

Crowd Dynamics: A Tool in Shaping Urban Spaces

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Abstract: *In designing urban spaces, crowd behaviour and their dynamics are usually overlooked. “Crowd dynamics can be defined as the study of how and where crowds form and move”^[1]. This paper aims to demonstrate how careful observation and analysis of crowd movement and the space. Crowd density and the response behaviour will vary for different nodes in a city. Crowd dynamics study help us to understand how crowd movement is affecting the space and how a crowd occupies the space. The morphological aspect has direct relation with people behaviour. Thus, crowd dynamics the result of a collective behaviour, which have impacts on physical setting. This is expected to be important for the shaping of urban morphology. The study is conducted by analyzing the urban form of the marketplace of the crowd interacting place of the city. The urban form characteristic i. e., the physical setting components of the market (here case Chalai Market) is analyzed to understand the interrelation with crowd dynamics. Thereby the study reaches at the conclusion by establishing the interrelation with the parameters identified on the pattern and density of crowd. The findings of this paper aid the place making process, which consider the aspects of crowd dynamics.*

Keywords: Crowd dynamics; urban form; morphology; space; city

1. Introduction

Population numbers has been found increasing and urban living is found to be the influential lifestyle in the world. The existence of high population density is the one identifying feature of such a life style. Thus, crowd in an urban area cannot be a neglected component in its design. A large number of people gathered and who behave in a unorganised way can be termed as a crowd. It is defined as a sizable number of individual when gathered for a specific reason, at a specific location with sufficient density distribution for a span of measurable time interval. The key criteria for defining a crowd can be identified, based on size, density, time and collectivity. The term “crowd dynamics” is used to refer to patterns of crowd movement, and more precisely to the coordinated movement of a group of individuals to which a semantically relevant meaning can be attributed, depending on the respective application.^[2]

Morphology of the space and architecture has role in the formation of this collective behavior. Major cities exhibits a pattern high - density urban interaction in its daily routine, like in a market space, a sports event, transportation terminals, or a religious place. This research is limited to the analysis of the urban form of a market space with that of crowd dynamics. The major determinants of crowd behaviour are the physical setting, social setting and the individual behaviour. The aim of this research is to assess the critical relation of crowd dynamics with urban form or the physical setting.

The objectives to be achieved in the research are to understand characteristics of crowd and define crowd dynamics with respect to urban design, to analyze the characteristics of urban form generating crowd movement and to study how crowd perceive urban form and how it affects movement and pattern using a case study.

2. Literature Survey

The theoretical framework includes crowd dynamics theory by Keith Still, which define the various aspects of crowd

dynamics like speed, movement, and density. Of which the movement aspect of crowd dynamics is supported by the ‘*The theory of natural movement*.^[3] by Bill Hillier. Thereby relating it to the urban design. This theory states that the urban form act as an attractor for the movement. In an urban system, the pedestrian movement pattern is generated by its spatial configuration. Movement is one of the morphological issue and urban grids are those, which channels and structure the movement. To analyse the urban form and to understand movement as a morphological issue, elements like

- Street pattern: the layout of urban blocks and movement networks between those blocks.
- Block/Plot patterns: the result of street connections and are well defined by a group of independent buildings plots. Subdivision of urban blocks results in plots or lots.
- Buildings footprint: The process of building development on each plot will lead to a building footprint. From the *Theory of urban morphology*^[4] by Conzen 1960. The physical development and urban form of the city is influenced by individual elements such as built environment, buildings and land uses as well as social groups, economic activities, and public institution.^[5] A city is physically described through its urban form based on its social, political, and economic factors. The urban form of the city varies with the market town, central city and for settlement type, where we find the crowd more dynamic.

The five design elements in urban design like imageability, enclosure, human scale, transparency, and complexity^[6]^[7] that could be rationally analysed to test the link between design and behaviour has been identified by Ewing and team in 2006. The pattern of people’s movement and activity is determined by the block pattern, which is the basis of urban blocks. Also, the smaller blocks tend to create movement channels due to its larger permeability than of larger blocks.^[5] Physical attributes affecting pattern of movement of crowd, or the parameters used here are imageability, street structure, views and vistas, block size, shape, built enclosure, active frontages and walkability, permeability, circulation pattern, built use etc. are used in the urban form analysis of the market.

3. Methodology

To address the research problem of what is the role of urban form in crowd dynamics the literature review is substantiated with a case study. Through the literature study the characteristics of crowd is identified and the definition for crowd is found out. To analyze the characteristics of urban form for generating crowd movement the aspects of urban form are identified through literature. Then the

findings were analysed considering the urban form of a market area (Chalai Market, Thiruvananthapuram, India). The analysis of this study on the urban form and crowd dynamics lead to the findings and are concluded by defining the interrelation between both.

4. Results and Discussion

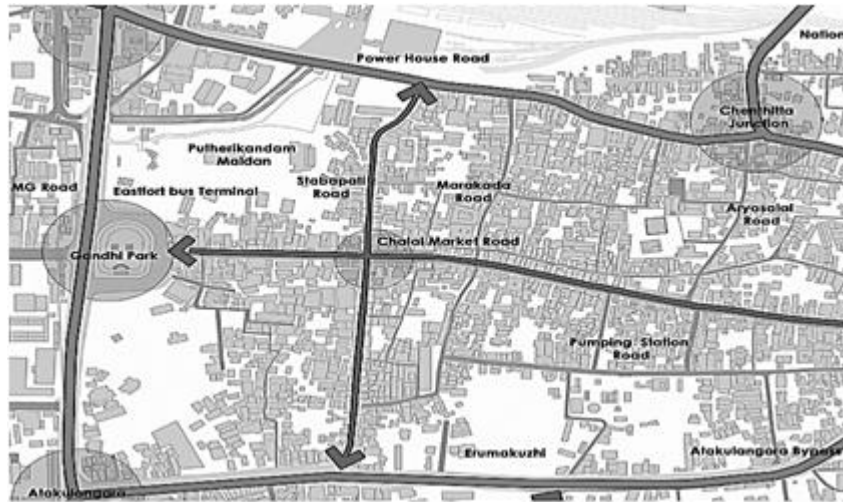



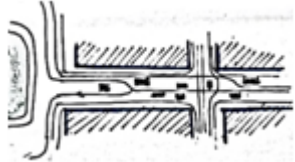

Figure 4.1: Delineation of Chalai Market (CAT UD Studio 2012 - 2017)



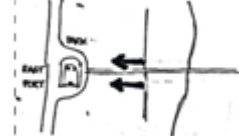


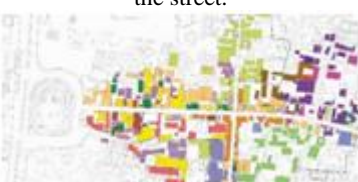

Case study - Chalai Market Thiruvananthapuram.

One of the prime markets in the historic center of Thiruvananthapuram city acting as a major hub of everyday shopping, ranging from electronics to fruits and vegetables. It is functioning as a wholesale market from 1921 onwards. Busiest of all markets in the city. Chalai market has a connected network of small roads and by - roads. During the night hours, the crowd in this area was found low, whereas during day these areas have a considerable number of people such as street vendors, salesgirls, consumers etc.

Road network and movement system in study area includes the road connecting from Killipalam junction to Gandhi Park with a one - way system. Minor roads like Sabhapathi Coil Street, Marakkada road, Aryasala road and Kothuval street etc connecting main spine contributes to the vehicular movement inside Chalai. The study area is in proximity East fort bus stand, Railway station, which are the main transit node of Trivandrum. The major pedestrian movement is from East fort to Aryasala side.

5. Analysis and Findings

Components	Analysis	Inference
Block size, shape	The sides of the parcels/buildings facing the street are narrow and small thus more multitude of shops	Multitude of shops within the relatively short length of the street induce more people interaction.
Permeability	Building blocks are small in size. Narrow passages in between buildings increases permeability with narrow side passages.	Permeability increases the people built interaction thereby movement.
Imageability	 Crowd is attracted towards landmarks on the street like park, temple, and mosque.	 The crowd is usually generated in the imageable areas.
Street structure, connectivity	 Streets have a linear structure. Commercial buildings are arranged on both sides of the street. There are several small streets which culminates to the main market street.	Better connectivity influences multitude of activities in a certain area. People walking in all directions on the road this gives us a picture in consistency of direction. People change the direction when obstructed or is caught attention.

Built enclosure	 The built enclosure quality is high due to two storey and three storey height buildings on both sides.	 Enclosure quality of the street enables active movement. Shade and openness accentuate activities.
Views and vistas/ visual field	2 - storey building with slope roof is the skyline feature of Chalai market. On the western side the visual field extend towards the East fort area, where the crowd always tend to move.	Crowd is attracted towards the imageable areas. 
Active frontages and walkability	 The commercial buildings in the street have veranda frontages. Product display and other street vendors attract crowd toward the blocks. More crowd is been observed in the area where there is active frontages.	 Active frontages attracts dynamic informal activities.
Through block connection	Through block connection diverge or converge the crowd from main spine	Through - movement is related more to the configuration of urban form.
Built use	The market constitute of mixed commodity of built use. Hetrogeneous use of buildings enables diverse activities along the street. 	 Mixing uses ensures that many services enable diverse activities. This is a crowd holding phenomena.

6. Conclusion

From the urban form analysis, it can be concluded that there is a critical relation between urban form with crowd dynamics. Urban form is the result of spatial configuration, which has direct influence on movement one of the main aspect of crowd dynamics. Visual permeability, the result of configuration space is one that controls the movement densities. High physical permeability also increases movement. It is found fine grain building channels movement than that of coarse grain which leads to multitude of activities. Vital and viable uses along with connectivity result in attraction and congregation of more crowd. It should be noted that market crowd is influenced by the type of commodity or the built use. Enclosure quality and scale of street as it effects on walkability it effect on movement of crowd.

Urban form can generate as well as modulate the movement of crowd with its characteristic features. From the study we can infer that urban form, which is not just a background to what people do, but the relationship between the complex things that people do, and the spatial environments they do it. The character of physical environment is derived from the activities they accommodate. For a better urban experience, the movement and flow of pedestrian within the space should be uninterrupted. Thus, for the design of a vibrant public space, understanding of crowd and its dynamics plays an important role and can be used as a tool to shape them.

References

- [1] Still, K. G. (2000). Crowd Dynamics.
- [2] Bandini, S., & Vizzari, G. (n. d.). Studying Pedestrian and Crowd Dynamics through Integrated Analysis and Synthesis. *Intelligent Transportation Systems*.
- [3] Kakirde, A. A., & Parishwad, O. G. (2016). Interrelating Urban Form and Pedestrian Movement (Case of Nagpur, India). *International Journal of Research in Civil Engineering, Architecture and Design*, 1 - 11.
- [4] Conzen, M. P. (1960). A study of town planning analysis. *Institute of British Geographers Publication* 27.
- [5] Carmona, M., Tiesdell, S., & Heath, T. (2010). Public places public spaces; The dimensions of urban design.
- [6] R. Ewing, S. Handy, R. C. Brownson, O. Clemente, and E. Winston. 2006. Identifying and Measuring Urban Design Qualities Related to Walkability, " pp.223–240,
- [7] R. Ewing and S. Handy. 2009. Measuring the Unmeasurable: Urban Design Qualities Related to Walkability. *J. Urban Design*. vol.14, no.1, pp.65–84,

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