation implies a three-dimensional facade, where windows and other elements have depth, creating a dynamic play of light and shadows. Typically the articulation will indicate the transition between floors and interior spaces, giving a human scale to the facade. This articulation can also include changes in materials, or material treatments.

- ·To encourage continuity in the streetscape and to ensure vertical 'breaks' in the façade, buildings should be designed to reinforce the following key elements through the use of setbacks, extrusions, textures, materials and/or detailing:
- **Base** – Within the first four storeys, a base should be clearly defined and positively contribute to the quality of the pedestrian environment through animation, transparency, articulation and material quality.
- **Middle** – The body of the building above the base should contribute to the physical and visual quality of the overall streetscape.
- **Top** - The roof condition should be distinguished from the rest of the building and designed to contribute to the visual quality of the skyline.

Buildings should contribute to a mix and variety of high quality architecture, while remaining respectful of downtown's context and tradition. To provide architectural variety and visual interest, other opportunities to articulate the massing should be encouraged, including vertical and horizontal recesses or projections, datum lines, and changes in material, texture or colour. Street facing facades should have the highest design quality; however, all publicly viewed facades at the side and rear should have a consistent design expression.

Typically, street wall heights are determined by using a1:1 ratio with the street width from the base of one building to another.

Heritage buildings in need of repair can often be saved from demolition by integrating them with new developments.



Infill development on Street will help form a continuous street wall, improving the pedestrian experience.

B. City/ Area: High Land Square Business District, Akron, Ohio **Guide line Principles are:**

1. Street Enclosure

Require the development of all new buildings and infill development up to the street edge/property line to establish a solid edge to the street along the building line. For retail buildings, the setback rule is straightforward: don't have one. Traditional retail, to be successful, must pull directly up to the sidewalk, so that people can see the merchandise in the window. Parking lots in front are of course forbidden: there is little that is more destructive to pedestrian life.

2. Cross Section of the Street

Buildings should be at least two storeys in height to establish a sense of street enclosure.

The relationship between the height of the buildings and the width of the street is important when maintaining a pedestrian oriented environment. **A two-storeyed building (approximately 27 feet high) will give a height to width ratio of 1:3. A three- storeyed building) approximately 40 feet high) will give a height to width ratio of 1:2.** If buildings are too high in relation to the width of the street, a canyon like effect can be created; if too low, there is no sense of enclosure.

The height to width ratio should be not less than 1:2.5 if a sense of enclosure is to be achieved

3. Promote mixed-use

Development throughout the district and particularly discourage single storey, single use development in the district. Encourage a variety and intensity of street activity. Promote a continuous retail edge at the property line. Re -establish street level retail continuity by infilling vacant sites. Develop a continuous retail edge on all new buildings, that connects to existing retail buildings. Promote a continuous retail use at the pedestrian level with office or residential uses on the upper floors.

4. Special Features

Street activities should include on-street parking. This brings people into the area at all times of the day and night, and provides another level of activity and accessibility. Encourage local cafes in the district. Build the front of the café so that a set of tables can extend the café out onto the street. Promote a sense of urban activity within the retail district that is "unique".

Vehicular and Pedestrian Access

Reinforce both vehicular and pedestrian access to the retail district. Off street parking should be convenient for customers and visitors, but its visual impact should be minimized. Provide clear pedestrian links from the parking area to the street and retail establishments. Parking should be provided behind the building and accessible from either adjacent street. Parking on the street edge between buildings and the street drastically reduces a favorable height –to- width proportion on the street.

Buffer the surrounding residential neighborhood from retail business uses. All service areas and trash

containers must be screened from view through the use of evergreen plant materials, masonry screens or similar solid structures compatible with the building design.

Street Facades

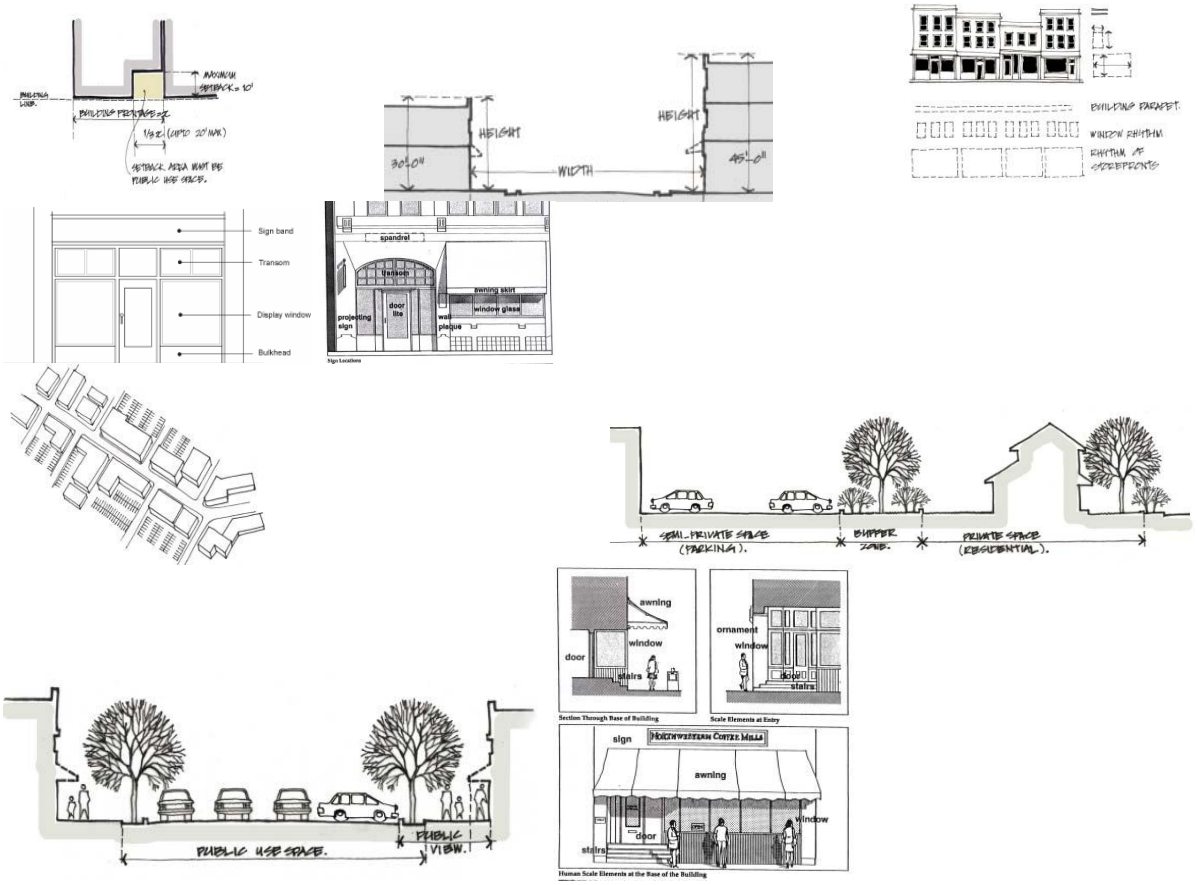
Major facades and entrances to buildings should face West Market Street. Access to service bays and parking should be from the cross street. The architectural composition of building elevations should express a base, middle, and top articulation on all street facades.

Storefronts

At least 60% of the total area of the first floor façade facing West Market Street and the public square at Highland Avenue should be windows display. Walls exposed to side streets must have doors, windows or fixed glazing areas of at least 30% of the total surface area of the wall facing the street**.**

Building Signs

Exterior signs should be located within the base of the building with concern for the appropriateness of location, size, color, and lighting



Parking lot- behind the building

C. City/ Area: Loughborough Town centre **Guide line Principles are:**

1. Principles of Continuity and Enclosure:

Development should be in the form of secure perimeter blocks, which clearly distinguish between public fronts and private backs, and follow a coherent building line.

Projections and occasional set-backs from the building line can be used to add emphasis, but the function of any space created must be clearly defined.

The primary access to buildings should be directly from the street.

Developments including large stores and other 'big box' units, such as multi-storeyed car parks, can create exposed 'dead' frontages (the Bridge Street frontage to the Rushes is a local example). Careful design will be required in any future developments of this nature to ensure the retention/creation of active and attractive street frontages, which are compatible with the fine-grain of the Town Centre.

2. Building use:

All new development will be expected to consider the opportunity to encourage a mix of uses that contribute to the economic and social 'health' of the area. Complementary uses can be mixed horizontally (side by side) or vertically (on different floors of the same building).

Large development proposals should provide a mix of housing type, form and tenure. A compatible mix of uses should include live/work units**.**

3. Special Features

A high quality design will be sought using layout, form, scale, massing, detailing and materials in the design of buildings and external spaces appropriate to the character of the street, place and Town Centre in general. Design inspiration should be sought from the particular local materials, building forms and features of character within the Town Centre.

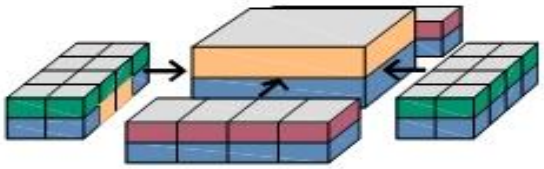
New development should respect the historic street patterns, intricate grain, and vertical and horizontal rhythms (e.g. the building widths, the proportion and scale of windows and doors etc.) of the Town Centre. Opportunities to repair street pattern and grain where this has been lost, should be exploited.

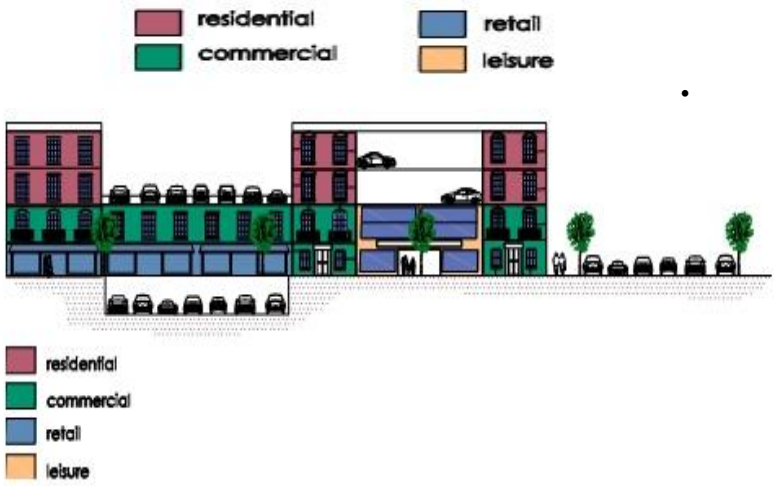
Create a skyline which adds visual interest and conveys particular activities and concentration of uses.

• The main entrances to public and other major buildings should be emphasized through carefully designed streets, lighting, signage and paving.

Existing important views and vistas should not be blocked or compromised by new development. In new development, the opportunity to create new views and vistas that will contribute to the legibility of the Town Centre, should be considered.

• Development at strategic corners should emphasis their importance through the use of building height, prominent entrances and other architectural features





Close attention to the detailing and quality of materials should be provided especially at ground floor and building entrances that are very visible to pedestrians.

D. City/ Area: NOTTINGHAM CITY **Guide line Principles are:**

1. Building Height: 17 m to 26 m

2. Street Enclosure:

This unity of character comes from the consistency of street enclosure ratio in the centre of the city. The enclosure ratio is a measure of the profile of the street. It relates the height of the buildings to the width of the street (expressed in this guide with the height of the building first). In a street with a 1:1 enclosure ratio (such as Lister Gate), the height of the buildings is the same as the width of the street. If the enclosure ratio is 1:2 (for example Mansfield Road), the height of the buildings is half the width of the street. An enclosure ratio of 1:0.5 (for example Kings Walk), means that the buildings are twice as high as the width of the street.

The main streets tend to have a 1:1 enclosure ratio, meaning that the predominant building height is the same as the width of the street. This ratio increases on secondary streets that are narrower. Enclosure for diff roads should ensure that the maximum heights of buildings do not overwhelm the Character of key streets.

a.	Arterial routes	1:2
b.	The Ring Road	1:1.5
c.	High Streets	1:1
d.	Secondary Streets	1:0.75
e.	Minor Streets	1:0.75
f.	Alleyways	1:0.5

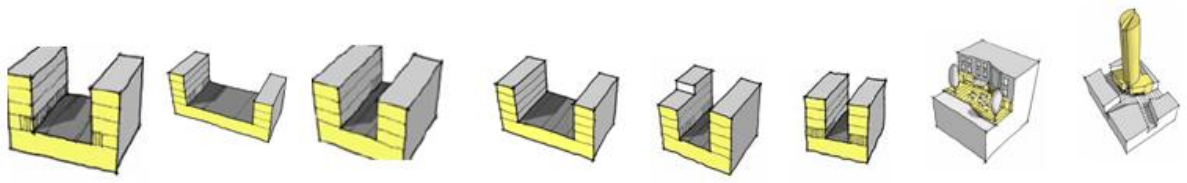
The beauty of the city comes from its streets and public squares, and these would be nothing without the buildings that enclose these spaces. The way, in which buildings enclose the streets, alleyways, parks and public squares of the city is known as its urban form.

The most beautiful city in the world is nothing if its streets don't throng with life and its buildings glow with activity. The activity in a city is, therefore, at least as important as its design. This relates to the mix of different uses that bring people into the city centre at different times of the day. It relates to the intensity of activity and the density of office and residential uses, that determine how many people there are about. It also relates to the design of buildings and the extent to which they animate the surrounding streets as well as the design of those streets, and the way they encourage vitality.

The strategy to maintain and increase activity in the city centre is based on three strands; increasing the density of development around the fringes of the city centre, promoting a greater mix of uses, and ensuring that buildings spill their activity out onto the street**.**

Arterial routes 1:2

Urban form relates to the way that buildings are positioned and designed to enclose public spaces, streets and squares.



E. City/ Area: Islington, London **Guide line Principles are:**

The height of street frontages should normally be in proportion to the width of the street

1. Street Enclosure:

Height also needs to be considered in terms of its proportion in relation to the size of the space it defines / encloses. The height of a street frontage should provide sufficient sense of enclosure, natural surveillance and

maximize the potential development opportunity of a site. Most of Islington's Victorian residential terraced streets have a height- to -width ratio of between 0.5: 1 to 0.7: 1.

Streets with a ratio of between 0.5:1 to 1:1 normally provide a well proportioned street frontage which provides a good sense of enclosure. Anything less than a 0.3:1 height-to-width ratio can result in streets, which suffer from too little enclosure where the buildings appear divorced from the street.

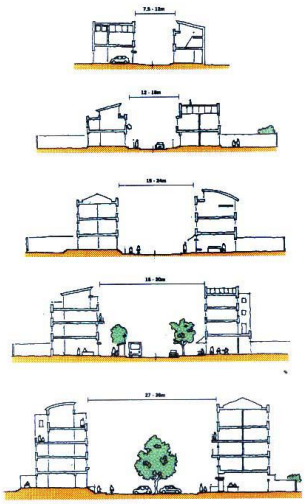
2. Special Features

Foot way design, Design of Street Furniture, Trees, and Accessibility for all. Nevertheless a building that stands out can sometimes contribute positively to the urban environment by:

- Becoming a focal point
- Providing an element of surprise or contrast.
- Reinforcing a sense of place
- Highlighting the importance of a public building

The scale of a building is also determined by its bulk and width, and the manner in which the façade is articulated. Historically, most of Islington's street frontages are characterized by narrow plot widths, where terraces are sub divided into plots, where the height is greater than the width of the building.

The vertical proportions are expressed both in the overall dimensions and the individual elements, especially the fenestration, and the manner in which they are composed within the frontage. The repeated pattern of narrow street frontages of Islington's streets creates a rhythm, harmony, and coherence.



THE SCALE OF BUILDINGS SHOULD RELATE TO THE WIDTH OF THE STREET

Rooflines should normally respond to the articulation of the rest of the façade. It should normally be possible to read the width of the plot divisions from the bottom to the top of the building. The roofline should reflect the rhythm, harmony and scale of the longer street frontage. Stepped or sculptured rooflines can appear monolithic, particularly where the shape of the roof does not pick up the sub division of the façade.

Window Shape, Position and Sizes

The windows are a key component of the façade, that help define a building's character and provide underlying order as well as its overall proportions. Care needs to be taken to ensure that the windows are of an appropriate scale to the façade, and that each window in the façade has some relationship with the other. Key to this is identifying the appropriate shape, position and size of the windows. Some elevations can be unduly monotonous, because of the number of repeated windows. The risk of this is greatest in large façades, particularly when small windows are used, where they can appear lost within the elevation. Too many different types of windows, particularly if they appear to have no apparent relationship to one another, can result in an untidy façade.

Use of Materials

The use of materials needs to be considered both in terms of the relationship with the surrounding built form as well as the articulation of a façade. Use of different materials can help to articulate and add interest to a façade. Facades can be further articulated by employing recesses and projections that can animate a façade.

The various case studies discussed reveal that there was always a thought process on the overall form and image of the city and its parts, with respect to the different parameters addressing imageability and sense of place, and firmly establishing the relation between the built environment and the public realm. In addition, the regulations were created with the formulation of planning guidelines. In the current design and planning policies for an urban environment, some of the major aspects of imageability, namely, legibility and identity are lacking, and this research tries to fill the gap. And also formulate the standards for the formulation of imageabilty parameters for Chennai city.

III. RESULTS-THE IMAGEABILITY PARAMETERS AND STANDARDS IN GENERAL

The list of quantifiable variables, which people choose to make a place more "distinguishable"- leads to strong imageability, with a strong identity and physical setting along the urban streets; this led to the urban

form, and was used for framing the design code for the city as given below. The standards for these parameters has been arrived from the case study and literature studies are tabulated in Table 2 below.

Each parameter is dealt with in detail and is discussed with the different aspects to be considered for it, with very specific reference to the hot humid climate as narrated below.

1. Harmony with nature - type of trees
2. Street width to building height ratio (Degree of enclosure)
3. Perimeter to Area (P/A) ratio
4. Building Orientation
5. Surface area to Volume (S/V) ratio
6. Roof Form
7. Fenestration orientation, pattern and configuration
8. Walls and Roof Materials
9. External colours
10. Textures
11. Density and size
12. Building massing
13. General building planning principles according to the Chennai climate
14. Air pollution
15. Area for Street furniture
16. Size of the Squares/ Open spaces
17. Sense Of Place And Space and Legibility
18. Building Frontage Design
19. Movement, Proportion and Scale of Built space

Table 2 The standards for the various imageability parameters in general

Parameter **1. Harmony with nature - type of trees** - Open spaces in & around the building **Different aspects to be considered** ✓ Careful plantation of trees so that they do not reduce the air speed (Arvind Krishan et al 2001) ✓ Integration of vegetation in building minimizes heat gain ✓ Buildings should not be attached to one another. ✓ Open spaces should be oriented with respect to wind pattern, and the funnel effect can be used to maximize the airflow within the complex. ✓ Operable glazing at the roof level in the courtyard/ atrium spaces allows heat escape during summer and heat trap during winter. ✓ Verandahs and courtyards lead to a very airy built complex in conjunction with the fenestrations. ✓ Wind catchers, objects of much interest, are employed.
Parameter **2. Street width to building height ratio (Degree of enclosure)** **Different aspects to be considered** ✓ 'Width of the street does not exceed the height of the surrounding buildings' ✓ Also affects the daylight received ✓ Generally, buildings are likely to provide a sense of definition when height-to horizontal- distance ratios are 1:4 when the viewer is looking at the buildings from the street at a 30-degree angle. ✓ The most comfortable pedestrian streets are those where the 'width of the street does not exceed the height of the surrounding buildings'.(ratio; 1:1) ✓ Spatial enclosure is a function of two main factors, the proportion of the space – the height of the buildings relative to the width of the space-and the architectural scale and character of the building facades that form the walls of the urban room. ✓ 2:1 and 1:1for intimate pedestrian space; 1:3 for more relaxed enclosure, up to a maximum of 1:6 for spaces with people and cars, but **climatic factors can affect decisions on urban proportions differently in different places.** ✓ We should try to create the maximum comfort shading space by buildings with graphic sun studies- projecting sun angles into the space for different times of the year.

Table 2 (Continued)

Parameter **3. Perimeter to Area (P/A) ratio (Plan Form)** **Different aspects to be considered** ✓ The prime concern is a plan form for maximizing air movement and **minimizing the P/A ratio is useful as it minimizes the heat gain.**
Parameter **4. Building Orientation** **Different aspects to be considered** ✓ North faces receive minimum direct radiation, and south, the maximum in summer. ✓ The orientation of the streets, the season of the year, the techniques and materials used in building construction may all affect the absorption of short-wave radiation.
Parameter **5. Surface area to Volume (S/V) ratio (the three dimensional exploration of the P/A ratio).** **Different aspects to be considered** ✓ Important factor in determining heat loss and gain ✓ The prime concern is creating airy space- so this might not be **necessarily minimizing the S/V ratio**. ✓ The materials of construction are such that they do not store heat.
Parameter **6. Roof Form** **Different aspects to be considered** ✓ Natural ventilation is desirable ✓ Building the longest dimension perpendicular to the direction of the air flow ✓ **Roofs overhang and pitch should be as high as possible; this results in maximum pressure difference and consequently maximum air flow.**
Parameter **7. Fenestration pattern and configuration** **Different aspects to be considered** ✓ Fenestration areas should be large to facilitate ventilation ✓ Large overhangs to cut off diffuse solar radiation ✓ Height of the fenestration should be such that there is a good distribution of air flow over the human body- **lower sill heights are preferable** ✓ **Windows should be staggered rather than aligned.**
Parameter **8. Fenestration Orientation** **Different aspects to be considered** ✓ **Should be within 45^0 perpendicular to the direction of the air flow**
Parameter **9. Walls & Roof Materials** **Different aspects to be considered** ✓ Wall materials should have low thermal capacity ✓ Roof should be light, probably having high U- values and low heat capacities.
Parameter **10. External colours and Textures** **Different aspects to be considered** Potentially colours in the built environment have an emotive effect on people. While such mental reactions are subjective and particular to the individual, there is evidence that, in general, 'certain colours are likely to produce certain feelings, and this aspect should receive consideration in regard to external design as well as internal design'. Considering the use of colour in the urban environment, the goal at all times should be the enhancement or revitalization of the aesthetics of the building or place. Toward that goal, there is, however, a great deal of scope as to the character or effect desired but, to this end, certain human responses to particular colours first need to be understood. Reekie provides broad empirical observations of typical responses to colour: ✓ Blue : soothing effect if not too strong; ✓ Green: similar in effect to blue; ✓ Yellow: cheering and stimulating; ✓ Red: exciting; ✓ Purple: in small areas, rich and comforting;

Table 2 (Continued)

- ✓ Browns: restful and comforting; and
- ✓ White: cheering and stimulating.

Writing about colour in architecture, promotes the axiom that architectural forms should be simplified if colour effects are to be successful, and as a corollary that colour should be employed 'wherever the opportunity to create effects by means of formal articulation has been denied... '. John Ruskin first advanced the theory that **'form and colour were enemies and should therefore be set on essentially different paths... The highest intensity of colour, in his view, should never coincide with the highest complexity of form' (Derek,2016).** These are guidelines but not absolutes, in view of changing cultural trends and norms of acceptability.

Apart from the emotional value of a colour arising from the psychophysical effect it has on us, working with colour in buildings or in the urban landscape can exploit certain visual expressiveness resulting from the inherent properties unique to each colour

i. **Directional colour contrast:** When two colours on opposite sides of the colour wheel (eg. blue and orange) largely determine the overall composition, this is known as a directional colour contrast.

i. **Light-dark contrast:** If the central contrast in the composition is light dark, the values of the colours used will come particularly into play and have a great influence on the overall effect. Here, the hues play a secondary role, being merely an accessory to the light-dark contrast.

i. **Pure and grayed hues contrast:** If the composition is carried out largely in one range of value (or lightness), its effects will rest on the contrasts between pure and grayed hues.

v. **Cold-warm colour contrast :** If the colours belong to the accepted cold or warm part of the spectrum, the predominance of one over the other will create the contrast; and

v. **Single hue compositions:** Variations of a single hue with accents picked out by contrasting degrees of lightness or darkness.

It is important that **there should be textural harmony in a building or in a group of associated buildings.** Ironically, a fragmented facade of visually rich building elements could conceivably be placed alongside a plain building; on the other hand, two facades dissimilar in the scale, proportion and colour of the facade elements could be discordant. States that **'Texture modifies colour'.**

Decorative texture and appropriate colour application provides both aesthetic appeal and functional purpose:

- ✓ In wetter climates a smooth texture will shed rain more efficiently.
- ✓ **In drier, hot climates rough textures provide surface shading, which reduces heat load.**
- ✓ In the developed world, the thin reflective glass curtain wall has other economy spin-offs – the advantage gained of liberating additional floor space for rental income, despite higher energy costs and polluting emissions into the atmosphere.

The employment of colour and texture can be beguiling, but requires to be in tune with the architectural style to avoid the impression of being alien or added on.

- ✓ Strong textural effects can merge the architecture with its setting, lending a strong sense of rightness with the place.

The decorative application of colour and texture is carried out with a definite aim in mind, whether aesthetic or functional. In such instances, **colours and textures are used**

- ✓ **to articulate,**
- ✓ **to distinguish and**
- ✓ **Enliven surfaces and objects, and so enhance the aesthetic attributes** of architecture.

It is equally valid to employ texture to provide a uniform surface where imperfections would otherwise detract from the aesthetic appearance of a building. For example, a high gloss paint finish on old plaster would emphasize the imperfections, whereas a more textural paint would assist towards their concealment.

An important contribution of texture other than that of purely aesthetic is that, if used selectively, texture can reduce reflectivity and therefore unwanted glare from the sun on horizontal as well as vertical surfaces. The vaulted architecture in the hot, arid regions of North Africa, for example, is often coarsely finished externally to provide partial shading from the sun.

- ✓ To **reduce heat gain–Light coloured and rough surfaces are preferable.**

Parameter

11. Density and size

Different aspects to be considered

- ✓ Two design features-

Table 2 (Continued)

✓ The fraction of the urban land covered by buildings ✓ The average height of the buildings in the given urban section ✓ The effect of the average building height is modified by the relative height of individual buildings.
Parameter **12. Building massing** **Different aspects to be considered** ✓ 'Golden section' concept ✓ A formula has been derived for the celebrated Golden Section, which is described as a 'uniquely reciprocal relationship between two unequal parts of a whole, in which the small part stands in the same proportion to the large part as the large part stands to the whole ... The complete reciprocity of this proportion strikes us as particularly harmonious and pleasing, a fact that has been proven by many scientific experiments.....' ✓ **Mathematical approximation of the Golden Section is a rectangle of approximately 5:8 proportions.** ✓ It can be defined **geometrically as a line that is divided such that the lesser portion 'a' is to the greater 'b' as the greater 'b' is to the whole 'a+b'. This can be expressed algebraically by the equation of two ratios: a/b = b/a+b.** Apart from changes to the landform and surfacing in the built environment, it should be understood by designers and planners that changes to the environs occur when buildings are grouped together ✓ They influence the energy balances of one another and complicate the air movements and heat flows in the intervening spaces. ✓ The bulk of two buildings of differing sizes adjacent to one another affects wind flows so strongly, that the downward flow of air on the taller block creates higher wind speeds in two zones. Such effects can be avoided by carrying out an appropriate analysis at the design stage, if necessary with wind tunnel models, to determine an optimum spacing to minimise gusting. ✓ Vertical walls tend to reflect solar radiation towards the ground rather than the sky. ✓ Re-radiation from the ground bounces back on to the walls of the adjacent buildings. ✓ **Skyscrapers can absorb more than six times the heat absorbed by the featureless rural plain, but an area of dispersed suburban housing would absorb only slightly more than the rural plain**
Parameter **13. General Building Planning Principles according to the Chennai climatic conditions** **Different aspects to be considered** ✓ **Free-standing buildings to allow air movement through generous openings in the north and south walls.** ✓ **Narrow plan shapes with single rows of rooms for cross ventilation.** ✓ **Good ventilation to remove excess humidity and provide thermal comfort.** ✓ **Totally shaded walls and external openings using broad eaves and deep verandahs.** ✓ **Lightweight construction with shaded walls.** ✓ **East and west facing walls preferably without windows or openings.** ✓ **Ventilated roof space to counter the effect of high solar radiation.**
Parameter **14. Air pollution** **Different aspects to be considered** In the urban situation, outlines effective design controls in the relationship between buildings and open space that together with landscaping strategies could promote air circulation and reduce the levels of air pollution(Thomas Derek 2002): ✓ In flat, open terrain under calm conditions, air pollution levels are highest adjacent to the road and decrease with distance from it. ✓ **Street canyons lined with buildings of similar height, oriented perpendicular to the wind direction, tend to have poorer circulation than street canyons that are lined with buildings of different heights and interspersed with open areas. To promote air circulation in street canyons, step buildings back from the street, increase openings and vary building heights.** ✓ **Wind shadows on the lee of buildings reduce air circulation and provide a place for polluting emissions to build up. To reduce wind shadow at the base of a building, buildings designed with a pyramidical shape or openings are more likely to permit air flow.** ✓ **The more enclosed the space the more likely the accumulation of pollutants. To promote air circulation, street side arcades or canopies designed to be high rather than low would ameliorate the situation.**

Table 2 (Continued)

✓ To reduce the effects of pollution, **create planted highway embankments and woodland growth landscaped to help filter pollutants from the air and the dispersion thereof.** ✓ It is desirable to locate pollution-sensitive uses away from the highway emission zones. ✓ Green spaces within the urban setting are dust-reducing and have the property of assisting towards cleaner air by a process of carbon-dioxide fixation through photosynthesis
Parameter **15. Area for Street furniture** **Different aspects to be considered** ✓ The **physical area for seating measured as part of the total area of an open space should ideally be in the ratio of 1:10** according to the circumstances. (Derek Thomas 2002).
Parameter **16. Size of the Squares/ Open spaces** **Different aspects to be considered** ✓ According to empirical observation **15 square metres per person in a public square is considered lively & 50 square metres per person in that same square can be regarded as dead (Alexander et al 1977).** ✓ The rule of thumb suggested therefore is: **for public squares, courts, pedestrian streets, any place where crowds are drawn together, estimate the mean number of people in the place at any given moment (P), and make the area of the place between 150 x P and 300 x P square feet (approximately 15 x P and 30 x P square metres).** ✓ It should be remembered that a square of 30 by 30 metres will seem deserted if there are fewer than 30 people in it and there are not many places in an urban context where there will always be 30 people. ✓ It is possible to recognise a person's face and a normal speaking voice to be heard across a spatial width of 23 metres. Alexander et al. propose that a public square, except where it serves as a centre to a large city, should be no more than 20 metres across. This applies only to the width; in the length there would be no constraint necessary. ✓ With the aim of either encouraging or discouraging social encounter, the issue of appropriate pedestrian density levels is a matter of importance, requiring to be addressed along with all other design aspects.
Parameter **17. Sense Of Place And Space & Legibility** **Different aspects to be considered** ✓ Part of the presence of any good place is the feeling of its embodying and being surrounded by a field of its own sort of space with its special limits and potentials. ✓ It is this field that is interesting today only if it implies connection: roads with buildings, buildings with buildings, with trees, with the seasons, with decorations, with events, with other people in other times. ✓ Just as each locality should seem continuous with the recent past, so it should seem continuous with the near future (Lynch Kevin 1981). ✓ A place is a space which is distinctive in character. ✓ Since ancient times the genus loci or spirit of place has been recognised as the concrete reality man has to face and come to terms with in his daily life.
Parameter **18. Building Frontage Design** **Different aspects to be considered** With building frontages onto public spaces it is advantageous that 'the public edge of the building should house activities which benefit from interaction with the public realm, and can contribute to the life of the public space itself '(Bentley et al. 1985). To achieve this: ✓ Locate as many entrances as possible in such positions that comings and goings are directly visible from the public space. ✓ Encourage compatible uses within the buildings to spill out into the public area. This principle applies to uses on the ground and first storey. ✓ Even if there are no public uses, most buildings contain activities which can contribute to the animation of the public space itself. ✓ It is still necessary to preserve the privacy of the indoor activity, so that the users will not feel the

Table 2 (Continued)

need to screen them totally from the public space. This privacy can be achieved by horizontal distance, a change in level and/or a combination of both. ✓ The usefulness of the edge is important for people-watching and is greatly increased by the provision of places to sit.
Parameter **19. Movement, Proportion and Scale of Built space** **Different aspects to be considered** On the matter of the effect of movement on scale and proportion, driving in a vehicle leaves little time for viewing and diminishes a person's capacity to absorb detail. Pedestrians have a better awareness of a place than drivers or passengers in moving vehicles. Appropriate adjustments about proportion must take four factors into account • The range of distances from which the various parts of a space can be seen. • The speed of movement at which a space can be seen. • The length of time during which each view will be experienced. • The relative number of people likely to see the building from each different viewing position, whether from a travelling vehicle or on foot. Similar adjustments in terms of architectural detail and scale need to be taken into account. Where the motor vehicle determines the speed of movement a different level of complexity of detail and scale other than the human scale is likely to be more appropriate to the context. Conversely, an environment that is visually comfortable from a motor vehicle could become monotonously boring on foot (Rapoport Amos1977). As speed increases, concentration becomes specific and several other things happen: ✓ The point of concentration (or focus) recedes from 185 metres at 40 km/h to 610 metres at 105 km/h. As a result **elements in the environment must become larger in order to be noticed or appreciated at all. Also, while objects perpendicular to the road become prominent those parallel to it lose prominence.** ✓ Peripheral vision diminishes so that while at 40 km/h the horizontal angle is about 100 degrees, it reduces to less than 40 degrees at 80 km/h. One result is 'tunnel vision' which may induce hypnosis or sleep. ✓ Side elements need to be quiet and subdued, and perceived subconsciously in the blurred field of peripheral vision, with the main features on the axis of vision and the point of concentration periodically moved laterally to maintain attention. ✓ Foreground detail begins to fade due to the rapid movement of close objects. The earliest point of clear view recedes from 9.5 metres at 65 kmh to 33 metres at 95 kmh. At the same time a detail behind 430 metres cannot be seen as it is too small, so that the range is between 33 metres to 425 metres - and that is traversed in 15 seconds. **Elaborate detail is thus both useless and unnecessary**. ✓ Space perception becomes impaired so that near objects are seen, get close and disappear very quickly. They thus tend to 'loom' which can become extremely stressful. Elements too close to the edge or overhead on traffic freeways, and sudden curves should be avoided. ✓ Architectural elements along a fast traffic way should provide information at an intermediate rate by **using a scale or texture discernible** at a higher speed. Also, to achieve gradual transitions, sudden contrasts are visually disruptive and should be avoided.

IV. THE IMAGEABILITY PARAMETERS AND FORMULATION OF STANDARDS FOR THE STUDY AREA, CHENNAI

From the analysis of various case studies, it is understood that nineteen parameters were addressed to formulate the design specific code for the area. From this thirteen parameters are drawn out with respect to the formulation of design code for the study area, Chennai to enhance imageability. Standards are formulated for these identified parameters, taking the climatic factors of Chennai city, such as sun, shade, wind direction, historic and site context, existing image as per the current planning regulations.

To enhance the Imageability, Design Codes are formulated for the study area, Chennai. In Chennai, the topography is a flat coastal plain and the climate is hot and humid, with the predominant wind direction from South East to North West; all this has to be reflected in the standards framed for the policy criteria of the built environment in concern with the above mentioned list of parameters. The identified list of quantitative imageability parameters are harmony with nature, building height, total massing, building orientation, parking, building use, degree of enclosure, land use, style of dwelling, exterior colour, exterior material finish, fenestrations in the elevation, elevation/façade details and signage/street furniture/ hoardings, and provision for parking. The methods in which these parameters are evaluated for the study area, and the standard for each parameter, are outlined in Table 3.

Table-3 The list of imageability parameters surveyed for the study area, Chennai city, along with the standards

Sl. No	Imageability Parameters	The surveyed parameter and Category				Standards for the Parameters for the Study area, Chennai
1.	**Harmony with Nature**	Presence of trees/greenery/landscape in the premise				Careful plantation of trees so that it doesn't reduce the air speed. Integration of vegetation in building minimizes heat gain. Planting more suitable avenue trees which will enhance the Imageability along the streets, without affecting the sky view factor shall be encouraged.
2.	**Building Height**	Low Height (G and G + 1)	Medium Height (G +2 to G + 3/ Stilt + 4)	High rise (G + 4 up to G + 20)	Skyscraper (Above G + 20)	As per the enclosure ratio for Chennai- Arterial Roads (40-60m wide)- 1:1 Sub- Arterial roads (30-40m wide)-1:1.25 Collector Street (20-30m wide)- 1:1.5 Local Street (10-20 m)- 1:2 The building height varies according to the abutting road width- related to sky exposure plane and is also included as the DESIGN CODE.
3.	**Total Massing**	Cuboids	Rectanguloids	Cylindrical	Others	Massing of the building varies at different places according to the street orientation and building orientation. To keep the perimeter to area ratio (P/A ratio) to the minimum as per the climatic suitability for Chennai; circular, square and rectangular plan forms which shall create the building mass as cuboids, rectanguloids ,cylindrical, which further minimize the surface area to volume ratio (S/V ratio) shall be encouraged and formulated as the DESIGN CODE.
4.	**Building Orientation**	Square	Perpendicular to the road	Parallel to the road	Others	Depending upon the orientation of the road the suitable building orientation varies. The best suitable orientation for the Street- should be oriented to utilize the natural wind patterns- South east to North west and buildings perpendicular to these streets will have the maximum natural ventilation. North faces receive the minimum radiation and south receives the maximum

						radiation.
5.	**Parking**	Provision of parking in the premises				Provision of parking in the basement or rear side of the building enhances the imageability so this is promoted as a design code in the form of DESIGN CODE.

Table 3

Sl. No	**Imageability Parameters**	**The surveyed parameter and Category**							**Standards for the Parameters for the Study area, Chennai**
6.	**Building Use**	Commercial	Office	Community	Mixed	Institution	IT	Residential	Mixed use enhances imageability, especially if it is on the ground and first floor.
7.	**Degree of Enclosure**	Height of the building to the abutting street Width Ratio							Enclosure ratio between 2:1 to 1:1 normally provides a well proportioned street frontage, which provides a good sense of enclosure. Anything less than a 0.4:1 height to width ratio can result in streets, which suffer from too little enclosure, where the buildings appear divorced from the street.
8.	**Style of Dwelling**	Building style before 1950		Building style 1950- 1990		Building style 1990-2010			Special provisions for Heritage/ Conservation regulation in context specific areas/ buildings are formulated as a design code
9.	**Colour**	Light Colour			Dark Colour				To Reduce the heat gain light coloured surfaces are preferred, which is coded..
10.	**Texture / Materials**	Smooth Plastered Finish	Glass and Aluminum Finish		Rough Finish	Others			In drier, hot climates rough textures provide surface shading which reduces the heat load. Wall materials with low u-value along with low thermal capacity and roof material of more reflective and low

						thermal capacity shall be preferred and the DESIGN CODE is formulated.
11.	**Fenestrations**	Big windows in the facade	Small windows in the facade	Nil windows in the facade		Fenestration areas shall be large to facilitate ventilation and be within 45^0 of theperpendicular to the direction of air flow. Lower sill heights are preferable. Windows shall be staggered rather than aligned in a straight line to maximize the air flow. Double glazing and reflective glazing shall be promoted. All these shall be brought in as the DESIGN CODE.
12.	**Elevation/Facade**	Plain	Plain with Fin	Plain with Balcony	Others	According to the orientation of the building the elevation and the facade details vary from building to building. Roofs overhang and pitch should as high as possible, results in maximum pressure difference and consequently maximizes the air flow.Shading of all the openings shall be promoted. All these shall be brought in as the DESIGN CODE.
13.	**Signage/street furniture/ hoardings etc.**	Presence/ absence of signages and street furniture				Good designed signages and street furniture increases the legibility and thus enhances the imageability. The DESIGN CODE for the same shall be formulated according to the context.

V. CONCLUSIONS

The standards were formulated with the identified quantified imageability parameters using Case study method to identify patterns of relationship between imageability parameters and Design Codes. Limitations of this paper is that only the selected quantified imageability parameters are identified in the case study area to formulate the Design Code to enhance the Imageability. The Implications of this paper is that any city shall be taken as a study area and the other imageability parameters at any level (Micro/Macro) may be considered to enhance the imageability, in its context.

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