

**MATERIAL WORLDS:
[DE]CONSTRUCTING THE ETHOS OF CONCRETE IN MUMBAI**

by

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Bachelor of Architecture
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and
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MASTER IN CITY PLANNING**

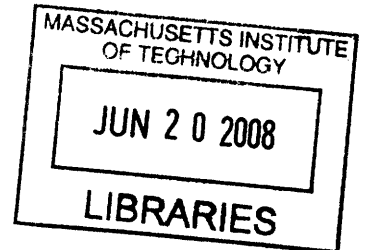
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CONTENTS

ACKNOWLEDGEMENTS

5

ABSTRACT

6

INTRODUCTION

9

CHAPTER I

THE CONSTRUCTIVE CAPACITY OF CONCRETE

19

CHAPTER II A

THE EVOLUTION OF CONCRETE: THE MATERIAL AND ITS GLOBAL SPREAD

35

CHAPTER II B

CONCRETE IN MUMBAI

45

PART II

THE ETHOS OF CONCRETE IN MUMBAI

CHAPTER III

THE SPATIAL ETHOS OF THE FRAME

57

CHAPTER IV

THE ETHOS OF PRODUCTION

103

CONCLUSIONS

143

BIBLIOGRAPHY

153

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**Submitted to the Department of Architecture and the Department of Urban Studies and Planning
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ABSTRACT

What can a building material tell us about a city? As the most widely used structural building material in the world, reinforced cement concrete shapes the urban form of several of our largest megacities – Sao Paulo, Cairo, Karachi and Mumbai, to name a few. The predominant building form concrete takes in these cities, is of the concrete frame. This dissertation traces the emergence of the concrete frame as the preferred form taken by reinforced concrete in widespread urban applications, over a myriad of sculptural possibilities that the material offers. Proceeding from the assertion that the manifestation of form reveals to us the condition of its production, in other words the built environment of the city can tell us about the society that inhabits it – I investigate what I call the ethos of concrete in Mumbai as a way of understanding the state of some aspects of the city's society. It must be emphasized that I look specifically at ethos of production rather than reception of concrete framed buildings in the city of Mumbai.

The findings of this thesis are both its method of investigation and its discoveries. The frame is seen as the form concrete takes in Mumbai; hence for the scope of this thesis, the frame is concrete in Mumbai. Using the concrete frame as a heuristic device to investigate the production of urban form in the city, the thesis constructs a narrative of the physical formation of buildings that make the urban form of Mumbai.

The frame is investigated at two scales, the terrain of the city, and level of the singular building. The ethos of concrete here is its spatial ethos and its productive ethos, each of which are seen at the scale of the city and the building. The spatial ethos at the building level tell us about the evolution of the space between individual buildings and the genesis of gatedness in concrete apartment buildings in India, as well as well the development of bye laws which govern the form buildings can take in the city. The spatial ethos at the scale of the city tells us about the relation between land subdivision and the spread of the frame on older patterns of land holdings in the city. We find that the Concrete frame buildings occur in areas that have previously had larger plots, or on reclaimed land, while dense areas in the central part of the island city with small individual land holdings do not have many concrete buildings.

The ethos of production at the scale of the city characterizes it as a “topological field” utilized for the serial production of the concrete frame as a lucrative commercial entity. This field of the city's plan on which the extrusion of concrete buildings takes place is seen the basis of the “chaotic” appearance of the city. And the productive ethos at the scale of buildings, seen as the generation of aesthetic design, shows us how the planimetric basis of the city is overcome by its buildings to invent new visual orders.

Finally the productive ethos at the scale of the building is seen as the work of architects, developers and labourers involved in the construction of the concrete buildings in the city. While the vast availability of informal labour perpetuates the use of concrete at the level of the structure of the building – I have found that a hybrid practice of professional architectural design and informal artisanal labour enables the reinvention of the generic concrete frame in the city – hence allowing it to periodically reappear in new incarnations. In conclusion the paradox of the material of concrete is that it enables both perpetuation and reinvention, its plasticity enabling newer facades to be applied to the same underlying frame, and its labour conditions facilitating upward mobility for the middle classes while reinforcing its own entrenchment at the bottom of the productive order.

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INTRODUCTION

ARRIVING AT THE QUESTION

Standing atop the roof of the tallest building in Sao Paulo in September 2006 – confronted with the vast expanse of that concrete city, I was reminded of a familiar sight. While Sao Paulo is perhaps the most acute version of a concrete city, panoramas over Rio, Cairo, Karachi or Mumbai present similar views of the dense concrete urbanism, ordered along no discernible pattern – a veritable concrete jungle.

How did one material become so utterly dominant in urban-scapes around the world, to the extent that these cities are unimaginable without it?

I began thinking about the city of Bombay from the perspective of the singular dominance of one building material. I soon realized that in addition to the preponderance of concrete it was the structural system of the Reinforced Cement Concrete [RCC]



MUMBAI



PANORAMA OF SAO PAULO

Frame which was the predominant, perhaps the only form that concrete took in Bombay. What did this mean for a city like Bombay, which is relatively young, with a history of not much more than 200 years where the RCC building is an indigenous native building form? What could the concrete frame tell us about the buildings of Bombay and how they make up the appearance of the city? The RCC frame building represented the medium through which the material proliferates through the city. The dynamics around the governance, design and construction of the RCC frame building in Bombay directed its physical development. The impression of the “concrete jungle” led me to identify the RCC framed building as the device through which the urban form of a city like Mumbai is generated.

These are of course, buildings with an RCC frame structure and brick infill as walls. Hence brick is widely used but that is not what drives the “form” of the city. I argue that the constructive capacity of the material used at the structural level drives the form of the city, hence focusing the discussion around concrete.

IN LIEU OF METHODOLOGY:

Based on the Benjaminian assertion that it is the manifestation of form that reveals to us the condition of its production, this dissertation investigates the ethos of production of concrete buildings, and presents one contemporary local account of such an ethos, in the city of Mumbai. Anyone reading this thesis for an interpretation of the affects of the Mumbai’s built form is likely to be disappointed, as my task here has not been to present the ethos of

the reception of concrete buildings, but rather the modes of its production.

I borrow from micro-historical methods of investigating a small part that represents a larger whole. In the case of Bombay's urban landscape I look at how this smaller part (the frame) came to proliferate the city and track developments related to the concrete frame apartment to tell the story how the city came to be the proverbial concrete jungle it is today.

*“Capitalism is not the only force for dehumanization in it. When capitalism achieves a maturity in producing artifacts as sophisticated as the passages, it creates new understandings of the human and the world...”*¹

The dissertation attempts to go beyond the assertion that the city is conditioned by capital relations, a phenomenon that could be better explored through traditional Marxist analysis. It focuses on understanding the implications of conditions of capital on how architectural form is conceived, designed and built. Capital creates the framework within which the productive ethos operates; in investigating how concrete is crafted in Bombay, I look how the processes of design and construction invent and navigate modes of production to produce the artifact of the building in the city.

The production of urban form such as Mumbai's which is either largely privatized or carried out by the disenfranchised typically evades historical recording. The actual built mass of the city, however, stands as evidence of its own production and registers

clues of that process. The form then also serves as something of a mine detector to unearth a history of the city and of the form itself.

The chapters presented here do not follow the intuitive order of my investigations, which were more intuitive than ordered. Beginning from the epiphany on the Sao Paulo roof top – I identified the material of concrete as the underpinning of urban form in Mumbai. Something in the social and constructive conditions of the city, it seemed to me, had to privilege the material for it to be so profusely used, practically excluding any other form of formal construction. The absence of structural steel, the other globally dominant urban building material, seemed like an informative corollary to the profusion of concrete in the city. What does the absence of steel in Bombay tell us about the city? I felt that investigating the reasons for one absence would reveal others in the productive chain of the built environment and in the process shed light on milieu in which the city is produced, and how that milieu is registered in the buildings of the city.

A brief summary of the chapters is as follows:

Chapter I contrasts the use of concrete as a building material in two major eras, the Roman and the last hundred years of the present modern times. The purpose here is to understand how a material was used to achieve built form and spaces that reflected a vision of the city and enabled a way of life in it. Roman concrete and architecture are a useful comparison for the present use of concrete in city building as they show the articulation of a single material in making several different forms of urban

buildings. These buildings, in concert, facilitated a “Roman” way of life and formed a city of domicile , and enabled its replication throughout the vast Roman Empire.

The advent of modern concrete is then analyzed in terms of what this new material meant and the discourse around locating its place in the lineage of building materials. Seen in the light of its coincidence with the rise of the new city planning. The emergence of two

Roman concrete is then compared to the uses of modern concrete, with an emphasis on the reinforced concrete frame, especially as it has manifested in the city of Mumbai. The appearance of the frame in various visions for the city of the industrial age are analyzed .

The RCC framed structure is seen as the underpinning of the way residential life is organized in the cities where it is the predominant form of urban construction. The chapter briefly elaborates on the constituent parts of a residential RCC building, the flat or apartment, which is the predominant mode of living and hence building in the city of Mumbai, a characteristic it shares with several other megacities such as Sao Paulo, Cairo and Karachi. The RCC frame, it could then be said makes the modern city of domicile. In this chapter the material of concrete is implicated as a form-maker at the scale of cities and is shown to both symbolize and facilitate the zeitgeist of living.

In modern times, concrete, it might be said, performed a similar function. As a material that did not suggest

any inevitable form or logic of construction, its systematization into the form of the concrete frame was born of the emerging imperative of housing or re-housing large numbers of people in compressed durations of time.

It would, however, be a fallacy to say that the material was utterly causal to the kind of city that resulted from it. Yes it is a simple fact that voluminous Roman architecture or the high-rise skyscrapers of megacities would be unachievable without the constructive capacities of concrete and steel. Yet the way a building material is disseminated for use, deployed towards making structure and the preferred forms it takes over a myriad of other possibilities are a result of using a material to achieve a vision of the world.

The trajectory of the choices by which particular types of forms become a material's most predominant expression soon come to be inseparable from its inherent constructive qualities. Hence while early on

Chapter IIa Concrete is seen here not as a material but as a process. This chapter traces the evolution of concrete construction from local knowledge to a global set of formulae and standards. It presents a brief account of the local exchanges of its earliest innovators, the transfer of techniques between different locally concentrated practices mainly by the work of building contractors, the generation of abstract universal standards from formal experiments by engineers, and finally the global dissemination of concrete construction technology. Important here are also the mediums through which knowledge

was shared and the building material publicized.

Chapter IIb traces the advent of concrete in India in the early 20th century. Being under British colonial rule, concrete technology comes to India from Britain which was itself delayed in embracing the material. Some details are presented here about the early manufacture of cement and use and expertise around concrete in India and prevalent labour conditions to convey a sense of the constructive climate around RCC.

Here I present findings of my early investigation on the crafting of concrete in Bombay and why the hegemony of the material continues to be practically unchallenged. Its preponderance into present times conspicuously reveals the absence of alternatives, especially as the city builds ultra high-rises. Where are the steel frames?

I attempt to answer this question through interviews, literature research and speculation. It is intuitive to wonder why steel would not be used when building tall in any place. In the context of India an equally straight forward response would include reasons of labour quality and economics and the expense of importing good quality structural steel. What I discovered, however, was a more nuanced and less intuitive answer.

PART II: THE ETHOS OF CONCRETE IN BOMBAY

Chapter III: THE SPATIAL ETHOS Here the reinforced concrete frame is used as heuristic device to retroactively trace the development of two

features integral to the nature of Mumbai's concrete urban form. The development of these features chronologically precedes the concrete frame in Bombay. The features are: firstly the element of the setback, the open space between a building and its site boundaries, and secondly the process of the progressive compromise of figurative urban planning and design, resulting in a simple subdivision of land into blocks and plots – a process I call the pixelization of the city.

The setback, which is the immediate surrounding condition of any building in the city, generates a detached urban form. The non-figurative plan and the rationale of plot divisions, that became the norm in the city's various urban schemes where concrete buildings are built, drive the accretive logic of the buildings as they appear in the urban environment. Both these processes are shown to diminish the scope of urban design down to the level of the plot, leaving singular buildings as the default generators of urban imagery. The underlying attempt in this chapter is also to unearth the apparent randomness of buildings in the city's panoramas, and explain the impression of ubiquity in the city's form.

Finally in Chapter III after we arrive at the scale of the plot [or pixel], I turn to the opposite end of the spectrum, the terrain of the city, to trace the occurrence of concrete buildings across its landscape. This mapping reveals patterns of residential and commercial concrete building types with relation to the city's original island mass and its reclaimed parts.

Correlating the building façade types with their location, it is seen that buildings with modernist or unadorned facades predominate the original island landmass, while several reclamation schemes over the years have presented the city with a new imagery either through a new aesthetic articulation of facades or by being an agglomeration of concrete buildings of size and density as yet unprecedented in the city. The facades of course are not limited to reclaimed schemes, and are found in other parts of the city as well, but the most emphatic impact is seen in development that was carried out on some form of reclaimed land.

Chapter IV: THE PRODUCTIVE ETHOS then brings us to the facades of these concrete buildings. Having established the concrete framed structure as the norm of building construction in Mumbai, I have found both intuitively and as a pattern traced in previous chapters that the building façades have been instrumental in generating an “image of the city”. I do not mean “image” here in Kevin Lynch’s way-finding sense as a system of urban markers, but rather an attempt to create and announce a “present” moment.

The aesthetics of these facades are related both to the developer’s intent as well as the trajectory of architectural discourse and practice in the city, which is briefly traced in this chapter from the early 1920s to the present moment.

The first shift towards a “designed” façades is seen in the work of the country’s most successful architect, and his collaboration with one of the city’s largest developers in the design of a suburban scheme in

the early 1990s is seen as seminal shift in the ensuing aesthetics of residential development in the city.

Finally the productive ethos at the scale of the building is seen as the work of architects, developers and labourers involved in the construction of the concrete buildings in the city. While the vast availability of informal labour perpetuates the use of concrete at the level of the structure of the building – I have found that a hybrid practice of professional architectural design and informal artisanal labour enables the reinvention of the generic concrete frame in the city – hence allowing it to periodically reappear in new incarnations. In conclusion the paradox of the material of concrete is that it enables both perpetuation and reinvention, its plasticity enabling newer facades to be applied to the same underlying frame, and its labour conditions facilitating upward mobility for the middle classes while reinforcing its own entrenchment at the bottom of the productive order.

ENDNOTES

¹ Arens, Katherine. "Stadtwollen: Benjamin's Arcades Project and the Problem of Method." Research-article, April 4, 2007. *MLA Journals: PMLA*, Vol. 122, No. 1, January 2007, p-57.

CHAPTER 1

THE CONSTRUCTIVE CAPACITY OF CONCRETE

It would, be a fallacy to say that a material is utterly causal to the kind of city that results from it. Yes it is a simple fact that voluminous Roman architecture or the high-rise skyscrapers of megacities would be unachievable without the constructive capacities of concrete and steel. Yet the way a building material is disseminated for use, deployed towards making structure and the preferred forms it takes over a myriad of other possibilities are a result of using materials to achieve a vision of the world.

Comparing the role of concrete at the center of two major urban revolutions that occurred two millennia apart, is useful here to reveal the dialectics between the inherent capacities of a building material and the qualities of the forms a culture chooses to craft out of it.

“The Roman architectural revolution was many revolutions, but above all it was a completely urban event. It was the dramatic and visible realization of a new concept of the city rendered by an imperial vision but accomplished largely by an urban middle class. The revolution in architecture was an urban revolution and social revolution, as well as a revolution in architectural form and the building of buildings.”¹

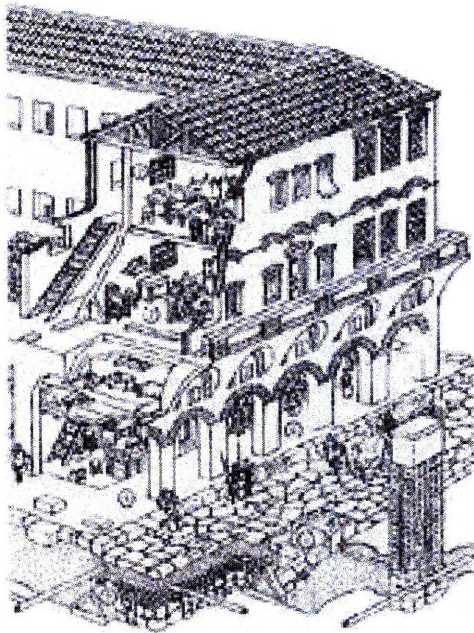
The same could be said of modern concrete, although this time the new concept of the city that it rendered was a capitalist rather than imperialist vision, articulated in its most provocative form by individuals like Le Corbusier, to subsequently be



THE INTERIOR OF THE
PANTHEON IN THE 18TH CENTURY,
PAINTED BY GIOVANNI PAOLO PANINI

emulated in diverse conditions and to profoundly different social ends.

What the Roman city was could be recognized in its standard repertory of buildings and public spaces: the paved street, often arcaded, with sidewalks and shops, the forum which usually included the basilica - a place of public assembly, the law courts, the libraries, the public bath, the theatre, the circus and configuration betray an extensively social use of architecture. In their work on 'Roman Concrete and the Roman Architectural Revolution' Heather Lechtman and Linn Hobbs echo what is believed by other scholars of Roman Architecture as well that *"These buildings served not only the civic, recreational and intellectual requirements of a large urban public, but also some of their most fundamental domestic needs"* It is important the stress here the difference between Roman and modern notions of domesticity and public life. What Lechtman and Hobbs are describing is a form of living that was fulfilled by many urban facilities distributed in the city-space, unlike modern domesticity whose needs and amenities are concentrated in the unit of the house. Privacy had not been invented yet and public life was, in part daily living distributed over urban space, these various building types. The Roman urban revolution and its architectural enablement reflect a new concept in the use of the city – the city as domicile.



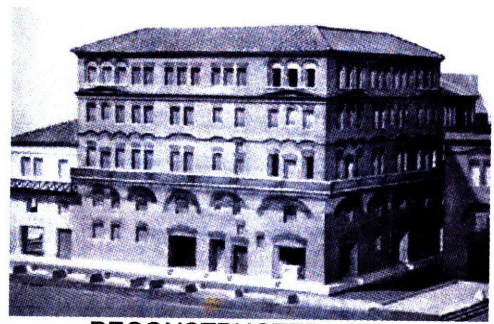
A CUT AWAY VIEW OF THE INSULAE IN THE ROMAN CITY OF OSTIA



RUINS OF OSTIAN INSULAE

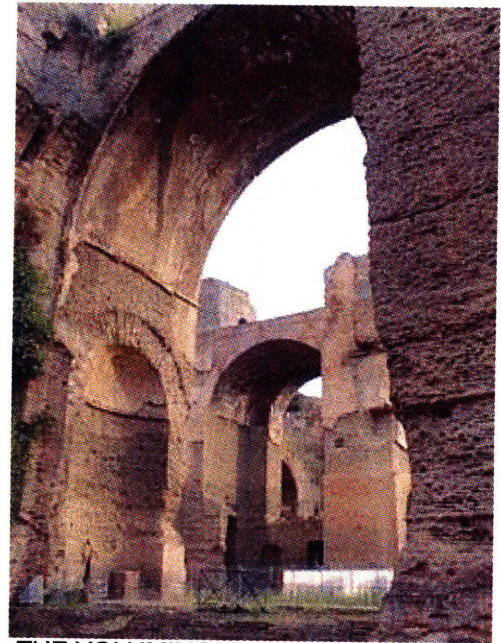
In this city, there were domestic spaces of "housing", distinct from public buildings and the two groups of buildings made the collective repertoire of the city. By the 2nd century AD many residents of the Empire lived in multi – storey apartments called insulae

built of concrete, but even the most generous of these rarely had kitchens or lavatories, and most apartments had poor lighting. These insulae were not equipped to fulfill all of the physical needs of their inhabitants, as modern day apartments, and were used primarily for sleeping and were too cramped to enable socializing.



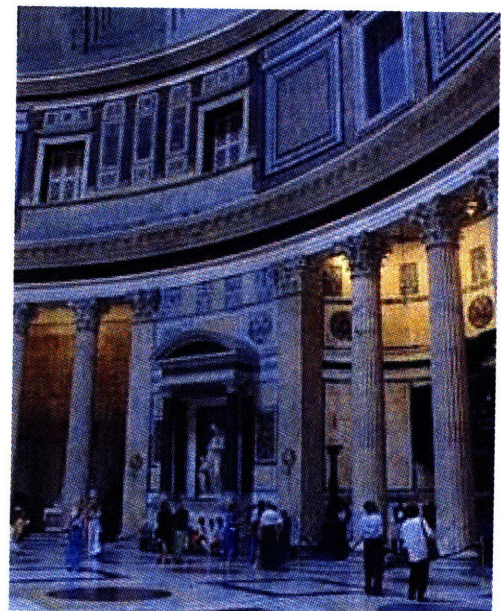
RECONSTRUCTED MODEL OF AN INSULAE

A large measure of community life was enacted outside these individual dwelling units, in the street and public buildings of the city. Scholarship on Ostia, a metropolis and the Roman Empire's first major port, as quoted in Lechtman's study casts the city as an entity intended to function as a single unit, in which most of the requirements of the vast majority of citizens were taken care of outside the domestic dwelling.



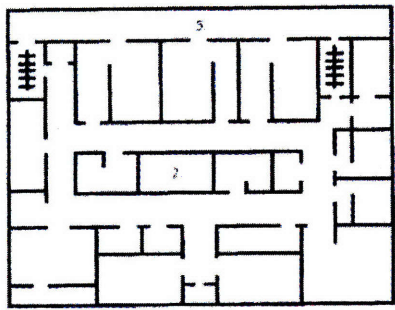
THE VOLUMINOUS INTERIOR OF THE BATHS OF CARACALLA

This characterization of the city as domicile is hinged on the nature of the space in Roman public buildings. Roman cities worked because they were equipped with buildings that liberated space – big structures with big interiors. Unlike Greek or Egyptian architecture the architecture of the Roman Empire was built for the social commonwealth. The programs of Roman buildings were socially utilitarian, the baths, the stadia, the Colossae, the imperial markets and arcaded streets facilitated the routine activities of thousands of people in vast interior spaces, that were made possible by Roman vaulted and domed architecture, that changed the nature of urban life.

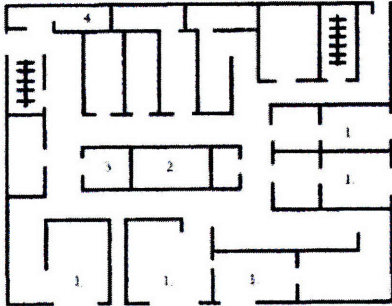


INTERIOR OF THE PANTHEON

“Roman imperial architecture was an architecture of curves, an interior architecture of voluminous spaces, in which the mass of the wall was subordinated to



Second floor

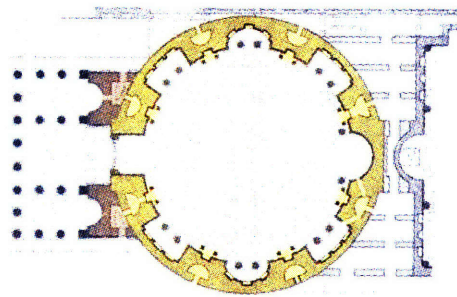
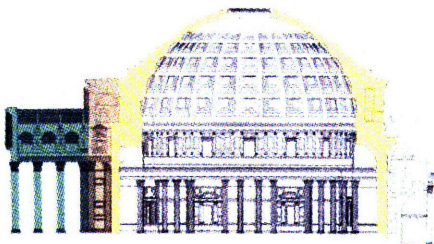


TYPICAL PLAN OF AN INSULAE

the spatial volume it created and enclosed..... A key and critical ingredient to the success of such buildings was the material of which, by mid-first century AD they came overwhelmingly to be made – brick faced concrete.”²

“The ultimate synthetic product of Roman experiments with mortars, aggregates and structural problems was the durable concrete of imperial times... Basically it was a material for casting on a monumental scale.”³

Another significant impact of Roman concrete was the construction of massive infrastructure projects that it enabled such as aqueducts and bridges. The advent of hydraulic cement enabled underwater construction of significant strength, facilitating an unprecedented network of infrastructure linking Roman cities to each other and to resources in the Empire. The emphasis of this thesis is on the habitable urban buildings that make up the imagery of a city and hence the role of concrete in infrastructure in both Roman and modern times is not discussed here.



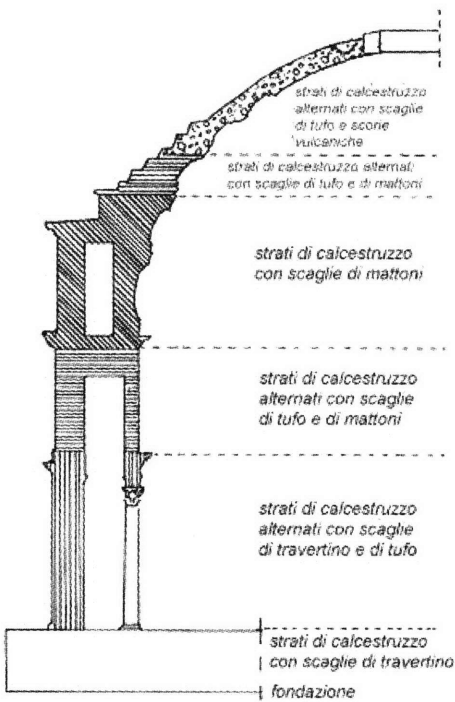
PLAN AND SECTION OF THE PANTHEON
CONCRETE CONSTRUCTION SHADED YELLOW

With the advent of the new material of concrete the focus paradoxically shifted away from the material, and space rather than masonry became the element to be manipulated. With Roman concrete architects were largely freed from the necessity of thinking and planning in terms of beams and isolated bearing points, and could evolve less fragmented structural and visual forms. This led to an architecture that was more modeled than assembled, which also helps to explain the proliferation of curves in plan and section from the mid-first century onwards.

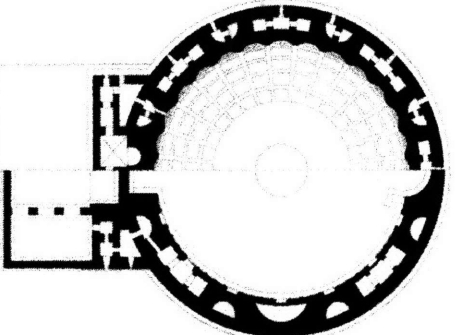
Spatial affect of Roman architecture and the forms and construction material which achieved that affect should not be seen in a hierarchical relationship. By the latter half of the first century AD, the new building forms and the new building materials became inseparable, the one realized through the other. Once the possibilities of the new material became evident, it could be said notions of space and design evolved with the implicit knowledge of the material's possibilities, with new ideas incrementally adding to material's constructive possibilities

This moulded Roman architecture was then replicated in all major cities of the Empire. The Roman architectural revolution was an urban revolution because the Roman Empire was an empire of cities, and at its center was the capital, the city that all others emulated. During the nearly 200 years of the Roman Empire the city was the privileged form of government and Rome sought to shape the great cities of its provinces in the image of the capital. The taxes the cities commanded along with gifts from the imperial coffers enabled them to undertake large public building programs, to embellish urban spaces and above all display the same repertory of buildings types as Rome. It was not just what the city did that mattered, but how it looked. No city was considered complete until it had assembled the basic suite of Roman Imperial buildings. Thereby the architectural symbolism of the city became regularized and the citizens of the Empire were reminded constantly that they were Roman.

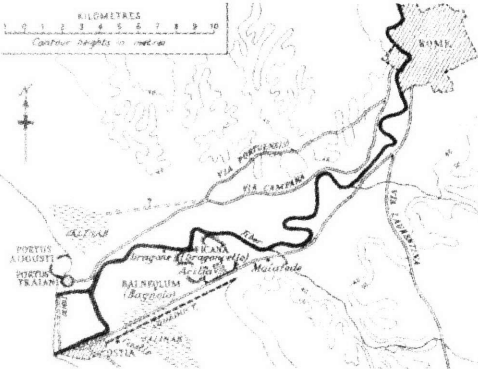
If the urban forms of Roman concrete made the habitat and appearance of Roman cities, it was the contemporary conduct of life, culture



THE GRADATION OF CONCRETE IN THE ROTUNDA OF THE PANTHEON



BRICK FACED CONCRETE ENABLED DOUBLE WALL CONSTRUCTION WITH INTERNAL CAVITIES



RELATION OF THE PORT CITY OF OSTIA, TO ROME

and economics of the times that it reflected and facilitated. The conditions in which the modern incarnation of concrete emerged, partnered with the innate capacities of the material to facilitate forms of habitation commensurate with contemporary visions of cities and living in the new industrial and technological age. The emergence of concrete also coincided with large scale nation-building and rebuilding as well. As the British, Spanish and French empires ceded control of the last of their colonies such as India and Pakistan, Egypt, Iran and Mexico in the early to mid 20th century, the newly liberated nations embarked upon the project of nation building. Contemporaneously, the destruction wrecked by both World Wars, necessitated a swift reconstruction of the built environment.

EARLY MODERN CONCRETE

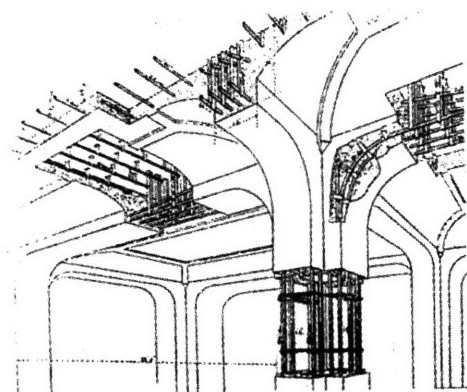
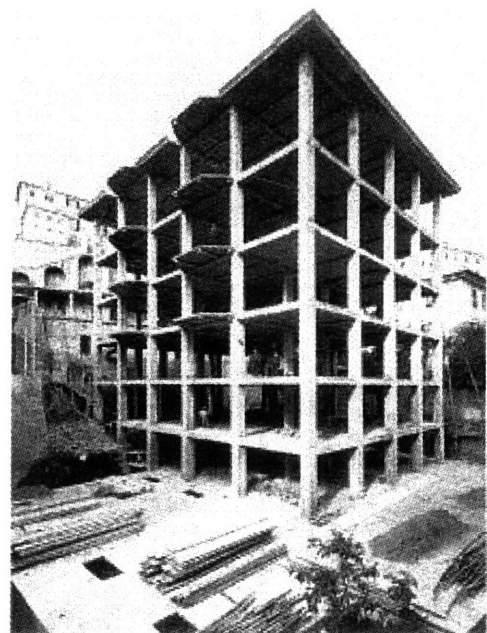
The early architectural debates around reinforced concrete centered around exploring the possibilities of the new material or mastering one of its forms, the traebeated system of columns, beams and slabs, of which the Hennebique system was considered to be a prototype. At the end of the 19th century these debates were particularly influenced by the French architectural fraternity, due to its proximity to the innovations in concrete that were largely centered in France.

The companies of Cottancin and Hennebique represented the then prevalent debate between material and system. Cottancin claimed “the only systems featuring flexibility in architectural forms” achieved by using “a metal framework without joints and with continuous nets as well as spike buttresses,

bricks and reinforced ceramics.” Cottancin’s process had been studied by the French master architect Anatole de Baudot. His clout brought the Cottancin system geared towards plastic forms for consideration among the architectural community, but the community expected detailed and scientific explanations from the inventor of the process. Simultaneously, representatives of the competing Hennebique process offered rigorous and precise details of their calculations. Though the two systems were based on different criteria and entirely different in outcome, Hennebique’s projection of a rigorous scientific system along with the cognitive simplicity of his system exposed the weak points of the competition.⁴

Hennebique’s strategy stressed that these formulae could be taken anywhere. Furthermore as long as material strength and system stability as prescribed by the formulae was achieved – the building would be deemed sound. Hence solidity, not only in appearance but in real strength became a criteria – Hennebique used this notion of strength to advertise his new technology. The elements of this new architecture were hence engineered to achieve these qualities of strength and the focus shifted from aesthetic stimulation as part of structural design to strength of structure and from proportion to sizing.⁵

The debates of the material versus system and technique versus element played out in French journals particularly L’Architecture and various conferences and expositions. The nemesis to Anatole de Baudot’s advocacy of considering the material possibilities of reinforced concrete, was L.C Boileau who had published extensively on the

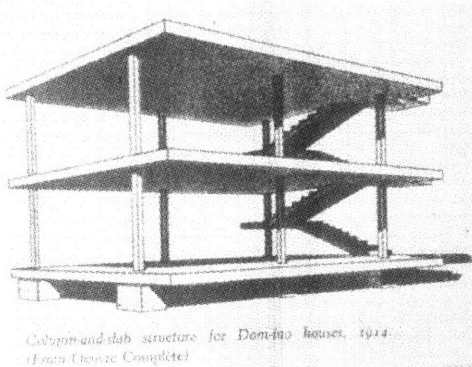


THE HENNEBIQUE FRAME WITH THE COLUMN BEAM AND SLAB AS A MONILITHIC CONSTRUCTION, PATENTED IN 1892

Hennebique system and came to be considered it “Godfather”. In his opinion the Hennebique system was the prototype of the different systems in use. His endorsement of the system represented the architects’ attempt to master, as early as before 1900, this building novelty and its possibilities, or rather the revolutions it introduced in the art of building. The challenge consisted for them in knowing all its aspects, being able to define the range of its applications, mastering economic and aesthetic questions. In contrast Baudot proposed to formulate a technique for the new material, rather than compose its elements.⁶

The debate characterized the position of “high” architecture on the one hand, or the *sinceriste*⁷, that wanted to approach every design project on its own terms and maintain a primacy of creation beginning with the material, and on the other hand, the acceptance of a pre-formulated system as the material and approach innovation from that point onwards.

Reinforced Concrete technology, hence, collapsed the notion of craftsmanship into empirical imperatives that the material and system had to fulfill – it was not crucial anymore to know the secrets of masonry building or the know how to handle building materials as per the stylistic demands of architecture. The size of the columns and beams were calculated primarily with regards to the chemical composition of the material and anticipated load. Hence the material became a system, and several other systems besides Hennebique’s flourished between 1880 – 1900. These systems were distinguished based on their configurations in transversal and



Column-and-slab structure for Dom-ino houses, 1914
(From Dom-ino Complete)

**THE MAISON DOM-INO
PROPOSED BY LE CORBUSIER
IN 1914**

longitudinal sections. The concepts of solidity and stability gained new relevance through reference to the section gradually eliminating references to proportion.⁸

THE MATERIAL AND THE SYSTEM IN ARCHITECTURE – LE CORBUSIER AND THE MAISON DOM-INO

“The frame has been the catalyst of architecture; but one might also notice that the frame has also become architecture, that contemporary architecture is almost inconceivable without it.”

- Colin Rowe,⁹

In 1923 in his provocative manifesto *Vers une Architectur* [Towards an Architecture], Le Corbusier announced “...Dwellings will incorporate the principle of mass-production and of large scale industrialization... Building “to measure” will cease...” Almost a decade before this statement was published, Le Corbusier had published the Maison Dom-ino project. It was the representation of a frame system of reinforced concrete construction invented in response to the urgent problem of rapid rehousing, which arose as a result of the destruction of whole villages and towns at the beginning of the War in 1914. The Dom-ino system of 1914 is generally considered to be Corbusier’s point of departure for realizing an ideal and personal vision of a new architecture in new materials.

Though it was never built as such the Dom-ino idea is considered seminal in the lineage of modern architecture and the trajectory of Le Corbusier’s own work. As we have already seen, the concrete frame

and slab monolith as depicted by Corbusier in the Dom-ino diagram had already been developed rather similarly by Hennebique more than two decades before this proposition. The modifications proposed by Le Corbusier were aimed at standardizing the elements of the system, making them cheaper to construct, and achieving a column free interior space that could be designed with complete freedom. The importance of the Dom-ino diagram lies in the focus it provides for discussions about the direction theoretical architectural discourse took when faced with the revolution in the building industry, where one process could now be used for all building types and the inevitability of a commercial organization of architecture. It is also a useful departure from which to trace the divergence between mass architecture and one emanating from a theoretical framework.

Through the Maison Dom-ino Le Corbusier acknowledges the new productive ethos that all architects would have to work within. The Dom-ino is hence reverse engineered from the point of its need and ultimate production process. Here was a fundamental inversion of the architectural design process, which normally worked with an implicit knowledge of available resources, technology and budgetary constraints but then was free to cast the project at hand as an architectural “*problem*” to which a “*solution*” would be designed. Frameworks of buildings typologies and programmatic needs served to keep the process from becoming a reinvention of the wheel, but there was no apriori solution until the frame appeared on the scene. What made the frame inevitable was the increasing hegemony of concrete framed construction. And if that was the way building was going to happen, a

new modern architecture would be possible only if architects accepted without delay the challenge and implications of the revolution in the construction industry.

The Dom-ino then represents a synthesis of Le Corbusier's ideas whose elements are:

Economic imperatives were forcing modern architects to use new materials and technologies whose modes of production were outside the architect's control. It was a matter of urgency that architects and engineers cooperate in order to develop the vocabulary of the new architecture.

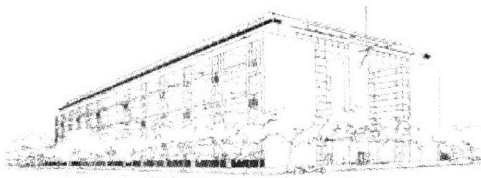
The increase in the scale of projects would cause new patrons to emerge: industrialists, businessmen, and public institutions including governments. To persuade them the modern architect would have to master the economic arguments of his designs, exploit press publicity and play political maneuvering games.

The new law of economy governing decisions to build and the inevitable increase in the size of projects would lead to the commercial organization of architecture.

The revolution in the building industry, where one process could now be used for all building types, would lead to an increase in the scale of operations. If the central problem of modern architecture was the house, then it would have to be considered in

*terms of the whole urban environment. In this way modern architecture would extend into town planning and assume a new social dimension.*¹¹

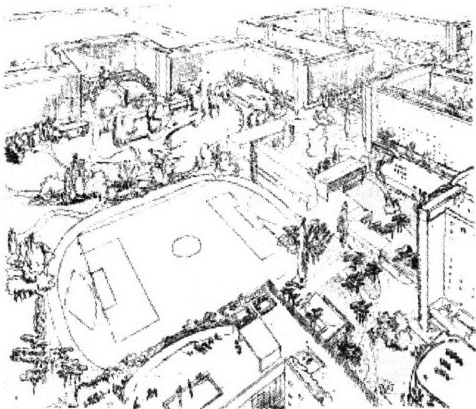
Manfredo Tafuri's commentary on architectural ideology in the capitalist age, to put it broadly provides a useful lens for understanding the use of the frame as a generative device in city design and for theorizing the divergence between the sculptural use of concrete and its systemic manifestations.



IMMEUBLES VILLAS - 1922



LE CORBUSIER - CONTEMPORARY CITY FOR 3 MILLION INHABITANTS
1929



LE CORBUSIER - THE RADIANT CITY
1930

In 1927 Ludwig Hilberseimer wrote:

*"The architecture of the large city depends essentially on the solution given to two factors: the elementary cell and the urban organism as a whole. The single room as the constituent element of the habitation will determine the aspect of habitations and since habitations in turn form blocks the room will become a factor of urban configuration, which is architecture's true goal. Reciprocally the planimetric structure of the city will have a substantial influence on the design and the habitation of the room."*¹²

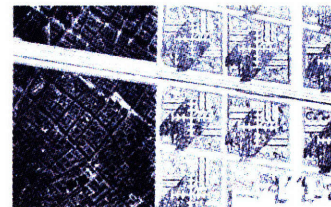
In his analysis of Hilberseimer's stance Tafuri identifies the cell as the prime element of the continuous production line that concludes with the city, and as the element that conditions the dynamics of the aggregations of building structures. The single building is no longer the "object" but the place where elementary assemblages of cells assume physical form. Since these cells are elements reproducible ad infinitum, they conceptually embody the prime structures of a production line that excludes the old concepts of "place" or "space". If the cell is the generator of capital the point is to maximize

its potential for profit. This drives the plan and the planning of the city.

Under this drive the plan of the city seeks to be a dynamic base across which the cell can be serially multiplied. Stabilizing devices of place making –such as figurative plans with centers and peripheries decelerate the process of multiplying the frame ad infinitum.

While the Domino diagram may be a shift in the very conception of architecture –Corbusier’s visions of cities design were still borrowed from the notion of architecture as a finite project. The totalitarianism, the lack of adaptability and organicism – that Corbusian city designs have been criticized for all employ the domino as a fundamental building block. If seen from the singularly architectural perspective of the building block - this use of the domino structure begins to negate the plan as an a priori generative element, especially under exigent conditions.

Yet, even as Le Corbusier’s plans for new settlements posited a radically different living environment compared to the order of the day they tied back to late 19th century reactions to the densifying city as a living environment, and the counter propositions of “settlements” away from metropolitan miasmas. The new building technology of the frame was to serve the realization of this fragmentary, static and anti-urban town as opposed to a city. These ideas were already typified by the Garden City, Broadacre City and Soviet and American decentralization. Corbusier’s plans for the city of 3 Million Inhabitants and Plan Voisin for Paris fall in this genre of alternative settlement models.



LE CORBUSIER - PLAN VOISIN FOR PARIS



THE CITY AS A TOPOLOGICAL FIELD PROGRESSIVELY INHABITED BY THE FRAME

“But this was not possible. The city of development does not accept “equilibriums” within it. Thus the idea of equilibration also proved to be a failure.”¹³

In Tafuri’s opinion these anti-urban utopias were nostalgia in an anti-capitalist guise. *“An anguished reaction to the highest orders of capitalistic organization, a desire to regress to the infancy of humanity.”¹⁴* The translation of these utopias was to be through an advanced reorganization of residential quarters and regional restructuring. Their tabula rasas hinted at the invocation of eminent domain to obtain territories that would be under singular control and safe from speculative forces. To be taken beyond provocation and towards realization these plans entered realms that were governed by both the interests of the state and private business, and were inevitably subsumed by new urban dimensions thrown up by the new orders of capitalistic productive organization.

If the Dom-ino is a paradigm shift in the conception of architecture – its mass deployment radicalized, the notions of center and periphery in a city; as a free floating plug –in component it could be deployed anywhere. Industrial production does not presuppose any single given location in the city. Serial production here implies a radical overcoming of any spatial hierarchy. The technological universe is impervious to the here and the there. Rather the natural space of its operations is the entire human environment – a pure topological field⁷.

Concrete in its modern state, aims to conquer this topological field, by making another city of domicile – but this time its driven by the modern advent of privacy – privacy of space and privacy of capital. The

new forms of domicile in the city – are systematized to a degree where they aren't physical forms anymore but accretions and agglomeration.

While the cell becomes the generative device of making the city, and the plan structures its spread. The building that Hilberseimer asserted was not the “object” anymore but a site where the cells assumed physical form, I argue, has not been dissolved in praxis, and in fact represents the last frontier for architectural intervention in the city, after the plan has been given over to the proliferation of the cell.

Part II of this thesis uses the city of Mumbai as a case to trace the urban accretion of cells in a concrete frame building and the process of planimetric organization of the city driven by the commercial promise of the serial production of the concrete frame.

ENDNOTES

¹ Lechtman, Heather and Hobbs, Linn "Roman Concrete and the Roman Architectural Revolution", *Ceramics and Civilization Volume 3: High Technology Ceramics: Past, Present, Future*, edited by W.D. Kingery and published by the American Ceramics Society, 1986; and Vitruvius, Book II:v,1; Book V:xii2 p

² Ibid p

³ Ibid p

⁴ Delhumeau, Gwenael. "Hennebique and Building in Reinforced Concrete around 1900", *Rassegna vol 49*, 1992.

⁵ Simmonet Cyrille, "The Origins of Reinforced Concrete", *Rassegna vol 49*, 1992, p 9.

⁶ Dumont, Marie-Jeanne. "The Philosophers' Stone: Anatole de Baudot and the French Rationalists", *Rassegna vol 49*, 1992

⁷ Ibid p

⁸ Simmonet Cyrille, "The Origins of Reinforced Concrete", *Rassegna vol 49*, 1992, p 9.

⁹ Rowe, Colin. "The Chicago Frame", *The Mathematics of the Ideal Villa and Other Essays* MIT Press, 1976. p 90

¹⁰ Le Corbusier, "*Towards a New Architecture*", Dover New York 1986, Reprint originally published by John Rodker, London, 1931. p 236-237.

¹¹ Gregh, Elenor, "The Dom-ino Idea", *Oppositions 15-16*, 1979

¹² quoted from Hilberseimer, Ludwig trans. by Julius Hoffman Verlag, "*Grossstadtarkitektur*" Stuttgart , 1927, in Tafuri, Manfredo, "*Architecture and Utopia: Design and Capitalist Development*" MIT Press 1979 . p 104

¹³ Tafuri, Manfredo, "*Architecture and Utopia: Design and Capitalist Development*" MIT Press 1979 . p 120

¹⁴ Ibid p 121

CHAPTER 2A

THE EVOLUTION OF CONCRETE: THE MATERIAL AND ITS GLOBAL SPREAD

“Modern reinforced concrete, a novel combination of concrete and iron, started in the mid-19th century as a heterogeneous set of local technologies without much knowledge of underlying technical principles. By the early 20th century, reinforced concrete had become a global technology with stable design rules and shared knowledge repertoires.”¹

This chapter traces the development and spread of know-how in concrete construction as socio-technological process. Its development is divided here into four phases, the local, the inter local, the trans-local and the global. The progression of these phases show the development of reinforced concrete from an idiosyncratic experimental innovation to its use in large scale urban and infrastructure constructions worldwide.

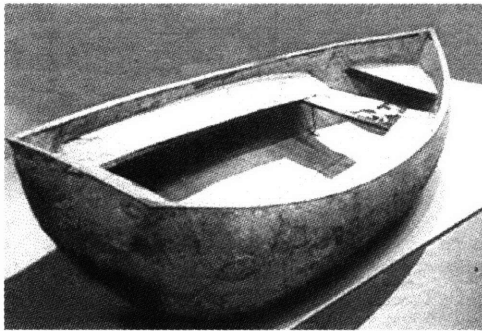
A substantial portion of this chapter benefits from the paper titled Local and global dynamics in technological development: a socio-cognitive perspective on knowledge flows and lessons from reinforced concrete by Frank Geels and J Jasper Deuten, published in the journal Science and Public Policy, volume 33, number 4, May 2006. I have used borrowed the classification of phases by Geels and Deuten to trace the evolution of the concrete frame from the various possibilities of form and structure that early experiments with concrete had revealed. When read in relation to the narrative of the previous chapter where I recount the dialogues between the

possibilities of concrete as a material and concrete a building system of frames, this chapter makes clear the emergence of concrete construction as systematized knowledge, both as frame and in other applications particularly infrastructure projects such as bridge building.

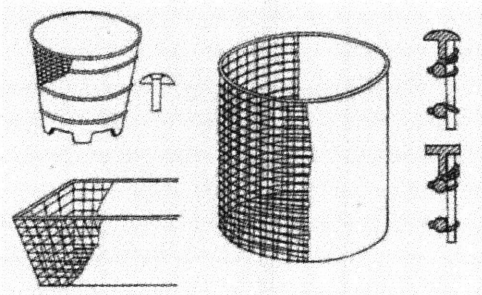
THE LOCAL PHASE

Reinforced concrete technology started as local solutions for specific problems with traditional constructional materials (wood, bricks, iron). Early forms of reinforced concrete included substitutes for wooden, rot-susceptible flowerpots, water reservoirs and rowing boats. The early applications of iron-concrete artefacts remained limited to distinct applications with venturing customers who highly valued the waterproofness, fire-proofness and inexpensiveness of the new building material. Local actors operated independently and created their own knowledge to serve their purposes.

By the 1860s, inventive entrepreneurs developed complete building systems based on novel combinations of iron and concrete. Patents were issued for concrete-iron elements such as pipes and reservoirs (patented in 1868), flat slabs (1869), bridges and footbridges (1873), stairs (1875), and floor constructions (1878). An inventive and entrepreneurial 'system' owner was the Frenchman Joseph Monier who took a universal patent on his 'Monier system' in 1878. This system was "backed up neither by theory nor by systematic experiment". As a technology that evolved through use rather than in laboratory based experimentation, knowledge in reinforced concrete was produced trial-and-error, guided by "constructional sense rather than by



J. J. LAMBOT, SMALL REINFORCED CONCRETE BOAT (1848)



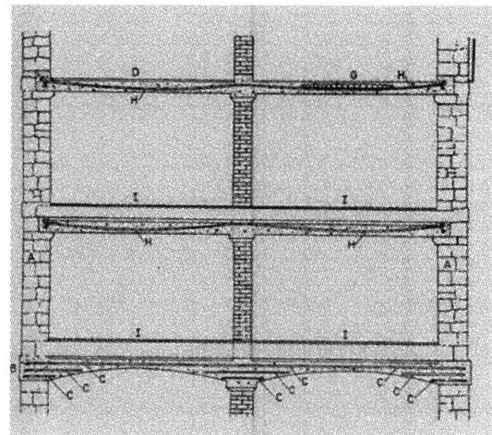
CONCRETE FLOWER POTS REINFORCED WITH A STEEL MESH BY JOSEPH MONIER (1850)

theoretical insights”. Monier’s construction systems were based on intuitions, not calculations, that concrete and iron could play complementary roles: while concrete took the compressive stresses and iron took the tensile stresses.

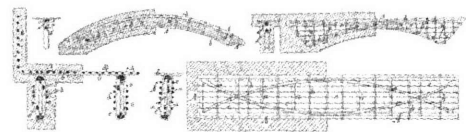
To attract attention to their novelties, system owners and licensees disclosed part of their knowledge. They organized demonstrations and performed public tests with their structures, for instance by burdening them with excessive loads. But such tests could not demonstrate durability over time, which remained a contested issue. “The local phase came to an end when reinforced concrete entrepreneurs wanted to enter mainstream markets in the building sector. To get permissions and meet building regulations, they had to improve their formal knowledge base to make performance more calculable.”

INTER LOCAL PHASE

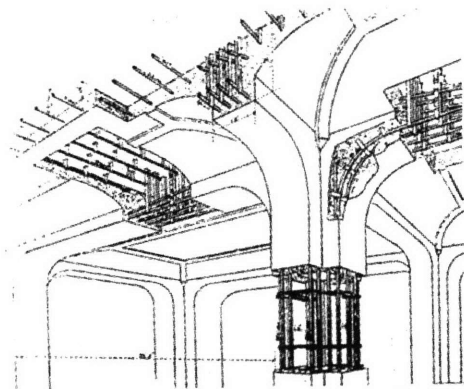
From the 1870s to the 1890s, new systems emerged besides the Monier system, protected by patents. To enter the mainstream building sector, reinforced concrete entrepreneurs had to develop new knowledge and master the technology. To improve the understanding of their proprietary systems, system owners and their licensees accumulated and exchanged experiences inside their social network. But knowledge production remained system-specific, and circulation beyond the network of licensees was limited. There were also technical reasons that limited knowledge transfer between systems: the varieties of reinforced concrete consisted of different mixtures of materials and positioning of iron reinforcements.



W. WILKINSON, REINFORCED CONCRETE SYSTEM (1854).



SYSTEM OF DISCREET ELEMENTS PATENTED BY JOSEPH MONIER IN THE 1880S



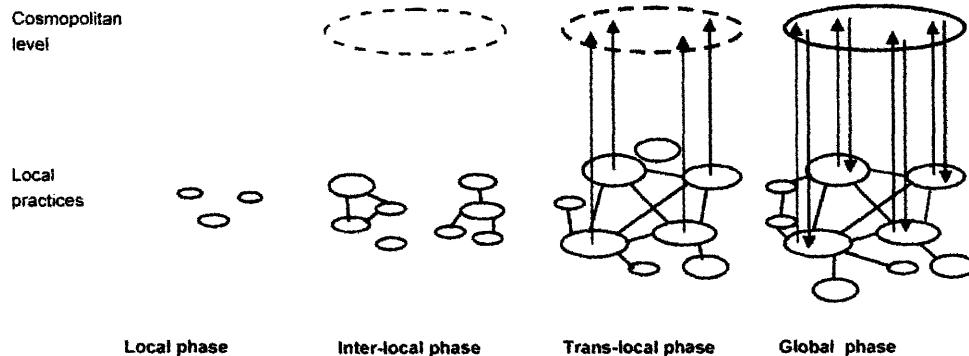
THE MONOLITHIC CONCRETE FRAME PATENTED BY FRANCOIS HENNEBIQUE IN 1892

A major step towards global knowledge occurred in the network around the very successful 'Hennebique system'. For more than a decade Hennebique performed numerous experiments, developing practical insights in the possibilities of reinforced concrete construction. In 1892 he patented a complete building system, in which columns, beams, joists and floors formed a monolithic whole. This was new, because the earlier Monier system used discrete elements, which were assembled on location. Hennebique established a consulting engineering firm to exploit his patent and set up an international network of licensees.

Hennebique's learning strategy was based on internal circulation and aggregation of experiences. Empirical tests were collected and compared to develop knowledge. But the accumulated knowledge was not backed up by theory or translated into generic statements. Hennebique also organized special training courses for concessionaires and developed a knowledge infrastructure, which included a journal and annual conferences. In 1898 the Maison Hennebique started publishing *Le Béton Armé*,² a monthly journal that supported his licensees. But the variety of systems increased uncertainty for contractors, customers and inspectorates. It was uncertain how to determine which system was better.

PHASES IN THE DEVELOPMENT OF SHARED TECHNOLOGICAL KNOWLEDGE

(SOURCE: Frank Geels and J Jasper Deuten, "Local and global dynamics in technological development: a socio-cognitive perspective on knowledge flows and lessons from reinforced concrete". *Science and Public Policy*, volume 33, number 4, May 2006, pages 265–275, Beech Tree Publishing, England.)



I present a brief account of the architectural preference of the Hennebique system in France. Through intense marketing and a series of entrepreneurial inventions, as well as through Le Béton Armé, Hennebique's firm was also spreading the use of RCC around the continent and overseas. By 1900 the Hennebique system had proliferated widely but was not the only system available in concrete. Customers had to trust reinforced concrete contractors and their idiosyncratic methods of calculation. Contractors had a 'monopoly of expertise' and their knowledge was largely contextual, geared to specific applications and systems. As long as the innovation race was not decided with the emergence of a dominant design, reinforced concrete producers had no incentive to share their knowledge.

An incentive to produce more aggregate knowledge came from increasing interest from large professional customers (Public Works departments, railway companies, the military and inspectorates). These customers demanded that uncertainties and risks were reduced before actual construction. Professional engineers, who were employed by large professional customers and inspectorates, favoured a theoretical and mathematical approach. For them, the way to reduce risks before construction was to underpin the technology with data from systematic experiments, which could be used to validate theories and calculations. They demanded a 'rational application' of reinforced concrete, in which calculation could be backed up by theory, and theory could be underpinned by experimental data. This formed an incentive for the production of trans-local knowledge.

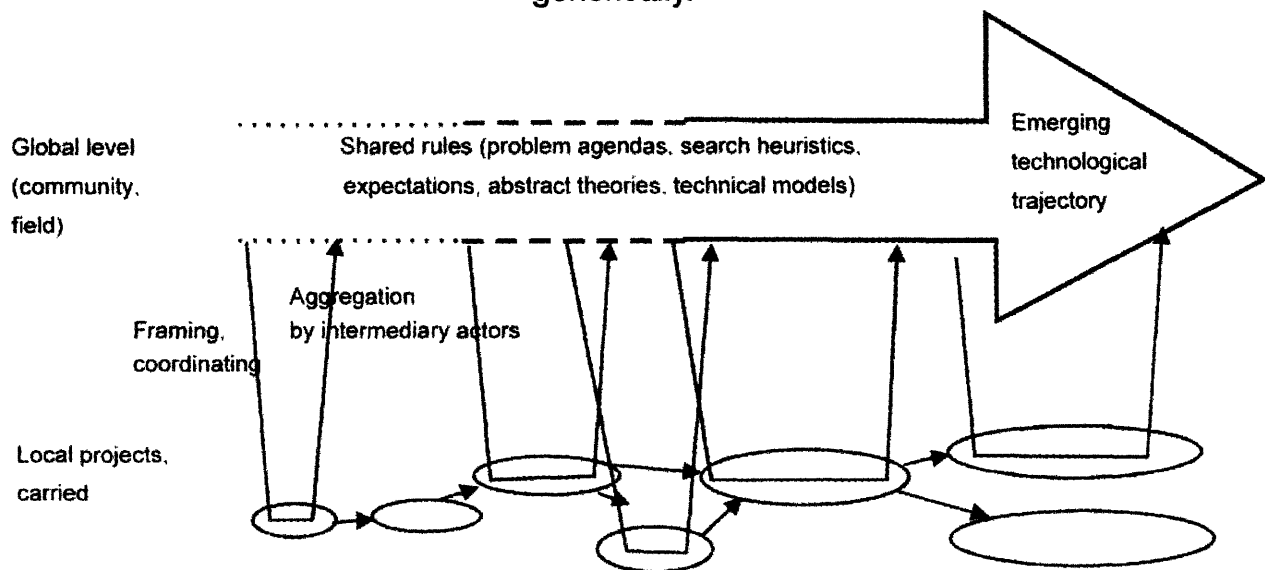
TRANS-LOCAL KNOWLEDGE

In the 1890s to 1910s, circulation and aggregation activities increased significantly. These activities were targeted at a new goal: the production of knowledge that was generic and applicable across locations. This involved roles for new kinds of actors and new kinds of knowledge activities. A division of labour emerged between local and global levels. At the local level, firms and contractors continued to collect hands-on experience, increasingly sharing this with others. But also a global level emerged where professional engineers, professional societies and standardization committees produced generic knowledge.

The global-level knowledge activities were supported by an expanding knowledge infrastructure of journals, which provided a forum for theoretical debates about generic knowledge. Additionally, because of demands for a common cognitive and legal framework that could help reduce financial and technological risks, publications emerged, which studied and modeled reinforced concrete generically.

LOCAL PROJECTS AND EMERGING TECHNICAL TRAJECTORIES

(SOURCE: Geels and Døuten, "Local and global dynamics in technological development: a socio-cognitive perspective on knowledge flows and lessons from reinforced concrete".)



However, as constituents of concrete like sand and gravel were locally procured and differed from place to place, meaningful inferences could be made only if this variability was reduced in a laboratory setting. Therefore the global-level knowledge project changed course towards systematic experiments under controlled circumstances to produce a set of outcomes that could be tabulated to a universal framework.

While early theoretical debates took place in existing journals, the early 20th century saw the creation of new and dedicated journals, mainly German and French to begin with, and subsequently as the technology took hold in other countries local regulatory bodies were set who produced that own references.

Thus, by 1910, reinforced concrete was no longer a disparate, local, heterogeneous set of local solutions to specific problems. A local–global division of knowledge production had emerged, supported by existing and new knowledge infrastructures. The result was generic knowledge now shared between the different global sites using concrete technology, captured in handbooks that compared and evaluated different systems and put forward theories and calculation methods. “Technological models were created, which explained performance in terms of a number of salient variables.”

At universities the new technology was incorporated in curricula and courses at polytechnics and universities (Lemoine, 1991). Gradually, a new generation of civil engineers was trained how to design and calculate reinforced concrete structures.

They subsequently carried the collective knowledge reservoir to the local practices of their employers.

THE GLOBAL COSMOPOLITAN PHASE

Reinforced concrete was increasingly applied after the First World War. The recovery of the economy led to many building activities, and it was a period that was optimistic towards innovations. After the war, traditional building materials were scarce and expensive, making reinforced concrete more attractive.

In addition, there was a shortage of skilled labour. Since reinforced concrete promised to save time, construction companies became more interested in the new material. Hence, reinforced concrete was increasingly used in municipal housing projects in Great Britain, Germany and Belgium. Design and construction with reinforced concrete became a 'normal practice', guided by global knowledge.

Previously developed standards were widely accepted and provided a legal framework for contractors and customers. Technological societies and branch organizations sponsored ongoing refinements at the global knowledge-level, distributing new insights and findings to local practices.

Also in another way, global knowledge contributed to transforming local practices. Findings, rules and calculation methods from theoretical experiments in controlled circumstances could not be used in local building practices that deviated too much from these circumstances. Therefore, much effort was put into creating more homogeneous local practices,

for example, standardization of raw materials, disciplining and supervision of actual execution of procedures for making reinforced concrete. In other words, local practices had to be made similar to the controlled circumstances under which global knowledge had been produced. Local practices were increasingly adjusted to meet technological rules from the global level, signaling a definitive reversal in their relationship.

The journey of concrete from disparate experimental applications to a global material also shows us the dialectical effects of discrete developments on global knowledge, which in turn creates norms that standardize local practices across different contexts. In this story also lies a partial answer to the commonly held impression of the ubiquity of urban form in cities of diverse cultures around the world.

The universalization of know-how could not be divorced from the universalization of form. The cognitive simplicity of the column-beam form of the concrete, combined with the fact that it had already been exemplified and disseminated by the Monier and Hennebique systems caused the frame to become the single most pervasive embodiment of the global cosmopolitan system of concrete knowledge.

SUMMARY

Local phase	Inter-local phase	Trans-local phase	Global phase
1850s–1870s: local solutions, trial and error, high variability, trade secrets, 'success without understanding'	1870s–1890s: proprietary systems protected by patents (regional sharing), 'understanding within systems'	late 1890s–1910s: standardisation (building codes and other rules) underpinned by theory and data; emerging knowledge infrastructure of journals and handbooks	1920s–1940s: two-level dynamic, normal practices defined at the global level, collaborative research; courses and training; standardisation of raw materials and disciplining of production process
Driver for transition to inter-local phase: local solutions develop into building technology, new types of customers and markets	Driver for transition to trans-local phase: risk reduction by anticipatory calculation, required by demanding customers, agencies	Driver for transition to global phase: increased interdependencies in reinforced-concrete industry and new social structures	

ENDNOTES

¹ Geels, Frank and Deuten, J Jasper, "Local and global dynamics in technological development: a socio-cognitive perspective on knowledge flows and lessons from reinforced concrete." *Science and Public Policy*, volume 33, number 4, May 2006, p 265–275.

² Simmonet Cyrille, "The Origins of Reinforced Concrete", *Rassegna vol 49*, 1992, p10

CHAPTER 2B

CONCRETE IN MUMBAI

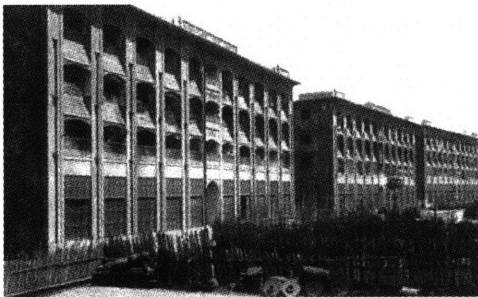
Until the beginning of the 20th century the major works of construction in India were carried out by the PWD. The first designers in reinforced concrete were all British and were credited as being “instrumental in introducing the use of reinforced concrete and brickwork for government purposes in India”. The earliest structures designed by the Royal Engineers were small in scale but this early knowledge meant that they could continue to be involved in designs for commercial clients until the 1920s , such as the reinforced concrete flats for mill workers at Spring Mills built in 1916. ¹

The influence of the Hennebique system, mentioned in previous chapters, can be traced to India via Britain. At the beginning of the 1900s the reinforced concrete specialist in Britain was a new advent of foreign origin. The most prolific among these was Louis Gustave Mouchel, agent of the phenomenally successful firm of Francois Hennebique. His business organization followed Hennebique’s model with specially trained regional engineers to execute working drawings [after initial designs by an architect or engineer]. Contractors “licensed” to execute them in return for royalties and nationwide expansion. By 1905 most reinforced concrete works and all framed buildings in Britain were in Hennebique’s system. In order to curb this monopoly institutions such as the RIBA committee Reinforced Concrete [1905-07], journal *Concrete and Constructional Engineering* and the Concrete Institute, were set up in Britain. These institutions and the writings of the designers who had worked with the Hennebique frame came

to inform concrete construction in India in the early years of its advent to the country.²

By the late 1920s Bombay had 33 contractors able to build with reinforced concrete, while Calcutta with large steel mills nearby had 12. The building of New Delhi was the largest single project in India during the 1920s-1930s, the tradition of building in load bearing masonry continued here and there is reference to just one engineer and contractor with expertise in reinforced concrete.³

The Concrete Association of India formed in 1927 to promote and develop the reinforced concrete market in India, published 39 booklets during the 1930s on subjects like concrete fences and gateposts, cement plastering and concrete roads. Volume 4 “Floors and footpaths” described how concrete would keep out rats and that “concrete pavements were imperishable and last forever. They can stand the vicissitudes of the Indian climate and once laid never need repair.”⁴



STUDENT'S HOSTEL FOR THE VICTORIA
JUBILEE TECHNICAL INSTITUTE - 1907

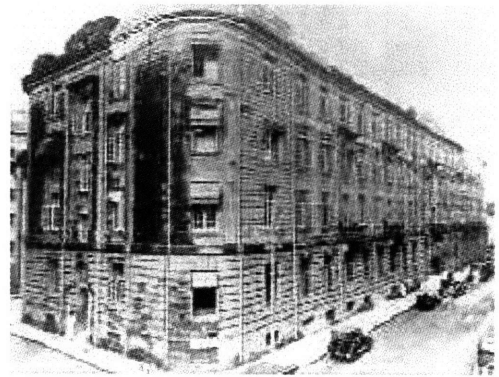
The earliest Civilian reinforced buildings are believed to have been built in Bombay. In the suburb of Byculla a 4 storey student's hostel built in 1907 for the Victoria Jubilee Technical Institute design by Messers Taraporvala, Bharoocha & Co is described as the earliest reinforced concrete structure in India . The best documented building from this period is the Spring Mill Worker's Chawls in Naigaum Road in the suburb of Dadar. These were 5 buildings built between 1915 and 1917 to provide low rent accommodation for workers at the nearby Spring Mills. The plan of the buildings is attributed to J F Watson who was a civil engineer serving with the

Royal Engineers in France during their construction. It is likely that he prepared the general arrangement drawings and an unnamed contractor carried out the design of the reinforcement.

By the 1930s most of the larger apt blocks in Bombay were reinforced concrete frame structures. The ability of reinforced concrete to support the imposed floor loads and allow a flexible layout for partitions meant that it quickly became established as the preferred method of constructing office floors and for the larger buildings it was also used to form the main structural frame.⁵

Bombay House completed in 1924 (same year as the Gateway of India) was a 5 story reinforce concrete framed structure that was clad in Malad stone. One of the earliest industrial buildings in India was Swan Mills in Bombay, constructed in 1905 using stone external walls with rc columns internally to support a saw tooth profile

The first buildings and structures used materials imported from the UK and it wasn't until the late 1920's that India was indigenously producing the quantities of cement and reinforcement bars that were needed. Once the industrial production infrastructure was in place the number of reinforced concrete buildings and the firms able to design and build with the material grew rapidly. The construction industry was steered towards the use of reinforced concrete by the promotion of the Concrete Association of India and the Associated Cement Companies which comprised of the various cement companies in production at the time. As in other developing countries the availability of cheap



BOMBAY HOUSE 1924



LABOURERS ON AN INDIAN
CONSTRUCTION SITE HANDLING
CONCRETE



HYBRID TAYLORIZATION OF
CONCRETE CONSTRUCTION

labour was a major factor in the persistent wide use of reinforced concrete for medium to large scale projects.

The growth of reinforced concrete construction during the 1920s and 1930s was largely an urban phenomenon spurred by rural to urban migration and the concurrent demand for larger scale, higher-rise buildings. The centralized factory based production also concentrated its use in larger cities, particularly Bombay with its established transportation links through roads and railways with the rest of the country and by port to international centers of cement production.

THE AVAILABILITY OF LABOUR

Concrete construction serves as an example of the junction between hand based labour of the colonial (now third world) artisan and the technological advances of the west. Precedents of this conjunction are exemplified by undertakings such the construction of the railway network or the salt works in India and the Indian artisan appears as a dichotomous figure, both resistant to and an enabler of “flexible accumulation”.⁶

The Indian construction worker or “artisan” then is the other half of the hybrid taylorization of concrete construction. The factory based production of cement and steel is the only truly “industrialized” part of concrete construction; the vast pools of labour in a place like India that facilitate the widespread use of concrete are the other half of its ‘technology’. Being semi-formal in large measure this labour cannot be characterized as an industrialized working class,

enjoying the benefits of the more technologically advanced inventions in the country. The migrant nature of this labour, its inability to unionize and the practice of sub-contracting that absolves builders of direct responsibility as employers towards the labourer are the conditions that make their employment cheap. As a labour intensive construction method, the availability of cheap labour is the most essential condition underpinning preference the preference of concrete as a building material in India.

The urban poor are the fastest growing segment of the Indian demography due to urban-rural migration. These migrants often begin their urban lives at the bottom of the labour chain. The urbanization of greater segments of the rural population is likely to keep construction labour abundant and cheap, which would further maintain concrete construction as the most viable option. Labour involved in RCC construction does not require very special skills – steel frame labour has to be highly skilled which is scarce in India .

If the conditions of labour were to change – if it were to be formalized or unionized and become even more expensive that this 50 – 75% hike– how do you think RCC construction would be impacted?

Developer: I've never thought in that direction

Basically know how is more important – so know how for RCC is very easy – anyone can do RCC work.7

The labour team at a RCC construction site comprises of fitters, carpenters, persons who fill the concrete slab, once that is over the masons come and do the



IN A PERPETUATION OF PATRIARCHAL CONTROL INTO LABOUR SYSTEMS - WOMEN OCCUPY THE BOTTOM RUNG OF THE LABOURERS ON AN INDIAN CONSTRUCTION SITE, LIFTING THE HEAVIEST LOADS WHILE MALE WORKERS CARRY OUT MORE SKILLED TASKS.



EXTERNAL PLASTER MASONS

block masonry, then the internal plaster masons and then external plaster masons - + plumbing electrical tiling etc

In order of hierarchy from most skilled to least skilled the labourers rank:

- 1] Ext plaster mason
- 2] Internl plaster mason
- 3] Block masonry mason
- 4] Carpenter
- 5] Fitter
- 6] Labourer – for filling the concrete (they are largest segment of the site’s labour force)⁸

Of the skills represented here are only the pouring of concrete is particular to the technology of RCC, all the other skills have deep histories, however their lineage is not reflected in their ranking. As is evident skill levels decline in proportion to the final visibility of the labourer’s work.

THE ABSENCE OF STEEL

If the typology of mid-rise and high-rise buildings is accepted as the inevitable solution to need for domicile, work and recreation space in Mumbai, the status of steel frame construction which offers the only alternative constructional technology for such building types must be assessed.

The absence of structural steel in Mumbai and (India) is attributed to:

The market availability of particular kinds of sections that might be used in taller buildings is uncertain. Manufacturers may say that they don’t have on their “rolling” program (rolling being the industrial

manufacture of steel sections) sections of particular specifications for [say] the coming quarter (critical mass of demand being a determinant in how many sections are produced). Hence the lack of readily available steel components for singular buildings which are not large enough to warrant a devoted “rolling program” of mass manufacturing prevents designers from using steel as structural material.

The steel sections (steel beams and columns) being manufactured are of smaller sizes – which are inadequate to sustain the loads of high and medium high rise buildings.

Manufacturers in turn report poor demand. Designers however cannot stipulate the use of sections that are not available because the design will revert back for revision and it is fundamentally not possible to build beyond a certain load bearing capacity out of the steel sections that are easily available in the market.

“We are not talking about the highly singular buildings that we design in many (not all of our studio projects) that can call upon specialized services – and even in the cases when they do call on specialized industrial services they are hugely expensive or don’t meet the critical mass of demand to make them feasible. Demand and supply governs the rolling program.”⁹

DECLINE IN DESIGN AND CONSTRUCTION SKILL

In the last 50 years (post-independence) the skill of fabrication – precise fabrication – (steel must be fabricated down to millimeters – if the holes

don't match the elements cannot be assembled)
– in reinforced concrete you can build a fairly stable looking and performing structure even with extremely crude craftsmanship – (crude bending of reinforcement bars, all covered with cast concrete – you have a ready structure – whatever its quality maybe)

Presently in steel fabrication, the workforce has drastically shrunk. if shop drawings are to be made for structural steel construction, there are few agents available – and fewer contractors of steel constructions can make shop drawings. It is considered bad practice to carry out steel construction without shop drawings – so with this deficiency of professional ability and skill of working with steel – steel remains underutilized.¹⁰

LABOUR AND STEEL

In steel frame construction the general fabrication happens in the workshop for drilling cutting etc and the components are brought to the site for erection – on-site skilled labour is expensive in West while in India the off-site construction is more expensive. Concrete permits an architecture that is “more modeled than assembled’. The outward appearance of stability and solidity serve to make even poorly constructed concrete structures acceptable. The high industrial precession in manufacturing and skill levels during assembly discourage the development of steel constructional technologies where support systems such as academic research on the performance of steel structures and professional training for designers to design them. The absence of these allied agencies is reflected in the built form

of the city, which serves as an embodiment of the current state of development in that society. This situation of the relative absence of steel as a building material also occurs in Brazil which until recently¹ was among the world 5 largest producers of steel. Researchers have attributed the absence of steel in the Brazilian construction industry to the absence of academic intuitions that are requisite to further the development of construction technology in steel.

The availability of labour that perpetuates the use of concrete and the absence of skill, knowledge and research to build out of steel are two sides of the same coin. Where the preponderance of concrete betrays the presence of cheap labour and its associated societal condition, the absence of steel reveals other a lacuna in the technological attainment of that society. If this gap were to be bridged, the change in urban form would betray society as having evolved beyond basic modes of survival.

ENDNOTES

¹ Tappin, Stuart, "The Early use of Reinforced Concrete in India", *Construction History: Journal of the Construction Society*, Volume 18, 2002

² Cusack, Patricia, "Architects and the Reinforced Concrete Specialist in Britain 1905-08" in *Architectural History*, Vol. 29, (1986), p 183.

^{3,4,5} Tappin, Stuart, "The Early use of Reinforced Concrete in India", *Construction History: Journal of the Construction Society*, Volume 18, 2002

⁶ Dutta, Arindam, "Strangers Within the Gate - Public Works and Industrial Art Reform." In Prakash, Vikramaditya and Peter Scriver (eds.) *Constructing Colonial India: Essays on South Asian Architecture and Urbanism, 1800-1947*. New York: Routledge, 2006.

⁷ Personal Interview with the Vice President of the Project Management of prominent Mumbai developer.

⁸ Ibid

⁹ Interview with a leading Structural Engineer in Mumbai

¹⁰ Ibid

PART II

**THE
ETHOS
OF
CONCRETE
IN
MUMBAI**

PART 2 CHAPTER 3
THE SPATIAL ETHOS OF THE FRAME
THE SETBACK, THE PLOT AND THE
PIXELIZATION OF THE CITY

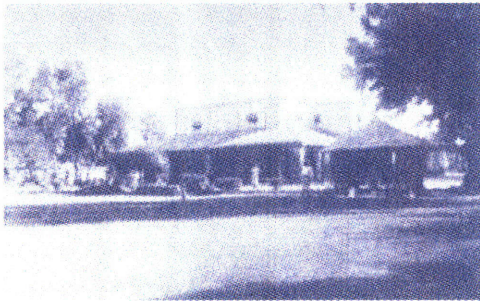
The city of Bombay verifies the concrete frame as a detached freestanding entity is the building block of the city. Integral to this detachedness is the setback, the open space between the building and the boundary of the plot it is located on.

If the concrete building is acknowledged as a freestanding building block in the city, then the feature that makes it freestanding, the space in between, bears relation to how the building agglomerates to make city form. This feature of space in between is shared by cities with framed buildings, be they steel or concrete, but like the crafting of the universal form of the frame, this universal space in between also has a lineage in Bombay that is particular to its history – as different from say Sao Paulo. I characterize its relationship to the frame as retroactive which itself is evidence of the fact that it is not a result of the frame or building materials – but it is also true that the most clear codification of this space around the year 1919 into the Bombay bye laws is contemporaneous with concrete frame buildings, and their progressive strengthening as “norm”, as directives for how a plot in the city should be developed is in anticipation of only one form – which is the orthogonal concrete framed building.

This is not to say that within the present bye-laws there cannot be a varying imagination of building form, but that places the onus on the design of the building – my argument here is that the imagination

of the building on which the bye law is based, is one of the generic frame. The bye law has not evolved, for instance like in New York to a more nuanced directive that results in the progressive setbacks and a particular profile of buildings in the skyline. Their intent remains limited at separation, provision of light and ventilation and protection of easements rights rooted in notions of private property. I have attempted to trace where these come from in the Indian context, in the larger exercise of explaining the appearance of buildings in the city.

While the setback is a feature that Bombay shares with several cities worldwide, its development here has roots in the colonial administration of India as well as Bombay. The evolution and governance of the setback in Mumbai is traced here and is found to be a result of two developments, both with colonial origins.



COLONIAL ADMINISTRATIVE BUNGALOW

THE BUNGALOW:

The dwelling form known by the term bungalow has been defined by varying criteria. In tracing its development Anthony King cites a spectrum of its incarnations from its earliest known version of the peasant hut in rural Bengal to its transformation in India and later to transfer to Africa as a house-type “*suitable for European residence in the tropics*”. When the term and idea was first transferred to England, the bungalow came to be distinguished by its function as a purpose built leisure or holiday house. At other times it was defined by manner of construction or design (single storey house), and on certain occasions by its location (in the country, by the sea or riverside). Through all these characterization



the bungalow consistently expressed the idea of getting away from it all .¹

The Anglo Indian Bungalow developed as a dwelling type following the comprehensive annexation of the Indian Empire by the British East India Company by about 1818, which brought the entire Indian Sub-continent under British military, administrative and diplomatic control. The two principal instruments of this new proto-imperial power, its army and its system of civil and juridical administration became the constituency for the bungalow.² And it was for these new political rulers that the bungalow was developed as the rural, and subsequently sub-urban “model dwelling” .

The emergence of the bungalow as a culturally distinctive house form was concomitant with the spread of British administration into the interior of India. The “officer’s bungalow on the cantonment, like the “magistrate’s”, collector’s or commissioner’s bungalow in the districts was the workplace and residence of the representative of the new ruling power. These buildings were few and scattered to begin with, however, the influence of the British rule on buildings in the Indian landscape sharpened after the responsibility of ruling India was transferred from the East India Company to the British government itself in 1858. Where a few European travelers had adapted themselves to Indian forms of shelter in the 17th century, the representatives of an imperial, political and cultural power brought an extensive adaptation of Indian forms less than two centuries later. By the last quarter of the 18th century, a new form of dwelling had been produced based on the Bengal prototype, but used only by Europeans.³

The setback in the Indian context can be traced to the way the colonial bungalow occupied its site and its location with respect to its surroundings. The bungalow was invariably situated in a large compound, an area of marked territory, which in turn, was located at a distance from other buildings or places of settlement. The compound was an enclosed space, either leased bought or appropriated by the foreigners from the indigenous inhabitants of the land. The development of the bungalow was a culturally distinctive form of dwelling depended, first and foremost on the secure possession of territory in which cultural choices could be expressed in an environment over which there was considerable, if not total, control.

Being only of one storey and with an extensive thatch covering the whole structure, the bungalow depended on its surrounding open space for light and ventilation. It was a direct inversion of the native courtyard house in the "native city" where a central courtyard facilitated the penetration of light and air. The houses of the native city were also 3 to 4 storeys high, with closely clustered buildings all around.

The location of the bungalow, in its compound, distanced from the Indian settlement also expressed the social and political relationship between the dwellers of both. Spatial distance reflected social distance. The bungalow, it could then be said, was also the advent of gatedness in the morphology of Indian settlement patterns, which while by no means uniform across the sub-continent, adhered to communal relationships in their various manifestations across the country.

The closely clustered houses of Indian towns and villages, whether they were abutting dwellings in

crowded urban *mohallas* or the Indian village with its free-standing or grouped huts and houses, reflected the kinship, social structure and relationships of the people living in them. Until the colonial bungalow, it might be said, Indian dwellings were situated in a spatial morphology that followed patterns of social agglomeration rather separation. At the scale of the city segregations were based on caste, class and religion which played out at the level of the sector or neighbourhood, with individual dwelling units in direct association with others within their spatial subgroups of neighbourhood or cluster.

Bungalows formed the living space of the law makers, and served to heighten the notion that the dense native town was a place of chaos and disease. The advent of the colonial bungalow was informed by two features: European notions of privacy [that were different from the Indian version] and the role its occupants played as the new ruling elite, both of which contributed to the formation of the “setback” as a distancing device.

The bungalow, I argue bears a relationship to the characteristic of concrete buildings in Bombay as separate gated entities. A building type and way of living that has arisen in the country only in the last 75 years – the gatedness of concrete buildings is an integral part of their function as habitat in the city. The relation of the bungalow to the concrete building is not one of a material connection of transference of features from one form (the bungalow) to another (the concrete highrise) or the registration of any persistent features through concrete. It is the spatial ethos of the concrete frame as a gated detached building, that has resonance in the lineage of the colonial bungalow.

THE ROLE OF THE PLAGUE IN THE EVOLUTION OF THE SETBACK IN BOMBAY

“On 23rd September 1896, A.C Veigas medical practitioner and local politician declared before the Bombay Municipal Corporation, and thereby the world, that bubonic plague broken out in the city”.⁴

By modest estimates, between 1896 and 1914 the bubonic plague claimed an estimated 183,984 victims in Bombay City, and 8 million lives across the Indian Subcontinent.⁵ Yet of all the epidemics that had afflicted the Indian Subcontinent in the late 19th and early 20th Century, the plague was not the worst; malaria, tuberculosis and influenza had each claimed twice as many lives in similar or shorter spans of time, and small pox and cholera tolls stood among the millions too. In this general climate of very high mortality, declining life expectancy and dwindling population, the plague epidemic evoked unprecedented fear and panic, and prompted massive state intervention to control its spread. These measures were characterized more by the panic around the plague than the virulence of the epidemic.

The colonial response to plague to India has been studied through various lenses, in terms of native-colonial value systems, the assault on the native subject's body by the colonial state, and the differing European and native response to the condition of disease and the process of its containment and cure.⁶ With regards to the urban form of Bombay and the evolution of the setback, two features of the colonial response to the plague are important. Firstly, the Contagionist doctrine that characterized

colonial conception of the plague's origin and transmission, and secondly effect of the contagionist doctrine on the discourse and practices of sanitary reconstruction espoused by urban authorities.

THE CONTAGIONIST DOCTRINE

In his essay on plague and epidemic politics in India, Rajnarayan Chandavarkar points out the paradox between the Colonial response to the plague in India, and the prevalent self-confidence in medical science, especially the newly founded and burgeoning branch of tropical medicine. The plague epidemic in India became the occasion for the most intensive international research on bubonic plague and its eventual findings laid the foundations for what is now known about the disease. With the advent of plague in Bombay several official teams of scientists sponsored by their governments flocked to the city to study the disease. Never before had such an imposing array of epidemiological talent assembled in one place for research into a specific disease.⁷ Despite the scientific spotlight on the plague in the city, the official construction of the plague epidemic was shaped by its assumptions of its own statecraft as well as its perceptions of the governed. At times these social assumptions drove the direction of scientific investigation as well.

The plague crystallized the most terrible anxieties about India in the British imagination. India had seemed to the British to be full of hidden dangers, both political and corporeal, which they were constantly confronted with in the habits and dense habitats of the natives. If these conditions were seen to be repositories of infectious diseases, their remediation



DENSE NATIVE URBAN FORM

lay in two forms of action. Either a massive program of sanitary measures would have to be undertaken by the state in order to protect themselves, the British would have to be segregated from the native town and maintain a substantial social distance from it.

Neither proved to be practicable. The British in India, as the Sanitary Commissioner reported in 1894 would "*never be safe so long as the native population and its towns villages were left uncleaned to act as a reservoir of dirt and disease.*"⁸ But the task of cleaning up the entire sub-continent was too gargantuan to even contemplate. Besides, despite British acknowledgement of the threat of disease - sanitation, sewers, town planning and public health were low on the imperial order of priorities. The colonial state was averse to sinking capital towards sanitizing India and the project would entail the problematic task of overhauling native beliefs and customs.

The British realized that the perpetuation of their political dominance, depended not on the social engineering of native living for the benefit of the natives themselves, but rather in the careful neglect of unsanitary living conditions. Towards this end, the entire problem of disease and sanitation was cast in such a way as to make it seem intractable. The unsanitary and unhygienic conditions of Indian towns and villages were increasingly portrayed as innate and natural to the sub-continent, and if the natives chose to live in filthy surroundings it was their choice and fate and not something that could be blamed upon the British.



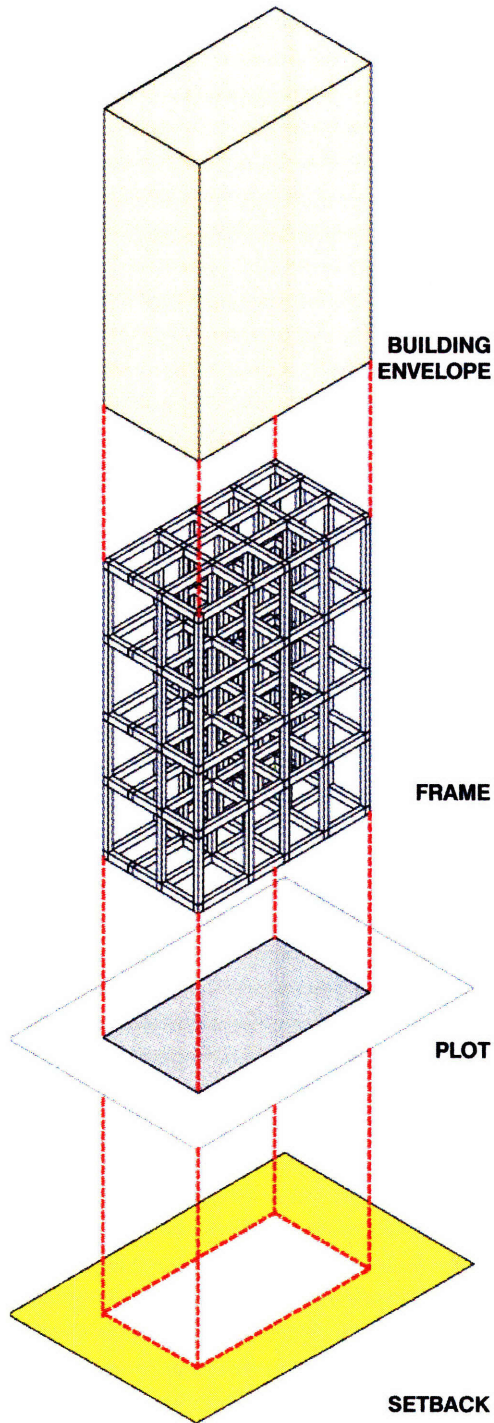
"CLEANSING" OF INFECTED BUILDINGS AND LOCALITIES

Hence, despite the investigations of medical science, the plague authorities still insisted that the disease

was caused by localized miasmas and could be contracted by contact with infected persons, air, water or soil. Early efforts at isolation of the infected, however, did not stall the spread of the plague, and hypotheses of contagion from contact with infected and infested entities were successively disproved. In fact by 1898 it had been established that the plague bacillus did not survive for long outside the body, rescinding the notion of a contagious or environmental disease. In a breakthrough, also in 1898, the French bacteriologist, P. L. Simond identified it as a rat disease, postulating that its spread to human beings occurred through rat fleas.⁹ Not having been experimentally proven, this hypothesis was dismissed by the scientific community as well the Indian Plague Commission, who persisted with the theory of unsanitary habits and living conditions of the natives.

EFFECT ON THE DISCOURSE OF URBAN SANITATION AND RENEWAL

In this light of the contagionist doctrine and the aforementioned disinterest towards providing sanitation infrastructure, colonial medical and sanitary officials located the primary causes of epidemics in the polluted state of urban spaces. This environmental condition, linked to poor sanitary conditions both within dwellings and in entire neighbourhoods, was held to be the principal cause of the disease. A British official, T. R. Fraser, quoted in the Indian Plague Commission [IPC] Report believed *“darkness and to a lesser degree, deficiency of light were conducive to the prolonged existence of the plague bacillus”* To suppress plague, Fraser argued, what was needed was *“pure air”*.¹⁰



RELATIONSHIP OF THE FRAME
PLOT AND SETBACK

The dwelling space had been firmly implicated as the breeding ground of the disease and hence the site of remediation. In keeping with the intuitive nature of the contagionist doctrine and the miasmatic characterization of the problem, “light” and air” as opposed to systemic provisions such as sewage and drainage came to be at the center of solutions. The perception that poor ventilation and overcrowding were the root cause of the plague epidemic also prompted the local urban authorities to turn their attention towards overhauling municipal building bye-laws. At the disease ridden end of the 19th century in Bombay the city’s Health Officer had frequently complained about the ineffectiveness of the city’s building bye laws, and now in the aftermath of the plague’s devastation, the tightening of those regulations seemed as a panacea for all the sanitary inadequacies of the city. ¹¹

Despite trenchant criticisms from Health official about the abysmal state of sanitary infrastructure the Bombay Municipal Corporation, which was the preserve of the city’s propertied ratepayers: the landlords, merchants and industrialists, was loathe to investing in services that would primarily benefit the working classes. But even as they prevaricated on the Municipal Commissioner’s [a British appointee] insistence on better bye-laws, the prospect of transferring the solution of the sanitary problem from capital intensive infrastructure projects to the costless idea of building regulation through bye-laws seemed ultimately more palatable to them.

First written in to the bye-laws as early as 1882 and subsequently further formalized in the Building Bye Law amendments of 1919¹², the setback had

been etched into the city's fabric even before it had been built. All new development would henceforth be governed by it, and it was effectively the end of the continuous, abutting building form of the native parts of town. The city would henceforth be made up of freestanding structures, and after the 1940s they would be pervasively built of the reinforced concrete frame.

Setback from the road, which was already a light shaft was in future contingency for road widening, rather than to serve the inner spaces of the building. While the concrete framed building is not implicit in the setback, nor does the setback necessarily anticipate the RCC structural form – the high-rise constructive capacity that concrete frame brought to the city quickly took the form of free standing apartment buildings. It is their accretive aesthetic in the landscape of the city that makes its urban form. As I state at the beginning of this chapter, the regulations concerning the setback to this day persists with mandating the same sanitary goals that it was initially devised to ensure. Its role has not evolved to impinging on the form of the building where like set back regulations in New York make for the particular profile of its skyline. In its present form by not evolving beyond a spatial divider, the setback maintains a link between the bungalow and the story of the plague by enabling the gating of urban buildings in India, and the provision of light and ventilation, and mandating little else.

At the urban level, by setting the building back from the street, the setback erased continuous streetscapes replacing them with autonomous freestanding buildings. The individual design of these buildings has driven the appearance of the city.



pixel, *n.* Each of the minute areas of uniform illumination of which the image on a television, computer screen, etc., is composed; (also) each of the minute individual elements in a digital image. - *The Oxford English Dictionary*

pixel - Contraction of *picture element*. A spatial resolution element. It is the smallest distinguishable and resolvable area in an image.

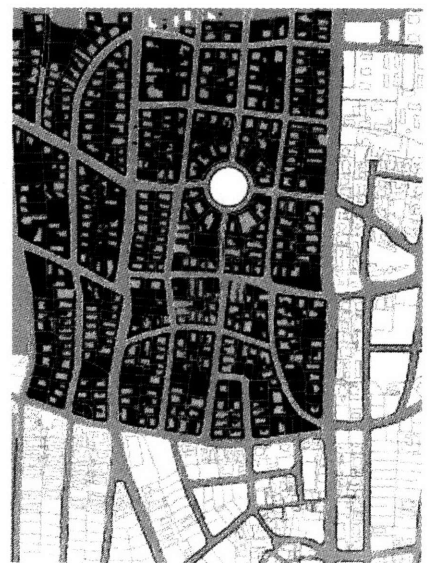
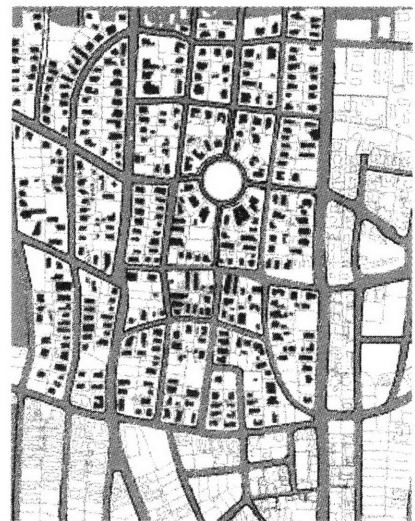
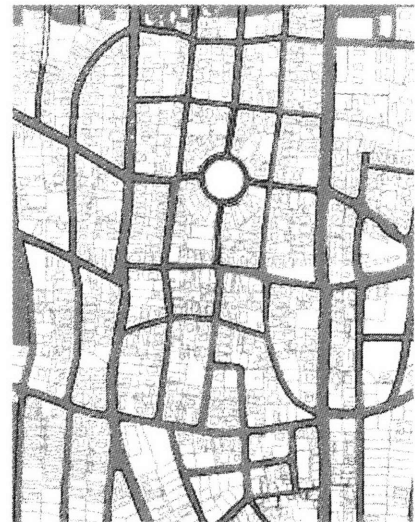
- *Rodolf E Graf, Modern Dictionary of Electronics*

THE PIXELIZATION OF THE CITY'S PLAN

Even a cursory glance at the map of Bombay reveals that the city is not figuratively planned. It does not have master figure or a master system of either grids or points and lines that structure it physically. The plan of Bombay has a physical rationale that is limited to adjacencies, orientations and polarities. The city grows suburban linearly from south to north, the western part of the city is generally more affluent and enjoys a higher status, as does the western sea edge of the city - but this is known, not read through the city's plan. In the following pages, however, I have demonstrated that by mapping the occurrence of different groups of residential concrete buildings, these polarities become evident in the map of the city as well.

The overall image of the city as a continuous accretion of buildings according to no discernable rules, which furthermore have had little impact on crafting urban elements such as streets, avenues, or open public spaces can be traced back to the how development was designed at the level of the plan.

At the beginning of the 20th century, with the emergence of international town planning movements, the government of Bombay did evince some interest in the new developments. At a discursive level, planning was placed on the governmental agenda via the well trodden routes of resolutions, committee reports and even the odd legislative measure. Officials were sent to study town planning schemes in England Germany, and returned with high praises for German working class



PROGRESSIVE SUBDIVISION OF
LAND WITHOUT A FIGURATIVE
BASIS



DISTRIBUTION OF BUILDINGS IN CENTRAL MUMBAI ON A BASE OF TOWN PLANNING AND DEVELOPMENT SCHEMES

housing. Yet the emphasis on the extensive powers of German Municipalities, particularly their policy of urban land acquisition for public purposes, *“merely exposed the political gulf separating this vision of modern urbanism from the fragmented and anarchic administration of Bombay city”*.¹³

The Bombay Town Planning Act of 1915, though couched in modernist discourse of “planning” did little to transform the role or processes of local governance of the city’s development. Initially applicable only to areas of suburban Salsette awaiting development, to the north of the Island city, *“the act essentially served as a means of enabling colonial agencies to bring suburban land suitable for building to the market.”*¹⁴ It did not overhaul the piecemeal colonial approach to urban development, which continued to envisage building operations which did not include any provision for water supply, drainage, sanitation or transport, much less be part of comprehensive urban visions with emphasis on collective urban form.

Thus town planning was not conceived as an active and coordinated process undertaken by a public authority in the interests of all citizens. *“It was something of a euphemism boiling down to a wholly inadequate attempt to control the private use of land in the city”*.¹⁴ The new laws and acts were inapplicable to existing built-up sites, substantial tracts of land owned by the colonial government and only partially applicable to the congested areas of the “native town” which was in fact the basis for all efforts and ideas of urban renewal in the city. The responsibility for the implementation of the new planning ordinances lay with the Bombay Municipal Corporation, which

was controlled by the city's landlords, elected by its wealthiest citizens, representing less than 1% of its population.

Under the implicit objective of creating saleable plots and the absence of sweeping municipal powers to acquire privately owned land and reconfigure it according to a holistic figurative vision at the level of the entire city, urban authorities progressed with a piecemeal ordering of the urban fabric with the primary objective of generating plots that could be sold or leased in the open market. Hence in light of the political quagmire of the city's governance, the urban planning and design process was compromised down to pixelating the terrain of the suburbs and city into individual plots.

While these plots were constituent parts of the larger agglomeration of the city, unlike plots in more holistic plans or pixels in digital images, the plots in Bombay stood autonomous of relative association the rest of the picture - its urban environment. The setback had largely divorced the building from the street and replaced the built edge of the street with a compound wall in most cases, except where commercial uses were programmed at the ground level of buildings. Additionally without a figurative plan the buildings were not distributed such that they had a relational logic.

The building on the plot became a default outcome of urban governance, rather than an intentionally designed entity with regards to collective urban form. The bye laws that were framed to govern them, in the aftermath of the epidemics, regulated the inhabited spaces within them, and later as real estate rates in Bombay escalated to unprecedented levels,

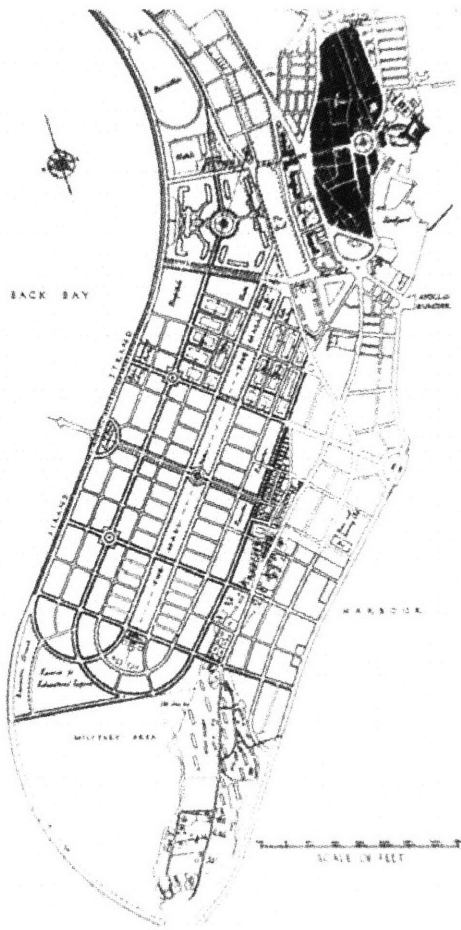
bye-laws governed square footage allowances as developers sought to maximize saleable built up area. Conspicuously missing from the city's bye laws were directives towards ordering form at the collective urban scale, or even within typologies of residential, commercial or institutional buildings.

The generation of regular building plots followed a few different processes across the city. While there is no binding figure or system at the scale of the entire terrain of the island city, smaller developments within it, such as the Back bay reclamation and Dadar Hindu and Parsi colonies were based on figurative plans. These plans were progressively compromised to the point where pixelization overtook their figurative armature, which survives in a skeletal form but does not overcome the effects of pixelization on the pattern of the schemes.

In the following pages I trace the process of pixelization through two examples, of a reclamation project and of the town planning schemes meant to urbanize the suburban areas of Salsette.

PIXELIZATION OF THE RECLAMATIONS

The Backbay reclamation scheme is located on the extreme southern end of greater Bombay, stretching from Chowpatty Beach to Colaba Point, on land that was originally dredged up from the sea in 1865. The primary purpose of the project then was to extend the Bombay-Baroda and Central Indian Railways up to Colaba to serve the Cotton Green Merchants, who were then located there, in their auction and export activities. The second phase of the Bombay Reclamation was initiated in 1913 and its third and most grandiose phase was initiated in 1922. Most of the following discussion is about the operations of the third phase.

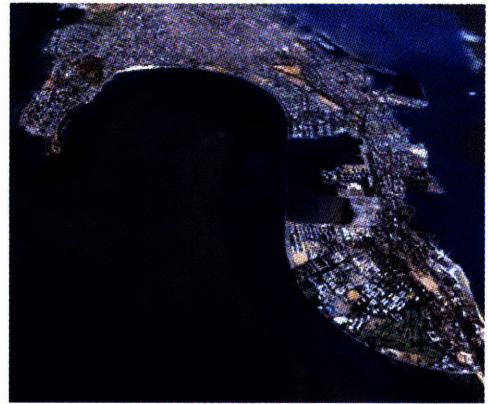


W. R. DAVIDGE'S PLAN FOR THE
BACK BAY RECLAMATION
1921

A plan for the Back Bay had been commissioned in 1921 from British architect and urbanist W. R. Davidge. The land would provide an extension adjacent to the established government and commercial center. Just west of Bombay's major monumental buildings, Davidge proposed a new commercial complex including head quarters for the legislative council. South of this enclave, about a hundred acres would be given over to offices, "grouped around shady quadrangles on the lines of Gary's Inn or the colleges at Oxford."

The area to be reclaimed was divided into 8 blocks, with the largest amount of land reserved as open spaces for parks and playgrounds. The first plan for this phase of the Backbay reclamation showed 145 acres for parks and playgrounds, 100 acres for public buildings, 28 acres for recreational purposes and 27 acres for educational use and no saleable residential or commercial component.

A section of the Improvement Trust was entrusted with implementing the scheme, however due to a leak in the sea wall built to enclose the reclamation caused the initial costs to rise to 3 times as much. Following public criticism, a committee re-evaluated the project, of which 4 blocks, 2 from each end of the scheme has been already partially reclaimed. The Mears Committee suggested altering landuse for the blocks already reclaimed, and curbing any further reclamation.



Combining classical formality and ornamental landscaping, the Davidge plan reflected the then fashionable tenets of Beaux Arts planning. The street Plan was laid out in a grid incorporating several broad tree lined avenues, including a landscaped boulevard along the sea front. Intersections were highlighted as focal points with squares or circuses. Extending North – South, was a landscaped mall designed to focus at its northern end on the tower of the Gothic University Building and at its south on a new public building.



As the reclamation area, was eventually built the Davidge plan was set aside for a more utilitarian scheme. The ornamental and open spaces and monumental aspects were suppressed and the district was given over to private plots sold at auction. In 1937, prominent British architect working in the city, Claude Batley, observed that changes to the plan had been made in order *“to sell the smallest parcel of land at the highest possible price, regardless of the inevitable result that the purchasers and their architects were bound, in order to get any return at all, to overload the blocks to the maximum extent that building regulations allow.”*¹⁵

BACK BAY RECLAMATION
TODAY

Building to the maximum extent permitted by the regulations would become the modus operandi of Mumbai's developers, and perhaps the sole driver in shaping the buildings of the city. In Backbay, eventually 4 blocks were completed in 1929, a total of 439.6 acres. Of this 234.8 acres was sold to the military at a cost of Rs. 2.06 crores, and 16.6 acres was incorporated into the Marine Drive and its sea-wall. The uneconomic cost – benefit ratio caused the rest of the project to be abandoned in 1930, until 28 years later, when it was reinitiated.

Between 1958 and 1970 the Backbay Reclamation Project went through a series of machinations by the state government, changes in administrative responsibility and suppression of information about the details of the plan for the remaining blocks. The un-detailed plans carried intentions of centralizing commercial activities in the forms of corporate and private offices, and were severely opposed by the city's professional architects and planners as well as various administrative authorities responsible for transport and sanitation infrastructure. Disregarding all these oppositions and through deliberate censorship of alternative options the state government approved the scheme. The only concession made was to earmark all reclaimed plots for residential use and reconfigure the ratio of commercial use to residential to 20:80. In reality, however, large plots had been sold in the 1960s to commercial houses such as Air India, The Express group of newspapers, the Mafatlals, the shipping corporation of India and Mittal Associates. In actual fact by 1992 the ratio stood almost inverted at 80:20 in favour of commercial buildings.

This development created the largest concentration of high rise concrete frame buildings in Bombay until the present time, and the concentration of workplaces was further multiplied by the occupation of a single building by several smaller firms. ¹⁶

Nariman Point remains one of the most costly real estate enclaves in the world. During the property boom in the early 1990s, average property prices here were in the region of Rs 25,000 to Rs 30,000 a sq ft. In October 1995, at the height of the then raging escalating property prices boom, the prime real estate of Nariman Point recorded two transactions at the rate of Rs 38,000 a sq ft in Maker Chambers.

TOWN PLANNING SCHEMES: A PROCESS OF PLOT RECONSTITUTION

The Town Planning Scheme is being followed as an alternative method to assemble the land for urban development activities in a faster and financially affordable manner without taking recourse to compulsory acquisition of land. Town Planning Scheme (TPS) is in operation in some of the states of Indian Union in the form of plot reconstitution. It is basically an area planning technique patterned on the concept of land re-adjustment. The state of Maharashtra, whose capital is Bombay, is a pioneer in the field of Town Planning Schemes. Here the schemes are implemented under the Maharashtra Regional and Town Planning Act of 1966. They were initiated in the Town Planning Act of 1954.

“The preamble shows that the Town Planning Act, 1954, which was intended to be a consolidating and amending Act relating to town planning, was

DEMONSTRATING PLOT RECONSTITUTION



NATIVE FABRIC



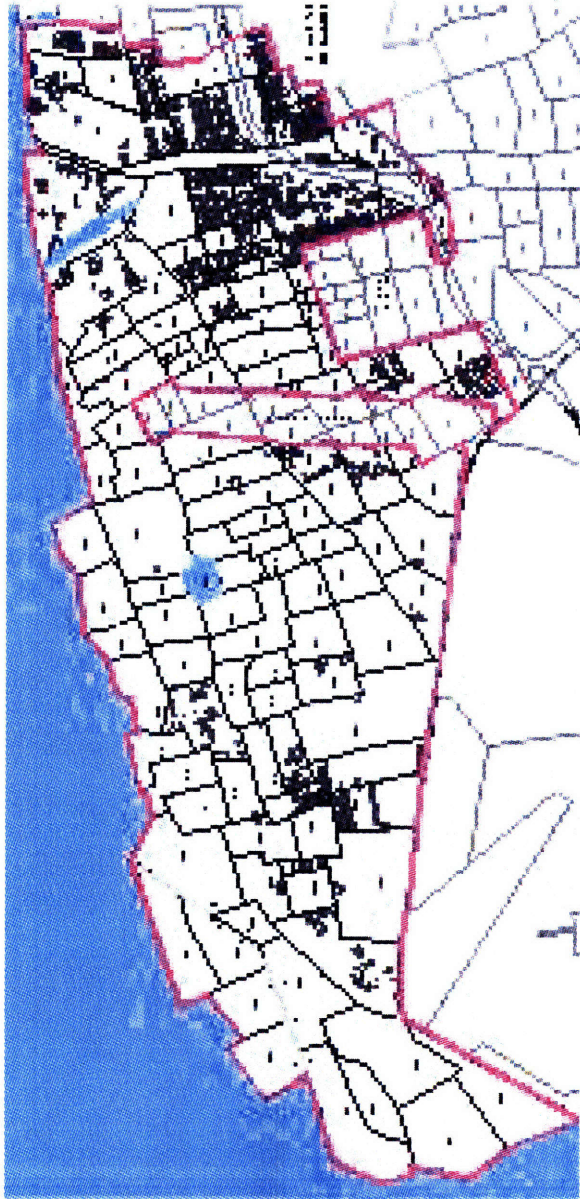
BLOCK DIVISIONS - LAYING OUT ROADS



PLOT RECONSTITUTION

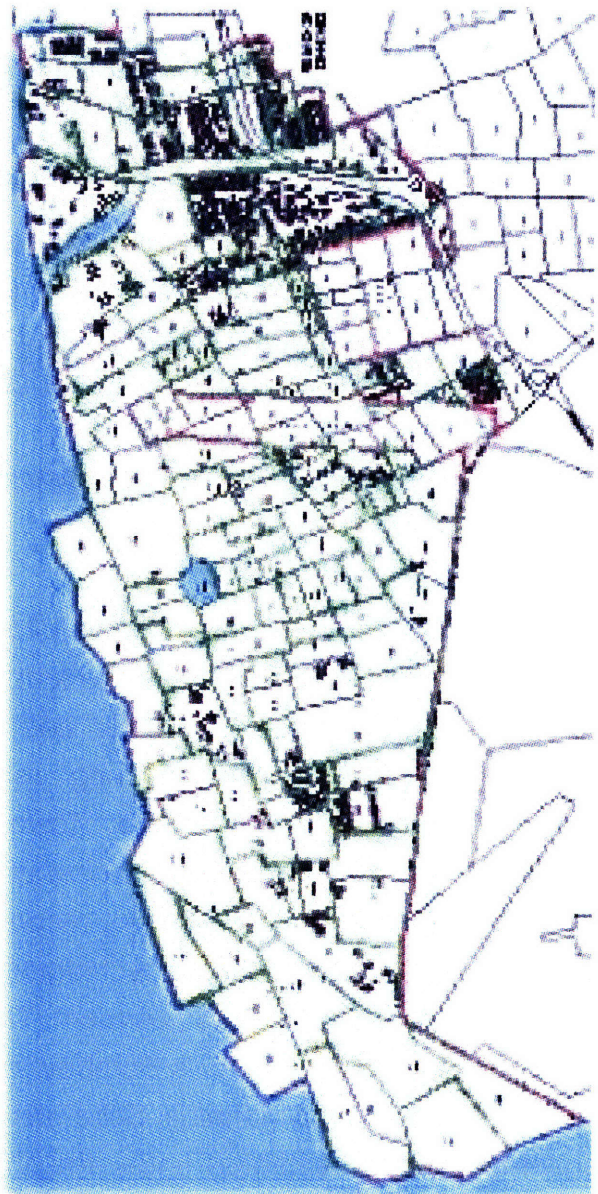
TOWN PLANNING SCHEMES: RE-ORDERING THE NATIVE MORPHOLOGY

1



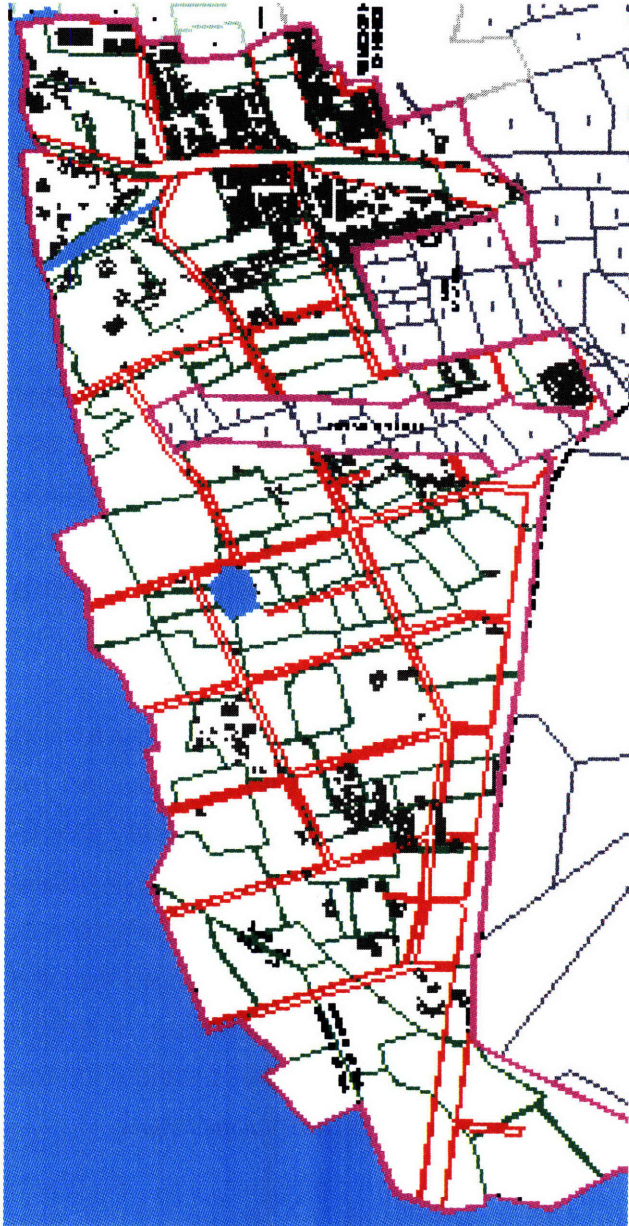
MARKING THE EXTENTS OF THE NEW SCHEME

2



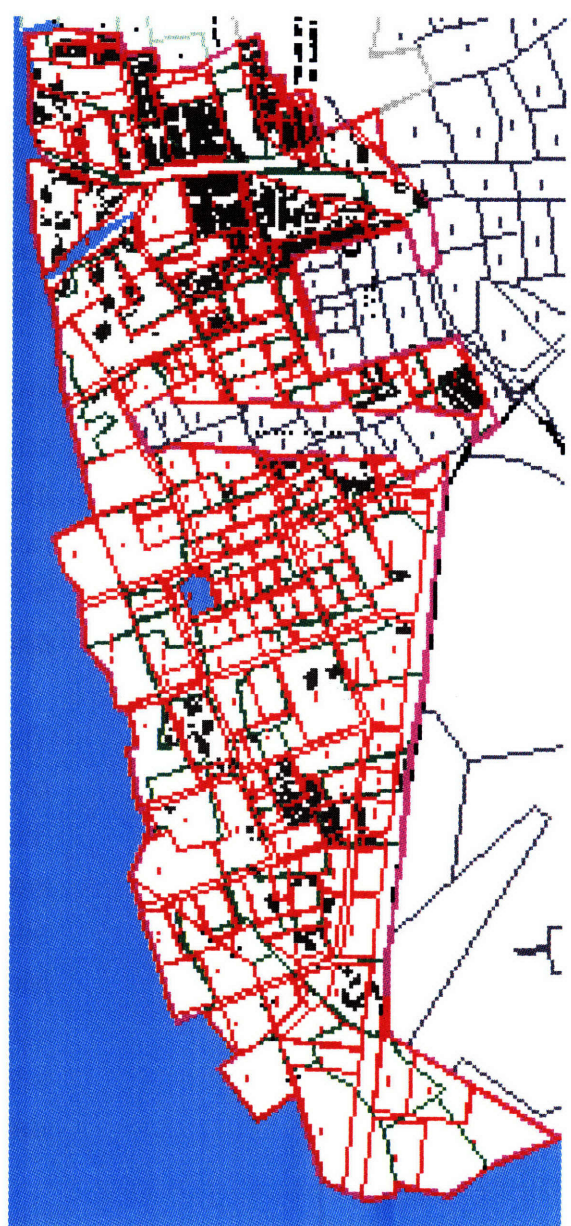
TRACING INDIGENOUS PATTERN OF LAND SUBDIVISION

3



BLOCK LEVEL RECONSTITUTION

4



ORTHOGONAL PLOT RECONSTITUTION

enacted with a view to ensure that Town Planning Schemes are made in a proper manner and their execution is made effective”.

Town Planning schemes were carried out to “regularize” suburban land and prepare it for development. The process of plot reconstitution entailed the removal of unauthorized structures from the land and the straightening of plot lines where a more organic morphology existed and the subdivision of larger tracts of land into plans for neighbourhoods.

The local authority, usually a branch of the municipal corporation, prepared a development plan for the entire area within its jurisdiction. By section 3 of the Act, the local authority was required to carry out a survey of the area within its jurisdiction within a certain time and publish a development plan.

The Final Scheme presented by the local governing body to the state Government usually provided for the construction of new roads with necessary storm-water drains on the sides of the roads, certain public sites within the area such as School, Playground, Market, Maternity Home etc. it was believed that the construction of new roads, the provision of public sites and the removal of slums will provide for the development of the Suburb on proper lines.

The over riding emphasis on these plans was provision rather than design. The anticipated building types on these plots, by the 1950s was already the concrete framed building. The bye-laws governing the setback were already in place, and plots of town planning schemes were devised

in anticipation of the application of those laws. Additionally controlling urban form and concrete buildings in the central suburbs was the presence of the domestic and international airports, whose flight cones suppressed the heights of buildings in a radius of about 7 kms in areas surrounding the airport.

So far the setback and plot have been traced in a retroactive relationship the concrete frame. It may be said that after the first Backbay Reclamation in the 1930s, a large majority of the plots that grew out of what I have called the pixelization process and were governed by the setback, were later developed with concrete frame structures. Elements of the immediate space of the concrete framed buildings have been traced in order to better understand the sitting, distribution and appearance of buildings in the city.

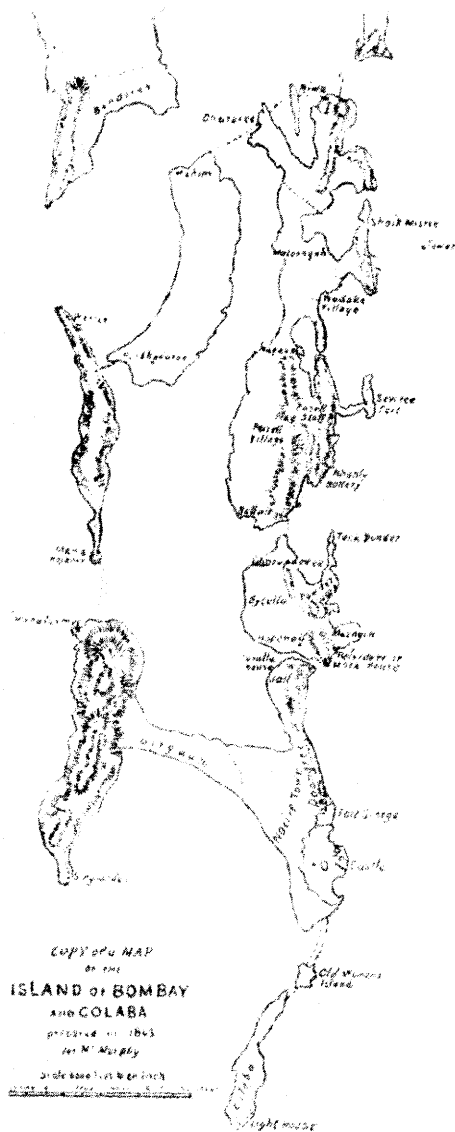
The following section traces the occurrence of the manifest frame on the city's terrain and marks the different for the frame takes with regards to its location in the city.

CONCRETE URBAN FORM ACROSS THE TERRAIN OF THE CITY

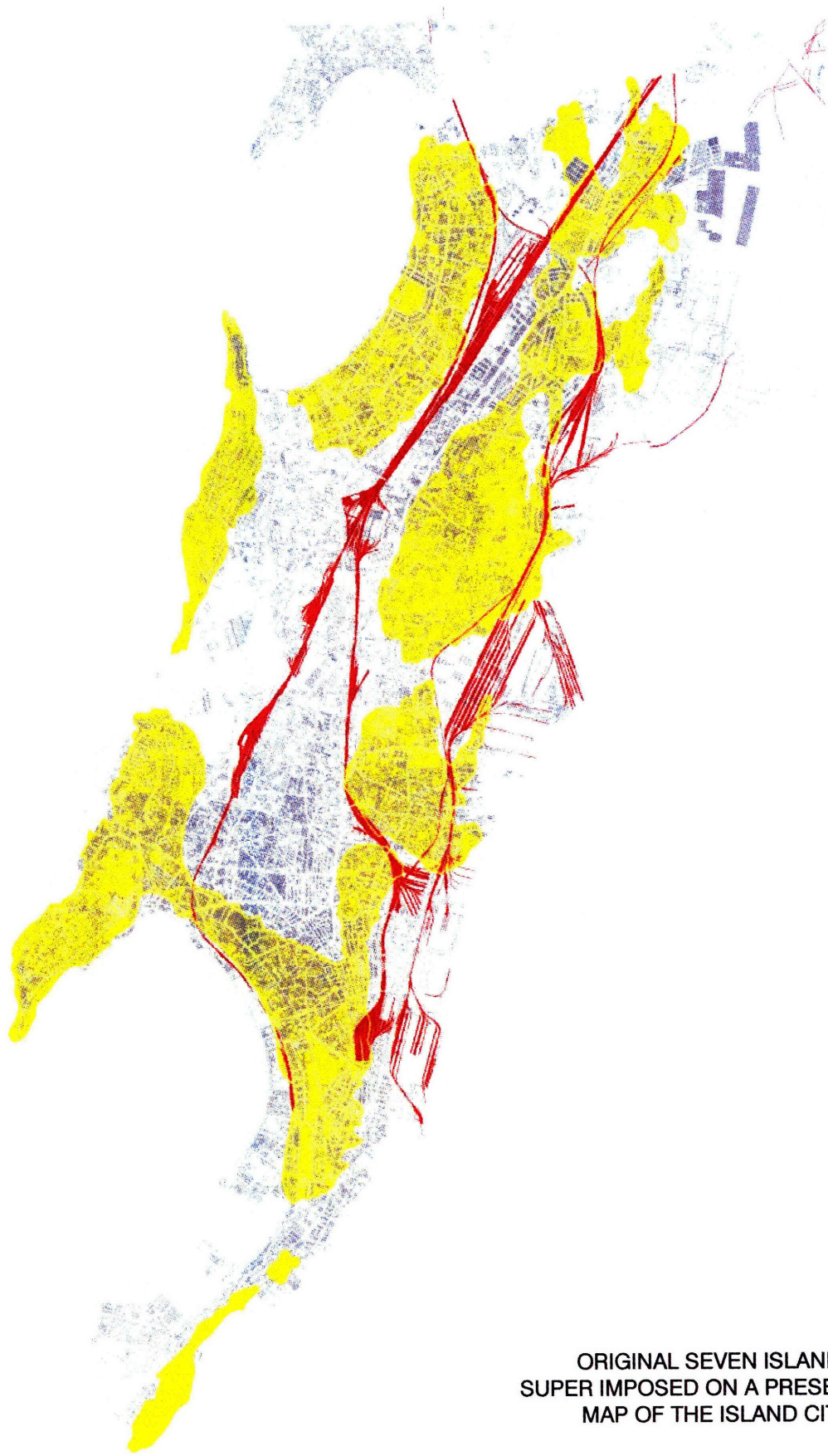
In the absence of a clear pattern of physical development in the figure of the city, I mapped the terrain of the city as per the pattern of the original island mass and reclaimed parts of the island city of Bombay.

The mapping superimposes the original 7 island landmass on the present day map of Bombay to track differential development and look for traces of the original landmass on the present city. This exercise initially came from thinking about the material landscape of the city of Bombay which is substantially reclaimed from the sea and from marshy mud flats. Considering the in-filled land as materially distinct from the original island mass, my intent was to investigate what form, if any, this geography took in the present morphology of the city. Were there any signatures of this terrain's fragmented past on the distribution of concrete frames in the city?

I discovered that the lineaments of some roads and railway lines as well as the distribution of green cover coincided with some boundaries of the original islands. The uncertainty of the distinct limits of the islands, especially towards the central mud flats makes precise inferences questionable. At the scale of the urban landscape, however, we can detect some patterns of inhabitation and morphology. Following the method of this thesis, I used the concrete framed building as a lens through which the city's terrain might be studied.

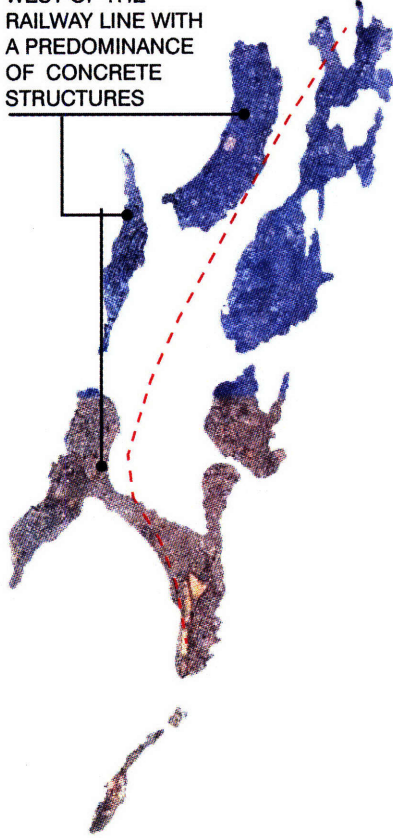


ORIGINAL SEVEN ISLANDS
OF MUMBAI



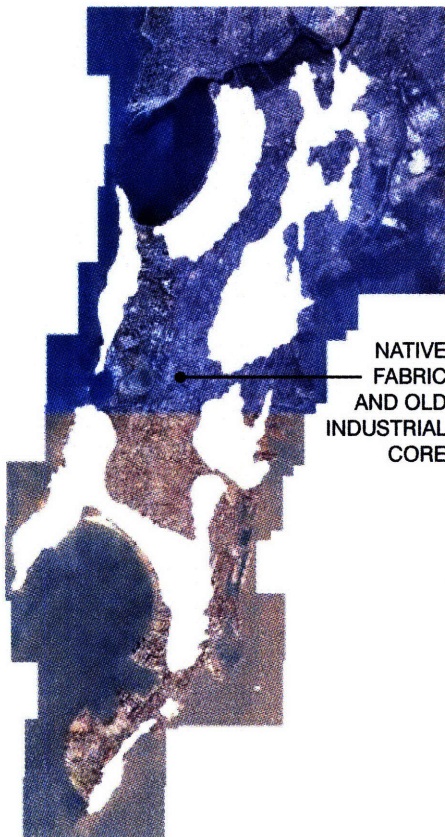
ORIGINAL SEVEN ISLANDS
SUPER IMPOSED ON A PRESENT DAY
MAP OF THE ISLAND CITY

ISLANDS TO THE WEST OF THE RAILWAY LINE WITH A PREDOMINANCE OF CONCRETE STRUCTURES



It was seen that in the island city – the present distribution of the concrete frame buildings is concentrated on the original island mass on the western edge of the city. The central terrain of former mud-flats is largely devoid of concrete framed buildings, as is the eastern edge along which were the thriving ports of colonial and independent Bombay. The concrete frame building is making an appearance in this central region on former textile mill lands concentrated in the central city as well. To the present day we see the persistence of the native town that began occupying the centre of the city in the mid 19th century when the tides had been successfully blocked from flooding this low lying land.

The islands to the west comprising of the Malabar and Cumbala Hill localities and present day Worli, were occupied early on by the British and local elite, often due to the virtue of this area's distance from the dense native town and industrial areas in the former marshland.



NATIVE FABRIC AND OLD INDUSTRIAL CORE

These two types of early occupation on these two terrains – original island and reclaimed flats - also bring to light the distinctly different sub-divisions of these two territories of land. The translation of terrain to land for occupation here is consistent with general observations about patterns of urban inhabitation: the ruling elite occupy high ground and the proletariat resides on land prone to assaults by nature – particularly flooding.

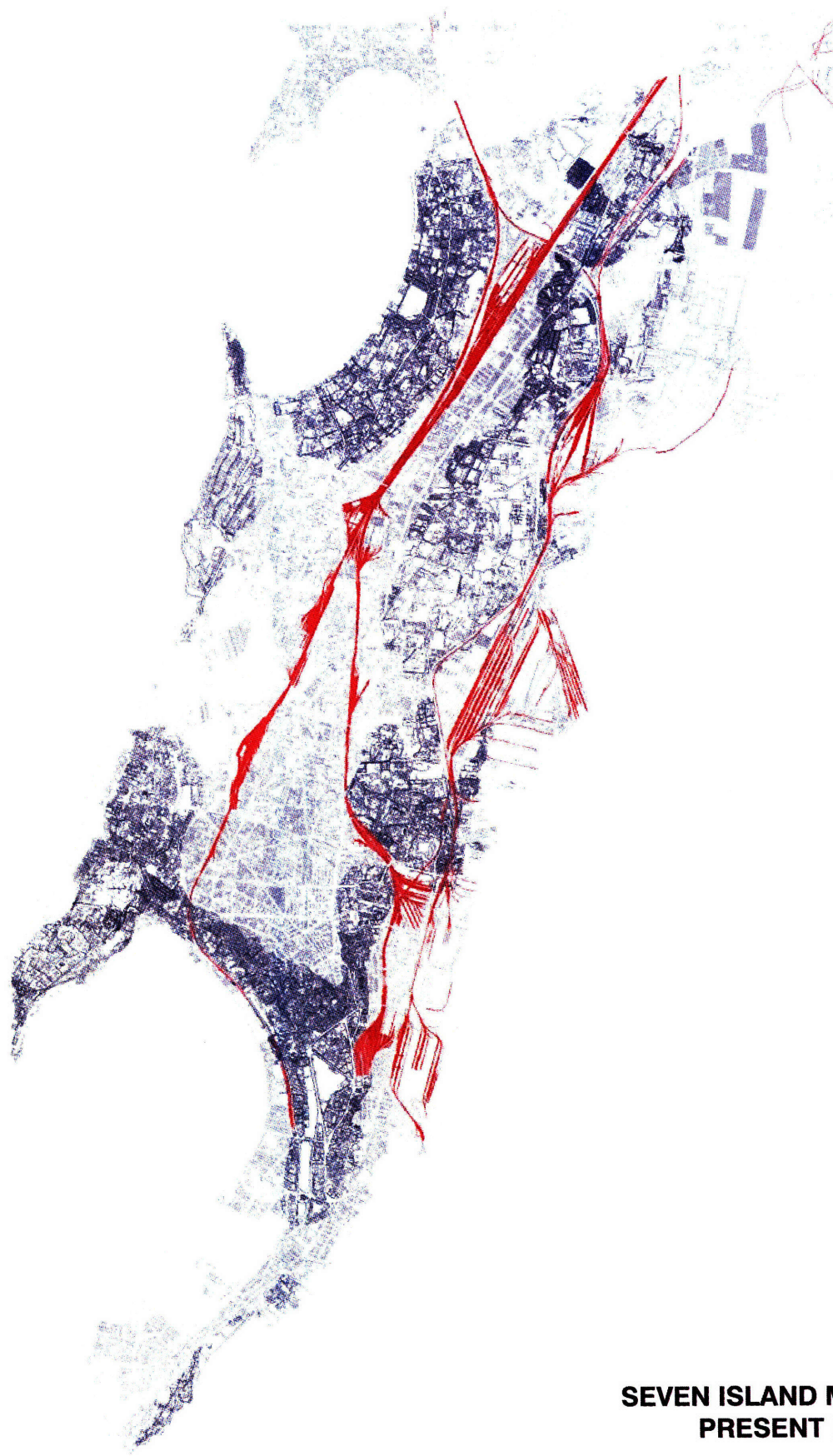
The higher ground in western Bombay occupied by the elite of the city who resided in bungalows, had larger land divisions than the dense native

town. It might be said that the private development process that accompanies the spread of concrete frame construction in Bombay found this land more amenable to the eventual building type they constructed on it. While in the native town several plots would have to be amalgamated to arrive at a plot size substantial enough for the types of buildings developers constructed, on the islands the bungalow plots were well suited to highrise concrete buildings. Their substantial areas also translated into more buildable floor space, as per the FSI regulations, which were aptly exploited in creating the city's first set of concrete high-rises in the neighbourhoods of Malabar Hill, Pedder Road, Altamount Road and Cumballa Hill.

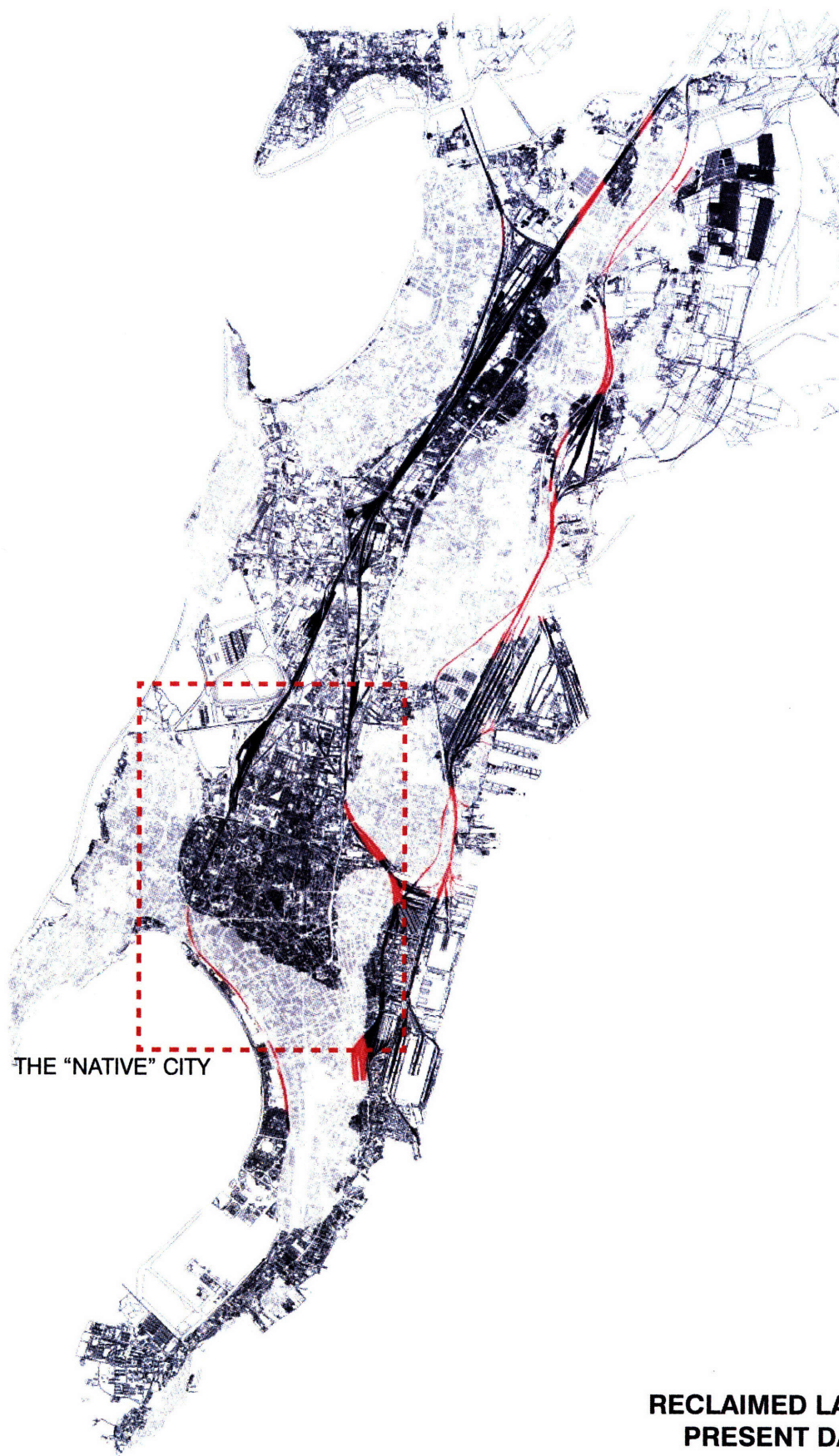
CONCRETE FRAMES ON THE RECLAMATIONS

Looking at the remaining reclaimed terrain, the mapping reveals concentrations of concrete frames on a series of reclamation projects in the city, with successive reclamations inventing a new idea of the concrete framed building or its agglomeration in the city.

Tracing the reclamations and their corresponding building types – it seemed that every new substantial reclamation project that was developed by private interest, after the 1930s gave the city a new imagery either through its building facades, or the size and agglomeration of its buildings. I list 6 seminal projects here each of which represent a paradigmatic change in the construction of buildings in the city:

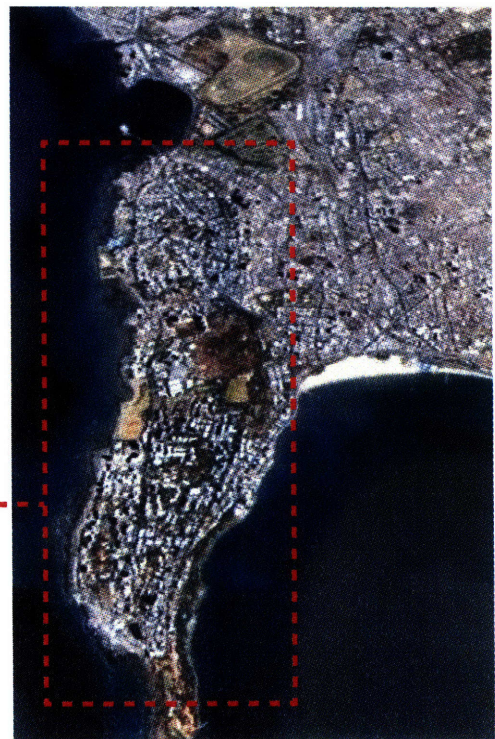
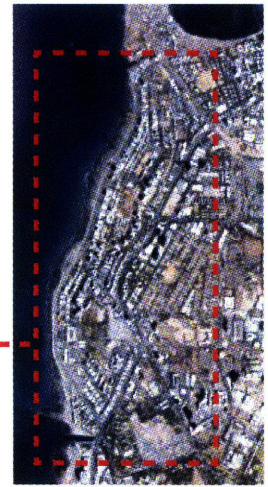
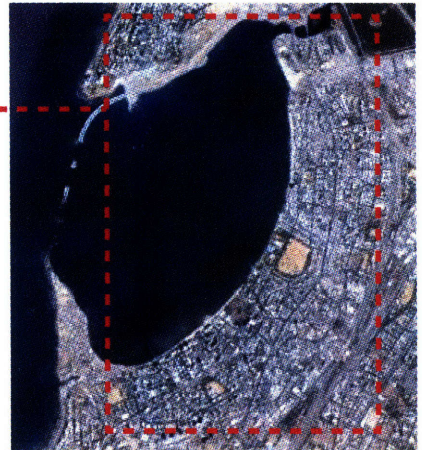
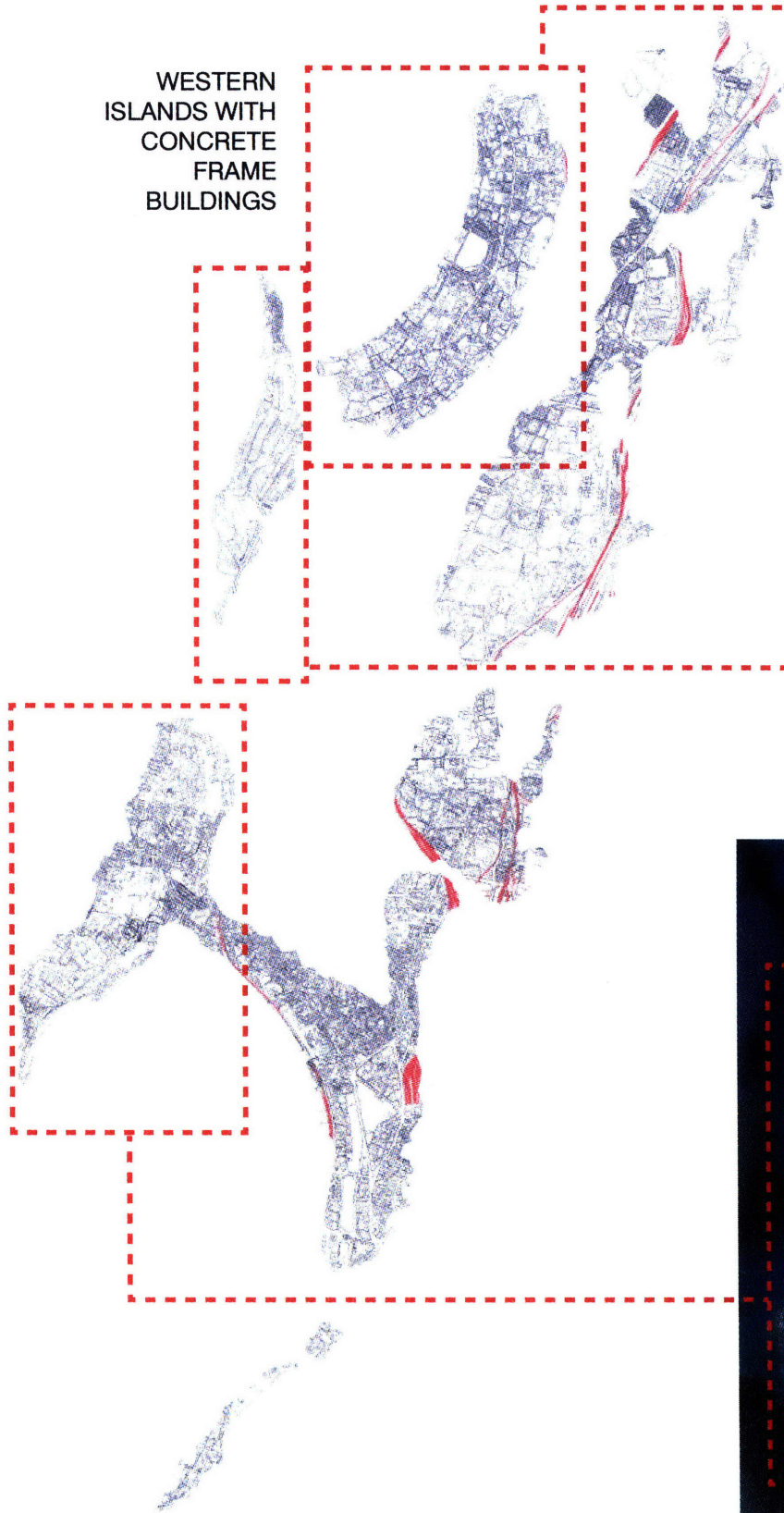


**SEVEN ISLAND MASS ON
PRESENT DAY MAP**



**RECLAIMED LAND ON
PRESENT DAY MAP**

WESTERN
ISLANDS WITH
CONCRETE
FRAME
BUILDINGS



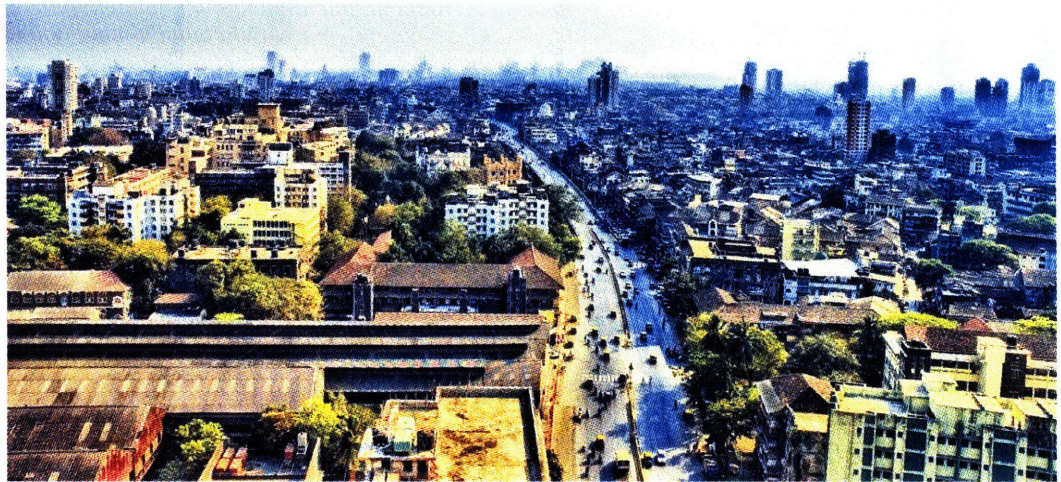


MILL LANDS IN THE CENTRAL PART OF THE ISLAND CITY - LARGE LANDHOLDINGS THAT ARE PRESENTLY BEING REDEVELOPED AS HIGH END, HIGH-RISE CONCRETE HOUSING



HIGH-RISE CONCRETE BUILDINGS PRESENTLY BEING BUILT ON FORMER MILL LANDS





LOOKING WEST FROM NAGAPADA [IN NATIVE TOWN]



EASTERN WATERFRONT - ABSENCE OF CONCRETE DEVELOPMENT
THE TALL BUILDING SEEN HERE IS THE BOMBAY STOCK EXCHANGE
LOCATED IN THE COLONIAL CORE



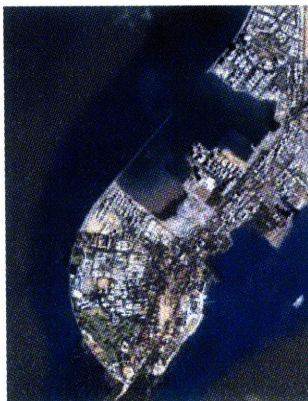
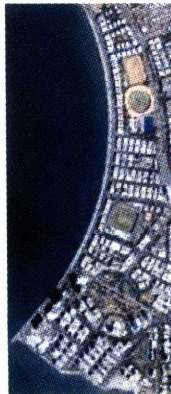
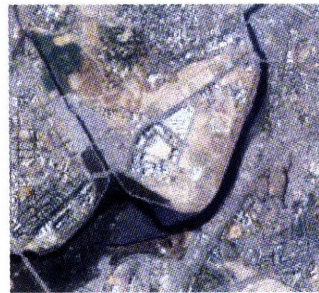
MALABAR HILL ON THE ORIGINAL ISLAND MASS



LOOKING WEST FROM THE COLONIAL CORE TOWARDS BACKBAY RECLAMATION



LOOKING NORTHWEST FROM MAHALAXMI RACE COURSE [ON RECLAIMED GROUND] TOWARDS THE ISLAND OF WORLI



LOKHANDWALA
COMPLEX

HIRANANDANI
GARDENS

BANDRA KURLA
COMPLEX

BACKBAY and
MARINE DRIVE

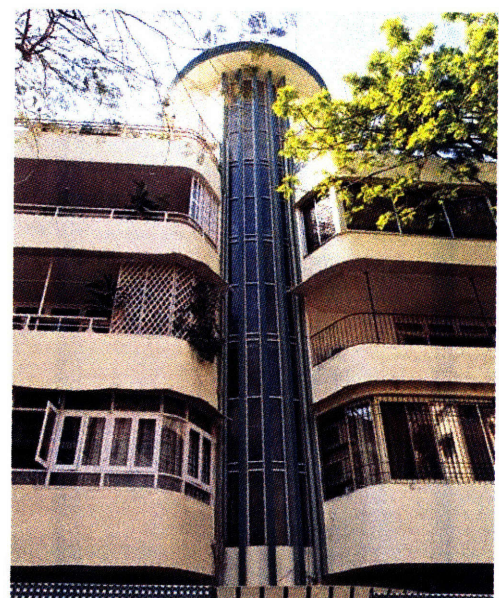
NARIMAN POINT
AND CUFFE
PARADE

BACK BAY RECLAMATION: MARINE DRIVE

The first large group of concrete frame buildings were assembled in Bombay on the first phase of the Back Bay reclamation and given the name Marine Drive. By 1940 the compromised layout of the scheme [as recounted in the previously] had been completed and the construction of buildings had commenced. This was the first site in Bombay where concrete frame construction was used on a large scale and in a concentrated area. Marine Drive, which is today Bombay's most spectacular urban space, nonetheless represented a break from the density and quality of the upper class housing that the British in the city.

The construction of the first substantial set of concrete framed buildings in the city coincided with the narrowest interpretation of the setback laws in order to build the maximum possible density of units on a plot, which itself was the result of carving up a more generous plan into smaller, more profitable parts. The constructive attributes of concrete that brought an unprecedented capacity to build to greater densities by building taller, overlapped in Bombay, with a governance attitude, espoused by the British and the local elite, set on primarily extracting profits from the development of the city rather than any urban design considerations.

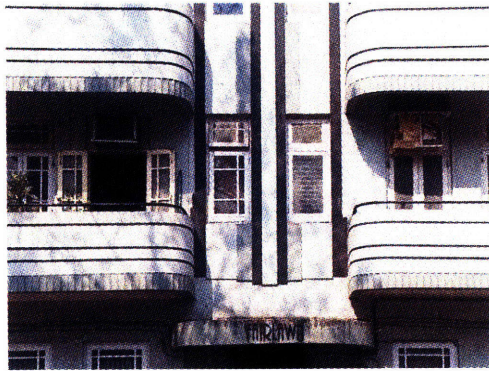
The buildings that resulted on Marine Drive were long, narrow blocks, with slim gulleys separating them, and a minimal frontage on the western sea face. Yet today these set of buildings are lauded for being exemplary in their design, not as living spaces, but from an urbanistic perspective. Widely



ARTDECO BUILDINGS AT BACK BAY AND MARINE DRIVE



claimed to be largest group of buildings designed in the Art Deco style, after Havana and Miami, what is primarily referred to here are the façade motifs of the buildings and their compound walls.



After being systematically sieved out of building regulations and urban plans, facades of free standing buildings became the only built sources of urban imagery. By design or by default, the inevitable visibility of building exteriors made their surfaces the last frontier for registering design in the city.



The post independence era after the construction of Marine Drive responded to the urgency of the influx of migrants and urban architecture remained largely undistinguished, until the 1980s. Subsequent developments, particularly on reclamations in the city, created newer formed of buildings and neighbourhoods, which while architecturally unremarkable set the pattern for other developments of similar kinds.

JUHU SCHEME [1960s]

The Juhu Vile Parle Development Scheme, was a stretch of reclaimed land along the western shore of Salsette. Here reclaimed land was pixilated into smaller plots and sold off. The difference however





CUFFE PARADE

Nariman Point and Cuffe Parade stand as exemplary cases in the city of the productive ethos of concrete driving development. As I have recounted in the pixelization of the Backbay reclamation scheme the single minded aim of constructing flats and offices for sale in this part of the scheme, left the city utterly polarized between north and south, residential and commercial, and middle and upper class, with the single biggest impact on the city's transportation infrastructure.

As building types, structures in Nariman Point and Cuffe Parade had an average height of about 20 storeys with some as high as 35 storeys tall – following the precedent set by the buildings on Malabar and Cumballa Hill and high FSI allowance wangled by the developers from the municipal authorities. Right from the beginning Cuffe Parade was characterized as upperclass housing but nothing about the buildings' appearance would betray that. The Cuffe Parade buildings were then the first dense high rise agglomeration of buildings in Bombay. With the allocation of an FSI for 4, and the plots leased on 999 year leases to developers, the area became like a labyrinth of canyons with skyscrapers on either sides that were the tallest residential buildings in Bombay at the time.



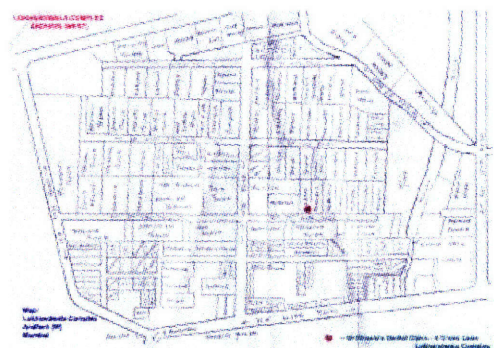
CUFFE PARADE

The location was the primary factor and the sizes of the apartments combined to make them expensive and unaffordable by the middle or working classes. The downtown location was eminently desirable and facades were not crafted with the intension of attracting them. As I have already mentioned, the buildings at the time were the first group of skyscrapers in the city and the prestige of location and high rise living were sufficient to attract buyers. A prevailing rate of about Rs 60 per sq. foot in the late 1970s in the area has multiplied almost 400 times in 25 years to a present [2007] average rate of Rs 24,000 per sq. ft. [~\$ 600], with certain properties hitting a high of Rs.33,000 [$>$ \$800] per sq. ft.

Cuffe Parade's dense agglomeration of tall buidlings could be seen as a precedent of the first sub-urban residential development modeled on similar lines – the Lokhandwala complex built in the early 1980s.

LOKHANDWALA COMPLEX [1978 - 1980s]

Lokhandwala Complex is built on a vast marshland in the area of Versova. The developer was discouraged from developing the site as it was believed that he



**LOKHANDWALA COMPLEX
PLAN**



would not be able to attract people to live that far away from the existing developed suburbs. Lokhandwala, however, did go ahead with his vision. To reclaim the entire Marshland, which was one big pit of quicksand, Lokhandwala, is rumoured to have sent out an army of camels to fill up that area with mud. Another anecdote from a broker back then says that when investors wanted to see where the building would be built, Lokhandwala used to throw a stone into the distance and say 'There' because there was still no path to the plot through all the quicksand. "But true to his word, Lokhandwala delivered and set new standards for middle class living through swimming pools and landscaping"



Apart from new standards for middle class living, Lokhandwala also set the precedent of encroaching on the city's wetlands and converting them to high rise concrete development. A recent ruling deemed it to be in violation of the city's Urban Land Ceiling Act, under which the land on which Lokhandwala complex stands today was deemed developable for the construction of poor and middle class housing, none of which exist on the land today.



As the accompanying map shows, several developments especially in the northern parts of the city have occurred on the edge of the city's natural reserves of forest or wetland.



The Lokhandwala complex was the advent of a new form of upper middle class suburban living, and changed the paradigm of development in the suburbs. In its immediate vicinity it encouraged other developers to raise buildings of similar density, soon giving the area a distinct identity. Occupied largely

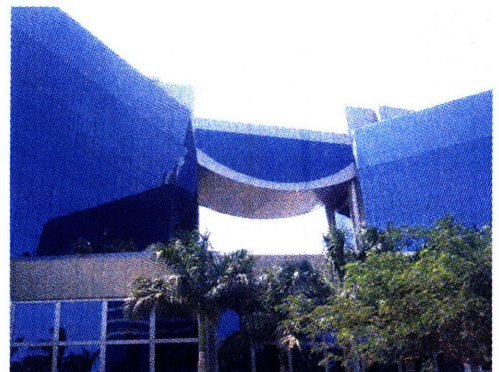
LOKHANDWALA COMPLEX AT THE
EDGE OF A WETLAND

by first generation migrants with mid-level corporate jobs in the city, it started something of a new lineage in the city. Lokhandwala today espouses a self identity that is not a binary relation to the island city, through many of its inhabitant commute daily to work there.



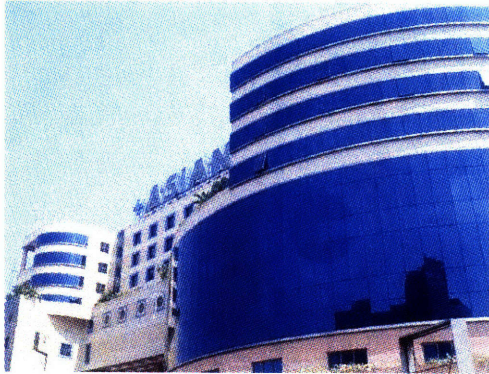
BANDRA KURLA COMPLEX [Late 1980s - 1990s]

First in the series of new growth centers planned in Greater Mumbai to arrest further concentration of offices and commercial activities in South Mumbai, it provides an alternative location where future growth of offices and commercial activity can be absorbed and where some of the existing activities from South Mumbai can be relocated.



The area Bandra Kurla Complex occupies appeared in plans dating as far back as 1964, before the Nariman Point Complex had concentrated development in South Bombay. It covers 370 ha. area of once low-lying land on either side of the Mithi river, Vakola nalla and Mahim Creek. The area had poor surface drainage and was severely affected by pollution in the Mahim Creek.





In 1977, the MMRDA was appointed as the Special Planning Authority for planning and development of this complex. The commercial development in BKC includes private and government offices (state and central), banks and wholesale establishments. The Mumbai Municipal Regional Development Authority has so far developed 19 ha. of marshy land in 'E' Block.



Side by side the development in 'E' Block, the focus of development of activities has also moved to the adjoining 'G' Block where a new International Finance and Business Center is planned.



The development of Bandra Kurla Complex was also the first space where commercial architecture of the city was consciously branded. Banks and multinational firms locating here constructed the first set of glass curtain walled buildings in the city which came to become the aesthetic of corporate architecture. Coinciding with the liberalization of the Indian economy in 1991, and the advent of large private multinational firms initiated corporate architecture in the city. Glass curtain walls that typically hang on a steel frame building in the western contexts are applied to concrete framed buildings in Mumbai. Despite being outside the realm of developer built buildings- the persistence of local conditions has not seen the advent of steel in corporate architecture in the city. The propagation of the underlying concrete frame in architecture here situates Bandra Kurla Complex in the broader narrative of the reinvention of facades in the city.



CORPORATE ARCHITECTURE IN BANDRA KURLA COMPLEX

HIRANANDANI GARDENS [1990s]

Built on a former quarry, Hiranandani Gardens was the first scheme in city to create a brand image for its developers through the aesthetic rendition of the buildings in the scheme. The seminal impact of this development was on the imagery of the ensuing developer built housing in the city, especially in its northern suburbs. This production of this imagery at Hiranandani gardens and as a phenomenon forms the basis of the narrative of the following chapter on the “ethos of production” of concrete in the Mumbai.



ENDNOTES

¹King, Anthony D. *The Bungalow: The Production of a Global Culture*. Routledge, 1984, p 1

² Ibid p 23

³ Ibid p 24

⁴ Chandavarkar, Rajnarayan, Plague Panic and Epidemic Politics in India, 1896 - 1914, in Ranger, Terence O., and Paul Slack. Eds, "*Epidemics and Ideas: Essays on the Historical Perception of Pestilence*". Cambridge University Press, 1995, p 206

⁵ Ibid p 203

⁶ Kidambi, Prashant. "*The Making of an Indian Metropolis: Colonial Governance and Public Culture.*" Ashgate Publishing, Ltd, 2007. p 50

⁷ Hirst, Fabian. L, "*The Conquest of Plague. A study of the evolution of Epidemiology*". Oxford University Press, New York, 1953, p 105, quoted in Chandavarkar, Rajnarayan, Plague Panic and Epidemic Politics in India, 1896 - 1914, in Ranger, Terence O., and Paul Slack. Eds, "*Epidemics and Ideas: Essays on the Historical Perception of Pestilence*". Cambridge University Press, 1995, p 214.

⁸ *Annual Report of the Sanitary Commissioner, 1894*, Calcutta p 27 quoted in Chandavarkar, Rajnarayan, Plague Panic and Epidemic Politics in India, 1896 - 1914, in Ranger, Terence O., and Paul Slack. Eds, "*Epidemics and Ideas: Essays on the Historical Perception of Pestilence*". Cambridge University Press, 1995, p 211

⁹ Ibid p 215

¹⁰ Kidambi, Prashant. "*The Making of an Indian Metropolis: Colonial Governance and Public Culture.*" Ashgate Publishing, Ltd, 2007. p 68.

¹¹ Ibid p 53, quoting the Government of Bombay Judicial, vol 37. Compilation no 129, Part 1, MSA.

¹² "The Building Bye Laws of Bombay", *Journal of the Indian Institute of Architects*, 1939.

¹³ Hazareesingh, Sandip. "*The Colonial City and the Challenge of Modernity: Urban Hegemonies and Civic Contestations in Bombay City 1900-1925*", New Delhi, Orient Longman, 2007, p 52-53, quoting B. W. Kissan, "Report on Town -Planning enactments in Germany", Bombay Government Press 1913

¹⁴ Ibid p 53, quoting A. E Mirrams, "The Bombay Town Planning Act of 1915" (Bombay Government Press, 191-6)

¹⁵ Evenson, Norma, "*The Indian Metropolis*", p 143, quoting W. R. Davidge, *The Development of Bombay, Town Planning Review 10* (Feb 1924)

¹⁶ Patel, Sujata and Thorner, Alice, "*Bombay: A Metaphor for Modern India*", Oxford University Press, Bombay 1997.

PART II
CHAPTER IV
THE ETHOS OF PRODUCTION

In the previous chapter, the setback and the plot in the city were retroactively related to the concrete frame, and tracing the spread of the frame across the terrain of the city related patterns of occupation to the urban form of the city. In this chapter I present the account of the production of urban form in Bombay. The productive ethos of concrete buildings is defined through three agencies integral to shaping them: the builder-developers, the architects and the contractors and labourers. I trace the evolution of the work of these three groups which together form the basic conditions in which the concrete frame building has been progressively developed in the city. The crafting of buildings is understood through the specific actions of these developers, architects and contractors, as well as their mutual influence on each other.

THE BUILDERS OF THE FRAME

Concrete buildings in Bombay were not always the preserve of the builder-developers as they are today. Since the advent of concrete in India and its first wide-spread use in Bombay's residential buildings in the late 1930s, both concrete as well as load-bearing buildings were constructed for rental use. This condition has been completely reversed today where in the last 40 years or so, almost no housing stock has been constructed by a builder for the sole purpose of renting. The origins of this reversal could be located on the eve of Indian independence and partition of the country into India and Pakistan on

August 15th, 1947. The vast exchanges of humanity between the two newly formed nations caused a massive influx of refugees into Bombay, prompting the Municipal Corporation to instate a Rent Control Act to avoid inflation of housing rents in the city with the sudden rise in demand.

The Bombay Rents, Hotel and Lodging House Rates Control Act 1947, popularly known as the Bombay Rent Act has been extended around 20 times since its instatement. The Bombay Rent Act of 1947, made renting un-lucrative and encouraged building for ownership, essentially beginning the transformation of access to housing in the city.

The first form of ownership buildings were in the form of co-operative housing societies where groups of households formed a co-operative society and commissioned the construction of a building that would be occupied by them. The owners or occupants were determined before the building was constructed, however the resultant buildings did not vary much from the prevalent norm in the city. On the other hand buildings were not designed with the purpose of attracting clients.

The next phase of development saw a combination of builder developers and “promoters” who acted as liaisons between sources of finance and the design and construction aspect. These promoters much like present day builder-developers conceived of a building as a commodity that would be sold post-facto..Instead of bearing the burden of financing the projects themselves, promoters sought financing partners who would get a return on their investment, with the promoter earning a share of the profits from

sales. This led to formation of the builder developer who was the both the financing and developing entity and undertook the entire risk of a building project.

The effect of the partition of the country on the ethos of concrete in the city was two fold: Through the Bombay Rent Act it set into motion the rise of the builder developer whose practices have governed the form and process of making the city's buildings. The second effect was through the people who arrived in Bombay as a result of the partition. Hindu Sindhis from Karachi – the capital of the Sind Province of Pakistan, were among the first group of developers in the city, who undertook the private development of residential and commercial buildings.

The present mode of developers' practices affects the crafting of concrete buildings in the city in a particular way. Since RCC work is incremental, several developers proceed with projects as they are able to obtain money [the largest developers, however, don't operate with such tentativeness]. In a highly fluid and uncertain capital flow system, developers use borrowed money or raise capital through pre-sale of the buildings. If the acquisition of capital is slow or is stalled, concrete construction may be halted. – While steel structures require more certainty before construction commences and commitment of greater capital as well. Again, the larger developers are equipped to make these investments, however they are unable to convert the benefits of steel construction into profitable gains due to the time lag of other construction processes. The higher cost of using structural steel is offset for developers by the time gained in the construction process. They find however, that the time saved

by using steel assembly does not translate into an overall time savings as the dearth of modular finishing materials such as wall panels maintains the persistence of “wet finishes” whose time of construction is not curtailed by using steel at the structural level. For the developer the persistence of concrete is maintained by the absence of modular finishes that would transform construction process into an assembly based process, thereby making the use of steel a viable option.

CONCRETE, MODERNISM AND ARCHITECTURAL DISCOURSE IN BOMBAY

The artistic ferment of the European Modern movement initially had little impact on India, since its link to the West was via Britain who had maintained a relatively conservative stance towards architectural modernism in the years before World Wars II. While concrete construction had made its way to Britain by 1905, upto the late 1930s British building reflected little of the architectural modernism that was taking over the Continent. Its colonial projects were engaged in creating a colonial identity through the historicism of the Indo – Saracenic style. This style had been adapted for a whole host of programs from Banks and commercial buildings in Bombay to the entire governmental complex of New Delhi, being designed by Edwin Lutyens in 1930. Other British architects of stature, like Patrick Geddes and Walter George advocated an architectural approach closer to the native climate and sensibilities.

Yet, in an environment of monumental historicism, and countervoices advocating local appropriateness, as well as a largely unindustrialized, rural and

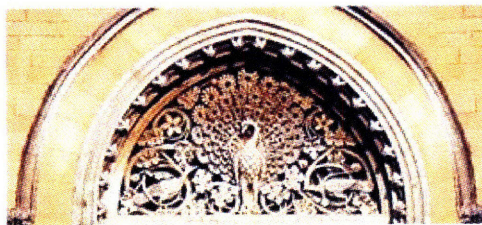
agricultural country, modernist architecture and living found a firm foothold in some of India's major cities.. The primary vehicle of this modernism was the new material of concrete.

As I have narrated in Chapter 2, concrete technology came to India via Britain where by 1905, most reinforced concrete works and all framed buildings were in Hennebique's system. In order to curtail the specialist knowledge of concrete and promote its use among architects, three institutions were set up by 1908. As a result by the early 1920s concrete construction was firmly present in the imagination of the English architects working in Bombay.

Addressing a group of his colleagues at the Bombay Architectural Association in the 1920s, Robert Cable, a British architect working in India declared "*Concrete to be a material that defies all the accepted canons of Architecture and which is going to upset all traditional forms which have grown out of the expression of construction, a material the universal use of which.. will tend to produce throughout the world one more or less universal style of architecture*" describing the spread of concrete on the Continent he went on "*a courageous architectural spirit has seized upon the possibilities of this novel substance and construction, and the results of which can only be described as revolutionary have already appeared. Here in India we have as yet scarcely begun to be conscious of this revolution at all.*"

Cable's audience, the Bombay Architectural Association formed in 1922 represented the Indian Architectural profession which was largely centered on Bombay, which also had the only professional

diploma program in architecture, in the country at the time. Bombay, being a relatively small but growing architectural community of Indian as well as British architects was then the apt space for an ideological discourse about architectural styles. Cable's veneration of concrete had been addressed to the very constituency that would initiate its use in the city.



BOMBAY GOTHIC

The British led professionalization of architectural design in the city co-incided with the advent of concrete in Bombay, a material which itself suggested no particular formal outcome but had been widely tested and used in the form of the structural frame in Britain. The ahistoricity of concrete, as a material that itself suggested no form coincided, in Bombay, with a city without a substantial past. The debates about Indianness in Bombay's architecture referred to the broader history of Indian building rather than a local lineage. Except for the revivalist gothic of monumental colonial buildings, Bombay did not have a substantial history of indigenous formal architecture, or a particularly long past in its native housing fabric. In a sense the city's space was a tabula rasa awaiting new form.

Convictions about traditional Indian revival in the late 1920s soon gave way to new ideology, with stalwarts like Claude Batley amending their revivalist stance to favour modernist design, which to him was not just a style but "a return to primary essentials". Denouncing the effusive decorations of Bombay's gothic buildings he declared "*any reasonable man will agree that they would be transformed for the better if one of us took an axe and chopped off every bit of ornament... for none is important, none even significant.*" He also asserted

that this new architecture would have to be modified to Indian conditions, particularly its climate. Modern architecture according to him rested “entirely on functionalism, and it would have to be studied in India from that point of view alone, in which case it must, subconsciously at least, take upon itself an Indian character.”

Indianness in urban buildings could be said to have primarily manifested as climatic response. The design of the envelopes of the early residential concrete buildings became an attempt at climatic mediation between the inner spaces and weather outside, and crafting modernist geometric form. The underlying elements of this envelope, the balcony, the overhanging cornice or *chajjah* and the form of fenestration became the staple elements of apartment buildings in the city, and around the country.

Concrete frame buildings became the modern vernacular for both residential and commercial uses in big cities across the country, their proliferation characterizing the urban landscape of cities like Mumbai as a ‘concrete jungle’. The appearance of these buildings was characterized not by their stylistic rendition, but by their building envelopes and its elements – the balconies and overhanging cornice of the *chajjah*. The appearance of these building was articulated over the depth of about 3 feet that formed the outer skin of the building. The materials of this appearance were concrete at the *chajjah*, and brick metal or glass at the articulation of the frame. The visual suppression of the underlying frame of the building depended on the degree to which these elements were pronounced.



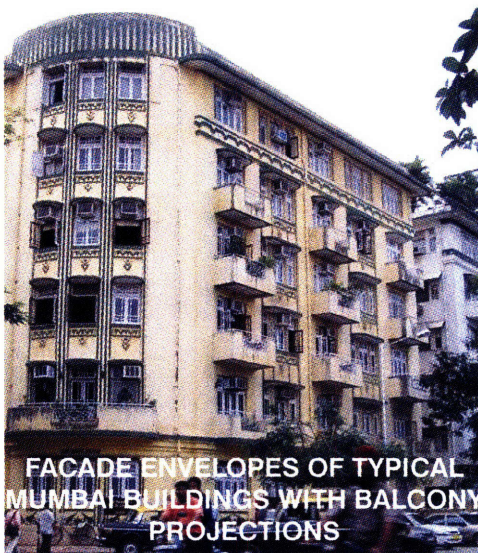
FACADE ENVELOPES OF TYPICAL MUMBAI BUILDINGS



After the Art Deco phase in Bombay, the architectural community in its varied efforts had not yet brought a unified or monumental vision to the design of building exteriors. Some of the early facades of the 1950s and 60s facades did betray an interest in modernist expression by the city's architects – but it was an interest whose subsequent dissipation is also betrayed by the same landscape. What might be called an effort to build a well designed building is heterotopically manifested around the city, and one might say that these are the sites where the architect's and developer's intent found some consensus. A well designed façade and good looking building was nonetheless still a modest attempt at standing apart among the ubiquity of the city's buildings, and not the brand signature that developers were to build beginning in the late 1990s.



There were distinctions, the entire concrete residential landscape was not middle – class. With some of the highest real estate rates in the world, areas towards the south of the city like Carmichael Road and Malabar Hill, may have had buildings similar in design caliber to other parts of the city but their location and primarily their type – as skyscrapers made them distinct.

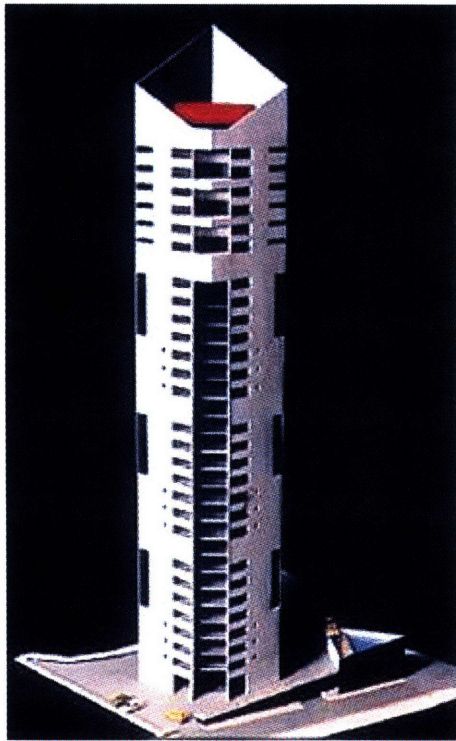


FACADE ENVELOPES OF TYPICAL MUMBAI BUILDINGS WITH BALCONY PROJECTIONS

The low-rise frame of the suburbs, and the skyscrapers of Malabar Hill, Nariman Point and Cuffe Parade, and Lokhandwala Complex in the then extended suburbs made up the vast ubiquity of Bombay's architecturally undistinguished everyday landscape. There was little attempt to mask the concrete frame in these buildings through embellishments.



THE HIGH RISE MIDDLE LANDSCAPE



By the 1970s modernist fervor had subsided in the city, and with the bulk of architectural commissions in the city coming from builder-developers, the profession had largely shifted towards serving their needs and away from the initial ferment around architectural expression. Historicism had been effectively set aside but rigorous modernism did not take its place in the lineage of Bombay's city form. The professionalization of architecture had led to a productive discipline, but a parallel discourse about the discipline found no institutional support and was limited to a few even within academia. The drive of builders and the city's entrepreneurial elite increased their prosperity but was yet to manifest into visionary urban form. By the early 1990s Bombay's real estate was some of the most expensive in the world, though its buildings didn't look it.

As the built form of a young city, until the 60s these unadorned frames were the first generation of buildings on the land they occupied. It is common to assume that these are intermediate and necessarily flawed points in a process of historical transition of the urban space. But instead of seeing them as a transition along the path to a steady state of better urbanism, I would like to argue that they represent a stable state within that progression.

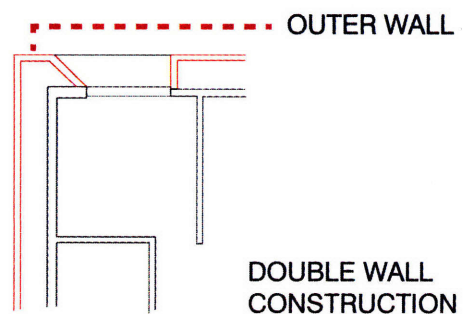
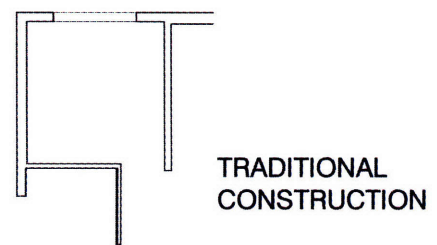
The unadorned buildings represent a drive to build a city of domicile – a response to the imperative of housing large densities of people on a small landmass that was uniquely facilitated by the constructive capacity of concrete to build tall. In the ferment of nation building, of which city form is an integral part, the first stress was on capacity building, where the mere provision of the building as housing

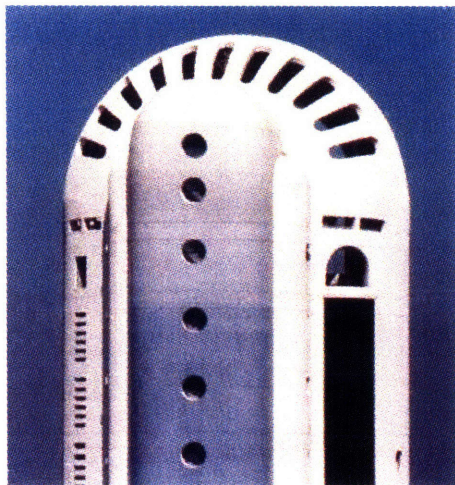
justified its existence. The transition of native forms of living to the apartment style was the modernizing process rather than the appearance of the buildings. I am not placing substance [apartment living] and appearance [façades] in a hierarchical relationship here, but suggesting that the unremarkable concrete frames of Mumbai's urban form represented a social imperative that would not have been served by their embellishment.

It is true that this drive for housing development was also largely privatized and its cornering of the housing market in the city worsened the conditions for the middle and lower classes who could not afford to buy into it. In that sense the ethos of concrete in Bombay could be implicated in the creation of the city's vast informal settlements, a condition that is only exacerbated by the current surge of housing construction in the city.

In the 1980's Bombay saw the construction of a few buildings whose façade aesthetic might be classified as post-modern. The emergence of a "façade architecture" in the city is attributed to Hafeez Contractor, who is the country's most popularly acclaimed architect. In a recent monograph of his work, Contractor says:

"The bulk of our firms' practice over the years has been real estate driven residential architecture. I have often asserted that other building typologies like public, institutional or commercial seem like a cakewalk compared to residential architecture. A corporate, public or institutional project with its massive budgets, relaxed regulatory setting and mostly devoid of tight real estate and market pressures





VAASTU by Hafeez Contractor
Credited as the first Double Wall building
in Bombay

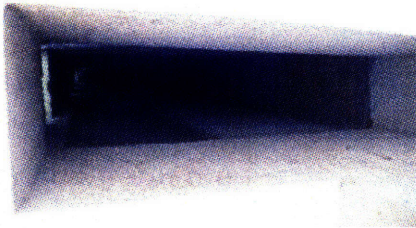
are a walk in the park. In comparison when creating a residential apartment one has to take into account the miniscule regulatory issues, real estate formulas, economics and market demands. Even though most purists might term my residential work gimmicky, it comes out of valid rationale. The numerous styles that tick off many people are simply a response to the aspirations of the consumers and the market context.”

“... I have to emphasize that Architectural practice is an outcome of a shared vision of many individuals of various disciplines and talents working closely together, I have to thank my team, my consultants, the construction workers on site..... Last but not the least; I am grateful to my clients.”

While it is often said that the new facades of the city, are the result of a cycle of creation and response to “aspiration”, as alluded to by Contractor as well, in the past fifteen years his work had lead creation of new images in the city. The work and design process followed by Contractor and his closest emulators gives us an insight into the reasons, conditions and productive methods of how these skins of concrete buildings are designed and constructed.

THE DOUBLE FAÇADE:

In late 1980’s, one post-modern building by Hafeez Contractor marked a departure in the construction of concrete frame buildings. Its aesthetic was a novelty in the city’s skyline, but its implication on Contractor’s future project’s was significant because of its use of “double walls” – an outer skin for the building on which the façade was articulated, which was distinct from the inner walls of the inhabited



**DOUBLE WALL
CONSTRUCTION:
STRUCTURAL
RCC BEAMS
CANTILEVERED
BEYOND INNER
WALLS TO RECEIVE
THE OUTER WALL**



spaces. The double wall enabled the creation of “necessary form” and modulations on the surface of the building. In having two having external walls now, the width of both walls were also reduced. “This system added value in the commercial sense as it delivered larger saleable space that was created due to reduced width of the external walls.”

The double wall transformed the visual of the normative housing scenario. In hindsight the double wall is explained as providing a double skin for the building and hence better weather protection, however it did not impact the speed or quality of construction that were fundamentally responsible for the poor weathering of buildings. Its commercial and visual impacts are perhaps the clinching argument behind its creation. The space between the inner and outer skins of building has become the site of floor area manipulations. With a booming real estate market, small additions to the space of a single flat add up to a substantially large area overall, the sale of which far outstrips the construction cost of the double wall, or payoffs to officials who approve the building after construction.

This additional area is not always achieved through explicit corruption. The presence of two walls is often used to conceal the additional space between them which usually houses additional closet or storage space, which counts as saleable area. The inner walls are completely built upto the point of inspection, and after the sanction, openings are created in the inner walls to access the additional space.

The double wall reutilized the space of the building

envelope, which I previously described as being 3 feet deep. The spatial nature of envelope which accommodated the balcony, has been fattened here to make the outer a canvas for generating imagery.

**ARRIVING AT IMAGERY:
THE CASE OF THE HIRANANDANI GARDENS:**

As I mentioned in the previous chapter, in 1991 Hiranandani builders acquired a large tract of land at the edge of hilly terrain in Powai, a northern suburb of the city. As a former quarry the site had little connection to the city, was far from transportation hubs and had little infrastructure. Much like the Lokhandwala Complex a decade ago, the Hiranandani set about creating a new settlement. “The visual imagery of the Hiranandani Complex is known to have instantly captivated to the Indian masses.”

The Hiranandani Gardens was conceived with the intent of attracting buyers and residents by providing an “urban” environment that was largely missing from the rest of the city – green spaces, parks, a New





Urbanist streetscape - but it was also to compensate for the amenities that it did not have, which other parts of the city did enjoy - such as transportation facilities, proximity to cultural spots like markets, restaurants, theatres etc.



The Hiranandani with Hafeez Contractor embarked upon a project to create a distinct style for the entire complex. Initially the architect experimented on various styles from Goan, Mediterranean, Contemporary, Indian to Neo-Classical. They settled on the neo-classical style due to the advantages they would have with making its elements in the Indian context of building construction. It was simpler to adopt the neoclassical elements to the labour intensive system of construction and the decorative double wall would be made to neatly accommodate the embellishments.



The development of the Hiranandani complex triggered a wave of emulation around the city and in other cities around the country. Developers demanded “façade treatment” as an imperative part of the project’s saleability. It is claimed that façade design by Hafeez Contractor and his emulators add a premium to projects beyond the already astronomical real estate rates that they command. In the northern suburbs the facades additionally perform the same function as they do in Hiranandani Gardens – they serve to instantly urbanize the hinterland and cajole its acceptance as a dwelling place. After this imagery appears on a landscape there is no looking back.



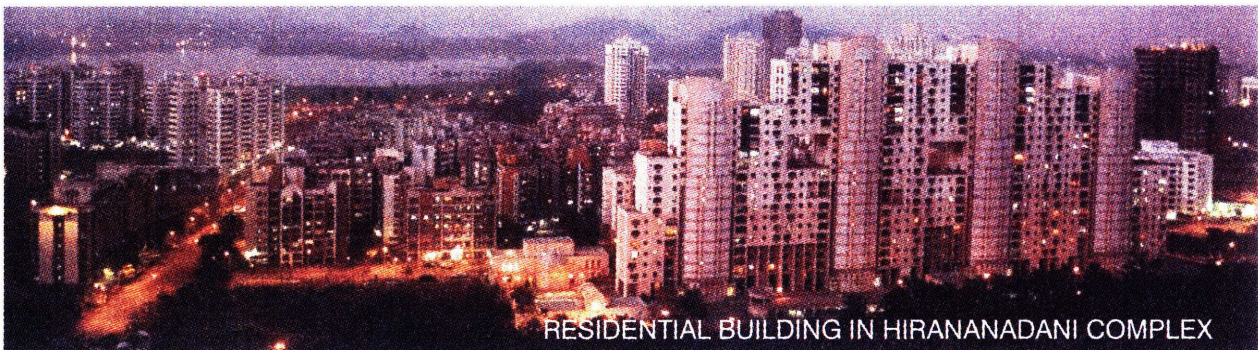
Options considered by Hiranandani Builders and Hafeez Contractor for the aesthetic of Hiranandani Gardens



HIRANANDANI GARDENS: DEVELOPER'S PLAN



HIRANANDANI GARDENS: MIXED USE DEVELOPMENT, SHOPPING AND RETAIL BEHIND ARCADED STRUCTURE, WITH A BACK DROP OF RESIDENTIAL BUILDINGS



RESIDENTIAL BUILDING IN HIRANANDANI COMPLEX



THE ARCHITECTURAL DESIGN OF THE DOUBLE WALL:

“The client has paid a particular advance – he has to pay the balance money and he has to generate that from the market – so he will sit on your head – make you do the drawings – make you do the perspectives – and get it out it in the market so he can harness the money - (this is also one crucial element of where time is getting constrained)”



Representations have grown to be an integral part of the developers advertising process, from brochures as ostentatious as upper class wedding invitations, to hiring expensive advert spots in the city’s newspapers and billboards.



Mittal Park
Thane

The representations often precede even breaking ground for construction. The double wall serves as a convenient device for the architect to demonstrate imagery before the spatial planning of the building is in place, Physically divorced from the inner wall – the images simulated before the internal planning is fixed are only approximations of the final façade but the finality of their renderings make them adequate for advertisement. As it is the imagery that is used to publicize the buildings, and developers commission them only after they have acquired the land, architects are required to deliver designs of publicity as well construction in relatively short durations of time.

While the assembly of actual buildings is not from a kit of parts – under extremely compressed time scales the design of buildings and their detailing is drawn from a set of blocks that are inserted into building designs in order to meet deadlines to

enable developers to sell a designed project before it is constructed - to enable its construction.

"You don't get time to think so you reproduce elements from past work (or other people's work) – cut and paste – no new thought or innovation. – and the clients say I can make my buck on it and they are happy – but then it's not real architecture"

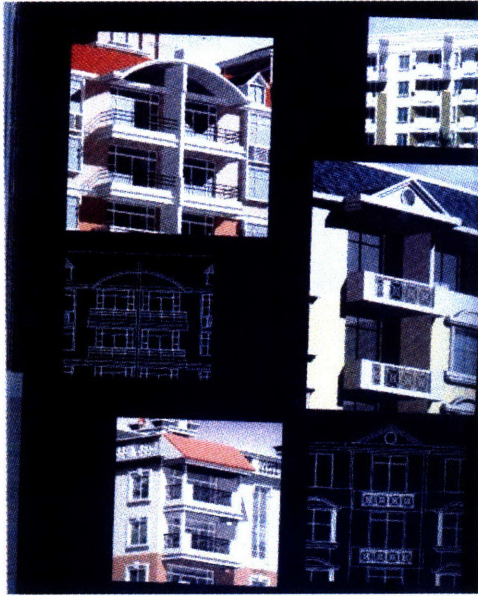
As the photographs and renderings tell us, this imagery is not the invention of a purely new style. Within architectural offices it is broadly categorized by terms such "modern", "geometric", "classical" or "ultra classical". While the internal planning proceeds as a strict response to the FAR regulations and is always an attempt to extract the maximum possible square footage, the outer facades are crafted from references as diverse as European tourist guides, coffee table books on western architecture, books such as "The Detailed Parts Picture-Book of Architectural Appearance" a Chinese publication featuring a plethora of computer generated renderings of façade embellishments.

The erasure of ornamentation from modernist design made architectural design entirely communicable through working drawings, whereby information of design is systematically conveyed to enable construction. The design of these facades on the other hand come seems to reintegrate the artisan into the process of construction. Drawings of facades are approximations of foreign images, basic dimensions of which such as height, width and depth are conveyed to contractors and fabricators who proceed to craft the embellishments out of this basic information.



THE DETAILED PARTS PICTURE-BOOK OF ARCHITECTURE APPEARANCE

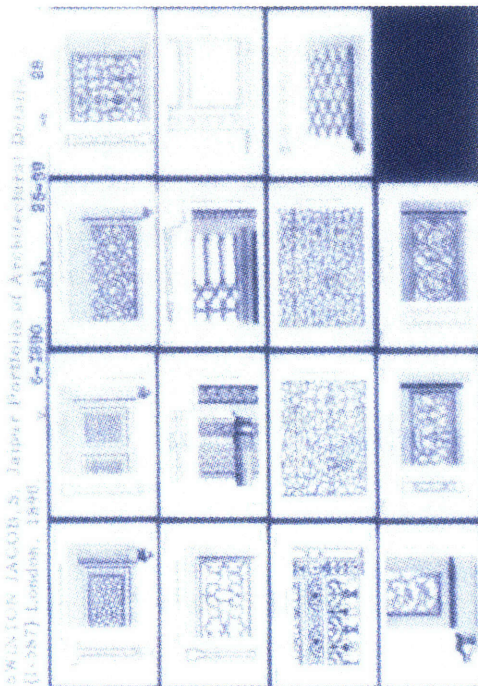




THE DETAILED PARTS PICTURE-BOOK OF ARCHITECTURE APPEARANCE

This condition harkens back to the debates on historicism and the colonial attitude towards Indian arts and crafts. Modernization, led by the colonial enterprise in India is commonly held responsible for the demise of the crafts in India, particularly in the building industry. An attempt to transition the Indian artisanal aesthetic to modern use is exemplified by the case of Jeypore portfolio.

The Jeypore portfolio was a ready reference of “Indian architectural details” compiled in 1876 by Colonel Samuel Swinton Jacob, who was the head of the Jaipur Public works department. Jacob an engineer by training and an ardent enthusiast of arts and crafts was one of the earliest champions of architectural drafting and invested considerable effort in teaching this skill to native employees in his department. Jacob’s largest production using this new skill was the Jeypore Portfolio of Architectural Details. “The idea was that these details would function as a ready reference that could be utilized whenever necessary”.



**SAMUEL SWINTON JACOB
THE JEYPORE PORTFOLIO
OF ARCHITECTURAL DETAILS**

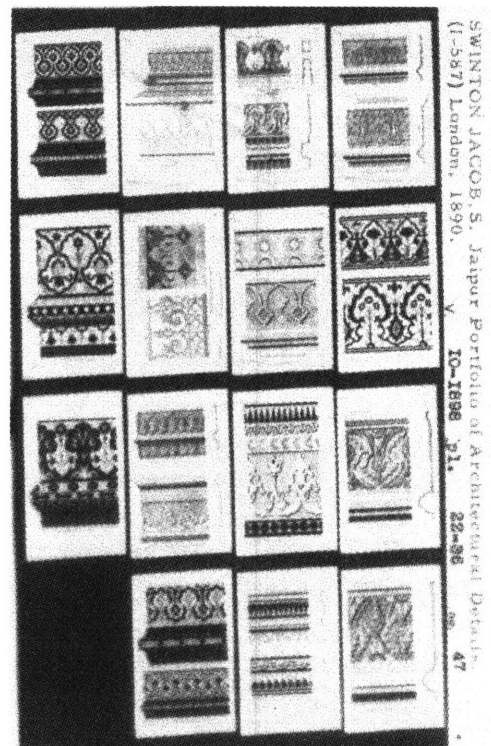
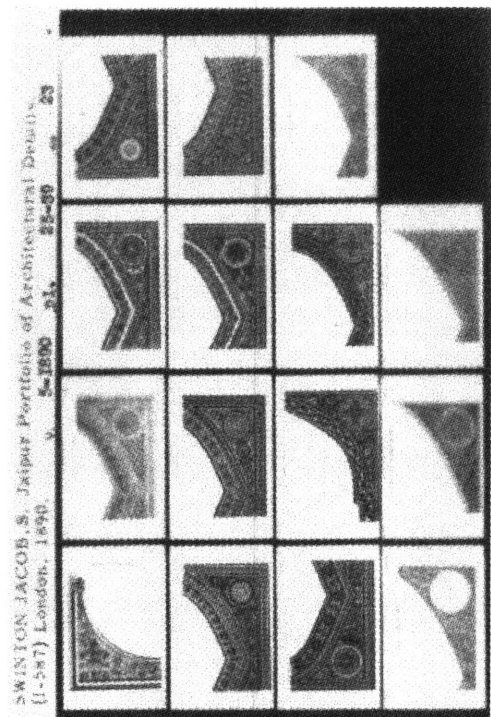
But the underlying motivation for making the portfolio was as a critique of the contemporary buildings being constructed elsewhere in British India by the Public Works Department. The primary objects of the arts and crafts enthusiasts’ criticisms were the “standard plans” and “pattern book” buildings that had to be erected everyday.

Jacob claimed the drawings the Portfolio would be “easily accessible and of use to the architect and artisans”. They could be used either directly as working drawings for direct reproduction or to adapt them to modern requirements or from them get

inspiration for work in wood, metal or stone, or in plain surface decoration. Jacobs hoped the Portfolio would help the craftsmen to revive their craft and adapt it in an authentic manner, unadulterated by Western influences, to meet modern requirements. The Portfolio would facilitate this adaptation by disseminating the drawings, to be used as a ready-reckoner for “indianness” in architectural decoration.

The portfolio is representative of two impacts on Indian artisanry. Firstly it is an example of the rationalization of Indian crafts and the conversion of the imagery it contained into a stereotypical “Indian” aesthetic. One that was born of the foreigner’s essentialization of an appearance actually rooted in an indigenous crafts practice. The second effect was on the creative act of the artisan, who now saw his native aesthetic redefined through foreign eyes. What was indigenous had been made “Indian”, and the meaning of this Indianness was manufactured for western understanding.

The portfolio exemplifies a turn for Indian architecture that has become sharply apparent in the present consumer age. As a catalogue of stylistic elements to choose from, the combination of which would result in a particular aesthetic it can be seen as an early example of how aesthetic production would also become serialized, with the serial production of architecture. The Portfolio became the pattern book that it was criticizing, and the antecedent of the picture books of today’s facades.



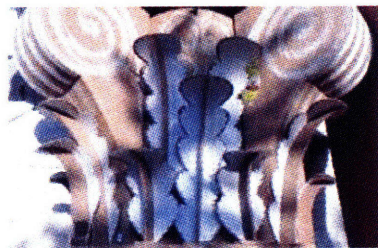
MOULDINGS AND CARVINGS



FACADE ELEMENTS IN FIBRE PLASTIC

The reemergence of the craftsmanship in the present paradigm, however, fulfills Swinton’s aim of re-integrating craftsman into modern architectural production. It is not however the traditional craftsman, the kind Swinton trained to draft. His draftsmen were usually Kumawats, The Rajput sub-caste traditionally responsible for building, today none of them seemed to have any extant building skills – drafting is their only forte.

The “craft” of making facades and its elements is a semi-formal urban business now. With fabrication workshops for formwork and fibre-plastic elements located deep within slum settlements, there is no glorious lineage here. The workers are trained at progressive levels of skill – the highest levels of which could be characterized as craft, even though it is without deep lineage.



The semi-professional mode of the communication of design between the architects, designers and contractors, however, shows us the co-existence of an innate crafts knowledge that fills in the embellishments of professional architectural work. A condition, I suggest it is a unique outcome of a society where modern professionalization and informal artisanry co-exist in the same city space. And it is the informality of the skilled crafts that allow formal structures like professional architectural design to reinvent themselves in a fast paced capitalist productive ethos.

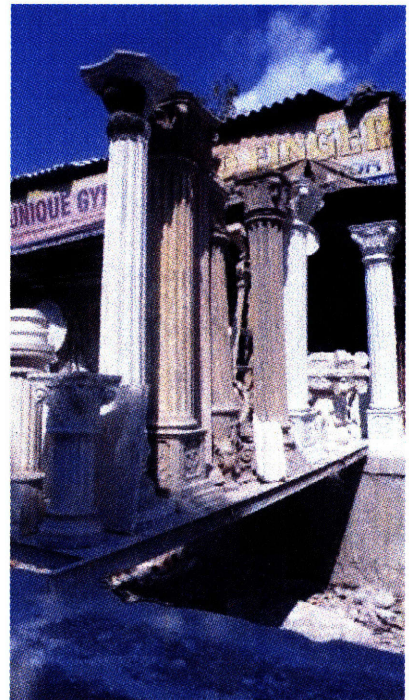
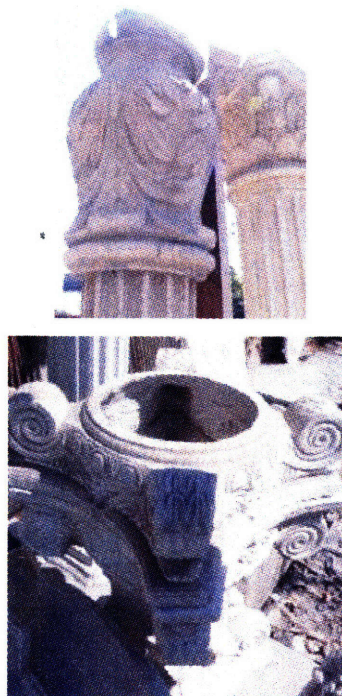
WOODEN FORMWORK FOR CASTING FACADE ELEMENTS IN FIBRE PLASTIC



**FACADE
ELEMENTS IN
FIBRE PLASTIC**

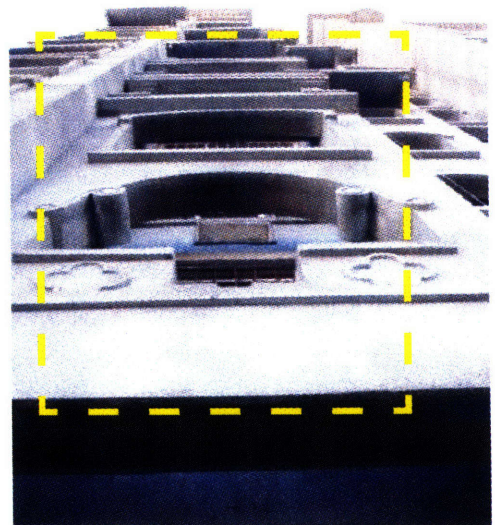
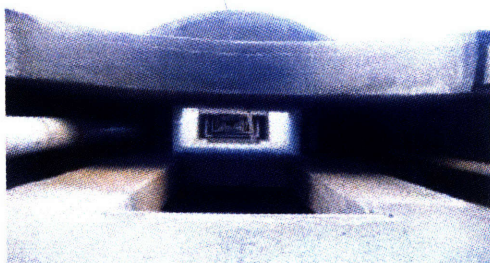
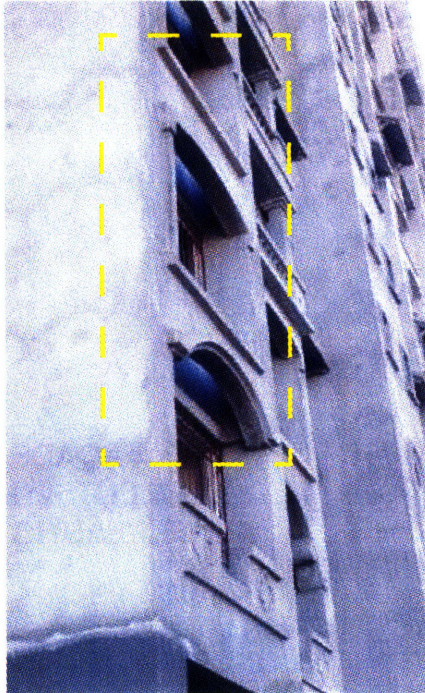


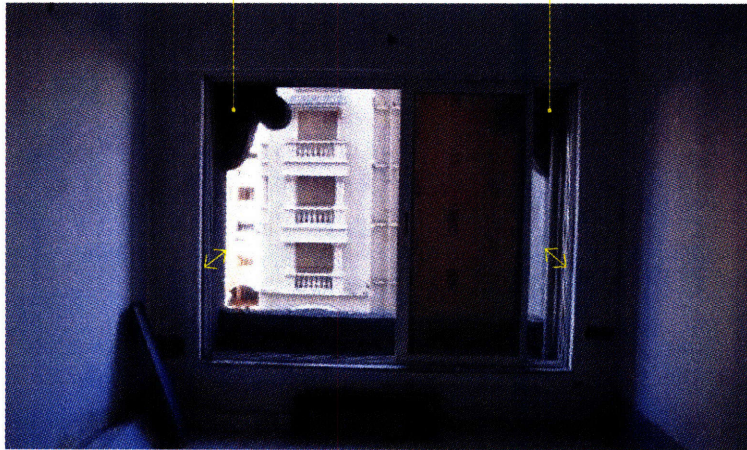
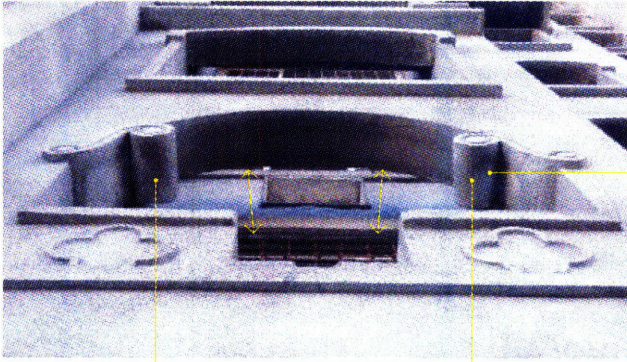
**APPLICATION OF
FACADE ELEMENTS**



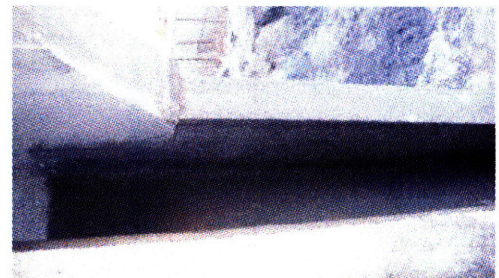
THE CONSTRUCTION OF THE DOUBLE WALL

The outer wall is erected on an extension of concrete frame beyond the inner wall and habitable spaces. In buildings that sport a bare outer-wall it is constructed of brick infill. In the large number of new developments that sport a "façade", its elements are constructed of unreinforced concrete, poured into formwork on site. The plasticity of the material enabling a myriad of forms to imitated without any structural imperatives. For instance, Greek columns and pediments framing a window are cast as a monolith from concrete poured into formwork. The columns do not perform the structural function of bearing the load of the pediment. The entire assembly serves only as a picture frame. A further evidence of this plasticity serving the city rather than the internal spaces is orthogonal nature of the windows on the inner wall which respond to the availability of window sections. Internal imagery is relinquished the realm of 'interior design'.

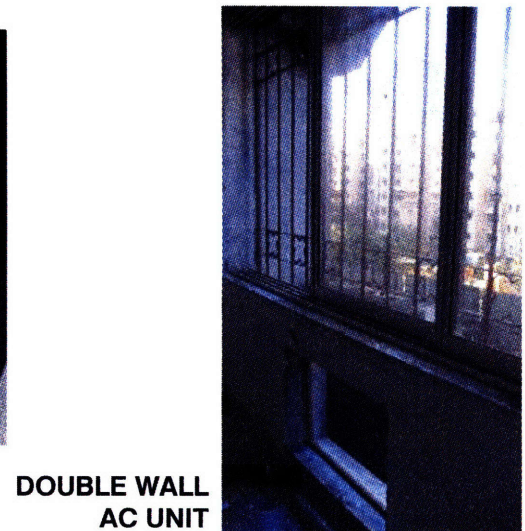




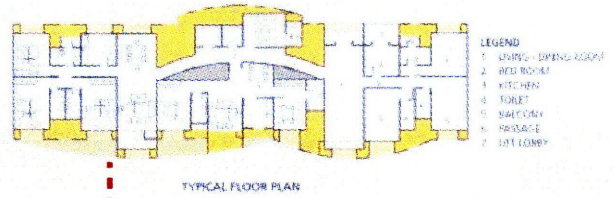
**DOUBLE FACADE:
INSIDE/OUTSIDE**



**DOUBLE WALL
KITCHEN WINDOW**

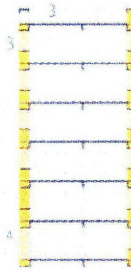


**DOUBLE WALL
AC UNIT**



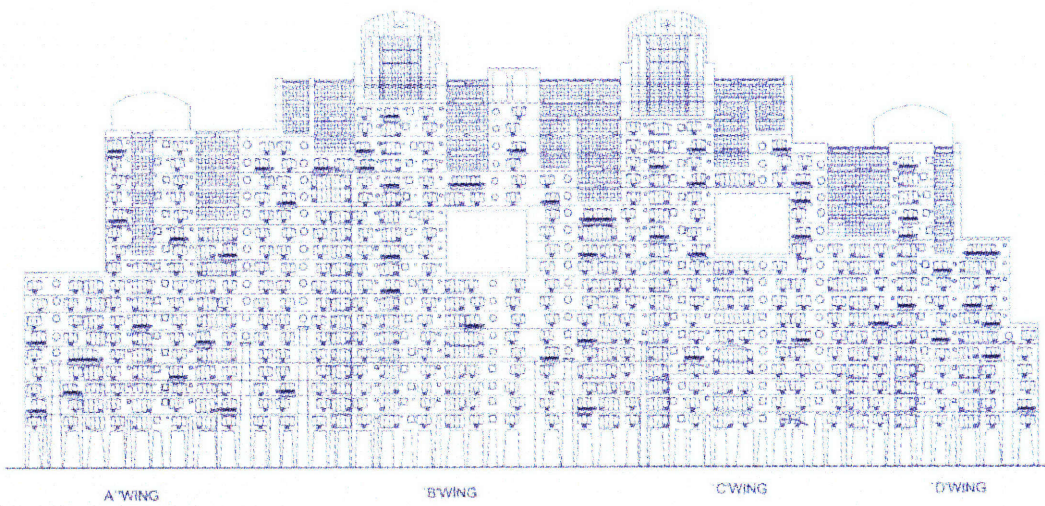
GAP BETWEEN INNER AND OUTER WALL SHADED IN YELLOW

**DOUBLE FACADE
 HIRANANDANI GARDENS
 LAKE CASTLE**



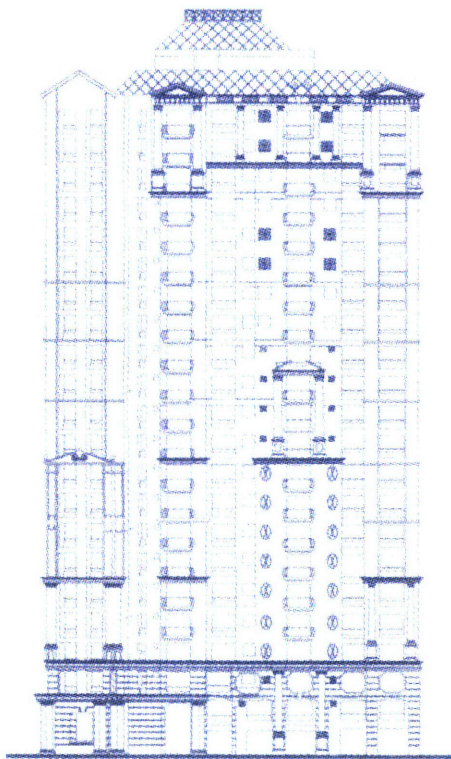
- LEGEND**
- 1. STILT
 - 2. ROOM
 - 3. TERRACE
 - 4. BALCONY

SCHEMATIC SECTION

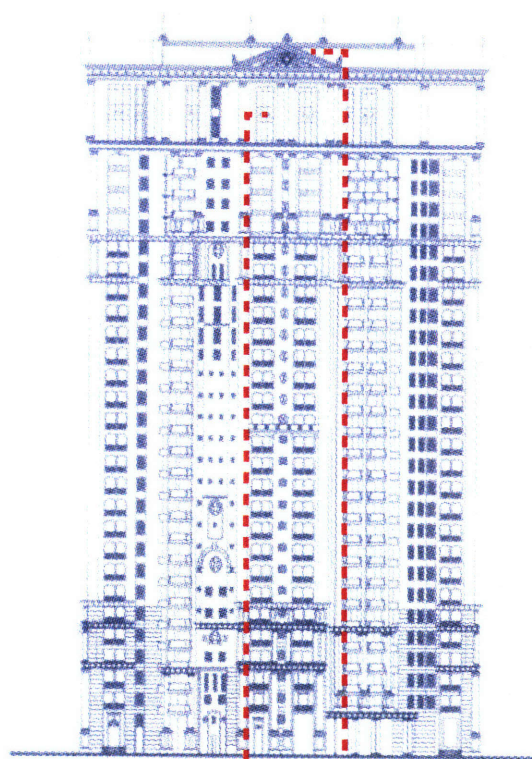


FRONT ELEVATION





ELEVATION

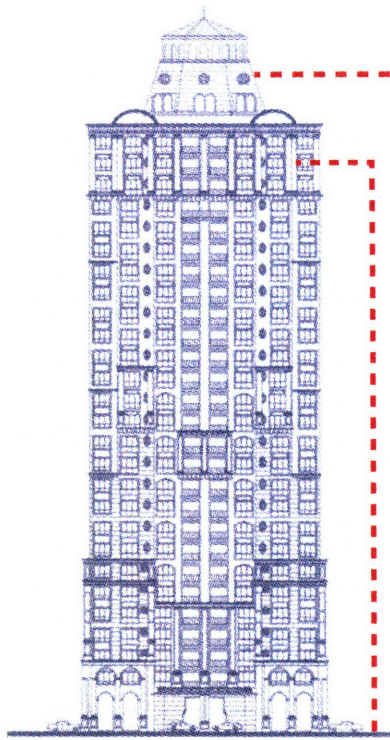


ELEVATION

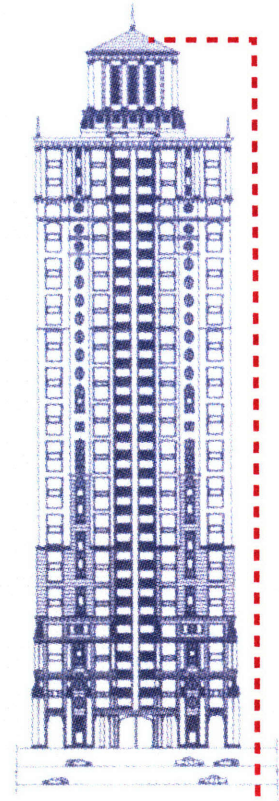


FACADE TREATMENT





ELEVATION

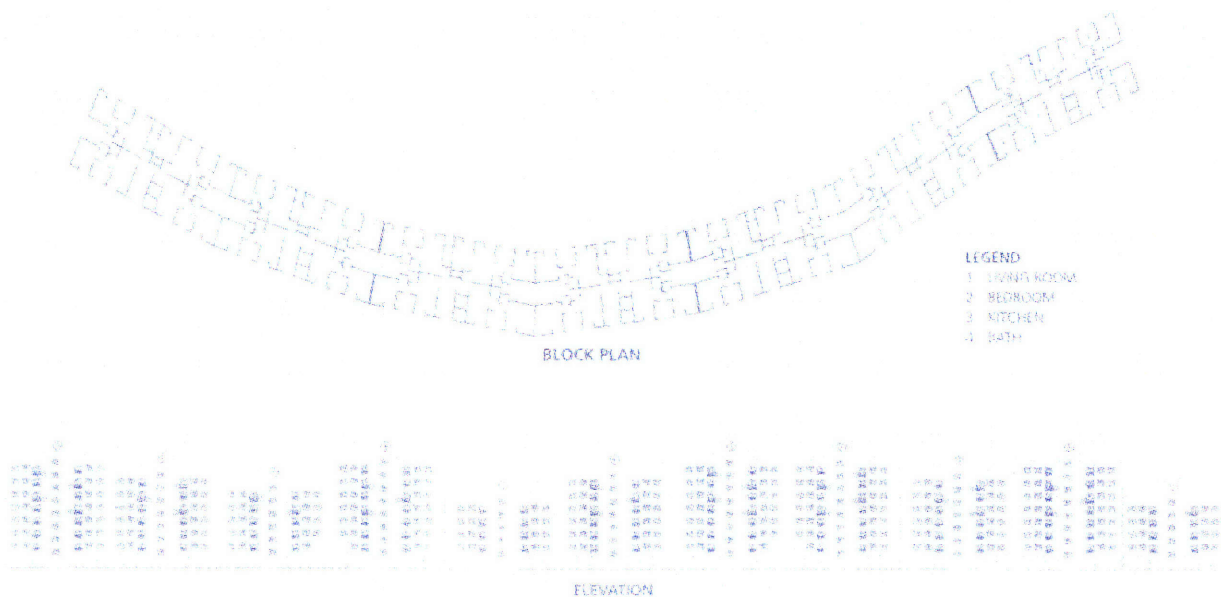




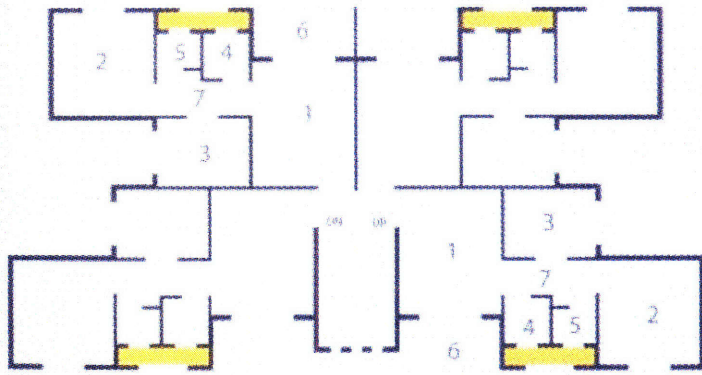
DEVELOPMENT IN NEW BOMBAY



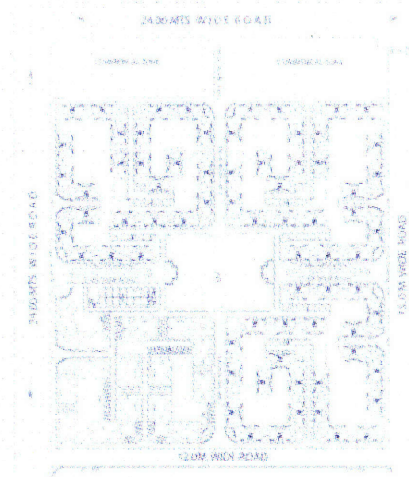
In state built housing for economically weaker sections of the city [opp. page] or lower value real estate, the application of a double wall is minimized to reduce construction costs, as the apartments are not meant for open sale. Techniques of applying colour patterns compensate here for the facade elements



LOW COST HOUSING



TYPICAL FLOOR PLAN



In state built housing for economically weaker sections of the city, the application of a double wall is minimized to reduce construction costs, as the apartments are not meant for open sale. Techniques of applying colour patterns compensate here for the facade elements

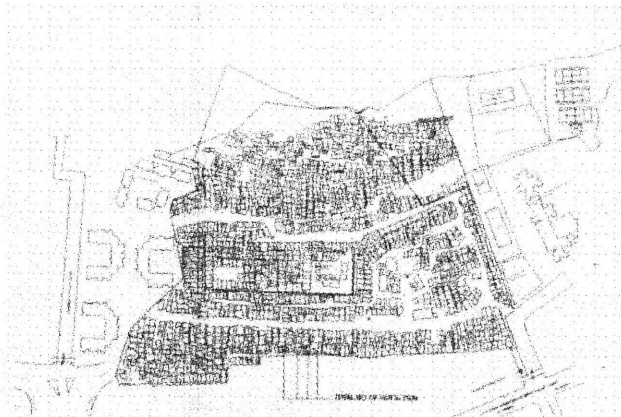


ELEVATION



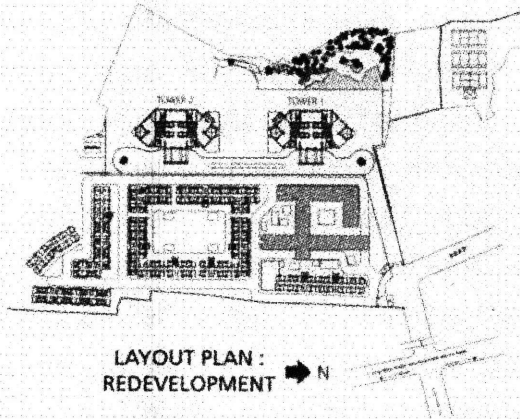
HIGH RISE CONCRETE FRAMES ON THE MILL
LANDS - ADVENT OF A NEW RESIDENTIAL
FACADE IN THE FORM OF GLAZING





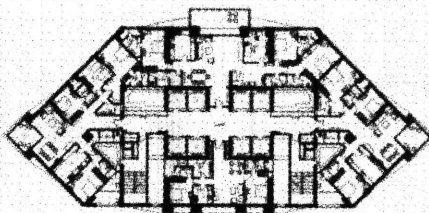
LAYOUT PLAN BEFORE REDEVELOPMENT : SLUMS → N

Left : The drawing indicates the blueprint of slums that had spread over the entire property.



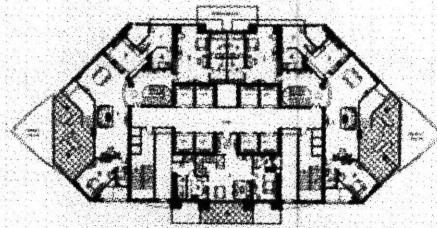
LAYOUT PLAN : REDEVELOPMENT → N

Left : Arrangement of the redevelopment plan which shows the saleable towers at the upper end and the rehabilitation block below.

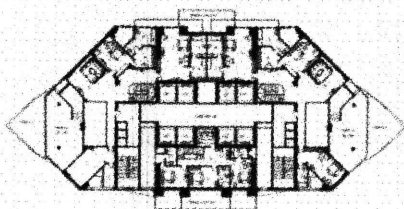


TYPICAL FLOOR PLAN
FLOORS : 2ND TO 28TH

- LEGEND
1. LIVING-DINING
 2. BEDROOM
 3. KITCHEN
 4. TOILET
 5. TERRACE
 6. SERVANT
 7. DRY BALCONY
 8. FAMILY LOUNGE

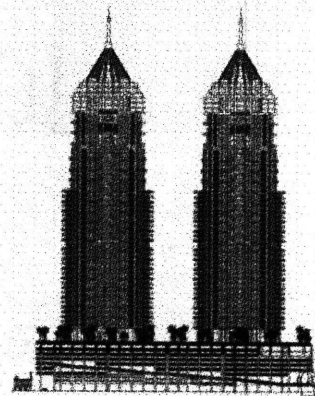


DUPLEX - UPPER LEVEL
FLOORS - 39TH TO 43RD



DUPLEX-LOWER LEVEL
FLOORS : 39TH TO 43RD

- LEGEND
1. LIVING-DINING
 2. BEDROOM
 3. KITCHEN
 4. TOILET
 5. TERRACE
 6. SERVANT
 7. DRY BALCONY
 8. STUDY



CROSS - SECTIONAL ELEVATION



THE PROLIFERATION OF FACADES:

“Until liberalization in 1991 Mumbai’s real estate market was relatively passive and operated in a fragmented fashion. With liberalization, regulations were eased, taxes were reformed, interest rates dropped, financial institutions got involved; the middle class was said to be expanding and the builders and developers geared up to compete.”



According to research by Jan Nijman , since 1998 housing construction in greater Mumbai has grown at an average of 15 to 20% a year, and nearly 200.000 homes were added to the city in eight years between 1998-2006, with 50,000 of those being completed in 2004-05 alone. The buildings constructed in 2004-05 alone account for twice the number of units built by the largest government slum redevelopment policy in Mumbai. Most of this new development took place in the northern and eastern suburbs, away from the older and more congested parts of the southern part of the city. Most of this new development comprises of high-rise apartment complexes built out of reinforced cement concrete, sporting embellished façade design.



Housing is generally considered the single biggest consumption item for any household and India’s consumer led revolution is therefore closely associated with these watershed changes in the housing market across major urban areas in the country. In prevailing narratives, proper housing has finally come within the reach of large segments of the population and the housing construction boom is seen as a reflection of household incomes and an expanding middle class. It is true that the new residential real estate market has allowed large



numbers of people to move into larger and better quality homes. But, who are these people?

A SIGN OF UPWARD MOBILITY?

According to a another survey of 1200 households in residential complexes constructed after the year 2000, the incomes in the new developments were found to be considerably higher than those in Mumbai in general. The median income of households in newly built homes is about Rs. 400,000 (~\$10,000), which is about three times as high as the median household income of the general population of the city.

Other findings of the survey (see appendix), however, suggest limited upward mobility of people from the lower strata into middle class categories with sufficient income to purchase new housing. Most developers target a more up-scale market with most new flats in the range of Rs 2.5 – 4 million [~US\$ 58,000-94,000] and the market segment below Rs 2.5 million is small accounting for only 17% of the total new housing stock. *“This confirms that more and more people with perfectly reasonable jobs cannot find affordable housing.”*

Other characteristics of households in these new developments also suggest that an elite and already privileged section are its occupants. [see table] 83% of all these households reported that their parents also currently owned or had owned a home in the city, so they were not first generation home owners, 62% owned a car, about half of them were dual income households and the average age of the male head of the household was 35 years and more than

three quarters of them had college or post-graduate degrees. This data may also be interpreted to say that several home owners in these new development leveraged their access to education and hence high paying employment or their family's prior wealth to be able to afford these homes.

Another survey by ICICI reported that supply exceeds demand in the Mumbai residential real estate market. In 2005 the surplus was estimated at nearly 25% of the newly built square footage. This figure seems starker when contrasted with half the city's population that resides in slums and about 200,000 who dwell on its pavements. The target market for the spectacle of the new high-rises is the same as that of several multinational luxury consumer brands of shoes, clothing and accessories.

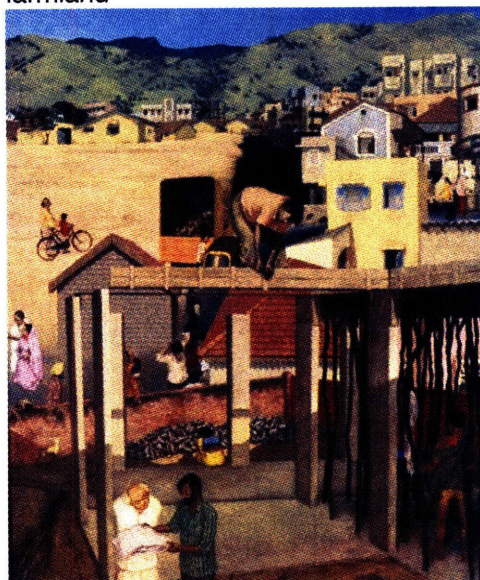
This growth of affordability does not come from the lower strata gaining more purchasing power but rather a rise in the absolute number of people in the middle and upper income stratas and by the rising incomes and purchasing power of the "core-middle", "upper-middle" and high income classes. In other words, the rich becoming richer underlies the new housing phenomena in Mumbai.

THE FRAME AS A DEVICE OF URBANIZATION

The frame, I suggest, has been the fastest device of urbanizing the fringe and the hinterland and bringing it into the fold of the "city". As ex-urbanization pushed the middle class away from desirable urban amenities such as centers of recreations like sports facilities, cultural institutions, even the better restaurants, schools and colleges,



Concrete buildings on ex-urban farmland



35 Town - Oil on canvas by artist Sudhir Patwardhan

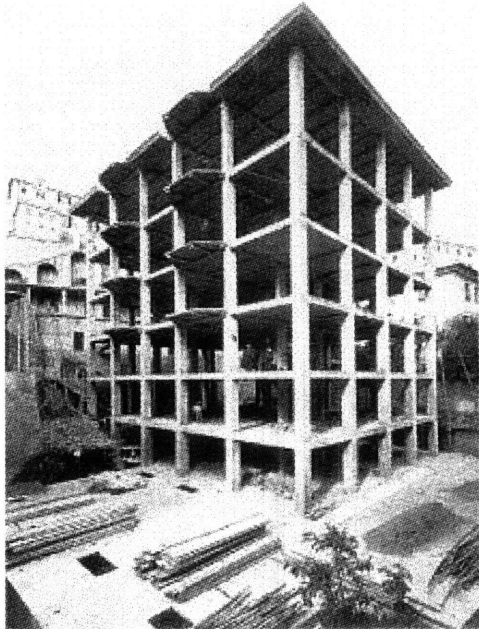
the compensation is a heightened embellishment of the apartment building. Being a purely visual effect – this embellishment is concomitant with the heightened graphical standards of architectural imagery and the quality of developer’s brochures. With the advent of virtual computer generated renderings of architectural environments in the late 1990s, the representation of buildings in developers brochures became evermore realistic and luxurious. These images of building facades suppress the grittiness of the real urban environments, [the buildings shown in isolation without any contextual reference whatsoever] and at the same time attempt to compensate for the city’s inadequacies which increased progressively with northwards sub-urbanization. The facades of these frames have come to encapsulate what it means to be upwardly mobile in a city with grossly inadequate facilities to support even the consumer middle class, much less the disenfranchised lower and poor classes.

The façade implicitly has no meaning with the lived reality of the spaces of the apartment – and from within the apartment is one vantage from which it cannot be appreciated. Like Maupassant’s famous quote about the Eiffel tower, being the only the spot in the city from where it could not be seen - the façade of a building in Bombay is meant not to serve its occupants –rather it exists for the city without and the imagination of those within.

The pixelated city has not created equitable access to housing. Housing development here operates through a process of tracking consumer affordability rather than actual need for housing. Despite a landmass as constricted as the city of Mumbai – and



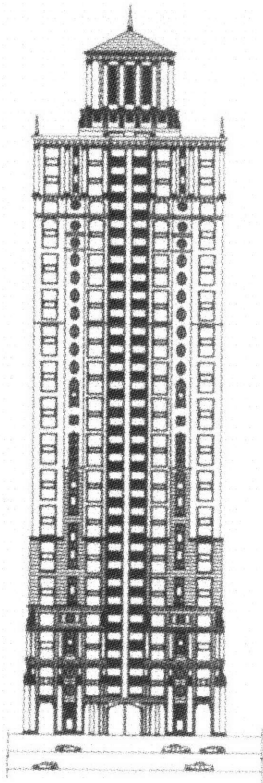
Nullah - Oil on canvas by artist Sudhir Patwardhan



the dearth of developable land, framed buildings dominate more than 80% of the city's landscape and house less than half its inhabitants. The story of the concrete frame in Bombay is one of the progressive relinquishment of the city as domicile to the control of the builder developer.

FACADES AND THE ETHOS OF CONCRETE

In conclusion I suggest that even with alternative imaginations of models of financing and commissioning buildings of domicile in the city, the frame has become the only imagination of the form they are likely to take.



The embellished facades of suburban Mumbai are evanescent and represent the current condition of the ethos of concrete. It is the perpetuation of the paradox of concrete that hegemony – the frame - and ephemerality – the outer wall - will both be wrought from it. The consistency of the frame in a serialized productive ethos, that taps labour and design conditions unique to Mumbai, enables its ephemerality, which does not impinge on the production of the basic lucrative unit – the apartment cell. In the present time it has taken the form of the double wall façade that literally and figuratively hangs on the generic frame. It is this ephemerality, right now made of concrete, that in turn perpetuates the hegemony of the frame, by bestowing upon its generic form the ability to reappear in renewed external incarnations.

HENNEBIQUE TO THE SPECTACLE OF
MUMBAI'S FACADE

ENDNOTES

¹Evenson, Norma, "*The Indian Metropolis*", p 143, quoting W. R. Davidge, *The Development of Bombay, Town Planning Review 10* (Feb 1924)

²Manohar, Prathima, *Hafeez Contractor*, Spenta Multimedia, 2006

³Prakash, Vikramaditya, Scriver, Peter,

⁴Nijman, Jan, "Mumbai's Mysterious Middle Class", *International Journal of Urban and Regional Research*, Volume 30.4, Dec 2006

CONCLUSIONS

This thesis set out to understand urban building form through the crafting of a building material. The preponderance of concrete frame buildings in the landscape of Mumbai, prompted me use the material of concrete as a singular focus to investigate the production of urban form in the city. The preferred form of concrete in Mumbai – the frame, was used as a heuristic device to unearth a plurality of narratives surrounding the siting and making of concrete buildings in the city, to ultimately explain the genesis and production of its built form.

The evolution of concrete construction into a standardized global technology, beginning from discreet localized processes also coincided with massive global need for fast paced construction to facilitate reconstruction after war and nation building after the freedom of several countries from colonial rule. This leveraged the wide spread application of concrete in building construction. As a material it could be handled by unskilled labour and built into a system that fulfilled basic necessities of housing.

The process of urbanization of vast numbers of people in developing cities like Mumbai, then created an urgent demand for housing in large cities, and also supplied the labour for building. The exigent conditions of housing demand as well as the availability of cheap labour perpetuated the use of concrete.

The standardization of the material of concrete into the system of the reinforced cement concrete frame both facilitates and is reflective of the advent of

modern urban living. As worker and family housing, the celluraization of urban living into apartment blocks was facilitated by the frame.

If the preferred from that a material takes from a myriad of possibilities encodes the motives and desires of a culture. Concrete's innate possibilities made two cities of domicile, the Roman and the modern. Their forms representative of the meanings of publicness and domesticity in the two eras. In a city like Mumbai, concrete, through the form of the frame represents the advent of privacy in the urban landscape – the privacy of space as well as capital.

CONCRETE IN MUMBAI [BOMBAY]

A casual glance at history will show conclusively that a new architecture invariably comes with a new constructive material and here we are with practically none.

In its imitative and plastic abilities concrete betrayed the law of materials. It turned out to be a material without a language of its own, without an inherent suggestion of the forms that could be constructed from it. But it is exactly for this reason that concrete can be called a truly social material. Out of a myriad of possibilities, we see today one form in clear predominance over all others, and this was a result of choice. The debates between the Hennebique and Cottancin systems exemplify the effect of choice on how the frame came to privileged in widespread use over the plasticity of concrete. Today, it might be said that the frame has become the “*natural*” form of concrete.

Bombay, as a city without a deep history, received the new form of the frame on a relative tabula rasa. The frame, it could be said is the vernacular form of Bombay. At the level of the building, the plot and the city plan, we see a uniquely Bombay influence on the production of the frame building, and in turn the effect the frame building has on the city's plan.

THE SPATIAL ETHOS

The spatial ethos of the frame is the evolution and governance of the immediate surrounds of the frame - the space in between buildings in the city as well as the terrain of the entire city. It is through this spatial ethos that we see the influence of Bombay's colonial past on its new vernacular, which has nothing stylistically in common with the colonial architecture of the city. While the physical form of the building doesn't reveal the city's colonial past, it is invoked by the bye-laws that govern the "*space in between*" and "*around*" the concrete buildings.

THE PROCESS OF PIXELIZATION

In Mumbai we have seen the pixelization of the city's terrain, in lieu of a physical armature for the city. Hilberseimer's assertion that in the capitalist ethos – the city would be formed of an accretion of cells, serially multiplied to form entire cities is exemplified here.

I have shown that rather than being conceived of as a master plan at any stage in its history, Mumbai is the result of a piecemeal but serial subdivision of the city's terrain driven by the prospect of commercial gain. The driver of this subdivision being the saleability of the land, and subsequently the prospect of

the building lucrative real estate on it.

No figurative plan alone translates into the intensions and polarities enshrined in it, without the governance of the development of that plan. And no ordering system such as a grid which is without inherent hierarchy, ensures a fair city, independent of the powers that develop it.

In Bombay, however, we see the physical form a city takes in the absence of a master plan, almost exclusive driven by the intentions of its developers, represented by both the state and the city's builders. I argue that the ultimate form the plots of the city take is based on the type of built form that is expected to occupy it. This built form, the concrete frame building is also the end goal of the developers whose influence reverse-engineers the plan of the city, and promote its pixelization to facilitate the construction of the buildings.

Even beyond the direct pixelization of the city's plan, the progressive conversion of sites on the city's peripheries and edges with wetlands is driven by the intent to erect buildings for commercial profit, thereby tying the concrete frame building to the growth of the city as well.

THE ETHOS OF CONCRETE – AND A REVEALING ABSENCE

Would steel frame buildings built for commercial gains not have the same effect on the city form? I argue that if the use of steel had been a viable option in the city's construction industry, it would be representative of a larger social condition where the

pixelization of the city would not occur as it does under the present regime of concrete.

As I have shown, the absence of steel is a sign of the absence of industrial capacity in manufacturing high quality structural steel elements, which is an advanced technological process. It is also a result of the absence of local knowledge in steel construction, usually generated through research, the inability to produce precisely manufactured elements and a dearth of skilled constructional labour.

I argue that the reversal of all these conditions would both entail and signify a broader societal change. The conditions of the presence of a skilled labour force in construction, evolution of a precision industry and indigenous know-how in steel would perhaps not co-exist with corrupt urban governance which permits the pixelization of the city as per commercial interests. When the abundance of cheap surplus labour in India changes, it will fundamentally change the productive ethos of its urban form. We will see this societal change registered in the form of Indian cities. Until such a time, the production of the concrete frame as a profitable commodity will define the process of urbanization in cities like Mumbai, serially pixelating any figurative intention.

While smaller schemes within the city may assert a micro-figure in its larger pixelated plan, this alternative will exist within the ethos of the frame, with architectural registration appearing in the interstices of its productive project.

THE PRODUCTIVE ETHOS OF THE FRAME

While the analysis of the thesis suggests that ineffectiveness of architectural attempts at the level of the city plan, it asserts the building as a site for the registration of architecture in the city. The stake that architectural design has retained in the city of Mumbai resonates with Le Corbusier's identification in his Dom-ino system of the frame as an a priori condition that architects would have to work with. Design was then both the crafting of the façade, that had been disengaged and hence liberated from the structure, and the ordering of the interior space. Mumbai however shows a reversal of his expectation that controlling the unit of the building would lead to entire projects at the scale of the city for the architect. With the city developed in a fragmented and staccato manner by the authorities and developers, the urban project that comes to the part of the architects in Mumbai is the crafting of the appearance of the city through its buildings, the scale of the city being governed by an undrawn plan of commercial interests.

The production of the appearance of concrete buildings reveals the peculiar state of commercial architectural practice in the city. A combination of professional practice and informal artisanal craft combine to make the present regime of appearance of buildings in the city. It also reveals yet another duality within professional architectural practice of precise drawings at the level of the buildings structure, and the approximated simulation of borrowed imagery at the level of the façade.

If the informal nature of labour, employed to

construct the structure of the frame buildings, is the underpinning of the perpetuation of concrete in the city, the use of informal artisanal labour enables the reinvention of the frame in a new avatar, further perpetuating it as well as the general condition of cheap labour.

When the data, showing these buildings as affordable only by the upper classes, is seen alongside this self perpetuating labour condition, we are confronted by fact that the productive ethos of concrete contributes to the social disparity of city. While this disparity is not causal to the forms these buildings take, their production on the mass scale is facilitated by it. If these buildings were truly representative of an upwardly mobile populace in the city, as is commonly claimed, we would see evidence of improving labour conditions and a wider affordability of this housing. Instead, much like the simultaneous advent of outsourced sweatshops and foreign brand commodities in India, we see the invention of newer forms of informal craftsmanship and more embellished buildings. This artisanal labour and the informality creeping into the professional design process should not be mistaken for the revival of the crafts. It is evidence of a society where disenfranchisement of a large section of the population enables a productive flexibility that maintains an uninterrupted serial production of frames in the city, and endows them with evanescent skins.

Finally as I state at the end of Chapter 5 The embellished facades of suburban Mumbai are evanescent and represent the current condition of the ethos of concrete. It is the perpetuation of the paradox of concrete that hegemony – the frame

- and ephemerality – the outer wall - will both be wrought from it. The consistency of the frame in a serialized productive ethos, that taps labour and design conditions unique to Mumbai, enables its ephemerality, which does not impinge on the production of the basic lucrative unit – the apartment cell. In the present time it has taken the form of the double wall façade that literally and figuratively hangs on the generic frame. It is this ephemerality, right now made of concrete, that in turn perpetuates the hegemony of the frame, by bestowing upon its generic form the ability to reappear in renewed external incarnations.

DOMINANCE OR HEGEMONY

The sub-altern theorist Ramachandra Guha contends that neither of the ruling elite classes in colonial India represented “hegemony” as characterized by Antonio Gramsci’s analysis of Western European history where the *state’s natural juridical power exercised by the ruling class was obtained by it either through moral and cultural persuasion of the people or derived from their common consent*. Guha argues that the universalizing tendency of capitalism, which in the western metropolitan bourgeois states had successfully leveled the traditional feudal, social and cultural barriers and inaugurated a new form of social, economic, and cultural ethics associated with capitalist industriousness of all classes, also inevitably required the Western ruling elites to derive their power of dominance from the democratic economic, moral, and cultural consent of the citizens, obtained through persuasion. Thus, according to him, the Western states were “hegemonic” in nature. Paradoxically, this social and cultural

process of capitalism did not operate in India under the British, who founded the Indian colonial state by unmitigated coercion and maintained their claim to dominance by monopolizing the means of violence. According to Professor Guha, this reversal of the Western historical process in India by the colonialists not only seriously limited the universalizing scope of capitalism in India and inhibited the natural formation of an indigenous Indian cultural bourgeoisie on the Western European model, but also disrupted the process of the pre-capitalist social class formation in India, an indispensable historical antecedent to the rise of the capitalist bourgeois class.

How can this analysis be brought to bear on the reading of present urbanscape of Bombay. Its facades are evenscent but have offered an imagination of the appearance of the city which is periodically renewed. From the glass buildings of Bandra Kurla Complex to the facades of Hiranadani Gardens, they have re-conveyed the underlying frame. I argue that the re-invention of the frame in different garbs is evidence of the establishment of hegemony in the city. It is the hegemony of the frame, whose form has been so tacitly accepted that any re-imagination of the city occurs only at the level of imagery. This is a condition that is not unique to Mumbai, but that Mumbai now indigenously creates its own images announces the passing of external dominance, and the emergence of a consensus driven hegemony. For whatever appearance it may take the frame is apriori to the builder on Malabar Hill or the tanner in Dharavi when *reimagining the city*.

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