— ENGINEERING FORMALITY: Flyover and Skywalk Construction in Mumbai

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Abstract

This article investigates the engineering of elevated transport infrastructure in contemporary Mumbai. It argues that the conception, construction and implementation of flyovers and skywalks in Mumbai over the past 20 years has been part of elite efforts seeking to instil a more free-flowing, predictable and regulated city. The techniques, routines, standards and visualizations comprising these engineering schemes have promised ways of reshaping the socio-material configurations and everyday landscapes of Mumbai into a more knowable, functional and integrated realm. The article suggests that this can be understood analytically as a means of trying to establish and maintain 'formal' ideals, citizens and spaces in Mumbai against wider urban contexts perceived as increasingly 'informal'. The article thus emphasizes the importance of exploring how the 'informal' and 'formal' are actively produced and imagined against each other through material practices and procedures, and the central role of urban engineering in attempts at reconfiguring the social and political dimensions of urban life.

Introduction

While walking towards the half-finished skywalk from Mira Road train station on the Western Line of the Mumbai Suburban Railway network in June 2009, I have to manoeuvre carefully to cross a road covered in puddles, mud and rubbish. I call the site engineer from the construction firm J Kumar and find he is directly above me, attending to some work on the elevated structure. He comes to meet me dressed in a smart white shirt with two pens in his top pocket. He has spent the past five months in the suburban district of Mira Road, on the very northern fringes of Mumbai, after working as a mechanical engineer in Qatar for many years. He allows me to walk out onto the skywalk with its light blue hexagonal steel frames, where a few workers are busy fixing flooring. From up above, I can now see the main street in Mira Road, with buses pulled up blocking traffic, people negotiating the street rather than the pavement and blue tarpaulin draped over roadside kiosks. There are large residential developments under construction along the skywalk's route, some by Jangid Group proclaiming they are 'Creating Landmarks', with accompanying adverts for property fairs promising 'the best place to fulfil your dreams'. In the distance stretch suburban housing complexes and salt pans. I ask if hawkers will be allowed on the skywalk when it is finished and the site engineer immediately responds with a 'no'. Afterwards we sit in the small cabin that serves as the office. On the wall, attached with tape, is a computer-generated rendering of the finished skywalk showing the bright blue supports framing a series of advertisements for denim, shoe and fashion companies, and cars running freely on the road underneath.

This article has as its focus the devising, construction, implementation and maintenance of elevated transport infrastructure in contemporary Mumbai, such as this skywalk project in Mira Road, to investigate the role of engineering in efforts at reshaping the everyday flows, socio-material configurations and spatial relations of

urban life. By examining some of the actions and motivations of engineers in Mumbai it seeks to open up an alternative empirical vantage point to a widespread emphasis on work within urban studies over the past decade on slums, hawkers and mafia associated with southern 'mega-cities' such as Mumbai. This alternative perspective emerges not only in relation to the actors, technologies, techniques and visions involved in urban engineering but in re-orienting attention to attempts at producing urban 'formality'. In much recent urban scholarship, formality has often been treated only as an implied or superseded domain of city making against increasingly informalized settings, logics and processes. This article argues that urban engineering has been key to efforts at (re-) establishing and maintaining formal ideals, standards, citizens and space against an urban realm in Mumbai perceived as informal, unauthorized and irregular. The article thus demonstrates how 'formal' and 'informal' spaces, bodies and categories in urban analysis are created and sustained as much through material practices, procedures and imaginations as through legal and representational strategies. Far from being a politically neutral and technocratic pursuit, engineering can play a central role in shaping urban social and political dynamics, and is itself shaped by the vagaries and uncertainties involved in mediating the multi-faceted and dynamic socio-material properties of a city such as Mumbai.

The article begins with an outline of some of the different ways informality and formality have been conceived in urban studies. It argues that recent attempts to disrupt a formal–informal binary have often over-emphasized the omnipresence of informality and neglected how the 'informal' and 'formal' have been actively produced, imagined and defined against each other. The article proceeds to focus on the construction of elevated roads (flyovers) and walkways (skywalks) in Mumbai to investigate ways in which this interface between the formal and informal has been negotiated in contemporary urban India. I suggest that these vertical forms of engineered transport infrastructure in Mumbai need to be understood as more than a technocratic solution to problems of urban congestion. They have also been a response instigated by elite groups to a perceived situation of widespread informality in the city in terms of everyday experience, political life and urban settlement. The article concludes by returning to the relationship between informality and formality and ways of thinking about urban engineering.

Conceptualizing urban informality and formality

Informality has tended to be understood as a categorization of people and activities outside of formal legal structures and processes. In this dualistic framework, the discourse of informality is framed as the *other* to formality, which is seen as proper and legitimate. An informal sector is generally construed as consisting of labour practices and socio-economic activities, such as those related to street vendors and the drug trade, that lie outside of governmental indicators, regulations and legal systems, and beyond formal systems of recording, remuneration and labour organization (Hart, 1973). In terms of housing and settlement, informality is considered to encompass territories outside of ordered and regulated forms of construction and land use (Turner, 1978). This means that informality is often associated with slums and squatter settlements (Neuwirth, 2004; Davis, 2006). Another associated realm of informality can also be identified in spontaneous, interstitial, 'kinetic' and ephemeral activities against more permanent, regular and static forms of urban life and urban design (Mehrotra, 2008; Hernández *et al.*, 2010). This divide between informality and formality, across labour, housing and everyday life, tends to be accompanied by a distinct geography; informality is generally connected with the urban poor, especially in the global South, whereas formality is seen as more mainstream, affluent and located in the global North.

Over the past decade, however, important alternative conceptual framings have been developed that problematize a straightforward formal–informal dichotomy in urban studies (Bunnell and Harris, 2012; Waibel and McFarlane, 2012; Varley, 2013).

These have sought to disrupt the implicit idea of formality as the norm and informality as the deviation; indeed, in many respects they conceive informality as the dominant way of life in processes and behaviours involved in city making (AlSayyad and Roy, 2004; Watson, 2009). Informality is understood not as a bounded and separate sector but as a *mode* of urbanization, what Ananya Roy (2005: 148) calls 'an organizing logic, a system of norms that governs the process of urban transformation itself'. This means that informality can encompass not only the domain of the poor but also the practices and rationales of the middle classes and elites. It can involve not only shacks built on public land that circumvent formal planning regulations but also upmarket malls, hotels and residential complexes that encroach onto land officially designated for other activities. What is crucial here is that informality is conceived not as the object of state regulation but rather as produced by the state itself (*ibid*.: 149). The state has the power to define and determine what is construed as legitimate and authorized—and what is deemed illegitimate and unauthorized.

This conceptualization of informality as a mode of urbanization offers an important emphasis on the directly complicit and flexible role of state action and authority in the production and management of informal urbanism. This extends not only to land redevelopment irregularities (see e.g. Pow and Neo, 2013: 2270) but to how informal workers such as unlicensed street hawkers can be involved in claims to substantive citizenship (Anjaria, 2011; 2016) and how informal practices and beliefs can be embedded in the everyday functioning of state bureaucracies and forms of urban governance (Bear, 2011; Meth, 2013). But where does this leave *formality*? The urban literature is increasingly suffused with informal modes of life, informal modes of settlement, informal modes of labour relations—what Ann Varley (2013: 17) refers to as the 'ubiquity of informality'—but what about the implicit converse: formality as a mode of urbanization?

For Roy (2005: 149, original emphasis), 'the divide ... is not between formality and informality but rather a differentiation *within* informality'. This implies that it is only different shades, values and intensities of informality, produced by the decisions and practices of the state, that shape the dynamics of urbanization (see also Roy, 2009: 81; Yiftachel, 2009; Roy, 2011: 233). This article argues, however, that rather than subsuming urban social and political relations solely within an idiom of elite and subaltern informalities, or reverting to a simplistic dualism, it is important to examine how the 'informal' and 'formal' are actively produced, imagined and defined against each other in contingent and multiple ways. More empirical research is required into the range of contexts, relations, geographies and histories involved in establishing and maintaining formality–informality regimes and the role of the state in valorizing, legitimating and criminalizing particular activities, territories and rationalities (McFarlane, 2012; see also Caldeira, 2001). As Sarah Nuttall and Achille Mbembe suggest in relation to their work on Johannesburg:

> The two processes of formalization and informalization work together. How they work together and how this working together ends up producing city forms and urban economies seems to be the question that we need to pursue (Nuttall and Mbembe, 2004: 9).

This article's focus on contemporary Mumbai examines how a series of apparently 'formalized' spaces, practices and landscapes have accompanied the informal mode of urbanization that Roy (2009) argues has defined the recent fast-paced growth of Indian cities. In this respect, the article accepts that informality needs to be understood as a norm rather than an exception in urban India, but it also explores how this situation of a widespread experience of informality has stimulated responses that seek to re-establish and re-work notions of 'formal' difference. Interpreting urban informality in 'fractal

fashion', as Roy (2011: 233) urges, not only implies enduring 'binary entrapments' (Varley, 2013: 13), but risks empirically underplaying how the 'fissure between formality and informality' (Roy, 2011: 233) continues to resonate and shape the imagination and parameters of everyday city making (see also Anjaria, 2016: 71, on 'a world-making dialectic').

This article, through investigating how flyovers and skywalks have been constructed and implemented, assesses how engineering practices, techniques of visualization and processes of standardization can be understood to be part of efforts to marshal formality against the seeming ubiquity of the informal world in contemporary Mumbai. This is an aspect of the relationship between informality and formality that has been under-explored in urban scholarship, perhaps in part because it involves technocratic actors such as engineers, project management consultants and maintenance contractors who are seemingly removed from 'political' life. The tendency has been to focus on planning instruments and legal norms around property, including the 'misrule of law' (Roy, 2009: 80), in framing the contrasting logics and rationalities of informality and formality (Watson, 2009; Yiftachel, 2009; Schindler, 2014), and visual orders and aesthetic judgements that seek to evaluate and establish differences between the informal and formal (Ghertner, 2011). Although legal and representational strategies are central to how formal–informal regimes are negotiated, it is also important to examine more fully how the symbolic-political intersects with the material-lived (Abourahme, 2015). In particular, forms of networked, engineered urbanism can shape how relations between formality and informality are constituted and construed—often regardless of legal status or physical appearance. For example, Lisa Björkman's historical and ethnographic research on a neighbourhood in Mumbai's M-East Ward shows how a once regularly organized municipal colony—as is clearly evident from overhead photos of its grid structure—was transformed into an illegal, informal 'slum' through the 'politically-mediated deterioration and criminalization of its water infrastructure' in the context of Indian liberalization-era policies (Björkman, 2014: 38). The undermining of connections to a formal water distribution network had the 'discursive effect' of helping produce this neighbourhood as a 'slum' despite its planned characteristics. Eyal Weizman's (2007) work on the 'hollow land' of Israel-Palestine also shows how connections to engineering practices associated with radio communications and highway construction can shape notions of formality even in situations that are technically illegal within international law.

Through a focus on the construction of flyovers and skywalks in Mumbai, this article similarly explores the role of the material components of infrastructure and engineering in efforts to define and distinguish urban spaces, bodies and categories.[1] Flyovers and skywalks have become an important, and highly visible, feature of the Mumbai metropolitan region over the past two decades, built by a variety of contractors and project consultancies (such as J Kumar Infraprojects, the Louis Berger Group, Patel Engineering and Gammon India). In contrast to thirteen flyovers constructed between 1963 and 1997, over 50 have been built since 1997. These have largely been constructed over existing roads and junctions rather than involving major clearances to the built fabric and do not readily align with notions of 'urbicide' and 'new military urbanism' (see e.g. Berman, 1988; Graham, 2010).[2] Since 2008, more than 30 skywalks have been built across the region, predominately providing elevated walkways over busy roads to feed pedestrians into train stations. These are projects that have been devised as part of an agenda of transforming Mumbai as a 'world-class' city, instigated by parastatal

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1   Waibel and McFarlane's edited book on 'reflections of the formal and informal' (2012) interestingly has a photograph on its front cover of free-flowing traffic on an elevated road in Hanoi juxtaposed in the foreground by a fruit seller with an improvised stall.

2   However, many more recent construction projects, such as the Santa Cruz-Chembur Linking Road and the Eastern Freeway, have involved demolition of existing settlements and led to significant numbers of Projected Affected People (PAP).

agencies such as the Mumbai Metropolitan Region Development Authority (MMRDA) and the Maharashtra State Road Development Corporation (MSRDC) and championed by prominent business leaders, industrialists and politicians (Bombay First, 2003; Anand, 2006; Harris, 2013a).

In many respects these projects continue aspects of transport planning under colonial urbanization. The British built roads and railways through Bombay not only to enhance their mobility within the city—and that of goods to the port—but also to help demarcate and bypass the so-called 'native' areas, as well as to integrate new suburban districts into parts of the city perceived as more orderly and regulated (Hazareesingh, 2007; N. Rao, 2013). What is different is the distinct *verticality* of present-day structures. The elevated forms of flyovers and skywalks act as prominent symbols for political performances of development within a postcolonial democratic realm (Hansen, 2001; Harris, 2011). They also offer an important material response for elite groups to try to mark out, instigate and reaffirm more 'formal' modes of urban life above and beyond a city below, which is increasingly identified as irregular and unruly. I draw on ethnographic, interview, visual and archival research undertaken over the past decade, especially between May 2009 and January 2010, including several field visits with engineers, to investigate how flyovers and skywalks shape and produce different domains of formality–informality.[3] The article starts by recounting a visit to construction sites along Dr Ambedkar Road, followed by details on a variety of aspects of the role and rationale of flyovers and skywalks: from their initial conception to their construction and implementation, and finally to the broader connections and relations they forge within Mumbai's metropolitan region.

Flyover construction between Byculla and Sion

In April 2009, outside Byculla Zoo, I met Mr Karmarkar, an engineer from one of the main consultant companies specializing in flyover projects in Mumbai. He had offered to show me around various locations where he was working, monitoring an ongoing project to construct a series of four flyovers, including one of 2.48 km in length, along a key North–South route from Byculla to Sion through Mumbai's Island City. Mr Karmarkar tells me he is a 'bridge expert' and has worked in Algeria and Saudi Arabia as well as for a range of companies in India. He informs me that this new stretch of elevated expressway will allow nine traffic signals below to be 'avoided', and that the longest section will be—for the moment—Mumbai's longest flyover, pipping the previous holder of this accolade, the JJ Hospital flyover immediately to the South, by a mere 100 m. The project also involves demolishing an older flyover at Lalbaug and rebuilding it higher so that a famous local Ganesh idol, almost six metres tall with its trolley, will be able to pass under en route to its immersion in the sea at the annual Ganesh Chaturthi festival. As we walk along the road, where completed flyover piers either side are awaiting the overhead section to be laid on top, Mr Karmarkar talks me through the sequence in which flyovers are built. The process starts by liaising with the Brihanmumbai Municipal Corporation (BMC) and local traffic police about minimizing disruption to existing vehicle flows—the road alongside us continues to operate noisily, the flyover piers and overhead sections threaded carefully through the centre of the carriageway. He explains that rather than cast the concrete components *in situ*, which would take up more of the limited space available, these are pre-cast a few kilometres away in Wadala on the eastern edge of Mumbai. Not only is this location currently disconnected from busy through routes and less densely populated, but it also provides an opportunity to use a 'concrete lab' within the casting yard to test concrete and steel frames for quality and resistance. An experimental flyover pier has also been built there by the contractor as a trial model for Mr Karmarkar's company to inspect and approve.

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3   For more on the methods adopted for this research, see Harris (2016).

We get into his vehicle and drive north up Dr Ambedkar Road to another of the construction sites. As we travel along I notice a prominent white sign with bright red letters stating 'Go Slow: Work in Progress. Inconvenience is Regretted'. There are also boards with the contractor's name, alongside that of the parastatal commissioning agency the MSRDC, and a series of images, rather flecked with mud, of various brand new infrastructural projects they have constructed, with flyovers and bridges most prominent. The next site we stop at is also boarded off in the middle of the existing road, with traffic funnelled around it. There are no flyover piers in place yet, but there is a large piling machine with thick caterpillar tracks and instructions at the back urging people to 'Stay out of Swing Area'. A loud, regular thud is heard as it drops its piling equipment into the brown earth. Mr Karmarkar explains that what is particularly problematic at this stage of flyover construction is that they do not necessarily know what they will be hitting during the piling process; there are no maps of the utilities that lie underneath. Usually, they first need to dig a trench and make initial explorations as to what they might locate. He tells me that they discovered an old pipe from the British era along this stretch, estimated to be 80 years old, which the BMC was not aware of. He admits that they do have occasional problems with burst pipes during piling, and the flyover designs often have to be changed to accommodate water mains found running down the middle of the road. Mr Karmarkar bemoans that this underground utility checking is required—he compares it to his experiences in cities in Saudi Arabia and Dubai, where contractors would know exactly where pipes are located and do all the planning beforehand, in their offices.

Further up the road, at a section that has almost been completed, I ask him about who maintains the flyovers once they have been built—when Mr Karmarkar is not necessarily on hand for inspections. He tells me that the BMC is responsible for keeping the structure free of bills and posters while another company will be awarded a maintenance contract, following a tendering process. This company's priority, he suggests, will be to ensure the heavy run-off in monsoons will be directed away from the road's surface and not allowed to seep through the concrete sections of the flyover, and also to regularly check the bearings that link together the piers and pre-cast segments.

Mr Karmarkar's careful monitoring of the various processes, practices and procedures involved in constructing these flyovers, and the efforts made to respond to specific issues and unexpected difficulties encountered, such as a lack of knowledge of underground utilities or the need to accommodate local religious traditions, is indicative, I would contend, of the key role flyovers play in efforts at materially reclaiming and reshaping Mumbai's everyday dimensions. In a city where 'slumdog' urbanism has not only created a world of social, cultural and aesthetic plurality, but one that points to the limits of fully understanding how the city operates (Roy, 2011), flyovers seemingly offer a clearly defined way of knowing, experiencing and navigating urban life. They provide what literary scholar Neferti Tadiar (2009: 217) calls, with reference to flyovers in Manila, 'a suspended network for the emergence of mobile, metropolitan subjects liberated from the assaulting contradictions of third world modernist development'.

Engineering urban flow and functional density

Flyovers, as well as skywalks, can be conceived, in particular, as part of ongoing elite efforts to produce—to engineer—an understanding and experience of orderly and functional density. In direct contrast to crowded, excessive and often threatening densities commonly experienced in commuter train carriages, in slums and at religious festivals, as well as on many streets in Mumbai, carefully engineered structures launched into the less cluttered skies promise a more knowable and easily controllable form of urban density. For anthropologist Vyjayanthi Rao, who draws on ethnographic work at sites across Mumbai, it is these differential densities that characterize the contrasting logics of formality and informality:

> Juxtaposition of densities of bodies, infrastructures, and affects makes possible incessant intersections that characterize the ontology of the informal ... The 'formal' sector in turn is formed by its ability to shield itself against these intersections, in other words, through its locking out the potential of these juxtapositions (Rao, 2007: 239).

As spaces designed and designated purposively for unidirectional vehicle and pedestrian flow, flyovers and skywalks do not necessarily have 'incessant intersections', and seek to 'lock out' the juxtapositions and mixing inherent to the informal. They envisage removing both the literal and metaphorical crossroads of the city.

Central to this promise of formality and ideal of density held by these elevated structures is how, by embodying the 'traffic logic' of civil engineering (Blomley, 2010) and the network-flow imaginary historically associated with modern engineering (Picon, 2018, this issue), flyovers and skywalks are seen by many transport consultants, politicians and business leaders as bringing linearity and regularity to the fluid choreography of Mumbai's urban space. As AbdouMaliq Simone (2010: 113) suggests in relation to research on Jakarta, flyovers, among other high-speed communication networks, 'would seem to filter out interruptions and constitute smooth pathways for big and well-financed aspirations'. Mumbai's roads tend to be a stop-start, crowded and chaotic world, even through the night for many prominent routes such as those around the airport (Harris, 2013a: 343). They often comprise a jumble of pedestrians, people loitering, cars, taxis, motorbikes, lorries, buses and hawkers, moving at varying speeds and in several different directions, with discontinuous movement often creating opportunities for vendors and beggars where traffic halts.[4] Moreover, unchecked development on the sides of many highways has narrowed space to manoeuvre and forced pedestrians onto the road, while the overall situation has been exacerbated by greatly increased private vehicle ownership over the past decade (Shirgaokar, 2012).

Flyovers seem to hold the potential of urban mobility without this interruption and turbulence, meeting modern ideals of free-flowing circulation and frictionless, seamless movement. As Nirmalya Bandyopadhyay and Amitabha Ghoshal (2003: I-2) argue in the *Indian Concrete Journal*, 'elevated structures are the first choice of the Structural Engineers [in India] while solving traffic bottlenecks at surface level'. In particular, overhead roads help bypass existing traffic signals seen as especially troublesome in holding up and hindering free-flowing traffic. This was one of the main reasons identified for constructing a flyover at Sion in the late 1990s: 'with no increase of the carriageway widths as existing, this led to huge traffic snarls and the waiting period at the signals rose from minutes to hours' (Bhobe, 2000: 4).

The widespread deployment of flyovers to avoid busy junctions and improve traffic flows in Mumbai has in some respects been successful since a major programme of construction began in 1997. Canadian transport consultancy LEA was tasked by the MMRDA (with assistance from the World Bank) to produce a Comprehensive Transportation Study for the Mumbai Metropolitan Region, reporting:

> The maximum average travel speed has shown marginal increase from 25 to 30 kmph, which is primarily due to construction of flyovers reducing location specific (and movement specific) delays (LEA Consulting, 2008: 2–2).

Yet, in other respects, flyovers—particularly those built in the late 1990s, which mostly only traverse one set of traffic lights—have been hampered by their limited ability to address congestion issues at a greater urban scale. They arguably have only shifted

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4   In recent work on Kinshasa, anthropologist Filip de Boeck argues that there is an important informal economy around discontinuous traffic flows, with money paid by drivers to enterprising individuals to fill in prominent pot-holes in the road—who promptly dig open the holes again at night-time (see, for instance, de Boeck, 2015: S153).

bottlenecks to where a flyover returns to street level, while some flyovers, such as the one built at Sion in the late 1990s, accommodated traffic flows solely on one side of road. This sporadic addressing of Mumbai's traffic blockages, which does not necessarily fully meet engineering's historic network-flow imaginary (Picon, this issue), means the city's overall congestion problems have not improved. Beyond reductions to 'location-specific' delays, the LEA study (2008: 2–2) also mentions how 'over the years, minimum average travel speed in the Island City has fallen from 18 to 8 km/h, in spite of major capacity expansion programs underway ... Most of the network remains highly congested'.

This inability for flyovers to install a fully formalized—and generalized—ideal of free-flowing traffic through Mumbai for the city's car-owning elites has subsequently led to longer elevated engineering solutions to be sought, even if this requires knocking down existing flyovers (Tembhekar, 2012). As Mr Karmarkar emphasized to me at Byculla, these joined-up urban expressways manage to more successfully 'avoid' the inherent interruptions posed by Mumbai's signals and crossroads.[5] Nitin Gadkari, former Minister of Public Works of the Government of Maharashtra from 1995 to 1999 and currently Minister of Transport for the national BJP government, proudly told me about the JJ Hospital flyover: 'twenty-one traffic signals are avoided by that flyover, twenty-one!' (interview, 2009; see Figure 1). Likewise, an oft-heard statistic associated with planning the Bandra–Worli Sea Link, which opened in 2009, was that it avoided 29 traffic lights and reduced travel time from '1 hour+ to only 7 minutes'.[6]

Yet, despite these larger and longer transport interventions conceived around 'avoiding' Mumbai's incessant interruptions at street level, frustrations still persist. The chairman of business lobby group Bombay First, Narinder Nayar, suggested he was not happy with what he described as the 'speed of progress', even given the construction of what he termed 'hop-overs', as well as longer elevated expressways (interview, 2009). Ideally Mr Nayar's dream is for a 'complete ring-road'; this, he argued, would 'solve all our problems'. It is these aspirations of unimpeded traffic flows right across the city, rather than only at isolated junctions, that have led to a mega-engineering project, a 35.6 km coastal road along Mumbai's western seaboard, comprising tunnels, elevated sections and sea links, to be approved by the Central Government in 2015, with construction starting in November 2016.

Another consequence of frustrations resulting from flyovers' inability to fully resolve Mumbai's unpredictable traffic flows, I suggest, is the emergence of skywalks in the 2000s as an alternative but complementary engineering fix for the city. Skywalks also promise direct and continuous routes without the encumbrances and the hustle and bustle of the streets below (Anjaria, 2012: 22). As Murthy *et al.* (2003: IV–38) posited in an article in the *Bridge and Structural Engineering* journal on the Mumbai Urban Improvement Plan, 'pedestrian grade separators create conflict-free intersections and ensure smooth passage of pedestrians and vehicles'. An Elevated Pedestrian Walkways Pre-feasibility Study produced for the MSRDC by Frischmann Prabhu consultants in March 2005 emphasized:

> In the current urban context, the intersections are the critical areas of pedestrian congregation and require safe and efficient crossing facilities while ensuring minimum delay to vehicular traffic (MSRDC, 2005: 3).

Not only do skywalks promise more efficient and smoother pedestrian passage in a 'current urban context' of streets often perceived as 'congested', they also seek to reduce

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5   One newspaper article reported how the time taken to travel along this particular route would be cut by 39 minutes with the introduction of the new flyovers: 'six minutes—that is the time you will take to reach Lalbaug from Sion. It now takes 45 minutes to travel the same distance' (Karnik, 2008).

6   These timings were taken from a Powerpoint presentation I was shown, which detailed planning and engineering calculations around the Bandra-Worli Sea Link.

FIGURE 1 The JJ Hospital flyover (photo by Chirodeep Chaudhuri, 2006)

vehicular delay by rerouting Mumbai's street informality into the air. As Mr Pahal, chief engineer at the MMRDA responsible for their implementation, told me, once skywalks are built 'it is then possible to remove [the] pavement from below' (interview, 2009). Whereas a key rationale for flyovers in Mumbai is to bypass and lock out ground-level congestion and unpredictability, skywalk construction aims to engineer another vertical arrangement whereby incessant interruptions associated with Mumbai's pavements are channelled skywards to free up space for vehicular traffic below.

In these efforts at improving Mumbai's traffic flows through flyover and skywalk construction, planners and engineers have sought to prevent further exacerbation of the stop-start world at street level. As a senior civil engineer from Larsen and Toubro Limited, N. Raghavan, suggests:

> Invariably in the Indian urban context the existing traffic corridors are already choked up with dense traffic and any blockage of these corridors arising out of the construction of new structures could cause considerable nuisance and difficulties to the travelling public. Hence, it is essential that these structures are constructed on a fast track basis and using techniques which pose minimal inconvenience to the travelling public (Raghavan, 2003: I-10).[7]

In addition to constructing flyovers and skywalks without closing the traffic on existing routes below, as far as possible, and casting concrete sections off-site for expressways through busy parts of the city, further strategies have been adopted to minimize the overall time these projects take. 'Stiff' bonus and penalty clauses have been introduced for contractors to complete schemes on schedule, while independent project management consultants (PMCs) with expertise in flyovers—such as Mr Karmarkar's firm—have been employed by the MSRDC and others to facilitate 'fast track construction' (Reddi, 2003: 1181–82).[8] As the signs indicate at many flyover construction sites: 'any inconvenience is regretted'.

'So many ponderables': engineering urban knowability and material predictability

While seeking to provide a 'shield' to the city's incessant intersections and uncontrolled densities, the logic of flyover and skywalk construction also offers those planning and governing the city an apparent way of making Mumbai more legible and ordered, and asserting more 'normal' rationalities through the procedures and principles of engineering expertise and abstraction. The ubiquity of Mumbai's informal realm, and its association with visual and sensory excesses, impenetrable epistemologies and lack of technological standards, makes it difficult to visualize, anticipate and maintain urban socio-material configurations in a straightforward manner. Atul Bhobe, managing director of one of the main flyover PMCs in Mumbai, detailed some of these uncertainties:

> there are so many ponderables or, I would say, things which you don't know, which come up when you actually start the work. Utilities are a major issue, traffic diversion is a major issue. You don't know what happens on festival days, especially in India where we celebrate practically every day as a festival somewhere in the country. It is very difficult to actually pinpoint to say that you

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7   In discussing the construction of the Sardar Vallabhbhai Patel flyover on Eastern Express Highway, Kanhere and Chonkar (1996: 250) similarly emphasize the importance of not inconveniencing existing traffic: 'It was claimed that with this design of steel superstructure, the traffic would run uninterrupted during the entire period of construction'.

8   Reddi (2003: 1182) describes some of the activities undertaken by these PMCs during flyover construction: 'The PMC assisted the owners in soil investigation, preparation of tender documents, pre-qualifying the bidders, evaluation of tender documents etc. After the award of the work, the PMC proof checked and recommended approval of contractor's designs, supervised the project, ensured quality assurance and certified payments. Designs were scrutinized and approved in weeks and bills certified in days'.

will have this problem at this date at this area. So it becomes a challenge sort of to do the logistics and still do it by the deadline (interview, 2009).

The challenge of installing flyovers and skywalks onto the urban landscape is, in part, a means of trying to control and manage these 'ponderables'. If construction deadlines are successfully met by the engineers, then the way Mumbai operates and functions is made, superficially at least, more knowable and predictable for those involved in managing, governing and planning the city.

Devising, detailing—and promoting—a flyover or skywalk project first requires visualizing the proposed structure and its urban setting through drawings, scale models and computer-generated images and videos. The offices of civil engineers involved in flyover and skywalk construction, such as the one at Mira Road, frequently contained notice boards onto which were pinned brightly coloured renderings of current and future schemes and proposed transport infrastructures, showing neatly arranged buildings and carefully organized urban design features and road markings. Similarly, underneath a large poster proclaiming 'Mumbai's vision', on the fifth floor of the MMRDA building in the Bandra Kurla Complex (BKC) business district, large models of transport projects were exhibited, demonstrating a regularly spaced and clean urban environment with minimal traffic. When I visited the large, uncluttered office of Mr Pahal on the second floor of this building in 2009, he talked me through a Powerpoint presentation prepared on 'Skywalks in Mumbai', containing computer-generated images of new schemes set against backdrops of trees, blue skies and a calm, sun-dappled sea.

The instigation and pursuit of these construction projects along prominent routes within the city has facilitated the imagination of new idealized visual representations of Mumbai cleansed of its irksome informality. The buildings are not higgledy-piggledy, the roads are uncongested, and the city is easy to observe and manipulate: there is thus limited attempt to portray actual ground-level realities beyond technical concerns for topography and existing road alignments. It is instructive that when these images projecting aesthetic formality onto Mumbai's urban spaces are inserted into the city as billboards along the routes under construction—beyond the office, foyer or screen—they are frequently flecked with dirt, bird-shit and red *paan* spit, and many bear scuffs and scratches from passing vehicles.

Even with the everyday muddle of Mumbai's streets absent from these visual renderings, problems nonetheless arise in getting these projects off the ground. Road widths and surface levels are not necessarily as predicted, especially given that much of Mumbai has historically been built on reclaimed land. This means, as Bandyopadhyay and Ghoshal (2003: 1–2) suggest, 'providing appropriate geometric solution (sic) in a congested locality, where the surface level road has "improper" geometry, often requires innovative structural solution'. In addition to this innovative addressing of 'improper' surface geometries, there are also the 'unknowns' of 'underground obstruction' (*ibid.*)— as mentioned by Mr Karmarkar in his frustrations about piling along the Byculla–Sion route.[9] Atul Bhobe recounts the situation the construction teams of the Sion flyover in the late 1990s faced:

> Underneath the Concrete road Dr Baba Saheb Ambedkar Marg is a jungle with all major Underground Utilities Criss-Crossing at every junction, alongside the Footpath as well as throughout the Central Verge (Bhobe, 2000: 16).

In terms of the need to negotiate and to begin mapping this 'jungle' of underground pipes, flyover and skywalk construction can be understood as a 'taming' of this opaque

9   This lack of knowledge about underground utilities is an issue not peculiar to Mumbai's hydraulic and transport engineering. Joe Hillier (2018, this issue), for example, details how the route selection for London's Water Ring Main was complicated by a lack of knowledge of subterranean obstacles.

territory embedded beneath Mumbai's main traffic routes.[10] The extensive details, tables and figures of span arrangements, pier configurations and structure dimensions included in *The Story of the Sion Flyover* (Bhobe, 2000) demonstrate, if not celebrate, the efforts undertaken to order this tangled subterranean world.

Construction of flyovers and skywalks also imposes new order and predictability on Mumbai's landscape in terms of adherence to particular design criteria and technological standards. Despite these structures involving a range of contractors, consultant engineers and commissioning authorities, and an accompanying variety of designs and surface finishes, certain features and specifications are common, such as desirable horizontal and vertical alignments, vertical and horizontal clearances, lane and shoulder widths, and the use of high-grade steel and high-performance concrete (see, for instance, Wilbur Smith, 2003: 2–4). In a 2006 Powerpoint presentation entitled 'Critical appraisal of [the] Mumbai flyover project', prepared by the engineer Mr P.L. Bongirwar, a former managing director of the MSRDC in the 1990s, the following list is provided under the heading 'Being standardised':

> Electrification details; Median verge shape; Merging and fanning details; Improvement of junction and lighting below flyovers; Hazard markers and Signage; Inspection and Maintenance of flyovers; NDT [non-destructive testing] and other testing; Typical girder and box sections.[11]

Flyover construction in Mumbai under Mr Bongirwar's watch led to the modification of many aspects in the Indian Roads Congress's codes for roads, bridges and 'grade separators', including new specifications on segmental construction, pile foundations, live load continuity and low-relaxation steel.[12] Flyover and skywalk construction can thus be understood as contributing to efforts for providing reproducible rigour and innovation to processes of city making in contemporary Mumbai—especially in contrast to the lack of formal organizational standards and technical protocols implemented in the city's extensive 'slum' settlements.

Nevertheless, this more formalized status that flyovers and skywalks affirm through modes and practices of visualization, mapping and standardization cannot be taken for granted. The capacity of flyovers and skywalks to offer a free-flowing passage through the city, and a predictable and routine experience, needs ongoing maintenance and attention—what one civil engineer I spoke to referred to as 'continuous jobs' rather than 'one-time jobs' (interview, 2009). If flyovers are to be understood by those devising and using them as more knowable spaces in an opaque city, potential problems and defects must be anticipated where possible—and indeed anticipated in the original 'design and detailing' of these structures (Bandyopadhyay and Ghoshal, 2003: I-3–4). Moreover, this attention and foresight helps reinforce these structures' status in contrast to large swathes of Mumbai, where buildings and surfaces do not necessarily receive the same concern and consideration; where disrepair, blockages and dilapidation are common if not ubiquitous (Graham and Thrift, 2007: 11).

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10   Interestingly, this lack of knowledge of Mumbai's underground pipes may not necessarily be a longstanding problem, as indicated by Mr Karmarkar, but part of the dismantling of informational infrastructure around public utilities associated with (ultimately unsuccessful) moves towards privatization over the past 20 years (see Björkman, 2015, Chapter one).

11   Mr Bongirwar was also a member of the Bridges Specifications and Standards Committee that drew up the Manual for Grade Separators and Elevated Structures for the Indian Roads Congress in 2010 (IRC, 2010).

12   In subscribing to globalized (rather than necessarily national) technical standards, flyovers in Mumbai can be considered part of an emergence of what architectural theorist Keller Easterling refers to as 'infrastructural space'. Easterling (2014: 172) emphasizes the additional role of management standards around 'the mysterious term "quality"' connected with the ISO 9000 certification process. This has also been a feature of flyover and skywalk construction in urban India: 'The design and construction organizations should get ISO:9000 certification or should at least follow all the ISO:9000 requirements in practice' (Reddi, 2003: 1182).

This maintenance involves a number of different practices and routines, enacted by the state through a myriad of subcontracted private providers. Flyovers are subject to structural inspections, usually weekly; these involve checking joints, lighting and potholes, and particular attention is given to these checks after the monsoons. A few flyovers in Mumbai are what one engineer working for Ashwini Infra Developments called the 'bad kids': they require regular 'patching up' and night-time closures (interview, 2010); they are also periodically renovated, which includes repainting twice a year and repairing their concrete covering coat every six to seven years. Mastic asphalt technology is used for surfacing on many flyovers; this uses three times more bitumen than normal, making it much stronger and more waterproof than roads elsewhere in the city, which are subject to more potholing than the flyovers. Flyovers and skywalks, in contrast to many other areas of the city, are also regularly cleaned. This ensures that drainage conduits are kept clear of obstruction. But cleaning flyovers and skywalks can be a Sisyphean task of sweeping clouds of dust into the air that simply land a few metres away. Perhaps the cleaning procedure can be understood as a performance of cleanliness and 'matter in place'—and as an attempt to instigate a certain order and formality consistent with many of the original visual renderings of these schemes.

Flyovers, skywalks and urban conduct

Although elevated transport projects seemingly offer opportunities to engineer a more planned, standardized and better maintained urban landscape in Mumbai, the informal world remains an uncertain element in their actual everyday use. As consulting engineer Atul Bhobe, who has helped design several flyover and skywalk projects in the city since the 1990s, perceptively attests:

> The challenge actually lies in tackling socio-economic problems and less in tackling the construction problem. The construction problems the engineers are trained and designed to tackle and overcome, but the socio-economic problem is something which is unique (interview, 2009).

Once inaugurated and operational—and out of the direct realm of engineers' design and monitoring processes beyond routine maintenance—flyovers and skywalks face the social complexities and ambiguities of Mumbai's street life. Moreover, in an urban environment infused with multiple modes of authority (Hansen, 2005), these transport structures encounter forms of 'political society' that can undermine ideals of bourgeois order (Chakrabarty, 2002: 77).

Nevertheless, as material forms prominently located within Mumbai's streetscapes, flyovers and skywalks offer a strategic arena for trying to instil assumptions of a stable and cohesive civil society, or at least establish levels of 'differentiated citizenship' (Holston, 2008). Access to most flyovers in Mumbai is prohibited for three-wheeled vehicles, pedestrians, pushcarts, bicycles and buses (see Figure 2). Often, police officers are stationed at the start of particular flyovers, such as the 2.4 km route along the Mohammed Ali Road, to ensure that these rules are adhered to. Pedestrians can, of course, access skywalks, but hawkers are permitted only in zones allocated to this activity on certain skywalks (although these seem to have limited use even during peak periods). Mr Lalla, chief engineer of Thane Municipal Council in the north of Mumbai's metropolitan region, for example, emphasized how the new elevated transport structures around Thane station 'will be hawker free. That is important' (interview, 2009). Efforts have also been made to instil order below these structures, in spaces left by construction work around the piers and supports. Railings and careful landscaping have been widely introduced to limit loitering, hawking and squatting (Harris, 2013b). Attempts are thus being made to keep Mumbai's informal world at bay—both around and under flyovers and skywalks—to contribute to their characteristics of controlled density and free-flowing traffic.

FIGURE 2   Prohibited forms of transport at the start of the JJ Hospital flyover (photo by the author, July 2009)

Once users are actually on these structures, they are also subject to forms of disciplining and codes of civility. Drivers on flyovers encounter signs emphasizing the need to keep a steady speed, and not to overtake or stop—this is a clear effort to help govern and maintain the linearity and predictability of traffic flows. Certain behaviours on skywalks are also strongly discouraged: there are frequent overhead signs in English and Marathi, with standard visual styling, prohibiting loitering, hawking and spitting, and some skywalks, such as at Thane, have 'welcome' and 'thank you' signs at the start and end. These widespread municipal signs suggest that skywalks and flyovers have become a key spatial component in ongoing bourgeois efforts, rooted in the colonial history of Indian cities, at winning what Sudipta Kaviraj (1997: 85) calls a 'war against spontaneous "indiscipline" [and] ... a pretence of unending invigilation over popular conduct'. These efforts also encompass more direct forms of control by guards who are often stationed on longer skywalks. The chief engineer of the MMRDA, Mr Pahal, told me that the guards were there to help maintain 'the discipline of people using the skywalk' (interview, 2009). When I spoke to some of the guards at Bandra East Skywalk in 2009, directly above an 'informal' settlement, they revealed that they had been told to restrict hawkers and people vandalizing the structure—although they admitted they very rarely had problems with this. They had also been instructed to stop people from spitting and to prohibit couples canoodling, mentioning that some people from the 'slum' area below would use the skywalk after office hours and 'sit and dirty it and spit everywhere'.

Flyovers and skywalks are also part of efforts to produce and affirm the Mumbai consumer citizen. This corresponds with how state authorities often try to cross-subsidize maintenance and security costs for flyovers and skywalks by selling advertising space. Flyovers frequently include a deluge of advertising billboards, which include advertisements for cars showing flyovers, while the actual flyover structures can also be

used in advertising: for example, the main supports of a flyover on the Eastern Express Highway were made to look like bones in an advertisement for a brand of calcium treatment. The lattice structure of skywalks is also a convenient and visible site for billboards, and many renderings and short films for skywalk that projects planners and consulting engineers showed me featured brightly coloured advertising for major bank, mobile phones and soft-drink brands. These transport spaces thus require not only 'correct' forms of movement through them but also help stimulate participation in Mumbai's consumer economy.

Elevated transport and formalized urban space

Given the seemingly formalizing possibilities, both socially and materially, associated with flyovers and skywalks across the Mumbai metropolitan region over the past 20 years, these structures have increasingly become a means of affirming the status of particular urban spaces and relations between them. The predictable and regulated ideal that flyovers and skywalks present has helped to link and define *pukka* zones against what is assumed to be a growing amorphous mass of 'informal' settlements. The engineering system of elevated roads and walkways connecting specific types of land use has not only helped compress distances and dissolve relations between the centre and the periphery, but has also provided a way of marking and legitimizing elite formal territories against surrounding informality in what Roy (2011: 233) calls the production of an 'uneven urban geography of spatial value'.

Several different types of urban development have been plugged into this infrastructural system for formalizing Mumbai's urban territory. In particular, the building of luxury residential townships has often been accompanied by flyover construction—or the construction of flyovers has heralded new upmarket residential enclaves. Flyovers are seen as helping improve accessibility and connectivity across the metropolitan region for residents of these townships, who are generally able to afford the private vehicles required to use them (see Chattopadhyay, 2012: 29, on the similar role of flyovers to residential complexes in Kolkata). But this construction of flyovers over the past two decades can also help assert the formal status of residential areas for those building them or investing in them, particularly in the case of developments sited outside the traditionally affluent districts of Mumbai.[13] As planning historian Michael Hebbert (2005: 40) commented in relation to highway engineering in 'developing countries', 'the "official" city ... is today recognizable by its looping distributor roads and access spurs'.

This relationship between 'official' Mumbai and flyovers is a key aspect framing the narrative in *Traffic Signal,* a 2007 feature film directed by Madhur Bhandarkar. In a scene in an office featuring pictures of high-rise buildings on the wall, a builder, Rasiklal, bemoans the issue of making a new housing complex viable with his local corporator, Dubey:

> Dubey-ji, it isn't the price. That's not the problem. The real problem is the road that leads to the residential complex. The municipality workers leave the road dug up for months on end. And then [there are] the slums, the beggars, the illegal stores. And countless traffic lights. They cause big traffic jams. You're half dead before you reach my housing complex, Dubey-ji. People say it should be called slum view not sea view.

Rasiklal has heard that the local government had ordered ten flyovers to be built in Mumbai, and one is to be built nearby. He suggests to Dubey that this flyover 'be extended to my complex, [and] my problems will be solved. The flats will go up in value. You help me. I can even give you the model'. Dubey agrees to see the chief engineer, Sailesh Jha,

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13 It is important to note that one of the busiest routes through Mumbai without a flyover, Peddar Road, also passes through some of the wealthiest neighbourhoods in the city.

on Rasiklal's behalf, but his proposal to extend the flyover is rejected, despite offers of bribes—precipitating a violent gang-related turn of events for this engineer (the engineers in the film sport conspicuously less gold jewellery than the politician and the builder). While these conversations are fictionalized, it is notable that the developer is worried about his new housing being thought of as subsumed within the surrounding informal world if there is no flyover: it will become 'slum view not sea view'.

The developers of new upmarket retail centres have also sought to establish close relations with Mumbai's flyover system. For instance, High Street Phoenix, a shopping, leisure and entertainment experience in central Mumbai, built on former textile mill land, has a large multi-storey car park, often with long queues of cars. The system of overhead signs within the mall mimics that of Mumbai's expressways in terms of colour, position and lettering. This suggests that the space has been designed to form a direct continuum with the flyover on Senapati Bapat Marg (Tulsi Pipe Road) outside, not least as both offer a sealed, enclosed world for moving through the city.

Newly developed commercial centres in Mumbai have also required transport projects, not only to improve accessibility but to solidify and legitimize understandings of their position in the city. For example, despite being established by the MMRDA and attracting the Diamond Bourse and National Stock Exchange, the BKC business district has until recently struggled to assert its identity in understandings of Mumbai's commercial geography, given the presence of significant 'slum' areas around it. The construction of a skywalk from Bandra train station in 2008 (with steps leading only to commercial offices such as the India Oil building rather than to a large low-income community also located beneath the station) and the opening of the Santa Cruz-Chembur Link Road in 2014 (with Mumbai's first double-decker flyover, described by National Geographic as an 'engineering marvel') have sought to address this.[14] These large infrastructural projects have not only improved the BKC's connectivity with the rest of the city, but have also affirmed its central place in a formalized infrastructural imagination of Mumbai.

While flyovers and skywalks help developers and planners to physically and culturally stitch 'formal' zones of the city together above and beyond the rest of the rapidly growing metropolitan region, they also play a role in efforts at upgrading the 'slum' spaces below them. In this they share similarities, albeit less pronounced, with the recent propagation of cable-car systems above *favela* hillsides in South America. As Brand and Dávila (2011: 357) report in relation to their research in Medellín, Colombia:

> Infrastructure was ... a means for the formal sector and state agencies of gaining access to previously no-go areas in the grip of local armed gangs ... the cable-car systems can ... be understood as mechanisms for the 'normalisation' of informal sectors of the city.

In Mumbai, the 1.3 km skywalk from Bandra train station also seems to play a role in reformulating and reclaiming the informalized urban space below it. Along the first part of the skywalk's route is an area called Behrampada, containing a labyrinth of alleyways, workshops and towering shacks (see Figure 3). The construction of the skywalk in 2008 brought new visibility to this once relatively unknown and unsurveyed part of the city. The vertical platform of the skywalk has created a gaze down onto terrain that had previously been thriving on a degree of impenetrability to outsiders.[15] Now placed within a clearer cognitive map of the city, the area has become primed for

14   In August 2015, plans were announced for several further flyovers to connect into the Bandra Kurla Complex (Mehta, 2015).

15   The documentary film *I Live in Behrampada* (1993), directed by Madhusree Dutta and shot after major communal riots in the city, seems to anticipate these vertical relations. One older gentleman suggests in the film: 'All sorts of things happen. People look on calmly. Even if someone here [in Behrampada] dies, they blame us. And Behrampada's down here, they are up there—can the ones below attack those who are above?'

FIGURE 3   Bandra East Skywalk above Behrampada (photo by the author, April 2009)

formal upgrading and redevelopment, given its location on valuable real estate close to a rapidly growing business district. In June 2009, the area experienced a major fire that left several people dead; the cause of it was never identified, and an exact number of fatalities was never given. The skywalk was convenient as a raised area for fire crews to extinguish the blaze, and subsequently acted as a temporary shelter for people who had been displaced by the fire. However, given Behrampada's new visibility amidst new 'formalized' structures, it was unclear whether the presence of mechanical diggers and excavators after the fire signalled reconstruction or slum clearance.

Conclusions

The focus on the construction and implementation of flyovers and skywalks developed in this article reveals how the world of engineering in Mumbai is centrally implicated in the social and political shaping of urban life. These new transport projects have been built ostensibly as a technocratic response to the rapid expansion of the Mumbai metropolitan region over the past two decades and as part of efforts to assert and perform Mumbai's 'global' and developmental status (Harris, 2013a). But they also need to be understood as a means for elite groups to try to address and reconfigure the widespread experience of informality in the city. Flyovers and skywalks in Mumbai function as a vehicle for attempts at re-establishing and re-imagining notions of order, movement, mobility, civility and connection against a city seemingly suffused with interruptions, uncertainty, crowds, slums and unruliness. The construction of transport infrastructure in Mumbai thus demonstrates how relationships between the 'formal' and 'informal' are actively produced and negotiated not only through legal regimes and aesthetic visions but also through material components, codes of conduct and their accompanying spatial relations.

Nonetheless, it is important to recognize how the construction of flyovers and skywalks can seek to engineer formality but cannot necessarily *fix* formality. Crucially, the ideal—the fantasy—of a modern metropolis of network flows does not neatly dovetail with the actual practices, social constraints and everyday negotiations required in implementing urban engineering schemes in Mumbai. The commissioning of flyover and skywalk projects has given engineers in Mumbai the task of meeting a series of technical challenges, such as those involving bearing loads, piling locations, concrete strength and drainage design, while also mediating between contractual arrangements, religious traditions, political demands and regimes of knowledge shaped by the postcolonial Indian context and transnational flows of engineering expertise. Many of these projects have been associated with murky dealings between politicians and construction companies over tendering processes, advertising hoardings and land acquisition and implementation, as hinted at in the film *Traffic Signal* (2007). Despite the increasing use of advanced engineering technologies and techniques, construction is often hindered by poor-quality materials, difficulties in procurement procedures (see Patel, 2016) and delays to ensure that opening ceremonies correspond with electoral cycles.[16] Over the past decade many projects have taken much longer than originally estimated owing to contractual disputes between different agencies around construction and maintenance responsibilities as well as to drawn-out discussions around the rehabilitation of persons affected by projects. This has often left semi-abandoned structures littering the urban landscape to be repurposed by squatters and hawkers, or by children as impromptu adventure playgrounds. Ananya Roy (2009: 84) is therefore correct to assert that 'the formal and the legal are perhaps better understood as fictions, as moments of fixture in otherwise volatile, ambiguous and uncertain systems of planning'.

Yet, even if ultimately 'fictional' and contingent on, and complicit in, Mumbai's informal social and political worlds, the formal should not necessarily be analytically jettisoned. It still plays a key imaginative and experiential role in efforts at remaking and re-moulding urban life in contemporary cities such as Mumbai. The formal offers important possibilities centred on law, infrastructure, democracy and development that can be inadvertently lost in a default emphasis on the improvisational and marginal qualities of urban informality. In the same way that it is critically productive to question the equation of informality with the poor and powerless, can notions centred on the formal also be challenged? If there can be 'informality from above', as Roy (2009) asserts, can *formality from below* also be conceived of and pursued? This might be developed in terms of practices of the everyday, ordinary and quotidian, such as walking in relation to urban transport planning. But it could also mean contesting assumptions about which actors and organizations possess the requisite formal knowledge and technical expertise. Perhaps future visions of Mumbai might be shaped not only through engineering solutions implemented by project management consultants, multinational contractors and unelected bureaucrats but also through forms of socio-material experimentation and techno-popular knowledges generated by what might be understood as forms of 'subaltern' engineering.[17]

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16   Some of these issues became tragically apparent with the collapse in March 2016 of the Vivekananda flyover, which killed 27 people. The flyover had been under construction along a busy Kolkata street, and the Indian Urban Development Minister suggested that construction work was carried out in 'an unscientific manner' (*Hindustan Times*, 2016).

17   With regard to opening up alternative social and political perspectives on the expertise involved in urban infrastructure, see Minuchin (2016) on the generative potential for urban construction practices in Argentina in reconfiguring political action, and Farías and Blok (2016) on the scope for experimental and collective forms of technical democratization in urban settings.

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