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KEYWORDS
coastal urban slums; flood adaptation measures; slum streets; urban morphology; Dharavi

ABSTRACT
In developing countries, coastal urban slums are acknowledged as highly susceptible areas to the consequences of climate extremes. With a limited capacity to absorb and prevent rising waters, coastal slums experience recurring floods. This challenge has led slum dwellers to develop local adaptation measures over the years.
The public space embedded within the slum morphology provide for spatial interplay between the floods and measures of adaptation. Formerly perceived as a threat, the excess of water is evolving into an opportunity. In these contexts, streets provide for essential physical space in the slum fabric, also useful to address the effects of floods. The form of the street allows temporary cyclical occupations that relate to the activities of the slum dwellers, the daily or seasonal rhythms, in which water level plays a lead role. Thus, the character of the street is both defined by the fixed section and the cyclical adaptive measures and elements that compose the liveable space.
Dharavi, in Mumbai, consists of a highly diverse informal settlement comprising streets that support the livelihoods of different communities, such as fishers in Koliwada, potters in Kumbharwada, and laundry workers in Dhobi Ghat, among others. In this paper, the diversity of street form and cycles is decoded and translated by interpretative drawings based on cartographic and collected images.
This study seeks to showcase the crucial role of slum streets, as urban morphological elements, in addressing cyclical floods. It contributes to the wider research into the typification of flood adaptation measures and the systematisation of a lexicon of flood adaptation measures for coastal urban slums.

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Street Rhythms in Dharavi: The Cyclical Flood Adaptation in Coastal Urban Slums

INTRODUCTION

Flood risk for coastal urban slums

Flooding is the most common hazard in coastal urban slums in developing countries. Climate change effects and urbanisation have aggravated the vulnerability of these areas. As per the recent 2019 announcement from UNISDR, floods remained the most impactful natural disaster, impacting a significant population, with 35.4 million people affected in 2018.[1] A flood is the result of combinations of meteorological, hydrological, and human factors. Coastal urban slums are more vulnerable due to their predominant location in areas prone to flooding and marshlands adjacent to coastlines or riverbanks, with inadequate infrastructural facilities and flood preventive government interventions. It is strongly anticipated that coastal systems and areas with lower elevations will witness a continued rise in submersion, flooding, and erosion in the 21st century and beyond, largely due to the elevation of sea levels.[2] Water is both the source of risk and the source of livelihoods. The perception of the most vulnerable that live in urban slums which is based on the immediacy of their needs is that they are able to create a shelter and a source of livelihood to support families and households, thus the location is the result of lack of choice and more seen as a source of income, proximity to transport and access to space based on the daily activities of the dwellers. This fact is pertinent taking into consideration the dimension of these physically vulnerable areas and the social vulnerability of most people living in these areas, preventing their mass dislocation or the use of conventional and high-cost measures of defence given the costs implied.

Local adaptation to flood

The adaptation to climate change involves an ongoing learning process focused on minimizing vulnerabilities through continuous adjustments.[3] Slum dweller's response to flooding play a crucial role in creating parsimonious coping strategies and adaptation measures tailored to

specific local conditions. Coastal urban slum communities now find it necessary to adopt vernacular adaptation measures to coexist peacefully with water as a fundamental requirement.[4] Costly formal measures, such as the ones implemented in developed countries, are inadequate to provide an efficient reduction of the vulnerability of urban poor. In these areas, the effectiveness of flood adaptation measures relies heavily on the ability of slum dwellers to address physical factors like water leakage prevention, drainage system efficacy, and landscape conditions, often achieved with minimal investment.[5]

On topographic and environmental levels: the physical location of Dharavi being a swampy lowland bordering the Mithi River leads to a higher vulnerability towards floods during the monsoon months. This slum settlement faces recurring seasonal submergence and is expected to be permanently submerged due to sea level rise and increase incidence of hurricanes in a moderate scenario proposed by Kopp for the climate central modelling tool.[6] In this context, slum dwellers have adopted local community led adaptation measures to cope with the severity of the monsoons since its early occupation. These local measures differ according to the seasons (wet and dry), in day and night and even in time relation with a particular flood event (before, during and after), being particularly evident in the space of the streets. These measures include actions like using plastic sheets to cover windows and roofs, elevating plinths and furniture to higher levels for safety, erecting flood barriers, and clearing drains to facilitate water flow. Here, the involvement of social networks and community participation greatly contributes to strengthening the flood resilience of urban slum spaces.

Street as physical space to address flood

The streets are the primary public space in Dharavi. Not just connecting places responding to the need of mobility, Dharavi streets are the space of social interaction and trade between dwellers.

Streets offer abundant economic and social opportunities, facilitating human interaction and commerce. Consequently, streets represent a collective space, with their perimeters potentially incorporating elements that serve as link between public and private spaces, particularly at street level.[7] The urban street interface, depending on its context, function, and layout, can denote areas for socializing and recreational activities, while also reflecting the societal

1

contradictions, expressions, and lifestyles.[8]

In Dharavi, where the narrow streets are surrounded by 2-3 storied houses, the ground floor level is usually used for activities that usually open up and extend out in the streets, while the upper floors are used for residential purposes. Streets in Dharavi provide physical space for livelihood and economic exchange and also consist of an essential space to address cyclical floods. The form of the street allows for temporary occupations that relate to the activities of the slum dwellers, varying with the time of day or changing seasons, with water levels prominently shaping the space. The study endeavours to showcase the role of Dharavi slum streets, as urban morphological elements, in addressing cyclical floods. It contributes to the wider research into the typification of parsimonious flood adaptation measures, aiming to build a lexicon of flood adaptation measures for coastal urban slums.

INTERPRETING THE FORM AND CYCLICAL ADAPTATION IN DHARAVI STREETS

To draw is to learn

Gandelsonas argues that drawing serves as a means to reveal formal configurations that may go unnoticed in reality, thereby influencing our perception of the city.[9] Additionally, Anne Vernez Moudon emphasizes that morphological analysis should take into account three aspects: shape, resolution and temporal changes.[10] Therefore, the coding of graphic representations is crucial for morphological analyses, with its effectiveness depending on the specific research objectives and questions.[11]

The interpretative reading of a street in urban slum from the different neighbourhoods of the fishermen, the potters and the washermen requires a decomposed approach that enables to simplify the complexity and allows to decode the formal composition and the transformation in time of this urban element. This allows to reveal the existent character of the street that is both defined by the fixed section and the cyclical adaptive measures and elements that compose the liveable space in accordance with changing water in time.

The present article focuses on the daily livelihood cycles of the investigated communities as well as the flood adaptation measures and built elements adopted by the dwellers in the streets. Therefore, interpretative morphological drawings are used to interpret and present the daily and seasonal cycles of the street.

While the typical spatial depiction is in plan view,

1
Location of Dharavi slum along the Mithi River in Mumbai (authors' edition, 2022)

2
Cross-sections from the different neighbourhoods in Dharavi (authors' edition, 2022).

3
Occupation of streets in the neighbourhood of Koliwada in Dharavi (authors' edition, 2022).

4
Dhobi ghat in the neighbourhood of *dhobis* in Dharavi (authors' edition, 2022).

5
A view of the streets of Kumbharwada, Dharavi (authors' edition, 2022).

representing it in section aligns more closely with our perception of the space, making the spatial features and characteristics the research emphasizes more apparent. Photographs of the atmospheres in different periods were chosen and rigorous sections were drafted to study the occupation cycles, the persistence, and the changes in the space of Dharavi streets.

Sections are drafted at uniform scales and adhere to consistent representation conditions: fixed elements are depicted with black lines, while the ephemeral elements are depicted with red lines, placing in evidence the day/night occupation cycles but also the flood levels and the measures and physical elements adopted by Dharavi dwellers in each of the neighbourhood communities' street spaces that were studied.

The aim is to identify and characterise parsimonious measures that ancestrally cope with urban floods in different community contexts of Dharavi.

Dharavi overview

Dharavi, located in the centre of Mumbai metropolitan area, **Fig. 1** accommodates nearly one million[12] inhabitants who have settled in this swampy region over the years. In the 18th century, inhabited by the fishermen community; *the Kolis*, today along with other communities, reside and engage in economic activities within Dharavi, significantly adding to Mumbai's GDP: $650 million (USD) annually. It consists of about 80 neighbourhoods or *nagars* with people from different livelihoods that originated and evolved in time with migration of people from different parts of the country. Over the years, Dharavi densified with migrants bringing different skills and backgrounds transforming it into a large informal economy.

The spontaneous and unplanned urban fabric of Dharavi holds great significance as a repository of history and memories for its resident communities. In Dharavi, the pedestrian oriented narrow streets are flanked by buildings ranging from 2 to 4 stories high. These structures typically host commercial activities on the ground floor and residential spaces on the floors above.[13] A characteristic of Dharavi is its very close *housing-workplace relationship*, and productive activities take place in nearly every street, which is not so common to find in other slum areas that are usually almost exclusively residential. It presents a self-sustained work-cum-residential settlement. Despite the lack of infrastructure and formal government interventions, the slum morphology of Dharavi provides for the requirements of both the place for industries and to live. This has resulted in an organic, community-centric, mixed use, high density low-rise streetscape.

The streets are used to support the people's movement but also for casual meetings, street vending and as an extension of domestic life. The children play and dwellers work in the narrow streets that are appropriated by different functions that change in time. The physical space in streets of Dharavi undergoes continual transformation by each community, adapting to their livelihoods needs and reflecting their specific measures for dealing with floods.

Dharavi streets rhythms and cycles

The physical structure of the city comprises a complex array of urban elements, each characterized by distinct morphological attributes shaped by multiple factors. An understanding of these elements and their perception by individuals is significant in shaping a liveable built environment. The configuration of the built environment is the result of adaptation in time and experiences over the years. The following cross-sections **Fig. 2** are derived from different neighbourhoods of Dharavi slum in Mumbai with the objective to understand the character of the street that is both defined by the fixed section and the cyclical adaptive measures and elements that compose the space.

While assessing the cyclical adaptation in different neighbourhoods of Dharavi in time; day-night and dry-wet

DRY SEASON

WET SEASON

DAY

NIGHT

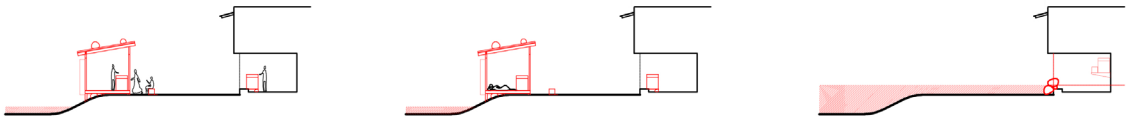
A

B

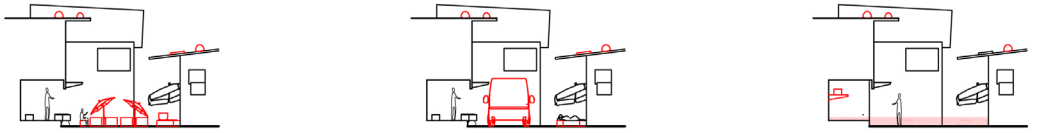
C

FISHERMEN
KOLI COMMUNITY

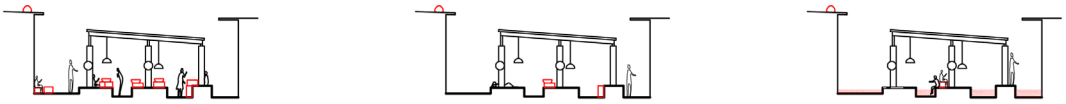
1



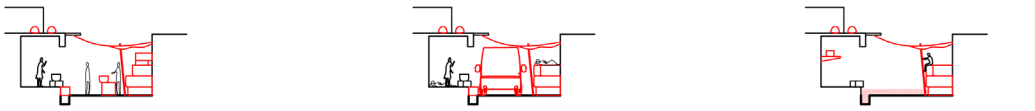
2



3

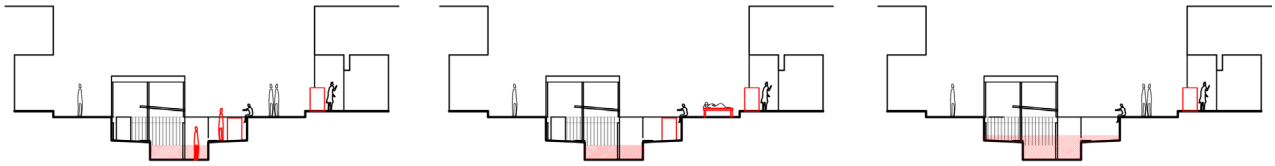


4



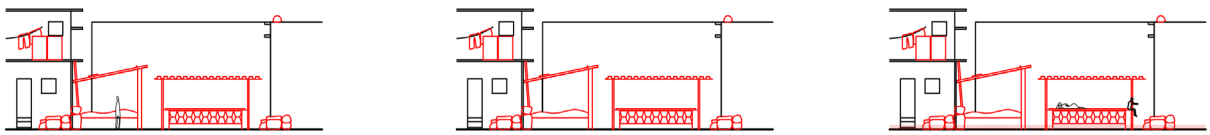
WASHERMEN
DHOBI COMMUNITY

5

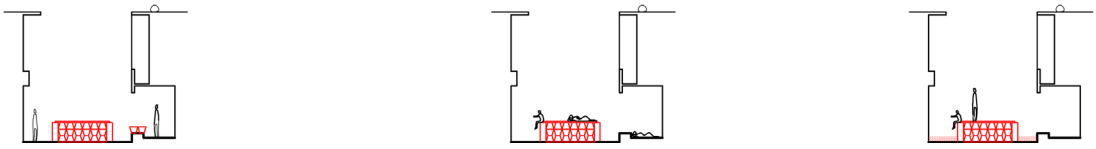


POTTERS
KUMHAR COMMUNITY

6



7



2

3

4

5

Zone/Community area	Social Characteristics	Adaptation measures and elements	Cross-section Ref.
The fishermen (*Kolis*)	Early settlement dated from the 18th century. This community is located along the coast. The men catch the fish from the sea/ river, and women sell the catch in the streets.	Construction of water embankments and retaining walls along the river bank. Constructed fish vending platforms (informal fish markets). The streets are used for vending fishes in day and night. During flood, the vending platforms provide for safe sites of gathering. Streets are occupied temporarily by the vending kiosks along the water lines.	1,2,3,4
The washermen (*dhobis*)	Early migrant community from Andhra Pradesh in Dharavi. This community is located along the *nalas* (the drains): water lines.	The streets along the *nalas* adapted into washing *ghats* with community led measures such as creating washing platforms, stepped retaining walls along the drain, etc. *Dhobi ghats* are used for washing clothes, social gathering, religious and leisure activities. Surrounded by 2-3 storied houses occupied by the families of *dhobis*.	5
The potters (*Kumhars*)	Migrant community in Dharavi for hundreds of years, now forms an essential part of Dharavi. Mostly occupy the neighbourhood of Kumbharwada (the colony of potters)	The streets in the neighbourhood are used for livelihood activities. The moulding of clay, sun drying or baking in a furnace and stocking of final products is done in streets. Potters have constructed raised furnaces, stocking platforms and retaining walls. These elements are prepared in the street in relation to vagaries of water in time.	6,7

Tab 1
Adaptive measures and elements in the neighbourhoods of Dharavi (authors' edition, 2022).

seasons, it was realised that livelihood occupations and water presence or absence has a significant influence in the street space. The cross-sections refer to three different neighbourhoods of distinct communities that inhabit Dharavi: the fishermen (*kolis*), the washermen (*dhobis*) and the potters (*Kumhars*).

The streets along the waterfront in *koliwada* **Fig. 2-1** are occupied by temporary kiosks that during the day are used for vending and during the night are used to sleep. The selling of fishes is a prominent function that occupies the streets in *koliwada*. **Figg. 2-2 | 3 | 4** Traditionally, men bring the catch and the female sells it in the streets. **Fig. 2-2** Slum dwellers have created raised platforms to sell the fishes **Fig. 2-3** which are used later to sleep during the night or as a safe site to gather during the floods. The streets that are used as open-air fish markets in the day are occupied by the loading vehicles at night. **Fig. 2-4** The same ephemeral built element that occupies the space of the street has the ability to support both the commercial function and spartanly answer the residential need, even if at a very basic level. **Figg. 2-1 | 2 | 4** People living in Dharavi employ simple measures to address the challenges posed by the heavy rains, and these are temporary elements which the community relocates to safer sites during the wet season. Also during the monsoon, plastic sheets are used to cover windows and protect the roofs, adding an extra layer to the usually more ventilated built structures. Furthermore, barriers are created at doorways with sandbags and mezzanine structures inside the shops are used to raise the furniture that occupy the streets during the dry season.

In a distinct Dharavi context, the *Dhobi ghat* **Fig. 4** is a space along a river, *ghat* means steps leading down to the river, where the washermen (*Dhobi* community) wash the clothes and it is predominantly used by the *dhobis* (cross-section in **Fig. 2-5**). In this specific example, the slum dwellers have identified the waste water channel, nala, which runs alongside the railway track along the street, as a potential site for a communal laundry area, *dhobi ghat*.

The appropriation of this wastewater channel, adapting it into a ghat, has generated a specific type of linear public space, a water street or channel which is used for the washing of the clothes, for community gathering and as a kids' play area during the day. The same physical space is used for sleeping during the night. Slum dwellers occupy the space with *charpai* (wooden bed) to sleep in pleasant night outdoor weather. The occupation of the street space

6

6
Collage: the cyclical flood adaptation in Dharavi streets (authors' edition, 2022).

changes according to these uses in time, nevertheless its physical structure remains the same, surrounded by the 2-3 story high houses where the families of *dhobis* live. The banks of the channel and the channel itself become a domestic extension of the household dedicated to work life but also to social life in this improbable context.

Kumhar means potter and *wada* means colony. Kumbharwada is a 12 acre area in Dharavi wherein people are solely engaged in the business of pottery. Kumbharwada, as also the Dharavi area, is a nearly hundred year old settlement where the dwellers carried on with their occupation of pottery over the generations. The potters shape the clay on the *chaak* or the wheel in desired shape that afterwards is dried in the sun or baked in a furnace. These activities are performed both in the squares or courtyards and in the streets of this neighbourhood **Fig. 5** and the availability of close water sources is mandatory for their subsistence. To perform in these activities, public spaces are appropriated with elements required in relation with the vagaries of water. **Figg. 2-6 | 7** The pots are stocked in streets along the retaining walls made with mud bricks. These same elevated areas made of bricks, which seem to only delimit a space for storing pottery, provide for protection from water during the floods.

From the reading of the street cycles in these three areas of Dharavi, a systematisation was built **Tab. 1** which presents the characteristics, adaptive measures and elements that were identified. It summarises the social characteristics of the assessed communities in the Dharavi slum along with the corresponding adaptation measures and elements that enable the dwellers to adapt the street space both to daily life and the vagaries of water in time.

Although these are local answers to cope with the daily needs and seasonal flooding, their essential, low-tech and parsimonious character, this identification and characterization consists in a step that might inform the creation of a synthetic lexicon for the adaptation of coastal urban slums with efficient measures and elements.

FINAL REMARKS

Over the years, the Dharavi slum dwellers have adopted local measures in-light of the requirements of their specific needs, livelihood and recurring floods. Here, the slum street, as an urban morphological element, not only supports changeable occupations on the daily life cycle but additionally contributes in addressing cyclical floods and providing physical space for its adaptation. In the absence of institutional flood adaptation measures, the cyclical adaptation in streets consists of parsimonious measures that are implemented by local communities. These measures vary in type (infrastructural, behavioural), scale (individual, community, neighbourhood), time (day, night), seasons (dry, wet), phases (before, during, after), role (defend, retreat, attack) etc. This provides for transformability to the toolkit that is envisioned for the adaptation of coastal urban slums to address future floods. Reading the occupation cycles related to water in the Dharavi streets revealed a set of parsimonious flood adaptation measures and elements that have evolved and perfected in time, according to experience and the availability or lack of resources. These traditional and very efficient measures that cope with seasonal flooding have the potential to be systematised and typified, contributing to build an instrumental lexicon for addressing flood effects from climate change and extreme weather events, not only in Dharavi but also in similar low resources and vulnerable Global South coastal urban slums contexts.

As Kenneth Frampton reminds us while prefacing the 2012, 3rd edition, of *De la Forme au Lieu* by Pierre von Meiss, "we cannot expect pertinent innovation without tradition and inversely we cannot ground a living tradition without invention."[14] In this sense, understanding and learning from the living tradition of street occupation cycles derived from flooding and water management in Dharavi may support the efficient pertinent innovation we strive for when facing contemporary and future urban challenges related to the effects of climate change.

Acknowledgements

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[1] "2018: Extreme weather events affected 60 million people," UNDRR.org, accessed July 2022, https://www.undrr.org/news/2018extreme-weather-events-affected-60m-people.

[2] Rajendra K. Pachauri, and others, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Geneva: 2014).

[3] Maria Matos Silva Cabral, "Public Space Design for Flooding: Facing the Challenges Presented by Climate Change Adaptation" (Doctoral dissertation, Universitat de Barcelona, Facultat de Belles Arts, 2016).

[4] Maria Matos Silva Cabral, Public Spaces for Water: A Design Notebook (Boca Raton: CRC Press, 2021).

[5] Anubhav Goyal, "ESTRATEGIAS Y ENFOQUES PERTINENTES AL ESPACIO PÚBLICO PARA HACER FRENTE A LAS INUNDACIONES," in 13_XIII Seminario Internacional de Investigación en Urbanismo, Barcelona-Bogotà, Septiembre 2021. Universitat Politécnica de Catalunya, Revistes, January 1st, 2022, https://revistes.upc.edu/index.php/SIIU/article/view/10153.

[6] "Climate Central," accessed February 27, 2024, http://www.climatecentral.org/.

[7] Nawaf Saeed Al Mushayt, Francesca Dal Cin, and Sérgio Barreiros Proença, "New Lens to Reveal the Street Interface. A Morphological-Visual Perception Methodological Contribution for Decoding the Public/Private Edge of Arterial Streets," Sustainability 13 (2021): 11442.

[8] Karen Franck and Quentin Stevens, Loose Space: Possibility and Diversity in Urban Life (New York: Routledge, 2006).

[9] Mario Gandelsonas, The Urban Text (Cambridge: MIT Press, 1991).

[10] Anne Vernez Moudon, "Urban Morphology as an emerging interdisciplinary field," Urban Morphology 1 (1997): 3–10.

[11] Sérgio Barreiros Proença, "Reading and Interpreting Portuguese Atlantic Seashore Streets in Sea Level Rise Context," in Happiness. The Built Environment: Shaping the Quality of Life, Vol. 1, Conference Proceedings. ARCC-EAAE 2018 International Conference, eds. K. Wingert-Playdon, and H. Rashed-Ali (Philadelphia: ARCC, 2018), 65–73.

[12] World Economic Forum, The Global Risks Report 2016: Insight Report, 11th Edition (Geneva: The World Economic Forum, 2016)

[13] Michael Conard, Geeta Mehta, and Kate Orff, Mumbai Dharavi – Scenarios for Development (New York: Graduate School of Architecture, Planning and Preservation of Columbia University, 2009).

[14] Pierre Von Meiss, De la Forme au Lieu + de la Tectonique. Une introduction à l'étude de l'architecture (Lausanne: Presses polytechniques et universitaires romandes, 2012).

BIBLIOGRAPHY

Anubhav Goyal, "ESTRATEGIAS Y ENFOQUES PERTINENTES AL ESPACIO PÚBLICO PARA HACER FRENTE A LAS INUNDACIONES." In *13_XIII Seminario Internacional de Investigación en Urbanismo, Barcelona-Bogotà, Septiembre 2021*. Universitat Politécnica de Catalunya, Revistes, January 1st, 2022. https://revistes.upc.edu/index.php/SIIU/article/view/10153.

Barreiros Proença, Sérgio. "Reading and Interpreting Portuguese Atlantic Seashore Streets in Sea Level Rise Context." In *Happiness. The Built Environment: Shaping the Quality of Life, Vol. 1, Conference Proceedings. ARCC-EAAE 2018 International Conference*, edited by. K. Wingert-Playdon, and H. Rashed-Ali, 65–73. Philadelphia: ARCC, 2018.

Climate Central. Accessed February 27, 2024. http://www.climatecentral.org/.

Conard, Michael, Geeta Mehta, and Kate Orff. *Mumbai Dharavi - Scenarios for Development.* New York: Graduate School of Architecture, Planning and Preservation of Columbia University, 2009.

Franck, Karen, and Quentin Stevens. *Loose Space: Possibility and Diversity in Urban Life.* New York: Routledge, 2006.

Gandelsonas, Mario. *The Urban Text.* Cambridge: MIT Press, 1991.

Matos Silva Cabral, Maria. "Public Space Design for Flooding: Facing the Challenges Presented by Climate Change Adaptation." Doctoral dissertation, Universitat de Barcelona, Facultat de Belles Arts, 2016.

Matos Silva Cabral, Maria. *Public Spaces for Water: A Design Notebook.* Boca Raton: CRC Press, 2021.

Pachauri, Rajendra K., and others. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Geneva: 2014.

Saeed Al Mushayt, Nawaf, Francesca Dal Cin, and Sérgio Barreiros Proença. "New Lens to Reveal the Street Interface. A Morphological-Visual Perception Methodological Contribution for Decoding the Public/Private Edge of Arterial Streets." *Sustainability* 13 (2021): 11442.

UNDRR.org. "2018: Extreme weather events affected 60 million people," accessed July 2022. https://www.undrr.org/news/2018extreme-weather-events-affected-60m-people.

Vernez Moudon, Anne. "Urban Morphology as an emerging interdisciplinary field." *Urban Morphology* 1 (1997): 3–10.

Von Meiss, Pierre. *De la Forme au Lieu + de la Tectonique. Une introduction à l'étude de l'architecture.* Lausanne: Presses polytechniques et universitaires romandes, 2012.

World Economic Forum. *The Global Risks Report 2016: Insight Report, 11th Edition.* Geneva: The World Economic Forum, 2016.

Ritmi di strada a Dharavi: l'adattamento alle inondazioni cicliche negli *slum* costieri

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PAROLE CHIAVE

slum *urbani costieri; misure di adattamento alle inondazioni; strade degli* slum*; morfologia urbana; Dharavi*

ABSTRACT

Nei paesi in via di sviluppo, gli slum *costieri sono riconosciuti come aree altamente suscettibili alle conseguenze degli estremi climatici. Con una capacità limitata di assorbire e prevenire l'innalzamento delle acque, queste baraccopoli costiere sono soggette a inondazioni ricorrenti. Tale sfida ha portato gli abitanti a sviluppare misure di adattamento locali nel corso degli anni.*

Lo spazio pubblico incorporato nella morfologia dello slum *consente un'interazione spaziale tra le inondazioni e le misure di adattamento. Un tempo percepito come una minaccia, l'eccesso di acqua si sta trasformando in un'opportunità. In questi contesti, le strade forniscono uno spazio fisico essenziale nel tessuto dello* slum*, utile anche per affrontare gli effetti delle inondazioni. La forma della strada consente cicliche occupazioni temporanee che si relazionano con le attività degli abitanti, i ritmi giornalieri o stagionali, in cui il livello dell'acqua gioca un ruolo di primo piano. In questo modo, il carattere della strada è definito sia dalla sezione fissa sia dalle cicliche misure di adattamento e dagli elementi che compongono lo spazio vivibile. Dharavi, a Mumbai, è un insediamento informale molto eterogeneo che comprende strade che supportano il sostentamento di diverse comunità, come i pescatori a Koliwada, i vasai a Kumbharwada e i lavoratori delle lavanderie a Dhobi Ghat, tra gli altri. In questo saggio, la diversità della forma e dei cicli stradali viene decodificata e tradotta da disegni interpretativi basati su immagini cartografiche e raccolte.*

Questo studio cerca di mostrare il ruolo cruciale delle strade degli slum*, come elementi morfologici urbani, nell'affrontare le inondazioni cicliche. Esso contribuisce alla ricerca più ampia sulla tipizzazione delle misure di adattamento alle alluvioni e alla sistematizzazione di un lessico di tali misure per gli* slum *costieri.*

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