

The Impact of Urban Morphological Transformation on Legibility of Old Neighbourhoods; with special reference to old Colombo – Kandy Main Road in Mawanella

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Abstract: Mawanella is a small suburb in Sri Lanka, has been developed as a transitional town since the colonial period. The historical layers of the town were reflected as traditional buildings on either side of old Colombo- Kandy main road. The development of road widening projects was carrying drastic changes to the existing urban form and many of old settlements were erased by uncontrollable development, practiced during the last 20 years. The study explores how the gradual changes in urban morphology impact on legibility of older neighbourhoods, considering Mawanella as a model case. Literature review synthesized the parameters such as pattern of urban morphology, serial vision along the main artery and the façade articulation to study the transformation of the city form. The methodology was adopted to identify the aspects that are contribute to the city's identity, how the urban morphology has been transformed over the last 20 years and how it impacts on city legibility through visual survey and a perception study. The research confirmed that people were strongly attached with the old city elements and the unique morphology of the old neighbourhood which were visually and physically contribute to achieve the city legibility though currently it was unable to gain through the modernized environment. The outcomes of the study were formed as an urban design toolkit, to be used for future developments of the older neighbourhoods.

Keywords: Urban transformation, Morphology, Urban grain, Serial vision, Perception, Urban form, old neighborhoods, Legibility

1. Introduction

A city can be configured in various ways, such as spatially, contextually, visually, perceptually, socially, functionally, and morphologically (Carmona, et al., 2003). Basically, the urban morphology can be referred as the study of 'urban form' (Cowan, 2005) or the study of the form of human settlements, as well as the process of their formation and the transformation. In addition, urban sprawl, growth pattern and rapid developments are heavily influencing issues on the urban form. Urban form is a result of a patchwork in which different features are stitched together and a coexistence of different features, each of which belongs to a clearly identifiable interpretation of city form. Lynch (1981) recorded that, "Urban form comprised of visual images of the cities, experiences, feelings, memories of place, thoughts and intellectual constructs anchored in the realm of art and humanities". An urban form usually comprises with regions, cities, streets, neighbourhoods, or blocks. Neighbourhoods are combined with different social communities and spatially specified to geographical areas (Schuck & Rosenbaum, 2006). The morphological study helps to understand the spatial structure and the character of the metropolitan area, city, town and village by examining the patterns of its components, the process of its development at different scale. In addition, the morphological analysis gives special attention on how the city form changing over time. Usually, cartographic sources such as maps used to study the morphological transformation. On the other hand, as a subfield study, it was helping to understand the social form through the physical

layout of the city which are expressing how the physical forms contribute to produce or reproduce the various social forms. (Carmona, et al., 2003) (Seçmen & Makaklı , 2019).

Mawanella is an older neighbourhood of Sri Lanka, developed as a transitional town since colonial period. Its historical layers were reflected as traditional buildings on either side of old Colombo- Kandy main road. The development of road widening projects were caused drastic changes to the existing urban form and many of old settlements were erased by uncontrollable development which has been taken place during last 20 years. However, it was observed that the lack of focus on fading characters of the traditional urban setting, is leading to negatively effect on particular spatial qualities while unable to fulfilling the essential urban needs. Not only Mawanella, but there are also many old neighbourhoods in Sri Lanka where slowly eroding the identities of the unique urban characters due to current haphazard developments. The unguided development plans were resulted in transformation of urban form caused to change the morphological characters of the cityscape. Thereby it effects on the legibility of the city (Behzadfar & Saneei , 2012). Lynch, (1981) mentioned the same issue in another perspective that whenever the city elements lose or changing their character, the particular setting has been changed and the result is reducing the legibility of the space. Hence, there is a profound need to investigate the impact of morphological transformation on legibility of such older neighbourhoods. Because the vitality of rethinking on how to mitigate such issues to create a legible city and how to develop cities with the minimal impact on its characters are important questions to be resolved in urban planning. Mawanella is a transitional point and the main gateway to the hill country since colonial period. When the British built the Colombo - Kandy main road as a trade path, a mix of commercial, residential, and linear settlements built along the road. Old settlements on either side of the Colombo - Kandy main road (Bazaar Street) brought a

unique meaning to the city though current city developments which have been practiced during the last 20-years, impacted on many traditional built structures. Some built masses are newly appeared, and some have disappeared from the city form, by interfering haphazard developments. Thus, there is a question aroused how this morphological transformation affect for the legibility of the Mawanaella town. 'Legibility' is a physical and a spatial quality which making the city as graspable and its important at two different levels; physical form and activity pattern (Alcock, et al., 1985). The combination of these two levels is contributing to provide a clear sense of the environment to its users. Awareness of these two must complement one another. The legibility of the city can be formed as an individual element or as a whole (Lynch, 1960). However, it is urge to understand how the urban morphological transformation occurred in Mawanella during last 20 years to analyse how it affected on legibility of the old neighbourhood.

2. Literature Review

The 'urban morphological transformation" can be studied through urban morphological analysis which used to study present and past conditions of the urban structure, form, land use and pattern. At different scales, including individual buildings, lots, street patterns, and blocks, explains the existing physical form and structure of the urban environment (Environment, 2006). Further, changing patterns of the urban morphology represented by, urban grain, building footprint, building orientation, land use pattern and other special qualities such as serial vision and facade articulation (Seçmen & Makaklı , 2019) (Liombo , 2012). According to Montgomery, (1998) successful cities are in part shaped by the relationship of built form to space, and the range, variety, and characteristics of the spaces. The Urban granularity divided the city into particular sizes of lots. Therefore the 'grain' describes as something made up with smaller particles and being a key element of hierarchy of urban form. Rooney & Houlston, (2017)

stated that the 'grain' represents the arrangement or pattern of the buildings and streets within the built form and forming as fine or coarse, formal or informal, linear, blocky, planned, structured or unstructured. The concept of urban grain has been applied mainly to understand the aspects of the physical form (Norton , 2016). The urban grain divided into two; fine grain and coarse grain relating to the way they perform the fineness, in the urban grain. The dominance of small plots within an urban block can be describe as a 'fine grain' (Norton , 2016). Fine grains are usually characterized by similar elements and functions are widely dispersed throughout the area without forming any large clusters. Norton, (2016) was summarizing the benefits of well-organized fine grain pattern, providing greater mix of use, greater mix of ownership, greater mix of business, enhanced streetscape, and enhanced street life. Montgomery, (1998) stated that traditional European cities are relatively dense and fine-grained. Coarse grains are given dominance to one or relatively few, medium or large-scale plots in a block. Usually, 'fine grain' indexes a vital physical condition for a good city form (Montgomery , 1998). As explained by Haughton and Hunter, (1994) transformation of urban grain of cities occurred significant changes in urban form in 20th century. In addition, the trend of lump developments caused the damages of the traditional urban grain (Tibbalds, 1992). However, there are traditional cities still remaining as a part of modern urban context; 'Salem' is one of traditional city work in the grain and fine old buildings are preserved and reused (Whyte, n.d.)

Warren & Andrew, (2021) explains that 'building footprint' also a metric that used to understand different spatial scales and spatial representations of a city. Further, 'building orientation' of a city helps to enhance the 'image-ability' of the city (Lynch, 1960). Well-oriented places and buildings are providing sense of emotional security and well-ordered, organized environments making harmonious relationship between people and the outside.

Visual elements are important inputs for the morphological analysis of a city (Black, 2020). Hoosgrahar, (2015) stated that visual elements can be classified as their height, volume, geometry, materials, shape, location, elevation, architectural features, function, roof form, fenestrations, and other features. 'Serial Vision' is a visual approach of a moving person's perspectives. This visual experience can be represented as series of hand drawn sketches. The aim of presenting is to express an informative illustration of spaces and it provides a sequence of revelations throughout the journey (Cullen, 1961). This method contributes to explore the transformation of the space from traditional to modern, pressure to vacuum or public to semi-public (Black, 2020). Further, street façades and elevations are one of the important visual elements helps to study city morphology (Rooney & Houlston, 2017). Hoosgrahar, (2015) has stated that 'street elevations' are kind of visual documentation and representing intervention, restoration, or re-functioning of the buildings. Classification of buildings of a street elevation are based on their language, visual elements, or the typology. These important tools can be forming as; 1) dimensions of the façade (ex: The dimensions are mainly focusing on the width of the façade and number of stories of the building) (Seçmen & Makaklı , 2019) 2) building edge (ex; Identity of the building fronts can be defined by the building edge and sometime it is the most active place.) (Alcock, et al., 1985) and 3) skyline (ex: Profile of built form and land defined against the sky. Sometimes referred to as silhouette.) (Rooney & Houlston, 2017). Distinctive skylines are essential aspects of visual identity of a city and it helps to form an iconic image. On the other hand, the changing skyline act as a dynamic visual artefact, which provide a detail guidance about how the city was evolved, influences at different period of times. Thus, the literature evidenced that all the important morphological features are described above supporting to ensure the legibility of a town or a city (Lynch, 1960).

As explained by Lynch, (1960) the vitality of legibility always offered an ordered environment and serve broad frame of references. It is providing sense of emotional security that can establish a harmonious relationship between human and the outside world, avoiding fear that comes with disorientation. That means a legible environment not only provides security but also heightens the potential depth and intensity of human experience. Further Lynch, (1960) highlighted that legibility is one of visual quality of the cityscape that visually grasped as a related pattern of recognized symbols. As well as they are consisting with easily identifiable, paths, nodes, or districts. The human experience and user perception was based on the environment and physical cues, or elements represented in the mind and the image can be described as individual personal experience of physical elements of particular urban setting.

Thus, the research focuses on small old neighbourhoods of local context which are influenced by uncontrollable developments. Because the lack of concern may cause erasing historical layers and this attempt is to understand the morphological characters of the traditional city and how current deviations impact on the spatial qualities of the city form. Furthermore, this study identifies how older neighborhoods contribute to create legible environments. Further, the findings of the study can be used as a toolkit of urban design to be applied while doing future developments on old neighborhoods. Addressing the main issue; the impact of morphological transformation on legibility, especially for small older neighborhoods like Mawanella, will be fulfilled the research lacking on urban design. Therefore, the research objectives are set as follows; 1) To identifying the morphological transformation that take place in case study area (The settlements along old Colombo – Kandy Road in Mawanella), 2) To understand how the city elements were adapted to morphological changes over last 20 years and 3) To identify how morphological changes influencing the legibility of study area (The

settlements along old Colombo – Kandy Road in Mawanella).

To achieve the said objectives the research methodology was adopted basically focusing on the patterns of urban form, serial vision, and the facade articulation. The study area is limited to the settlement on either side of the old Colombo- Kandy main road of Mawanella. As a linear city most of traditional built masses tend to densify along the road. Therefore, to simplify the analysis, the whole study area was broken into 03 blocks, a linear stretch along the road. Each block is approximately 500m lengthier and the width of a block extend to 50m from the road edge. Due to Covid-19 pandemic situation, it was limited to interact with the user to get their perceptions.

3. Research Methodology

'Morphology' is a study of change in form and shape overtime. Therefore, the study was focusing on the urban pattern and the composition. Through the literature review, the list of parameters was synthesized to understand the changing urban pattern and composition of Mawanella over last 20 years (2000-2020) and to analyse the user perceptions on the changing city attributes and how it impacts on city.

List of Identified parameters of urban Morphology was studied through the visual survey and the perception study as shown in Figure 2 such as; 1)**Urban patterns** (Urban grain, Building Footprint, Building Orientation), 2) **Serial vision along main artery** (City elements within the studying Boundaries, the relative width of street, horizontal and vertical components, symbolic direction with its image and function), 3) **Façade articulation** (Architectural features, Scale and proportion, Dimensions of the façades, Skyline and Building edge)

1. Justification for the study area

Old Colombo- Kandy main road of Mawanella, was used as the model case study (Figure 1). Here the main focus was given on the

transformation of built patterns and composition of the selected town area. It supports to identify the morphological transformation which represents via buildings, streets and the physical layout of the case study area.



Figure 1. Case study area (old Colombo-Kandy Road)

(Source: Google Earth)

2. Data Collection tool

1) Maps: Maps were sourced by Sri Lanka survey department, google earth and the author. The transformation of urban grain, building orientation and building footprint was studied by evaluating figure ground maps of years 2000 and 2020. For the analysis, it was introduced special grading matrix and colour coding system for the urban grain and the building footprint. In respect to the literature review (Carmona, et al., 2003) and the evaluation of maps, it was identified that there are six (06) number of buildings within a 400 sq.m area to become a 'fine grain' setting and if number of buildings are less than three (03), the grain defines as 'coarse' as shown in Table 1 and 2.

Table 1. Grading matrix for the categorization of grain pattern

Type of urban grain	Colour code	No. of buildings belonging to 400 sqm area
Fine		06 buildings
Mix		03 buildings
Coarse		< 03 buildings

(Source: Author)

Table 2. Grading matrix for the categorization of building foot print

Range of building foot print (sqm)	Colour Code (Colour range to show the footprint intensity)
< 40	Yellow
40-80	Light Grey
80-160	Medium Grey
160-280	Dark Green
>280	Black

(Source: Author)

2) Photographic Survey: Visual images were sourced by the author, google street view and some old photographs were collected from the old shop owners and residence in Mawanella.

3) On-site observation: On-site observation was conducted to identify the present condition of the context and the city elements within the selected town case study area.

4) Questionnaire: The main target group of the study representing the residents in Mawanella including shop owners and pedestrians. The survey was carried among 100 participants, who was above 18 years old. Purpose of the

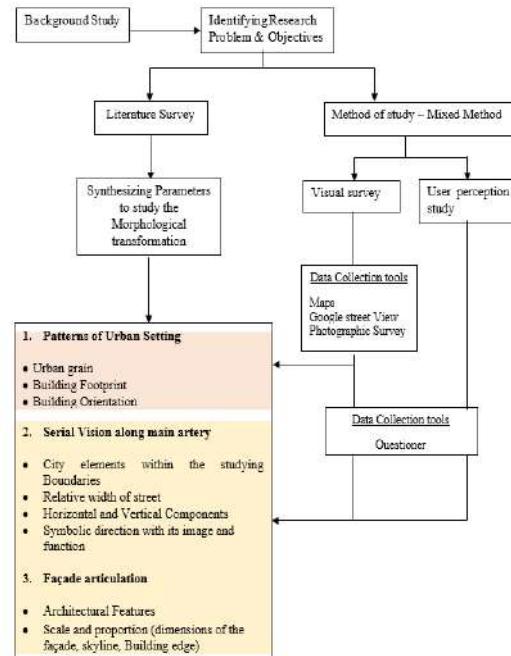


Figure 2. Methodological frame work

(Source: Author)

questioning is to get a public image of the area and how they felt recent changes and how it affects when reading the city.

4. Case Study

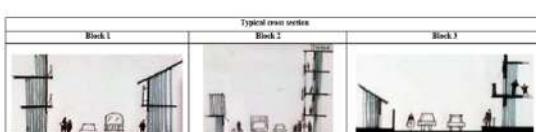
The existing old Colombo-Kandy main road was earlier known as "Bazaar Street" during British colonial period. The route was mainly used for the transportation of goods and passengers. However, the literature says the Mawanella town was used as a transition point by traders while travelling to Kandy or Colombo because they used to get breaks from their long-distanced journey and engaged in commercial activities at Mawanella. This resulted to bloom in series of colonial structures like 'shop-houses' which were built on either side of the road giving unique character to the main town artery. For the purpose analysing the selected context the selected case study area (ex: Linear artery) was divided to three (03) blocks as shown in Table 3 and Table 4.

Table 3. The selected three (03) case study areas were mainly focused on block 1, 2, and 3.

BLOCK	IMAGERY VIEWS
Case (I)- Block 1	
Case (II)- Block 2	
Case (III)- Block 3	

(Source: Author)

Table 4. Typical cross sections through Block 1,2,3



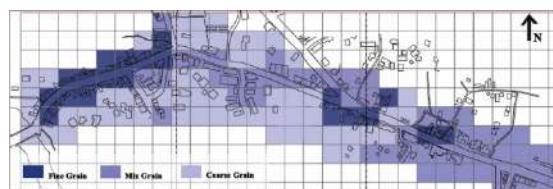
(Source: Author)

The simplified three (03) blocks in the case study area were used to evaluate the transformation of urban morphology serial vision and legibility of Mawanella town.

5. Results and Discussion

1. Changing components of Morphology

It was founded that the urban grain has been changed over last 20 years of the selected areas. The "fineness" of the grain was differed in each selected block. Considerably, block - 1 and block - 3 were largely affected due to road developments and number of old buildings were demolished. The grain has changed from 'fine' to 'coarse' in block - 3 from year 2000 - 2020. In block- 1, more 'fineness' can see in year 2020 than the year 2000 (Figure 3, 4 and 5).



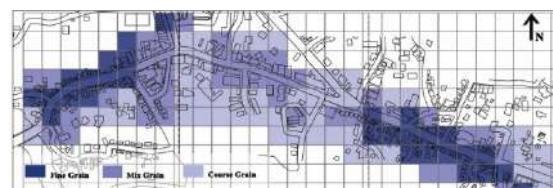
Block 1

Block 2

Block3

Figure 3. Urban grain of the study area 2020

(Source: Author)



Block 1

Block 2

Block3

Figure 4. Urban grain of the study area 2015

(Source: Author)

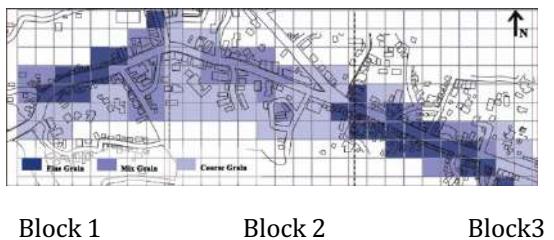


Figure 5. Urban grain of the study area 2000

(Source: Author)

Building footprint has transformed over last 20 years due various developments. Majority of buildings which had small footprint (<80sqm) are residential buildings with colonial architecture. Usually, large footprints founded in public places and large malls only. (Figure 6 and 7)

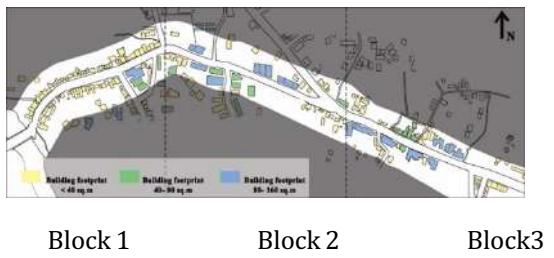


Figure 6. Building Footprint of the study area-2000

(Source- Author)

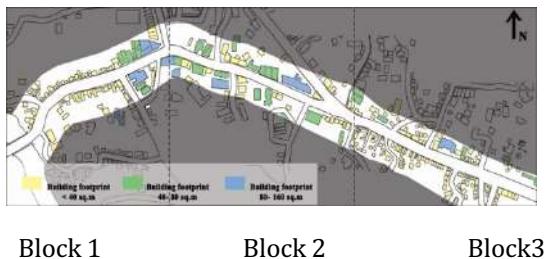


Figure 7. Building Footprint of the study area-2020

(Source- Author)

Building orientation did not show a drastic change in the study area. Compared to urban grain, the building footprint was highly affected due to the morphological changes happened from 2000 to 2020. Therefore, from the components of morphology, building footprint

was provide greater contribution to change the pattern of the physical setting.

2. Serial vision

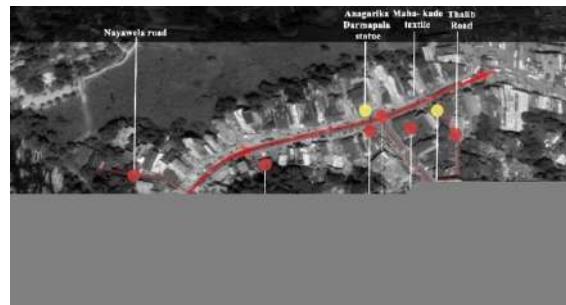


Figure 8. Identifying city elements within Block - 1

(Source: Author)

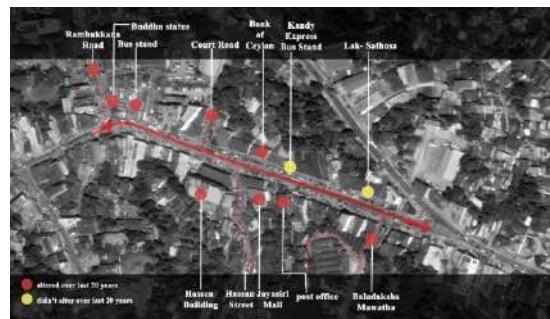


Figure 9. Identifying City elements within Block - 2 (Source: Author)

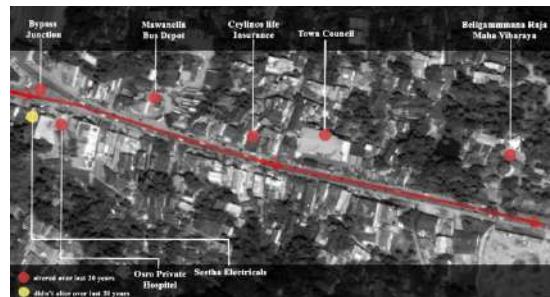


Figure 10. Identify City elements within Block - 3 (Source: Author)

80% of city elements were altered over last 20 years according to visual survey as shown in Figure 8, 9 and 10. According to user perception analysis it was found that old elements (20 years old or above) are involving to create the overall city image rather than new ones (Figure. 11).

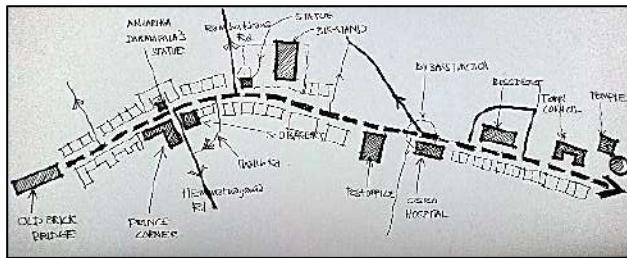


Figure 11. Typical cognitive map of overall city, produced using the user perception analysis

(Source: Author)

The road width of the main artery of blocks 1 and 2 were expended in twice the original size due to road widening project. Thus, the perception study was revealed that expanding road width was affected on respondents' comfortability and they have lost the sense of place. They highlighted that the current condition of the road is majorly responding to the vehicular movements only.

According to the visual survey the rhythm of the space was created by both horizontal and vertical components of the façade. However, it was gradually fading over the time, with the absence of delicate components. Perception study revealed that the visual harmony which was offered by traditional facades were unable to perceived through the modern facades. Old shop-houses were expressing the symbolic meaning that the rich socio-economic background of the old neighbourhood of Mawanella. In addition, '*Uthuwankanda*' mountain is one of the significant landmarks which providing sense of direction through the old neighbourhood though it is not much highlighted now with the modern town setup (Figure 12).

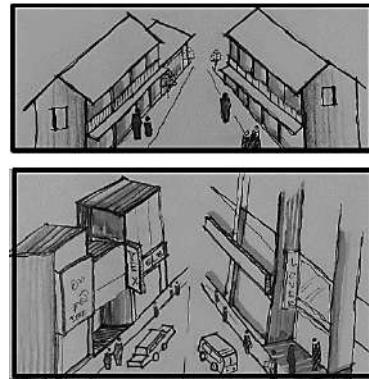


Figure 12. Serial vision then and now (Source: Author)

3. Facade articulation

Architectural features: The spectrum of different aged façades (ex: colonial, post-colonial and contemporary) have been transformed over long period of time. Visual obstacles are overwhelming the detailed appearance of the façade and that unique contrast was unable to perceive through the monochromatic facades of new buildings (Figure 13).

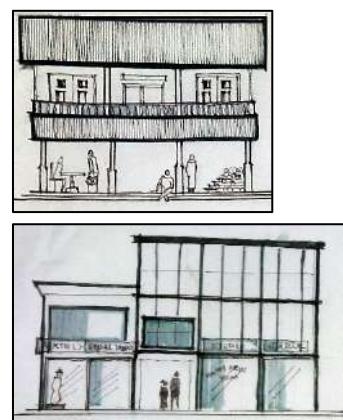


Figure 13. Typical facades of then and now (Source: Author)

Scale and proportion of the façade: The average facade width of colonial or post-colonial buildings is about less than 15 meters (<15m) and predominantly they are built in single or two storied. Contemporary building's façade width is about 03 meters (narrow facades) or 25 meters (wider facades) and can be reached up to five or more stories. Respondents were enjoying with more welcoming wide entrances

including with single or double storied heights of traditional buildings. Unlike uniformly distributed traditional building profiles, the new trends of varying heights creating undefined skyline and cause to made confusion to configure the dominant traditional silhouette. Extended shopfronts are more visually and physically permeable and creating active building edges (Figure 14).



Figure 14. Shop fronts then and now (Source: Author)

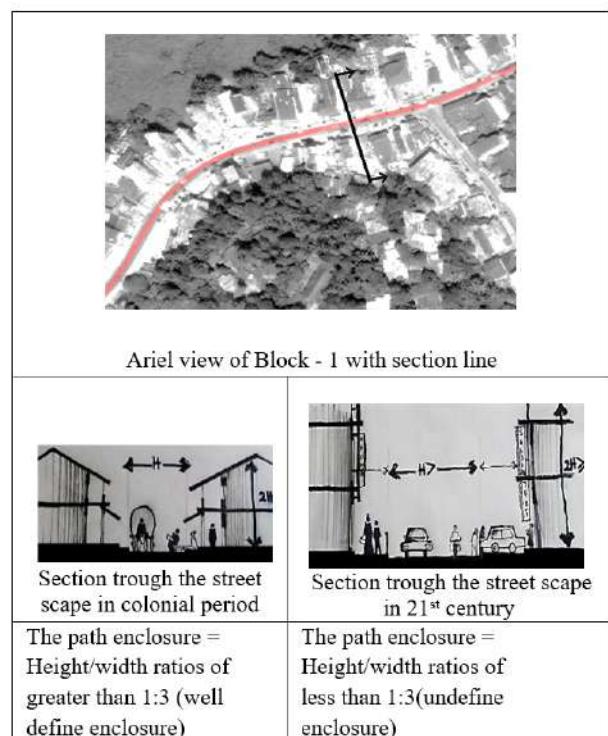
4. The impact of morphological transformation on legibility of Mawanella

Montgomery, (1998) has defined the city image as a combination of identity of the place and set of feelings, impressions about the place of user perception. To describe the overall public image of the old Colombo- Kandy main road in Mawanella, it was considered the user preference on city elements. 80% were given their preference to old city elements and 15% were chosen new elements. Thus, it was confirmed that the memorability of the building setting should stronger enough to enhance the image of the city and its uniqueness (Lynch, 1960). Accordingly, the traditional elements of the city were providing a strong identity to the city, but haphazard development and misconceived modernization cause to diminish the unique character of the old neighbourhoods like Mawanella.

According to Seçmen & Makaklı, (2019) changing patterns of urban morphology reflected through its urban grain, building orientation, and building footprint. The map analysis showing that urban grain and the building footprint were drastically transformed and comparatively the building orientation was not much effect on the morphological

transformation. The mapping was clearly figure out buildings which had small footprint ($<80\text{sq.m}$) were belonging to the fine grain, and large-scale buildings were belongs to the mix or coarse grain. Therefore, all the colonial shop houses were belonging to the fine grain and this unique character contribute to creating a stark contrast by repeating similar elements until year 2000. Coarse grains are usually large-scale buildings, tend to segregate from each other and scattered over larger areas dis-orderly. Fine grained, orderly organized built fabric are providing multiple choices available in the town setting (Carmona , et al., 2010). However, currently it was almost left the finer grain pattern and introducing coarse and mixed grain to the urban setting in Mawanella.

Alcock, et al., (1985) stated that the 'path enclosure' is a crucial factor that effect on legibility. He described that this quality helps to improve strong character while bringing functional importance to the streetscape and helping to distinguished to the user as well. Also, the path enclosure should be (Height/width ratios) less than 1:3 seem Figure



15. Path enclosure then and now (Source: Author)

weakly enclosed (Alcock, et al., 1985). It was identified through the visual survey; the heights of the traditional building layer were almost existed and the road width also comparatively doubling in the present condition (Figure 15).

It was clear that varying road widths and heights of the buildings were leading to undefined enclosure result in lack of legibility of the road. Before year 2000, the uniformly

identified through the visual survey, and the result from the questionnaire, it was identified that majority (78%) were agreed that the detail appearance of the aged facades was overwhelming by the large sign boards and cladding facades while obstructing the visual cues of the users.

40% user preference was showing that buildings which merge with the street edge are



distributed heights creating homely enclosure throughout the journey. While comparing to the user perception on recent road widening project, the majority of 76% were agreed that the current image of the old road is lack of comfortability.

According to Alcock, et al., (1985) people used to interpret the context using visual cues, and it supports express the right meaning of the place. People more likely to attract horizontal and vertical components on old facades, because traditional elements of the buildings providing visual harmony for their journey. It seems to be the interplay of horizontal and vertical rhythm of elements contribute to made visual cues. Alcock, et al., (1985) mentioned that the horizontal and vertical interplay of components are involved to create the rhythm of the journey. Relatively the horizontal rhythm was contributed on visual harmony. 68% of people were interest on repeating balconies, overhanging and even the handrails that provided by the traditional facades.

Since year 2000 there was a spectrum of different ages of buildings built during colonial, post-colonial and contemporary eras could found in Mawanella area. However, it has been drastically changed over last 20 years and remain only handful of colonials, post-colonial buildings where majority of the buildings were replaced by contemporary structures. According to the architectural features

more functional rather than set-back shop fronts (Figure 16). Further, it was identified that traditional buildings having active and more welcoming entrances rather than set-back buildings. Wide openings that are extensively exposed to public, are more visually and physically permeable and accommodate to public activities while creating an active building edge (Mehta , 2013). 42% of participants were agreed that old traditional buildings are supported to create an active functional building edge in selected case study area.

Figure 16. Largely affected shopfronts (Source: Author)

Nevertheless, it was largely affected on active shop fronts along the old main road (Bazaar Street) due to recent road widening project implemented since 2019. The town lost number of active shop fronts of the old neighbourhoods. That was clearly identified through the footages of a colonial building located at the Hemmathagama junction and how its envelope was changed over last 10 years. On the other hand, old shop houses and '*Uthuwankanda*' mountain are providing evidence for the rich identity of the city. Therefore, the symbolic direction of the main artery providing a greater contribution to create the city image. However, over the time, despite the fact of changing the unique pattern and composition of the urban

setting caused to made confusion (Lynch, 1960).

According to the results from visual survey, it was almost vanished the usual skylines as well and varying heights were caused for undefined skylines. Large scale masses reaching up to 03 to 05 stories and some of facades were defined by flats capes. The questioner survey showed that the silhouette of massive scale buildings was unable to easily perceive by pedestrians due to the height of the buildings and the uniformly distributed skylines with traditional layer promoting the path enclosure. Further, current undefined skyline was giving lack of contribute on vertical rhythm and visual cues of urban setting. When, the morphology of the old neighbourhood was transformed over long period of time, several spatial characters that inter-linked and impacted with the 'Legibility' of the town and it was unable to perceived through the current environment as follows (Figure 17);

5. The city image of Mawanella, is strongly associated with its unique pattern and composition of traditional built form on either side and main artery. Therefore, the contribution for the legibility has much provided by visual and physical qualities of these composition.
6. Decaying traditional elements and replacing into large clusters have caused to change the fine grains into coarse grain. Different sizes of building footprints made coarse patterns of the grain.
7. Relative to other key parameters, changing morphological patterns such as grain, footprint and orientation are majorly impacted on the legibility of the physical setting, but less effect on user.
8. Old neighbourhoods were comprised with different symbolic meanings. The entire image of the city was based on collective images of the main artery and the built forms. Earlier, the symbolic meaning of the place was enhanced by the traditional buildings and the axial view of the main

artery. But currently, the transformation of symbolic meaning of the city does not reflect through the city elements.

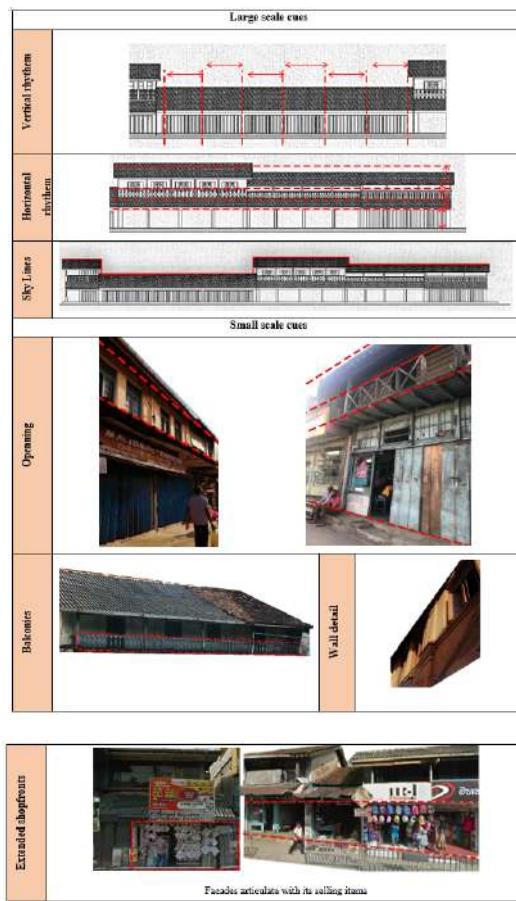


Figure 17. Identified small scale and large-scale contextual cues which promote the legibility of old neighbourhood

(Source: Author)

9. Expanding road width, undefined skylines offer less path enclosure and lack of contribution on path legibility. Recurring visual features along the road including horizontal/ vertical components, detail appearance of the façade, skyline that most people likely to experienced, have been unable to fulfil through the existing context. Therefore, it causes to reduce the large scale and small-scale visual cues of the environment. The collective contribution of façade width, skyline, horizontal, vertical components were important for the visual cues.

Ultimately, the findings that obtain through the survey can be include to a framework as shown in Figure 18.

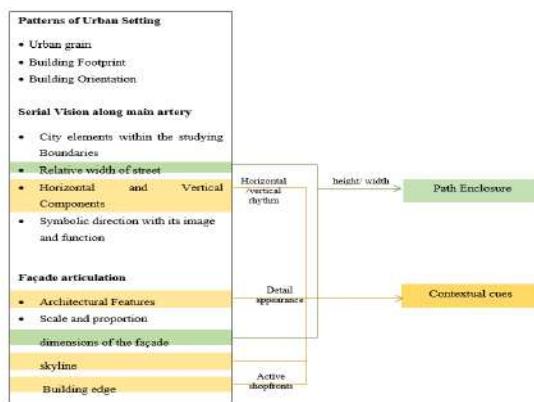


Figure 18. Framework of the research findings

(Source: Author)

6. Conclusion

Old Neighbourhoods and its elements are the roots of city image, tightly bound with its unique morphology. Therefore, it should have a deep need for taking into account about transforming older neighbourhoods due to haphazard developments. As mentioned before, Mawanella is one of the model case studies which representing linear and old neighbourhoods in Sri Lanka. The research design was created to identify how a traditional neighbourhood can sustain the legibility of a town. According to the discussion, the overall findings relating to the transformation of urban morphology and its impact on legibility can be summarized as follows;

1. From the questionnaire, 80% of respondents have chosen old elements associate with some important public activity to describe their journey. 20% of respondents are tend to select newly appeared elements. It was found that the city image of Mawanella strongly attached with its unique traditional elements.
2. The mapping shows that, there has a considerable change of the urban grain and the footprint during last 20 years.

Traditional buildings were helped to create finer grain patterns and it was visible in the maps extracted in year 2000. In year 2020, it was gradually transformed to a coarse grain pattern included with large clusters due to rapid commercial development. In addition, individual buildings with larger footprints contribute to reduce the "fineness" of urban grain of Mawanella. Building orientation was almost perpendicular to the main road and did not change over last 20 years. Ultimately it was identified that, the formation of old Colombo-Kandy Road during last 20 years, was the main reason for the transformation of urban grain and the building footprint. Although there is considerable impact of morphological patterns (such as urban grain and building footprint) for the legibility of physical setting from year 2000 to 2020, though it has less effect on the user perception.

3. It was identified that the ribbon development of the main artery was catalysing the transformation of the urban morphology of the Mawanella. While changing the road width and the varying heights of buildings made confusion on street enclosure.
4. Majority of old elements of traditional façade are more contributing to create visual cues rather than new cladding facades. As well as it was clear that, over the time, building envelops tend to adhere cladding facades and made monochromatic building interface along the road.
5. In the past, shop-houses by the road providing symbolic meaning of the rich socio - economic background of Mawanella. The unique character itself almost left and unable to fulfil through the modernized built environment. Therefore, Mawanella city does not provide any sense of transition to

passengers when passing through the main artery from Colombo to Kandy.

From the results obtained through the perception study and the visual survey, it was observed that, changing factors highly influenced the legibility of Mawanella, and the greater contribution was offered by the path enclosure and the contextual cues that was created by, façade articulation and serial vision rather than morphological patterns. Ultimately it was clear that, old neighbourhoods are very sensitive portions of large-scale urban settings and should highly concern about its physical composition and building interfaces on either side of the road when proposing city development projects.

7. Recommendations

Old linear neighbourhoods like Mawanella, threaten by uncontrollable ribbon developments. Therefore, the identity of the city does not clearly appear from the physical environment. In proportion to the research outcomes, the determinant factors of visual cues and the path enclosures are the major concerns of an old neighbourhood when preserving its legibility. Thus, the developed research design can be used as a reference in designing older neighbourhoods. Further, the research outcomes are able to use in developing different levels of planning policies relating to the urban rejuvenating projects of old neighbourhoods in Sri Lanka.

References

- Behzadfar , M. & Saneei , M., 2012. Regeneration of Isfahan Historical Axes with Emphasis on Design (The Case Study of Joibareh Neighbourhood). *Procedia-social and behavioral sciences*.
- Liombo , E. J., 2012. *Effects of Urban Morphological Transformation on Legibility of the city of Dar-es Sallam Tanzania*, s.l.: University of Nairobi.
- Montgomery , J., 1998. Making a City: Urbanity, Vitality and Urban Design. *Journal of Urban Design*, Volume 3.
- Tibbalds, F., 1992. *MAKING PEOPLE-FRIENDLY TOWNS*. London and New York: Longman Group UK, Ltd.
- Alcock, A., Bentley, I., Murrain, P. & McGlynn, S., 1985. *Responsive environments:A Manual for Designers London*. s.l.:The Architectural Press Ltd..
- Anon., 1990. *Urban Morphology Research Group*. [Online]
- Available at:
<http://www.urbanform.org/glossary.html>
- Anon., n.d. *Development plan for Mawanella Urban Development area 2004- 2020*. s.l.:Urban Development Authority," Sethsiripaya", Baththaramulla.
- Black, P., 2020. *MUD-Lab Toolkit: Serial Vision* , s.l.: s.n.
- Carmona , M., Tiesdell, S., Oc, T. & Heath, T., 2010. *Public places- Urban spaces; the dimensions of Urban deisgn*. 2nd ed. Amsrterdam : Imprint of Elsevier.
- Carmona, M., Tiesdell, S., Heath, T. & Taner , O., 2003. *Public places_ urban spaces, the dimensions of urban design*. s.l.: Oxford: Architectural Press.
- Cowan, R., 2005. *The dictionary of urbanism*. s.l.:Streetwise Press, Tisbury.
- Cullen, G., 1961. *The Concise Townscape*, NewYork: Van Nostrand.
- Environment, M. f. t., 2006. *Urban Design Toolkit*, s.l.: Wellington: Government of New Zealand.
- Gehl, J., 2010. *Cities for People*. Washinton-Covelo-London: Island Press.
- Hoosgrahar, J., 2015. *Knowledge and planningtools in F. Bandarinand O.Van; Reconnecting the city*, s.l.: Wiley,U.K.
- Hosagrahar, J., 2015. Knowledge and planning tool. *Reconnecting the City: The Historic Urban Landscape Approach and the Future of Urban Heritage*.

- Lynch, K., 1960. *The Image of the City*. Massachusetts, USA: The MIT Press .
- Lynch, K., 1981. *Good City Form*. London: MIT Press..
- Norton , C., 2016. *THE ROLE OF FINE URBAN GRAIN IN securing the diversity of the urban grain*. s.l.:s.n.
- quasim, M., 2012. *Urban types and transformation of City*. s.l., s.n.
- Rooney, J. & Houlston, . I., 2017. *Townscape Character Assessment* , London: Landscape Institute.
- Schuck & Rosenbaum, D., 2006. Promoting Safe and Healthy Neighborhoods: What Research Tells Us about Intervention. Issue The Aspen Institute..
- Seçmen, S. & Makaklı , E. S., 2019. The Urban and Architectural Characteristics of Voyvoda Street from Past to Present. *International Journal of Architecture and Planning*.
- Sewwandi, S. & Jayasinghe, A., 2021. An investigation of the effects of new bypass roads on build form in small towns in Sri Lanka. *Journal of South Asian Logistics and Transport*, Volume 1.
- Warren , C. J. & Andrew, . J. T., 2021. Tools for mapping multi-scale settlement patterns of building footprints.
- Whyte, W. H., n.d. *the social life of small urban spaces*. s.l.:s.n.