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DHARAVI

INFORMAL SETTLEMENTS & SLUM UPGRADING



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INFORMAL SETTLEMENTS & SLUM UPGRADING

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National Slum Dwellers Federation



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1_INTRODUCTION

In September 2011 sixteen students and two staff from the Melbourne School of Design spent 11 days exploring informal settlements and slum upgrading in Dharavi, Bombay. The studio was hosted and assisted by SPARC, in collaboration with the National Slum Dwellers Federation. This report is an edited version of the analysis and urban design work emerging from the studio.

At about 223 hectares and housing around 600,000 people, Dharavi is one of the world's largest, oldest and most famous informal settlements. It has grown over the past 50 years from a fishing village on a swampy and unused patch of land well north of the city centre of Bombay to currently occupy a much sought after location at the heart of the expanded metropolitan area.

The standard mode of upgrading in the past has been to demolish sites of about a hectare and construct eight-storey housing (known as a G+7) generally enclosed within a compound wall. The planning backdrop is the Dharavi Redevelopment Project (DRP) wherein private developers were invited to bid for redevelopment rights and required to provide eligible households with replacement housing (of 30 sq metres). This market-led framework has not been successful and following community resistance led by the National Slum Dwellers Federation, a commitment has been made to community-led redevelopment. The students were invited by SPARC to think outside the confines of existing proposals and to imagine alternatives to those proposals in terms of both planning process and urban design outcomes.

The community we studied is a one-hectare neighbourhood known as Navrang that has been labelled 'ambiguous' because it embodies a range of different redevelopment interests and has not formed cooperative housing societies. It is occupied by over 300 households plus a large number of migrant workers who live in the small textile factories that occupy about half of all floor space. While nearly all of the housing in this location is viewed as a slum, upgrading is complicated by the fact that most households own their own house of 2-4 rooms, yet rent out perhaps



half of it and are dependent on this rental income. It appears that the residents of Navrang have proven resistant to upgrading plans largely because they fear the loss of rental income from their existing property.

The buildings are generally of sound construction – single room accretions that have grown over 40 years to a height of 2-4 storeys forming rows lining narrow lanes. Cantilevered upper floors often almost meet above the narrow lanes, however the solid construction and lack of sunlight also produces a relatively cool microclimate. The lanes are too narrow for vehicular traffic and the largest open spaces are about 4 metres wide. The site is framed by vehicular streets of 6-8 metres wide to the north and south lined with shops.

Our initial responses to this place were often conflicting desires to preserve and to replace it. The desire to preserve is linked at once to the aesthetic of informality and the intense sociality, diversity and productivity of the streets and lanes – it is an incredibly interesting and diverse urban assemblage. The desire to erase stems from poor conditions of sanitation, ventilation, light, open space and overcrowding in some areas.

This project seeks to build on previous projects undertaken by SPARC in collaboration with KRVIA – an urban design and architecture school in Bombay. It has become apparent that redevelopment cannot proceed effectively without integrated urban planning and design visions that can test the redevelopment framework and model a range of possible outcomes in terms of density, height, open space, building types, vehicular access, functional mix and so on. In the short time frame of this studio we cannot suggest solutions – our goal has been to analyse and learn what we can about one particular piece of Dharavi and to suggest a range of possible responses in terms of both planning process and built form.



2_URBAN_PLANNING_CONTEXT

While once peripheral to the peninsula city of Bombay, Dharavi now lies at the heart of the metropolitan network of traffic flows, well-served by transportation infrastructure and services. It is immediately south of the high-income area of Bandra and across the river from the new Bandra Kurla Complex, which is intended to serve as Bombay's second CBD. The site lies in the fork of the two major railway lines connecting central Bombay to the larger metropolitan area with walkable connections to three stations. Major arterial roads line all sides.

The history of redevelopment in Dharavi is well covered in the booklet Re-Dharavi (SPARC/KRVIA, 2010). Briefly stated, the current framework is to provide redeveloped housing (30 square metres per household) for all eligible households through a market-led strategy that seeks to utilize high potential land values as a means of upgrading existing housing while also leveraging profit for both the state and private developers. The planning tools involve the application of a Floor Space Index (FSI) coupled to Transferable Development Rights (TDRs).

The FSI (known elsewhere as a Plot Ratio or Floor Area Ratio) is the ratio of constructed floor area to site area. The redevelopment framework determined that Dharavi have an FSI of 4, compared to 2.5 in other slum rehabilitation projects (for comparison, suburban densities often have an FSI below 0.1). If developers do not utilize the maximum amount of FSI, the excess FSI can be transferred to other developments within Bombay but north of Dharavi through TDRs. TDRs can also be sold. Since the existing FSI of the informal settlement is about 2, the redevelopment framework enables substantial increases in density.

The idea behind the Dharavi Redevelopment Plan is that the value created by the FSI and TDRs would enable developers to buy the land, provide free housing for eligible households, invest in municipal services and also profit from private development, both on-site and elsewhere using the TDRs. It has been estimated that if the land could be cleared and sold then it would yield the government \$US25 billion. Anticipating such profits, in 2007 the Maharashtra Government initiated a master plan that divided Dharavi into giant sectors and called for private tenders. A combination of the GFC and resident resistance to this plan has ensured very little redevelopment.

While a small proportion of Dharavi is privately owned, most of Dharavi is legally owned by the State. It should be noted, however, that most of this land has long been occupied by a very dense and substantial informal settlement and all of these houses are owned by the families who built them. In some cases occupancy of the land dates from the mid-nineteenth century. The Plan originally proposed that families that could prove residency prior to 1995 would be eligible for free rehabilitation housing; in the face of significant opposition the Government has proposed to revise the eligibility date to 2000. Estimates as to the number of eligible households range between 57,000 and 90,000 families, however, 30%-40% of the existing population would remain excluded from the redevelopment, including recent owners, renters and migrant workers.

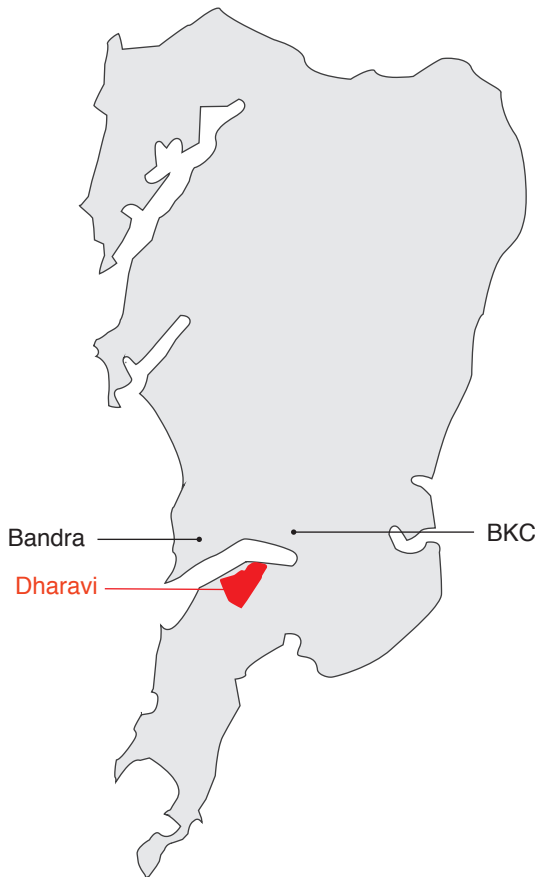
A distinguishing feature of Dharavi has always been its production and commercial activity - 80% of those employed work within Dharavi. This is primarily an informal, decentralised production process relying on a network of small, home-based production units that provide space for recycling industries, leather tanneries, heavy metal work, manufactured goods like garments, shoes, luggage and jewellery, and even the production of WHO certified surgical thread. These products generally serve all of Bombay, and many are distributed into global markets. One estimate places the annual value of goods produced in Dharavi at US\$385 million – 288 million. While potential developers undertake to provide space for economic activities, it is generally anticipated that this will serve only a small proportion of existing economic activities. This contributes to resistance to the redevelopment plan

Resistance to the Dharavi Redevelopment Plan was led by several resident groups

and the Alliance of SPARC, NSDF & Mahila Milan. Residents were anxious about the master plan and frustrated by the absence of community consultation and involvement. Their concerns were expressed through a number of peaceful protest marches and grass roots campaigns.

In 2010 an alternate strategy was outlined by SPARC/KRVIA in the publication 'Re-Dharavi' where they argued for a smaller grain approach that recognized the existing nagars, chawls, and co-ops of the informal settlement. The giant sector size of the master plan was broken down to a more incremental process with high levels of resident participation and community control. The report embodied a critique of the FSI controls and argued that the FSI of 4 was far too high to be achieved on-site. Key issues to emerge included the displacement of residents who did not meet eligibility requirements, the loss of industrial and commercial activity and the loss of rental income when rental space was not replaced.

Greater Mumbai



Dharavi - divided into 5 sectors



Navrang Community



3 SOCIAL & ECONOMIC CONTEXT



The one hectare study site of Navrang is home to around 300 households plus a large number of migrant workers who live in the production rooms in which they work. The community is highly socially mixed in terms of ethnicity, religion, caste, age and gender. Both Hindu and Muslim communities are substantial with a mosque on site and a Hindu temple adjacent. Many of the residents are transient with a large number of renters and male migrant workers. Some residents suggest this transient population creates a feeling of unsafety and restricts the movement of women, however, it is also often geared to the flows of rental income upon which they depend. This is a key issue that has produced ambivalence towards redevelopment.



The current planning framework is largely based upon resident needs (rather than rights) and determines that all long-term residents shall be 'given' a 30 square metre apartment to replace the house they currently 'own'. Migrant workers and residents who rent are excluded from redevelopment along with those who have 'bought' property since 2000. Long-term residents have often constructed a 3 or 4 room house (as a vertical stack of rooms) over a long period of time and they often rent parts of this space to either other families or industry. The current planning framework has no place for this mix of uses in the redevelopment scheme.



Dharavi in general is a major site of informal manufacturing production with different neighbourhoods specializing in the production of recycled plastics, pottery, textiles and surgical thread. Much of this industry is conducted in sweatshop conditions in terms of heat, ventilation, safety and overcrowding. The exploitation of cheap labour is enabled by the unregulated informality of the informal settlement. The employment generated by these industries is a major driver of rural-to-urban migration and many rural families will slip into poverty if it is lost. These industries are interconnected within Dharavi through intricate networks of local suppliers and vendors. The working conditions within our study site are better than many parts of Dharavi since they are almost entirely textile related – clothes and accessories, embroidery and wallets and belts.

The site currently comprises close to 1000 rooms, of which approximately 50% are used for industrial production and migrant housing - rented from the long-term residents who built them. The flows of rental income are regarded as crucial to their future – particularly their children's education – and many are reluctant to agree to any redevelopment that does not sustain this income. The conundrum is that residents are unlikely to agree to lose existing housing and rental income; yet the redevelopment framework has no scope for the replacement of rental space.



There is a very limited provision of local schools, libraries, community space or childcare. There is one community room on site but very little open space. There are two communal toilet blocks on the site and no private toilets.

Most families live in a single room house of about 15 square metres with many in spaces of no more than 8 square metres for five people. This space will generally incorporate a large amount of storage and can only function through time cycles where the single space becomes kitchen, dining, living and sleeping in sequence. Increasing their living space is very important to residents, but is balanced against the desire for rental income. Residents have both material and emotional investments in the buildings and interior spaces are often richly decorated and personalised. Migrant workers sleep on the floor in the rooms in which they work (about 5 per room) and generally use street vendors for food.

ACTOR NETWORKS

The research and interviews we have done suggest eight key ‘actors’ with different sets of interests in the use of space and possible outcomes of redevelopment. The series of vignettes that follow are not specific people but are constructed from interviews.



NM



MR



IF



NR



RESIDENTIAL OWNER

Hadiya, along with her husband, built their G+1 house more than 50 years ago. It is now shared with other family members including 3 sons, 3 daughters-in-law and 5 grandchildren. While Hadiya, and her daughters-in-law attend to domestic duties, her sons generate income for the household as an electrician and rickshaw drivers. Her husband has been unable to work due to poor health. Hadiya and her husband occupy the ground floor at night. Her 3 sons, their wives and children live in the space above which is partitioned for privacy.

Dharavi has been her family home for many years - she likes the local Mahim school that teaches English and has good credentials. Hadiya's concerns include limited space for children to play and the public hospital is too far away. She recounts feeling unsafe with so many male migrants in the neighbourhood plus a sense of unease at her family being a Muslim minority in an otherwise Hindu area. Yet Hadiya is happy where she is and does not wish to move. She would support redevelopment if her family were offered space equivalent to or better than that currently occupied.



RESIDENTIAL TENANT

Umila has lived in Dharavi for 25 years after migrating with her family as a teenager. She has lived for 10 years with her husband and four children in a ground floor room of 18 square metres which she rents for Rs3500 per month. This space is used for eating, sleeping, living and working - she says she is happy with the size.

Umila works from home preparing lunches for migrant workers. She buys produce from a local shop and currently supplies 80 workers with their lunch every day. Until 10 years ago Umila lived and worked in a room half this size which she said was very difficult. She sends her children to school, but cannot afford the well-credentialed English schools and is concerned that her children will not have access to college. She has entered an agreement with an NGO where the funds she invests in her children's schooling will be reimbursed (by the NGO) upon graduation. Umila would like to remain in close proximity to her sister and their family, and would like a safe playground for the children.



INDUSTRIAL TENANT

Ishmael is the owner of a wallet-making business who lives in outer Bombay but rents space in Dharavi for his business. He sources his leather from local suppliers. Currently he has a contract with a handful of shops and stalls who sell his wallets in Bombay. His business employs six wallet makers who work six days a week for Rs150 per day. The space in which they work is a 15 square metre room with stair access and a window for light and ventilation.

Ishmael rents space in Dharavi due to its close proximity to suppliers, clients and because rent is cheap. He is open to the idea of redevelopment but needs space for his business with access to supplies. His priorities are economic; if displaced from this rental space he would seek other rental space in Dharavi.



INDUSTRIAL OWNER

A long-term resident of Dharavi, Akhil has used his knowledge of the area to establish a business manufacturing women's shoes. He bought a G+1 building in 2006 and now employs 12 migrant workers from villages outside Bombay. Akhil sees his business as integral to Dharavi and as employment for the migrant workers. As a recent owner, Akhil does not have the identity card required for inclusion in redevelopment plans and he fears he will lose both his business and his building. He sees the current system of entitlement to redevelopment as flawed, since those who bought space in the last ten years will be forgotten. Akhil understands that change in Dharavi is inevitable and wants to fight for the retention of industrial space in the redevelopment plans.

LANDLORD

Sabal is aged in his early twenties and lives on the ground floor of a three-storey building with his mother and sister. The family owns the two storeys above his home and the G+1 structure next door. Sabal rents all of these spaces out to industrial tenants who currently include two textile manufacturers and a wallet maker.

Sabal is studying for an IT degree at university. While he is currently Hindu, he plans to convert to Christianity in a year's time. He says does not like believing in many Gods, but also alludes to the fact that he is of a lower caste and it affects his future opportunities. Sabal opposes redevelopment in the Navrang area. His extended family is spread out through his 'nagar' and would support upgrading only if his situation could be preserved.



COMMERCIAL OWNER

Rashmi has lived in Dharavi for most of her life and began building her current house with her husband 36 years ago when they were about 20. Since then they have added three further floors to make it a G+3 structure. Rashmi lives in and runs a shop on the ground floor with a partition separating commercial from living space. She rents the two rooms above to embroidery businesses. The money she has earned from her rental and commercial spaces has been used to support her three sons.

The conditions in Rashmi's area have improved - flooding during monsoon season once inundated the shop and surrounding homes. Rashmi and her family are happy with their situation and do not want to move. They have invested a great deal into their home and now receive good revenue from the shop and rented spaces above. Any redevelopment would mean a significant loss of income.



COMMERCIAL TENANT

Aslam grew up in Dharavi and has lived in the same family home with his eight other family members for all of his thirty-five years. Now with a wife and three sons to support, he rents a small commercial space of 1.6 square metres adjacent to a pedestrian corridor. Here he sells household goods such as detergent, water and rice from a small wooden structure attached to the side of a dwelling. He rents the space from the owner of the attached building.

Aslam aspires to own his own commercial space but fears any redevelopment plans may put this potential out of reach as the value of property would increase. He also fears his rental space will not be transferred into the vision for the new Dharavi, and that the cost of commercial rental space will increase.



MIGRANT WORKER

Aged in his early forties, Ravi works in a small sewing factory. After each six months of work he returns home to his village for a number of weeks where his family rely on his earnings to survive. The factory is three rooms high and employs 16 workers. Ravi works six days a week and sleeps on the floor. Ground floor flooding during the monsoon season forces all production to crowd into the upper floors. Ravi has no objections to redevelopment as long as it does not interfere with his earnings, however, he is largely excluded from any such negotiation. Better working conditions would be seen as a positive benefit.



ACTOR NETWORK ANALYSIS



This assemblage of interests helps to understand why this community is generally opposed to redevelopment and the conditions under which they may agree. In general terms those who own the properties have the greatest long-term interest, but only the long-term owners are included in current redevelopment plans. None of them will automatically benefit under the current proposal because of the lack of provision for rental or for commercial/industrial property. The settlement has evolved into much more than simply a squatter settlement.

Everyone wants more space but as the settlement has adapted over time to provide more space it has largely been turned to rental. The economic interests of owner/occupiers have led to the growth of the textile industry. These residents often prioritize their children's education above internal space standards.

The tenants and migrant workers clearly have less long-term interest in redevelopment and they are largely excluded from negotiation. However, their position is often marginal and they will inevitably be affected. While rental markets are adaptable the long-term effect of redevelopment will reduce the availability of cheap rental while separating residential from industrial and commercial property.

The migrant workers are the least powerful and most vulnerable within this network. Their migration to the city is part of a global migration to cities that is economic in nature and cannot be stemmed. A key task in this regard is to develop upgrading programs that acknowledge this and incorporate strategies that enable integration into urban life.

These actors form an interactive network. The resident owners build the rooms that they rent or sell to industrial tenants or owners who hire migrant workers who buy lunch from residents and goods from shopholders who rent from owners and so on. This is a dynamic but relatively resilient system in the sense that it is constantly changing yet resists wholesale transformation.

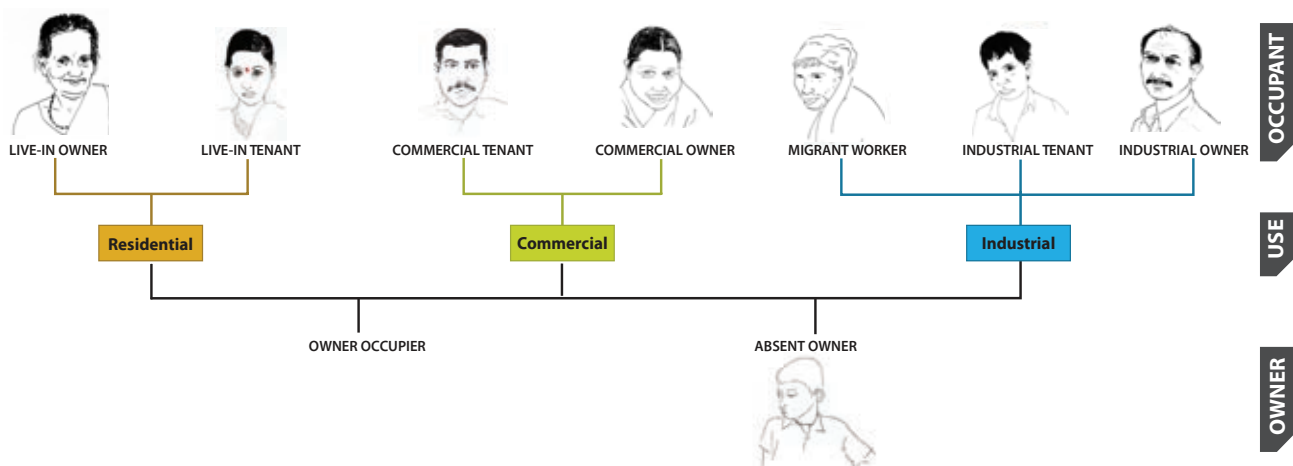


SOCIO-SPATIAL MIX

The stories in these vignettes hint at the complexity of building ownership and occupation in Dharavi. The section below shows a hypothetical distribution of these functions and distributions across the 3-dimensional space on the site. One row of buildings may contain all of the actors in this network.

It is generally assumed in current redevelopment plans that industrial and commercial functions need to be close to the ground with residential property above. The existing situation, however, is much more mixed and industrial functions are more commonly on the upper floors. This is largely because such rooms are rented from owners who seek to inhabit the ground floor. This location is more crucial for housing because the overcrowded interiors are relieved somewhat by the capacity to spill both social life and domestic items into the adjacent laneways during the day. The industrial uses are more self-contained and do not have these threshold functions nor the volumes of entry traffic. Retail functions are clearly linked to ground floor locations but they are also linked economically to residential so that shops can also function as housing and shopkeeping can be integrated with domestic life.

The stories in these vignettes hint at the complexity of building ownership and occupation in Dharavi. The diagram and streetscape below shows a hypothetical spatial distribution of functions and actors in this network.



Typical Spatial Distribution of activities and ownership

4_EXISTING_MORPHOLOGY

Like nearly all informal settlements globally, this part of Dharavi has been formed by a process described variously as incremental housing or room-by-room accretion. This is largely a practice of self-organization where families house themselves – first in a single room with others added over time. A total of 388 individual lots exist on this site with varying floor space and heights. Buildings range from 1-4 floors and the scale of each room or ‘unit’ varies from about 10-30 sq metres with an average of about 15 sq m. The accretion process is both horizontal and vertical - rows of houses have formed into blocks of up to about 10 connected buildings, generally one room thick. In the northern part of the site the morphology suggests that a rough grid plan has been staked out prior to construction with narrow lanes between rows. The additive process on each property has then been vertical – the settlement has intensified to a height of 2 -4 storeys.

The existing morphology of the site with regard to building location and height has been mapped as part of a government survey. While the plan is substantially accurate, the height of buildings is unreliable. While all buildings in Dharavi are unregulated, there is a government edict that no building should be more than 2 storeys high – the survey suggests that this is the case but the reality is that about 35% of all buildings are 3 storeys (G+2) and about 10% are 4 storeys (G+3). The survey shows the locations of community buildings and retail but not industrial production.

The increment size of a 15 sq metre room is a global norm with many variations - limited by the size and weight of materials as well as cost. The height limit of four floors is also self-organized – beyond three levels both access and construction



Existing pedestrian network and grain size (Source MHADA survey)

rapidly increase in difficulty. Upper floors have often been added to provide rental income for the owners of the ground floor with external access provided via a ladder that enters a cantilevered upper floor from beneath. This system cannot easily continue beyond 2 storeys and the third and fourth levels are often accessed internally. This in turn reduces the adaptability of the building since upper floors must be used and rented as clusters rather than single rooms. Thus the self-organized system of room-by-room accretion and individual access to upper floors reaches its limit at four levels. Since ceiling heights are not high, the settlement peaks at about 11 metres.

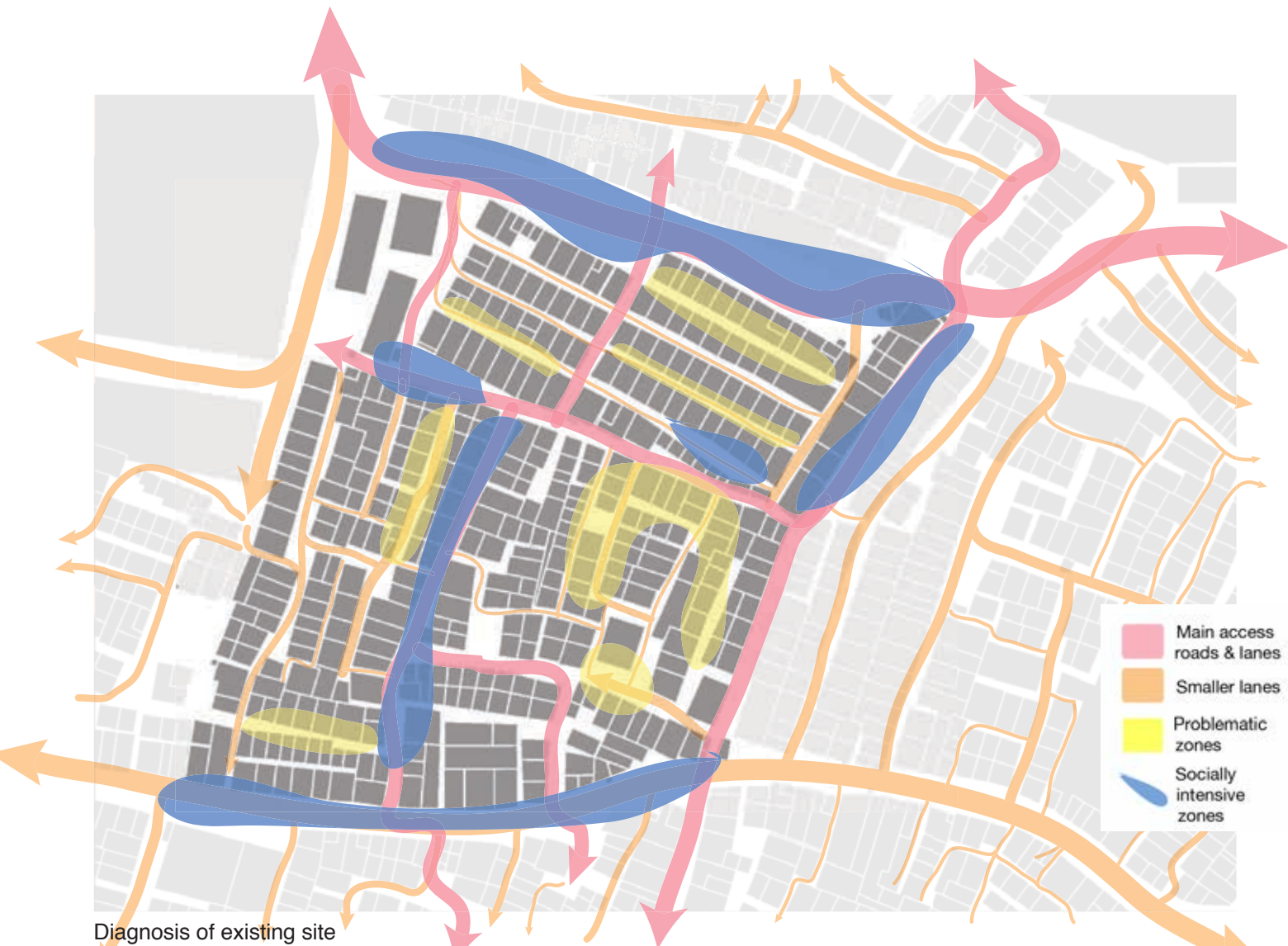
The site is framed by vehicular streets to the north and south with an intricate network of laneways connecting the 100 metres between them. This network of public space varies from the narrowest lanes of a half-metre to the broadest streets of about 8 metres width. While there is no clear street hierarchy, these streets and lanes differ markedly in character as they change scale.

DIAGNOSTIC MAP

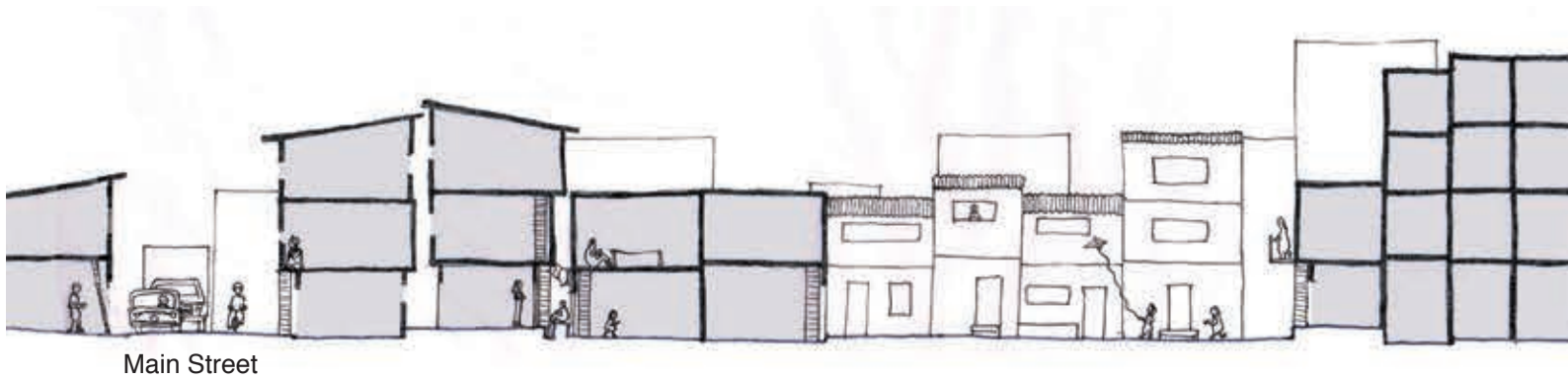
The map below shows a diagnosis of the existing site indicating the main access lanes, problematic zones with poor light or ventilation and the areas of intensive social activity.

OPEN SPACE AND COMMUNITY FACILITIES

There is very little open space on the site and most of this is little more than interstitial space or occasional widening of laneways. There are 2 blocks of sanitary facilities for common use.



Diagnosis of existing site



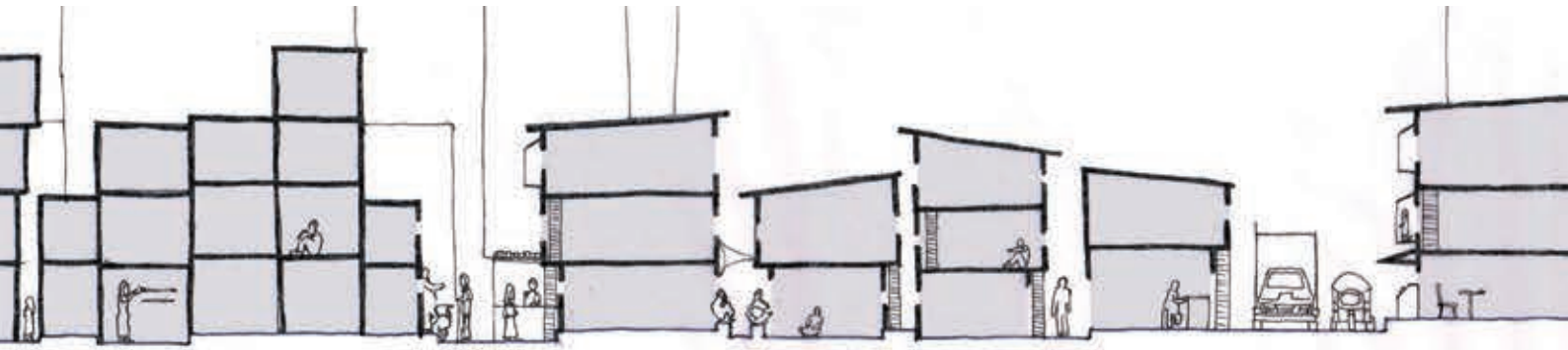
Main Street



[Illustrations: Annie Harrison]

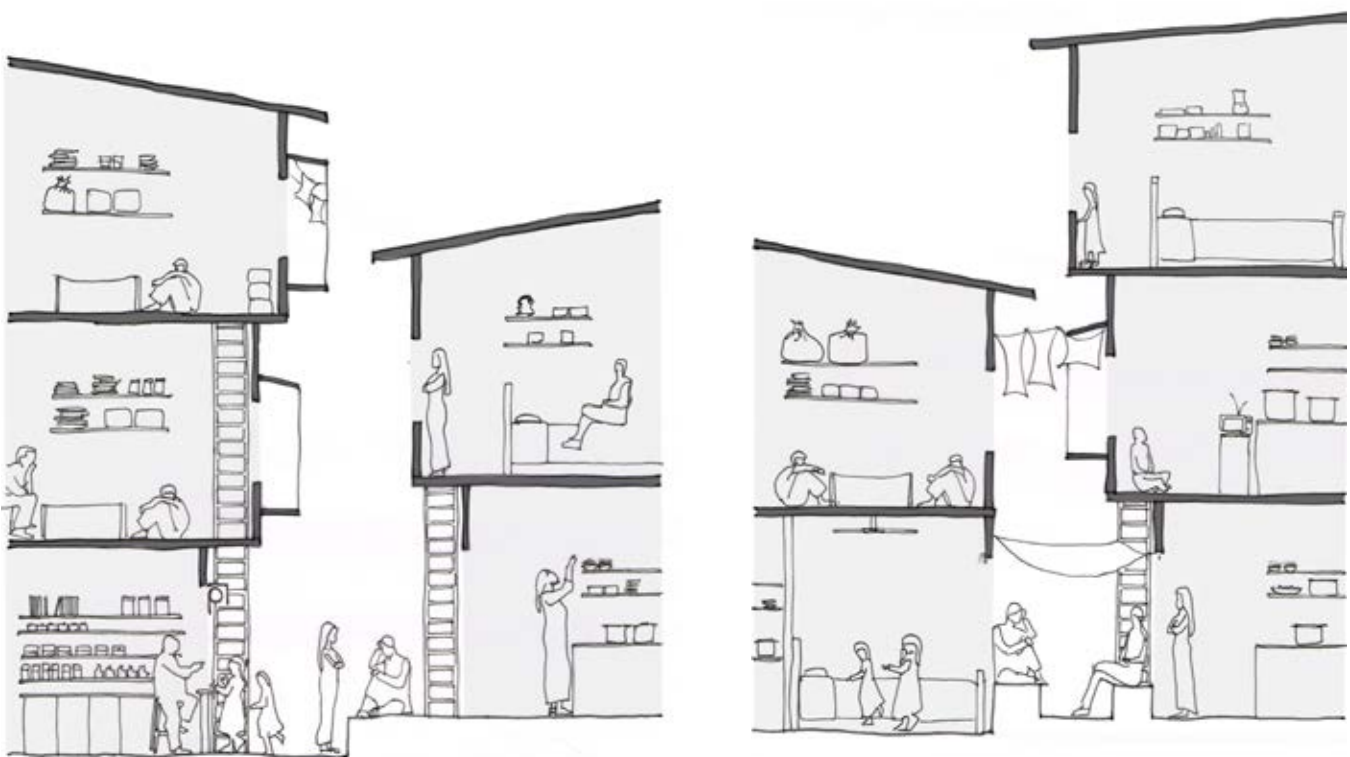
MAIN STREETS

Main streets are at least 6-8 metres wide but with an irregular shape that appears to have been produced by the demolitions necessary to provide vehicular access. The small alcoves along the edges have generally become pedestrian eddy spaces. These main streets are lined primarily with 2-3 storey buildings with shops or commercial enterprises on the ground floor. These streets are thick with pedestrians – dominated by adult males to some degree but with a strong presence of women and children. The street becomes noisy when vehicles move through, tooting constantly in the pedestrian traffic. The eddy spaces along the edge are particularly valuable as pedestrian retreat and social space; some have street furniture that prevents parking. These main streets are the spaces that connect this community to the larger city and they are vulnerable to increases in vehicular traffic and parking.



Main Street

FULL SECTION OF SITE



LARGER LANEWAYS

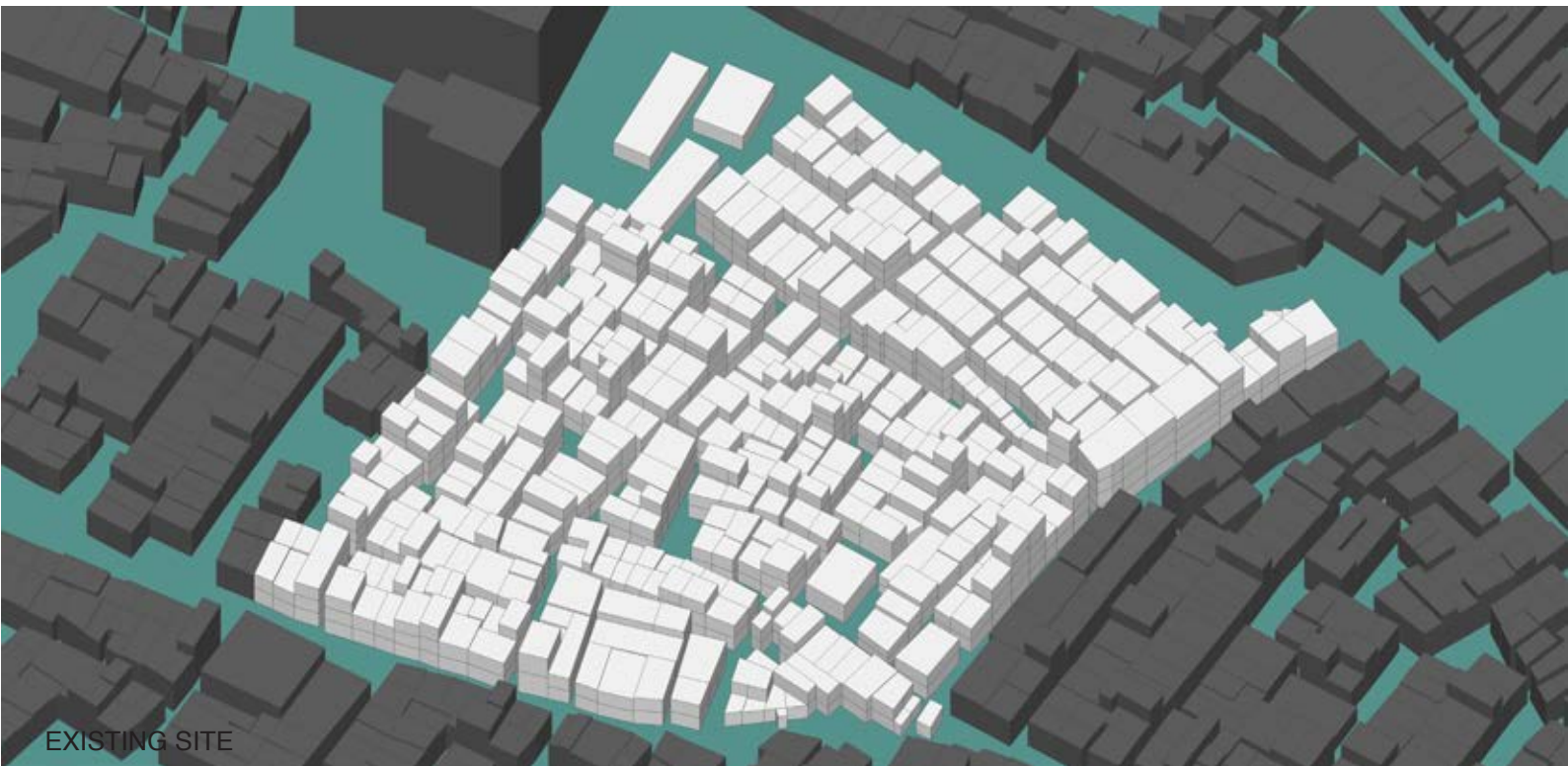
The larger laneways are 2-3 metres wide and lined with building entrances on both sides. Entries are usually set up behind a narrow plinth that serves as flood barrier, entry porch, seat, work platform and storage. These plinths are also the base for steep stairs or ladders that provide entry to the overhanging upper floors. These lanes are often bridged with colourful washing lines; they can be highly social spaces and quite beautiful streetscapes. Elsewhere in Dharavi are examples of broader lanes of 4-5 metres which, if protected from vehicular traffic, are often vibrant social spaces.

SMALL LANES

Smaller lanes range from about .7 to 2 metres wide. The smallest of these are minimal urban passageways without entry transition, storage or social life. At 2 metres wide the lane allows some transition space and ladders to upper floors but the overhang means that upper floors are at times almost joined.



NM



EXISTING SITE



KD



ECC



NM



KD



KD



5_CONSTRUCTION

The prevailing construction throughout our site and most of the informal settlement can be described as room-by-room accretions in rows with each building extending between 2-4 rooms high. This is thus a micro-construction industry that is adapted to the narrow alleys and lanes where vehicles cannot penetrate. There are some rare examples where it is clear that more than one room has been constructed in a single project – these may involve the collaborative upgrading of up to 4 adjacent houses.

ACCESS

The 4 storey limit is partly a result of limited access. Construction in these areas does not require cranes – materials are brought to the nearest location on trucks or hand-carts and hoisted up the existing building as each room is added. All of the newer high-scale developments have been constructed adjacent to main roads with vehicular access.

STANDARDS

Standards of construction vary markedly across Dharavi but are generally far more sound and permanent than in most newer informal settlements.

MATERIALS

Ground floors are generally concrete with a ceramic tile or stone finish. Ground and first floor walls are commonly brick or concrete block with a painted cement render; interior surfaces may be tiled. Upper floors may be timber framed with metal, plywood or fibro-cement (asbestos?) sheeting. Upper floor construction is commonly steel I-beams (spanning 3-4 metres) with concrete or timber flooring finished with tiles or render. Roofing structures are also steel I-beams or occasionally small trusses for longer spans. Roof cladding is commonly metal or fibro-cement (asbestos?) sheeting and may be covered with tarpaulin sheets for additional waterproofing.



OVERHANGS

Upper floors are generally cantilevered with an overhang of about 500-800mm which serves a key function of enabling an external ladder access for rentable space. The cantilever is generally achieved with small steel I-beams. On the wider laneways the overhang provides a narrow porch/seat/storage/work area. In narrower alleys the overhang blocks light and ventilation, and can be a hazard for those walking beneath.

PROCESS

Almost all construction is micro-scale – one room at a time. Additional levels may be constructed by erecting a working platform. Once the supporting brick walls are constructed, they are topped with either steel girders (in the event another floor is to be added), or metal sheeting to form a roof.

RETENTION OF EXISTING STRUCTURE

There is little evidence of buildings in a state of collapse; much of the building stock has served for over 30 years and need not be demolished for constructional reasons. Existing brickwork construction in some areas could be strengthened with thickening or steel sections to create greater rigidity and capacity for additional floors. This could reduce the amount of new construction that is required and speed up the redevelopment process. Demolition of asbestos roofing carries a serious risk.

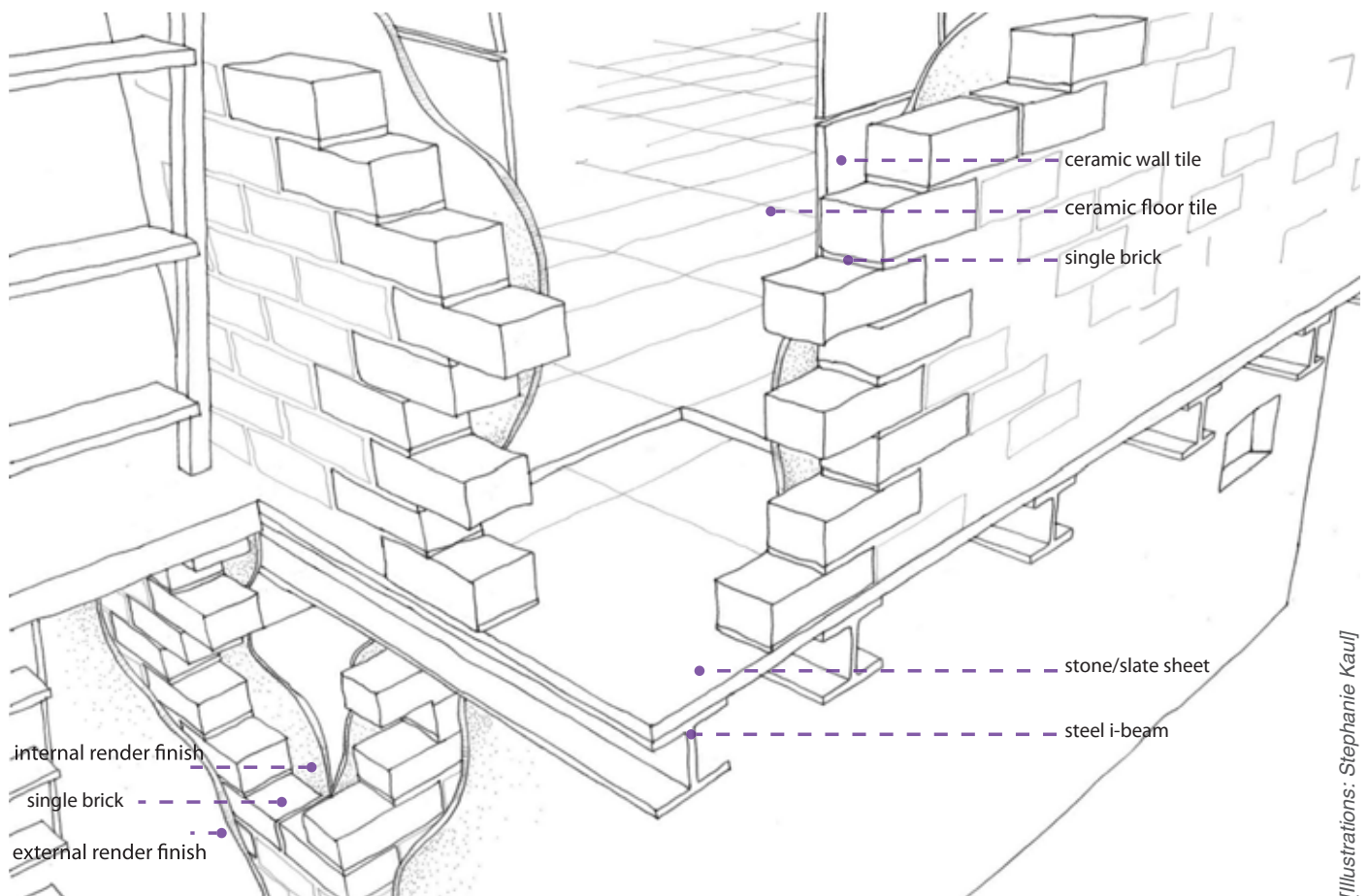
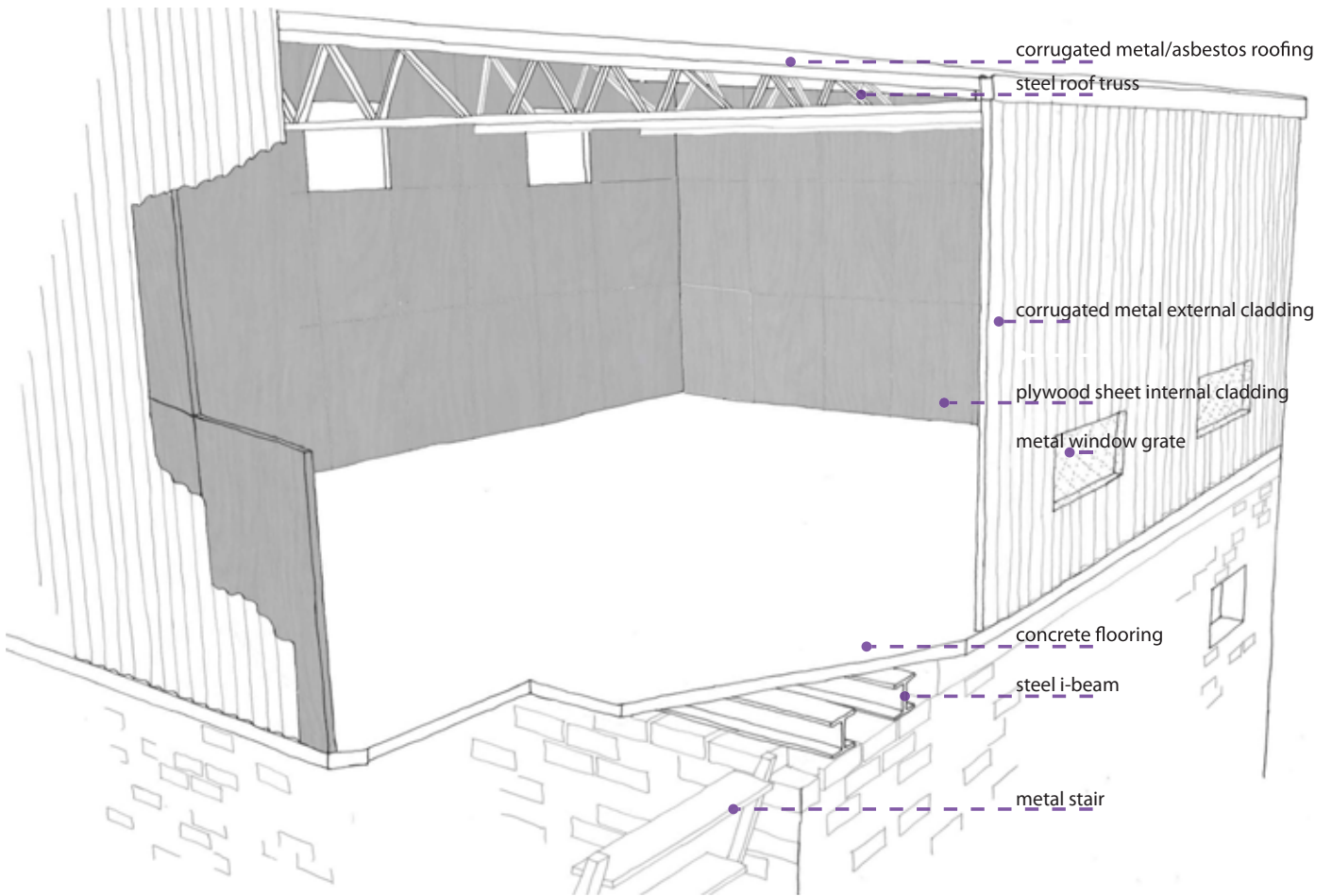
BUILDING TYPE

The construction type of single rooms in rows reflects the fact that internal ventilation is crucial to thermal comfort. While there are some sections of the site where rooms are joined on three sides, these are in the minority and these interiors have very poor ventilation.

REDEVELOPMENT

A post and beam construction system could be well-suited to redevelopment since it leaves space open between columns and allows for incremental change and adaptation with a variety of materials and elevations. The use of repeated structural elements would be cost effective and such a system could be inserted into the existing morphology with small spans (between 3 and 5 metres)





[Illustrations: Stephanie Kaul]

6_CRITIQUE_G+7

The G+7 is the common name for a number of rehabilitation projects that have adopted an eight storey building type – often with community and commercial uses on the ground floor and 7 floors of apartments above. Most residents of such projects have been resettled from other parts of Dharavi but many have also moved from nearby settlements on railway easements and some are former pavement dwellers. Most such projects are enclosed within compounds with restricted access and where commercial operations are difficult; others merge directly into the streetscape with ground floor shops. The building form often wraps around a courtyard or semi-enclosed open space. We were able to visit some G+7 projects and interview a small number of residents.

INTERIORS

Many of the apartments have a 4.3 metre ceiling which includes a mezzanine level of 1.5 metres. The design of higher ceilings was the result of pressure from residents and NGOs to incorporate some of the upper level space that was otherwise lost in the move from the most common two-storey buildings to the apartments. The mezzanine level is generally a sleeping loft or storage. One 3 generation household (with 9 residents) had extended the loft across the entire room and divided the upper level into 3 closet sized bedrooms for the married children and grandchildren. The single entrance largely prevents the loft from being rented or used for industrial purposes. Each dwelling that we visited had a toilet.



[Illustration: Andrew Yit]

Typical apartment

RESIDENT SATISFACTION

The residents interviewed consider the apartment to be an improvement on their previous housing. Most of this satisfaction focused on the interiors and the sense of having moved out of the slums. These apartments are also regarded as generally safe and peaceful compared to the neighbourhood beyond the compound with better sanitation and kitchen space. Many residents have the same neighbours they lived with in the slums but they also enjoy a higher social status. These views are from a tiny sample and may not be representative.

SEMI-PUBLIC SPACE

There is a dramatic difference between the semi-public spaces of the informal settlement and the G+7 upgrade. Here the single-loaded corridor access to and between apartments is well maintained but there is little vitality. The sense of domestic, social and economic activity spilling from entrances into the laneways does not occur in these corridors. Domestic space is less integrated with public space and the semi-private spaces are largely reduced to a single function.



[Illustration: Andrew Yit]

Typical apartment with loft



ELEVATORS

Elevators are often broken due to poor maintenance so some residents are regularly faced with a long climb for access. All residents pay the same maintenance cost but have vastly different levels of reliance on the elevators. The high ceilings (allowing for the loft) of most of the apartments exacerbates the problem because the first five floors are already the equivalent of eight floors. Five storeys is often considered the limit for buildings without an elevator but eight floors may be an unfortunate height in the sense that it is just below the level at which a dysfunctional elevator could not be ignored.

ENCLOSURE

Many of the G+7's in Dharavi are enclosed in high walls that mark a clear distinction between old and new developments. This enclosure is seen as desirable by residents for many reasons including cleanliness, security, status and symbolic ownership. The street level spaces, although often neat and tidy, are devoid of the rich multilayered social interactions that can be found beyond the wall in Dharavi's streets. With their setbacks and modernist forms they are reminiscent in some ways of public housing projects in rich cities of the West that have long been deployed to keep the poor at a distance from the rest of society; yet here they are formed from a desire for retreat.

The creation of large enclaves at ground level can also be disruptive of the richly interconnected spatial structure that is crucial to the social and economic vitality of Dharavi. Just northwest of our site is a cluster of five buildings within a single compound that blocks these flows for over 100 metres. Not all G+7 redevelopments are in compounds - some of these blocks are integrated directly into the street network where the ground floor becomes retail and the network is largely maintained.



EFFICIENCY

The commercial viability of the ground floor has been compromised by being disconnected from the wider traffic flow and the open space at ground level is very inefficiently used. While the courtyard and fringe areas of the compound are large enough for social life and children’s play they seem little used compared to the informal settlement.

DENSITY

While the FSI of the G+7 is usually about double that of the informal settlement (4:1 vs 2:1), this does not produce a doubling of density because a large proportion of built space within the G+7 is consumed by access routes and stairwells. The net density of the G+7, depending on compound size is about 400 dwellings/hectare. If the study site were developed in this manner while allowing for street access, then the yield would be about 300 dwellings – similar to the current density but without the industrial production or the commercial network.



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7_NEW_SPATIAL_TYPES

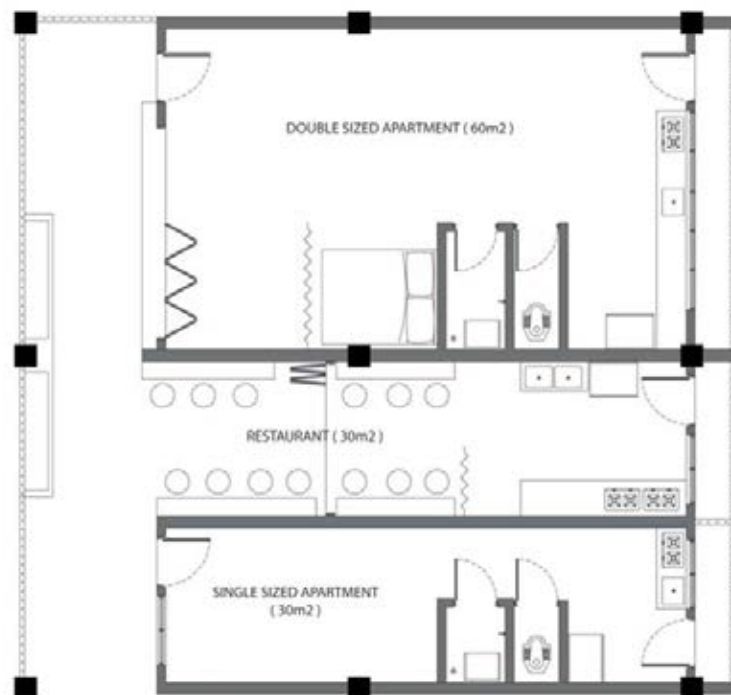
The site is remarkably homogenous in spatial typology due the single-room increments of the construction process; limitations on access and long span materials have ensured that almost all buildings are variations of a footprint of about 3.5 x 5.5 metres (10-20 square metres) and extend between 2-4 rooms vertically. Most buildings are attached on two sides as row houses although some are attached on 3 sides with no cross ventilation. Interiors may be partially subdivided. Upper floors generally overhang by 500-800 mm with external ladder access from the ground floor. Access beyond the first floor may be internal or external.

COMBINE ADJOINING HOUSES

The most significant problems with the current typology are where the houses are adjoined on three sides without cross-ventilation and where the entry adjoins a narrow laneway that lacks light and air. The significant number of such units could be simply adapted by opening up of walls to provide cross ventilation and double the floor area to about 30 square metres.

POST & BEAM INFILL

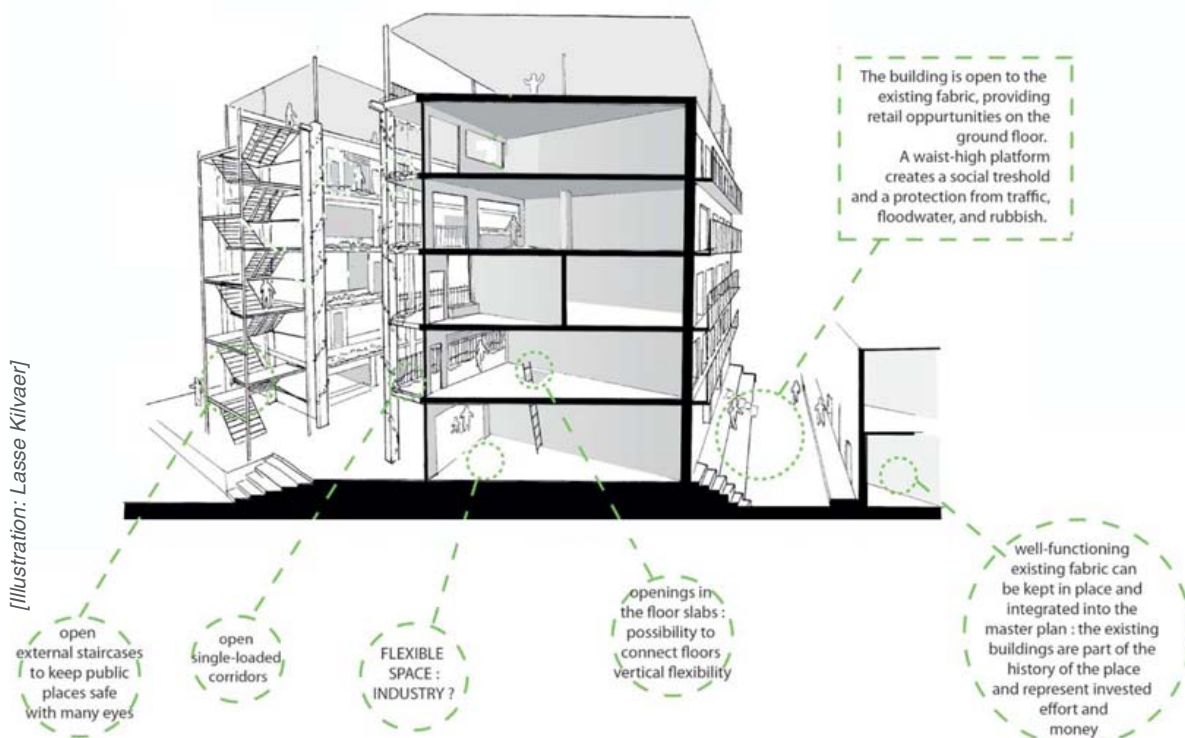
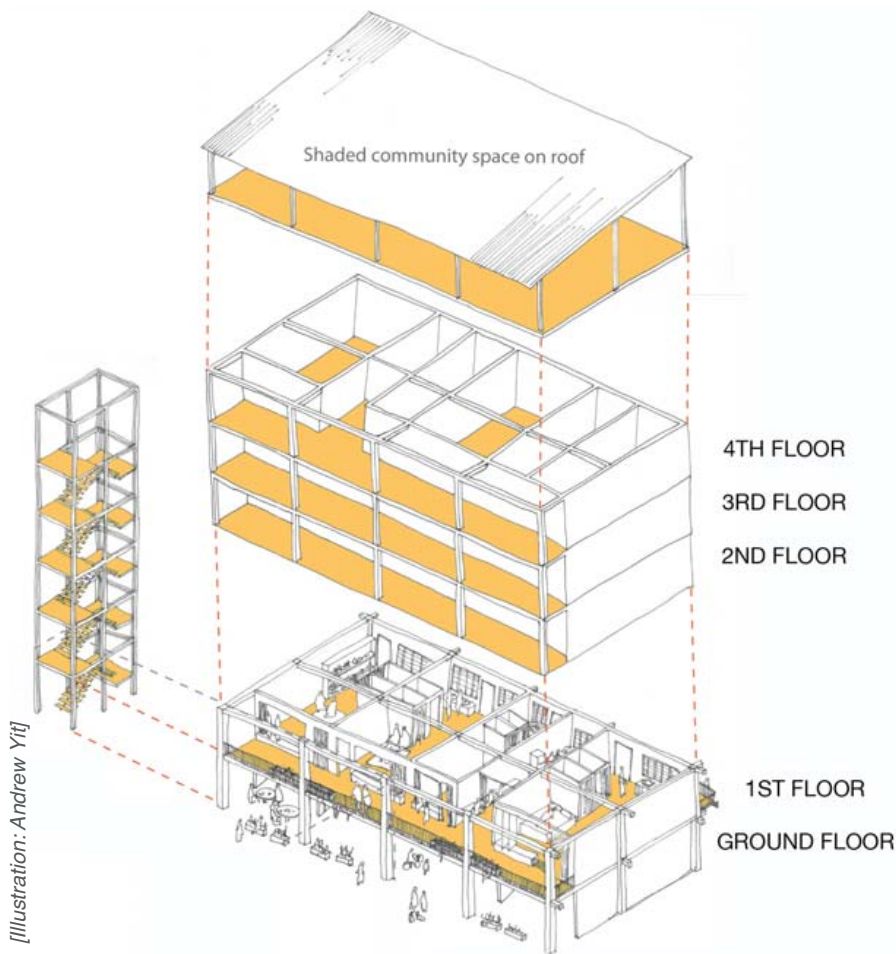
Since all apartments need cross ventilation, a plan-type with long narrow apartments produces a higher FSI and reduces the amount of laneway space required. A 6 metre grid of post and beam construction could create new spatial types as below:



The post and beam framework enables current high levels of spatial adaptation to continue through expansion and partitioning of interior spaces.

This type also creates a deeper setback on the main entry side of the building which becomes an external space for household chores, drying clothes, possible shopfronts and enhanced streetlife. External entry to upper floors can be via ladders or separate stairways. A wider laneway would provide more light, air and potential for greenery (note the planter boxes) and social life. In this scenario rear lanes would remain small with through access closed to discourage subdivision into smaller rooms without ventilation.

Following are illustrations of how such spatial types could be expanded into a G+4 typology with community space on the roof.



8_SPATIAL_TRADING_SCHEMES

The informal settlement of Dharavi is characterized by very high levels of flexibility and change with regard to spatial functions and allocations – rooms can be added and functions converted between residential, industrial and retail; and from ownership to rental. This adaptability is an integral part of the local economy and we have explored some possible strategies and systems that may facilitate such flexibility in space allocation. These schemes recognize the changing needs of informal settlements and propose an adaptive spatial strategy that allows multiple changes and adjustments to occur during the process of development.

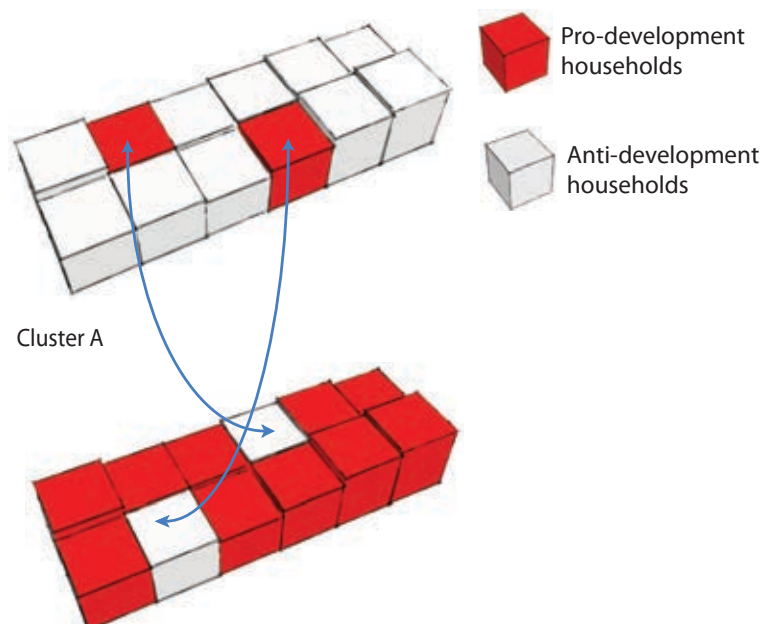
SCHEME 1: HOUSE SWAP

One of the greatest barriers to slum upgrading in this location is the problem of getting agreement from a diversity of residents. The current planning framework suggests that 70% agreement is sufficient but has not been possible in this area. This scheme is designed to enable house swapping between owners who support and oppose redevelopment – thus enabling supporters to swap to an area with sufficient support while others can swap to an area that is not threatened with redevelopment. Imagine the following scenario:

Hadiya is an owner-occupier who opposes development because she is happy with her current situation. However, many of her immediate neighbours want redevelopment. Sabal is a nearby owner who desires redevelopment yet his immediate neighbours oppose redevelopment. The proposed scheme allows for Hadiya and Sabal to swap their properties (possibly including a financial adjustment) and maintain priorities. It enables the emergence of clusters of households with common interests and helps to build resident support for redevelopment.

Much of the existing housing is similar in size, amenity and construction standard. In order to keep social networks intact house swapping would work best between houses that are largely within the same neighbourhood and redevelopment framework. Thus, this scenario will work best if redevelopment schemes are relatively small in scale and proceed as one neighbourhood cluster at a time.

This scheme has the potential to facilitate change in a deadlock situation where required levels of resident support cannot be achieved. It also provides an opportunity for those who are uncertain about the process of upgrading to make an informed decision after viewing the process of change.



SCHEME 2: RENTAL REPLACEMENT

The existing situation is essentially an accretion of rooms where ownership applies to stacks of 2-4 rooms of about 15 square metres each. The current redevelopment framework suggests that each long-term owner be granted ownership of 30 square metres of redeveloped housing - often less than the amount of space that current residents own. While the redeveloped space will be of higher value, the rental income will not be replaced. This scheme seeks to provide flexibility through the opportunity to trade within a framework of allocated space.

Imagine the following scenario:

Sabal currently owns a four-storey building that he has built incrementally over 40 years; his family lives on the ground floor with the three upper floors rented. He is offered an upgrade of his current living space from 15 sq metres to 30 sq metres but does not agree because he loses 50% of existing space. This scheme would offer to replace a percentage of his current rented space. Since the rental space will be upgraded to a higher value Sabal is likely to agree to less than full replacement.

This scheme makes upgrading more expensive but it also more economically sustainable and has the potential to increase the level of resident support.

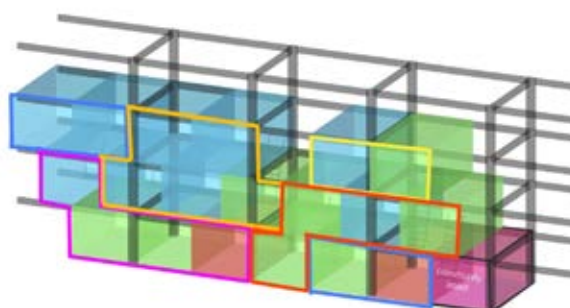
A variation on this scheme is to offer additional space in the redevelopment at a subsidized rate up to the level at which existing space is fully replaced. This subsidy (and/or the % of replaced space) can be negotiated to the level necessary to secure resident agreement to upgrading. Beyond the level of replacement space would be traded at market rates. This scheme would enable individual families to enlarge their houses and to continue or develop commercial opportunities.

SCHEME 3: ADAPTIVE SPATIAL DESIGNS

These spatial trading schemes cannot be seen in isolation from the architectural and urban design of the redevelopment project. The spatial framework should be designed to allow for houses to extend and contract, for functions to be changed and for external access to different spaces to be available wherever possible. Such a scheme is most likely to be facilitated by post and beam construction with a high level of interconnectivity and adaptability between cells. It is important that the redevelopment scheme does not implement a strict separation between functions and locations but rather learns from and retains something of the flexibility of the existing morphology. Scenario:

Pradeep currently owns a shop and lives both in and above it. He negotiates that his house in the upgrade will be at the rear of a new shop. Over time he wants to expand the living space and negotiates to rent or buy one of the spaces above. Later when his children move out he may choose to rent part of this space, or to sell the shop.

An adaptive design enables the expansion and contraction of families and enterprises to be integrated with transformations of space and architecture.



EFFICIENCY

The commercial viability of the ground floor has been compromised by being disconnected from the wider traffic flow and the open space at ground level is very inefficiently used. While the courtyard and fringe areas of the compound are large enough for social life and children’s play they seem little used compared to the informal settlement.

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URBAN PLANNING AND DESIGN PRINCIPLES

Resident Driven Not Market-Driven: The desires of residents and not developer profits should be the drivers of redevelopment. Resident/owners have a right to remain in the houses they have built until agreement on the forms and processes is reached in an open and transparent manner.

Staged Redevelopment: Staged projects are easier to insert into the existing fabric with minimal disruption and more likely to gain community involvement and approval. The northwest corner of the site adjacent to existing high-rise buildings currently houses a toilet block and community room. This location presents the best opportunity to begin redevelopment with a substantial building that can then be used for temporary housing during construction.

Laneways: All laneways with poor light and air should be upgraded or replaced. As a general principle laneways of less than 2 metres width are problematic.

Entrances: Entry areas to private space should be designed to enable social interaction.

Pedestrian Network: A permeable pedestrian network should be created or maintained at ground level and protected from vehicular traffic.

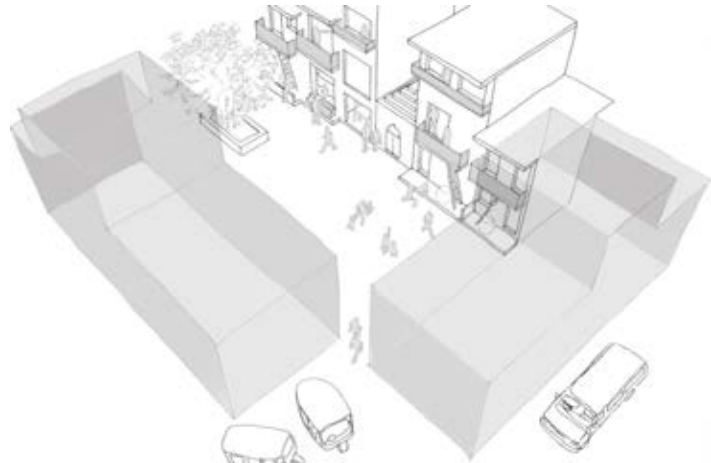
Open Space: A minimum of 400 square metres of open space should be provided in addition to access laneways. Such space should ideally be sufficient for children's play, weddings and community events - protected from vehicular traffic. It should be shaped and integrated in a manner that inhibits encroachment by new informal housing.

Community Facilities: Existing toilet blocks should be maintained or replaced and space should be included for new community facilities where possible.

Functional Mix: The redevelopment should maintain a mix of commercial, residential and industrial space. It should recognize that spatial adaptations between such functions will inevitably continue.



Open spaces protected from traffic



SCENARIO A: SUBTRACT AND INSERT (Central Open Space)

MICHAELA NIKAKIS

This scenario provides all existing owners with an upgraded 30 square metre apartment and replaces all existing rental space. There is provision for additional space to be acquired at market rate. The overall vision allows for the existing fabric to remain in place so far as possible, with improvements to infrastructure, access, street frontage, cross ventilation and light. The proposed new construction is concrete frame and brick infill - a system that allows a degree of flexibility with partition walls so that spatial allocations can occur according to residents' needs. This system also enables possible future expansion on upper floors.

Construction will occur in stages with disruption minimised by erecting a G+7 tower in the north-west corner first. Residents will be temporarily relocated here to allow for new development to occur, one block at a time. Wider lanes have been created as both pedestrian walkway and open space while protected from vehicle access. A large open space has been created at the centre of the site with generous playspace for children. Adjacent to it is a community centre which includes a school, childcare, library and hall. Some narrow lanes have been retained as 'back' lanes for cross ventilation and light but the main entry to every house is onto a more generous lane or open space.

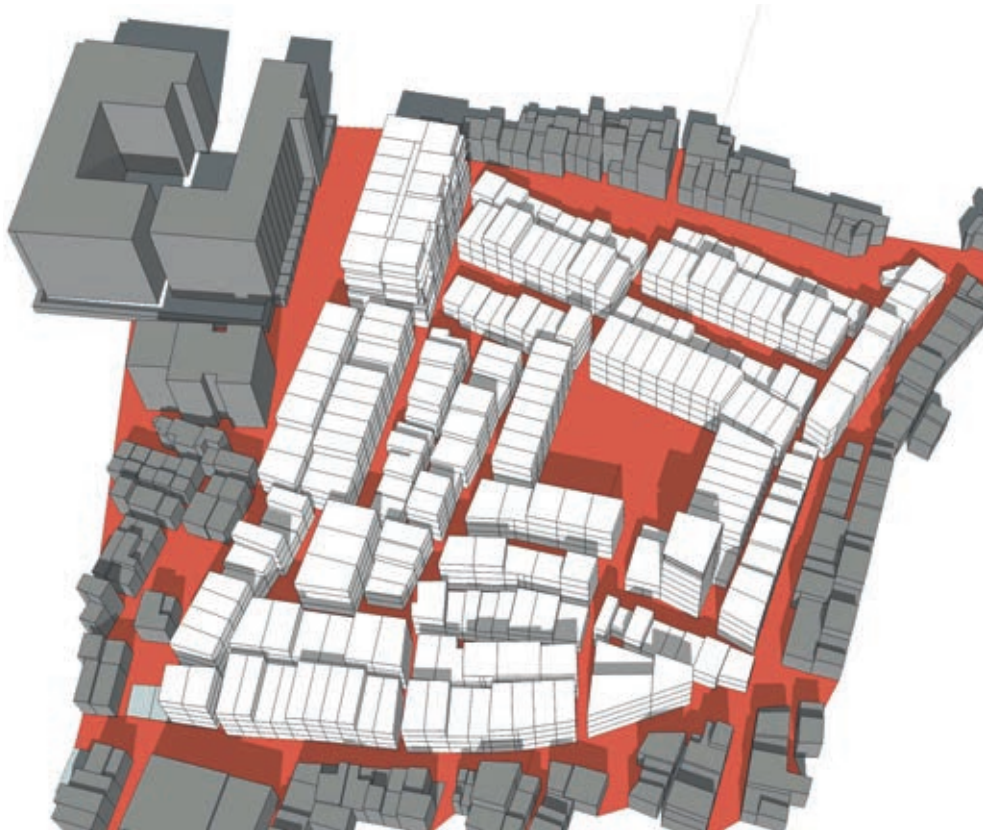


DIAGNOSIS

FUNCTIONAL MIX



DEMOLITION



NEW BUILDINGS



PEDESTRIAN NETWORK

SCENARIO B: SUBTRACT AND INSERT (DISTRIBUTED OPEN SPACE)

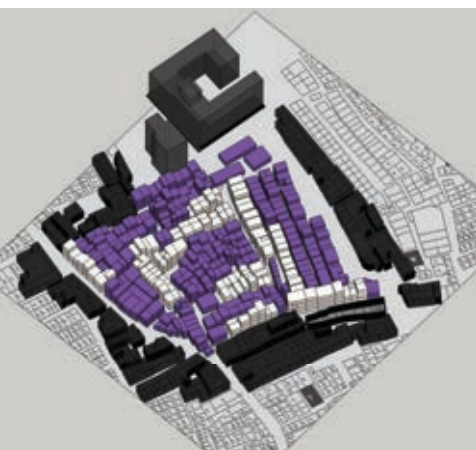
This scenario is an example of possible redevelopment where all existing resident owners receive a 30 square metre apartment (roughly double their existing ground floor space), plus replacement of all existing rental accommodation. Existing parts of the settlement that have valuable characteristics are retained while making strategic demolitions of problematic areas and insertions of new projects to create greater amenity. These projects can be relatively small scale, staged over a long time frame and involve different developers as residents may decide.

PRINCIPLES

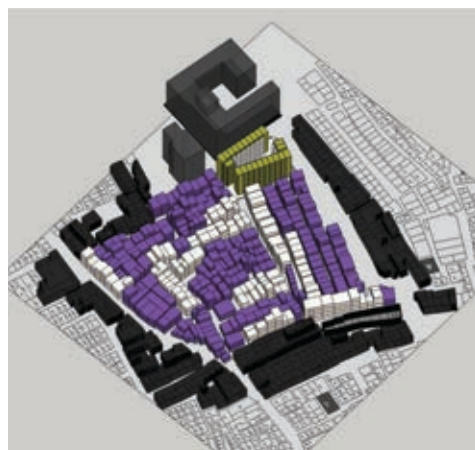
Higher density along existing wider commercial streets with lower rise developments on narrower streets/smaller open spaces between. Retain the existing commercial streets with their 'staggered' footprints and eddy spaces. New small open spaces to be distributed throughout the site. Improvement of dwellings without cross-ventilation or with small plot size



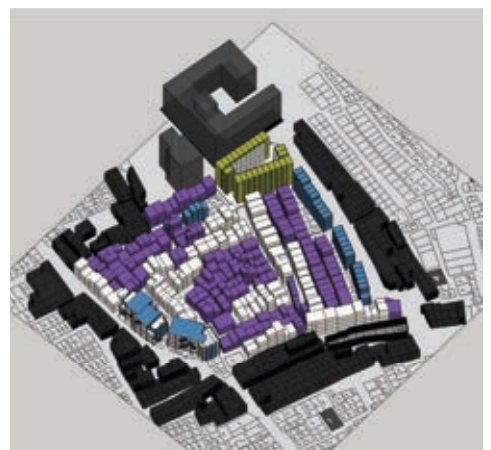
Open space and pedestrian network



Existing (purple to be demolished)



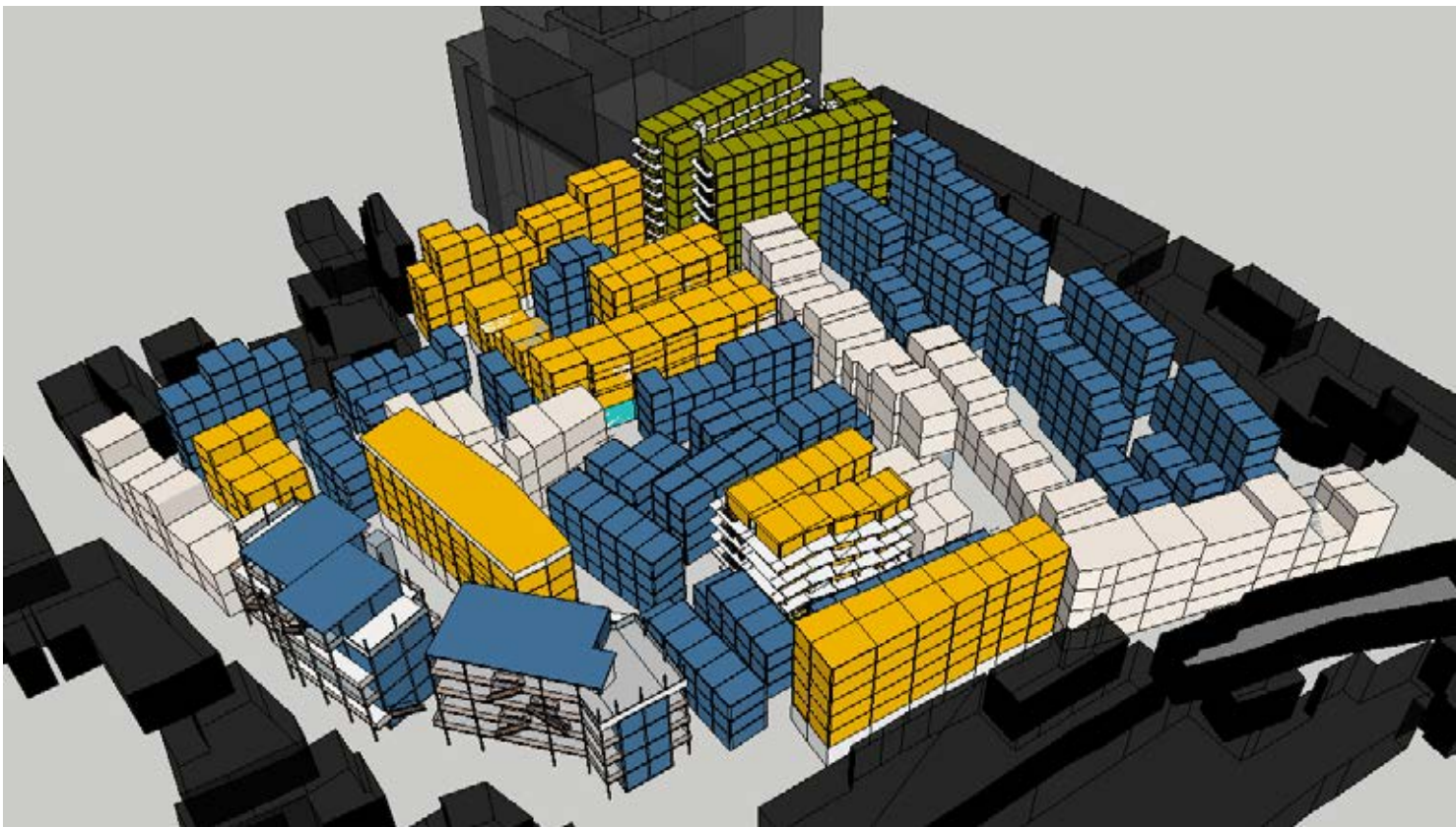
Stage 1



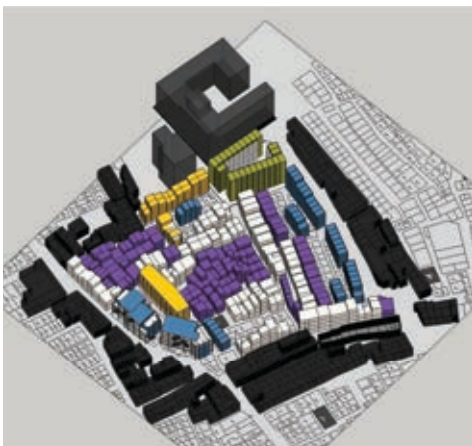
Stage 2

STAGING

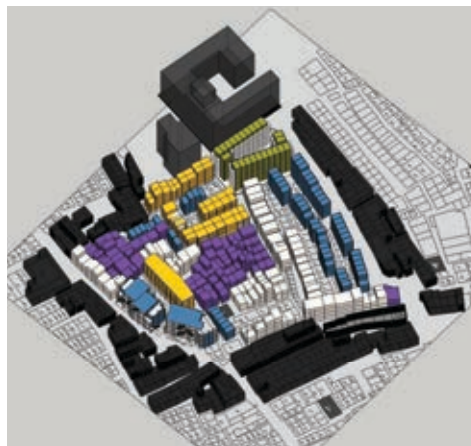
Many staging options are possible within this scenario, beginning with demolition of the existing northwest toilet block and construction of an eight-storey apartment tower as temporary housing for residents while construction is taking place. This block matches the height of existing buildings across the street and will offset density requirements in other areas of the site. Residents from other parts of the site can be relocated as development agreements are reached and construction commences.



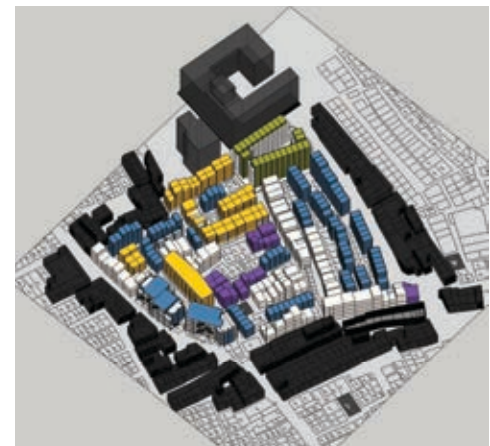
Stage 6



Stage 3



Stage 4



Stage 5

SCENARIO C: CLUSTER BASED REPLACEMENT (20% FOR PROFIT)

This scenario models one possible outcome if the current pressure to secure partnerships with private developers were to be accepted by the community - 20% of the site is set aside for ultimate ownership by the developer. The proposal also models a process of development in stages through the demolition and replacement of relatively small-scale clusters. While all of these clusters are necessary to the staging process, two of them comprising 20% of the site have been reserved as 'for profit' sectors. The eligibility framework is that all existing resident/owners are provided a 30 sq m apartment and over half of all existing rental is replaced.

Development begins on the northeast corner site where there is easy access, minimal existing residential property and capacity for significant bulk without disruption (it is adjacent to other bulky developments). Residents of each successive cluster occupy the temporary housing during demolition and construction of their cluster.



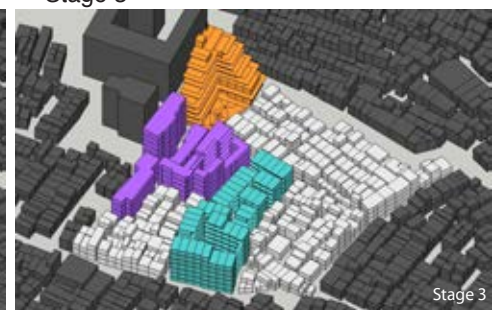
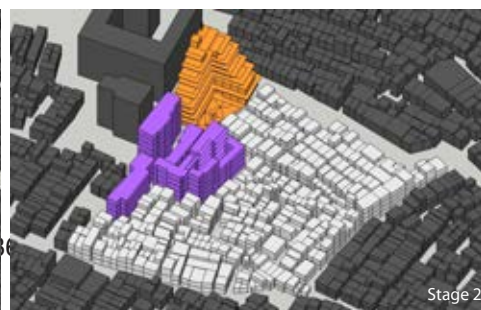
Existing showing clusters and staging

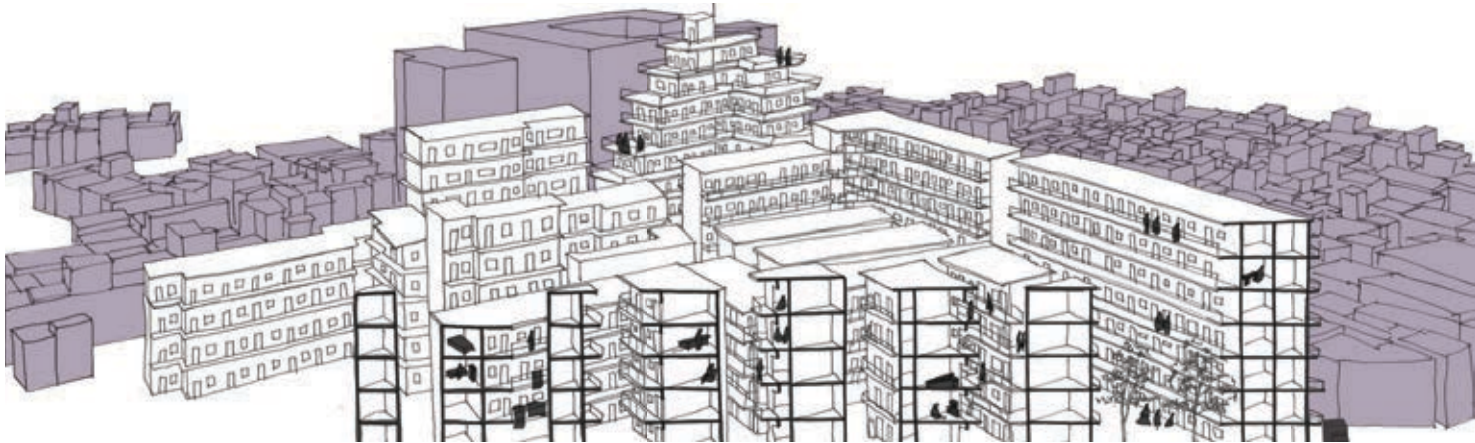
DEVELOPMENT STAGES

Stage 1: Temporary Housing - This building would be used for temporary housing and sold for profit at the conclusion of the development process.

Stage 2: Residents move into the temporary housing while the first cluster is demolished and redeveloped at 4-7 storeys.

Stage 3





This scenario demonstrates one way in which cluster-based staging could occur through the use of temporary housing that ultimately becomes 'for profit' housing at the conclusion of the process. In this scenario such conditions produce primarily 5-7 storey walk-up housing that is slightly lower in scale than the G+7 but with minimal open space. The degree to which this scenario improves the current condition would be contested along with the acceptability of 7 storey walk-ups.



Final Plan

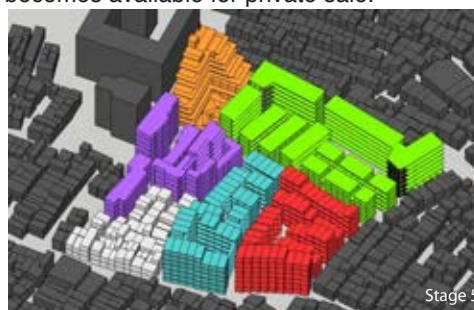
Stage 6: Residents of the final cluster move into units distributed amongst the previously developed clusters 2-5. The final cluster area is then demolished and redeveloped for profit.

Stage 4

Stage 5: When stage 5 is occupied the temporary housing (stage 1) becomes available for private sale.



Stage 4



Stage 5



Stage 6

10_AFTERWORD

KIM DOVEY

One of the more enlightening comments by Sheela Patel during our visit was: “You know, you didn’t come here to solve the problems of the slums; you came here to learn...”. Indeed we learned so much in this short time and much of what we learned was how little we know of this extraordinarily complex place with its diverse residents and industries, its labyrinthine spaces, politics and transformational practices. We were invited to engage with these issues and much of what we learnt has come from entering into the difficulty of this multidisciplinary assemblage of planning and design issues. Dharavi is a paradigm case of a wicked problem where every definition of the problem involves an over-simplification, where every prospective solution raises more complications, where every new building or policy produces unpredictable adaptations.

The work presented here should be seen in this light as just another cluster of analysis and ideas thrown into this mix. The student work is undertaken primarily for them to learn, to struggle with the difficulties of the real world without the responsibilities of implementation. This works best if they do this with the freedom to imagine and to re-think existing approaches but within the constraints of the possible. This means engaging with the processes and morphologies of informality that have produced Dharavi in the first place.

So what do we learn from this? One key lesson was that the sociality and productivity of this neighbourhood is highly dependent on the spatiality of the streets and laneways. Many of the lanes are dark and narrow without the space or light for social, domestic or productive activity to spill into public space – they represent a clear case for upgrading. Yet as the lanes widen beyond about 2 metres width they become highly intensive spaces of social interaction and productivity, crowded to be sure but with light, air, occasional sunshine and open space. Such spaces only work in this way when protected from the noise, smell and danger of vehicular traffic.

Another lesson is that the existing housing and infrastructure represents a huge investment that is primarily built and owned by current residents. Much of the housing stock is of permanent and sound construction that could continue to be upgraded without demolition. The primary current strategy for upgrading is market-led, based on the idea that existing property values can be leveraged to provide new housing for eligible existing residents (free of charge) plus private profit and without cost to the state. The main tool for achieving this is the allocation of a very high Floor Space Index (4) coupled with Transferable Development Rights. The existing FSI on our study site is about 2, which is a natural limit for the incremental building type. Scenarios A and B show that a minimal increase beyond this is possible while preserving significant portions of the existing housing, opening up the most narrow access lanes and creating new open space and community facilities. While Scenario C shows how the demolition and replacement process can be broken down into clusters, it also suggests that setting aside a portion of the site for profit pushes the density towards a high-rise typology that requires complete demolition of existing housing. While it is possible that all of the private development could be transferred to other sites, the intention of the state is clearly to retain it within Dharavi in the belief that high property values can be used to both extract capital and fund redevelopment. The evidence here suggests that unless the FSI can be strictly limited this market-driven scenario is inconsistent with the development of a sustainable, livable and productive community.



ACKNOWLEDGEMENTS

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None of the ideas expressed here necessarily reflect the views of SPARC or NSDF.

All student work is group work with the exception of Scenario 1 which was undertaken by Michaela Nikakis as her Design Thesis. Photo credits are as follows: AY (Andrew Yit), EGC (Elba Garcia Clark), KD (Kim Dovey), KO (Keelan O'Hehir), MR (Marli Roberts), NM (Nigel Mak), NR (Nurliyana Rusli)

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