

Concrete geographies

Assembling global Mumbai through transport infrastructure

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Through a focus on the concrete geographies of transport infrastructure in contemporary Mumbai, this paper develops a critical engagement with assemblage theory and the global city. It details how international consultants, contractors, investors and investment, as well as materials, techniques and technologies, have helped sustain and strengthen Mumbai's relations, associations and flows of global reach. In so doing, it demonstrates how 'global city-ness' is generated and articulated through diverse human and non-human components. However, the paper argues this exploration of socio-material assemblages needs to be combined with an analytical probing of the comparative imaginations, discursive categories, elite coalitions and uneven geographies involved. By drawing on post-structuralist theories of globalisation while emphasising the practices, visions and agendas of specific social groups in Mumbai, the paper aims not only to provoke new empirically grounded dialogue between assemblage thinking and critical urbanism, but also to encourage alternative ways of imagining and planning the global city.

Key words: global city, assemblage, Mumbai, transport planning, comparisons

Introduction

Arriving at Mumbai's Chhatrapati Shivaji International airport in December 2009, the immediate experience of the city outside the main terminal is one of concrete blocks, dust and construction. Ramps and bridges are being built over carefully manicured lawns and gardens to connect to several new multi-storey car parks. The road from the airport to the Western Express Highway is jammed with traffic despite the late hour. Access to the middle of the road is restricted with large yellow and black 'Larsen and Toubro Limited ECC Division' barriers, some garlanded with

lights, and an array of flyover piers. Some of these bear concrete segments of the new 'Sahar Elevated Road' while others are still in steel skeletal form. Beyond the road, large piling rigs marked Bauer and the silhouetted cranes and mixing units of Larsen and Toubro's casting yard can be seen (Figure 1).

Over the last 10 years, there has been a flurry of new transport initiatives in Mumbai such as the Sahar Elevated Road, often involving complex engineering procedures and international contractors and expertise. These have included the construction of elevated roads (flyovers), the opening in 2008 of Mumbai's first 'skywalk' (elevated pedestrian walkway), the launch of



Figure 1 Concrete casting yard for the Sahar Elevated Road, in the vicinity of Chhatrapati Shivaji International airport, December 2009. Photograph by the author. Please visit www.verticalurbanism.com for further visual material

metro-rail projects, the opening of the Bandra–Worli Sealink in 2009, and plans for more roads, metro-lines, mono-rails, skywalks and sealinks—at a variety of heights—threading through the entire metropolitan region (Figure 2). This expansion and upgrading of Mumbai’s transport infrastructure is a response to what the *Economist* (2012, 105) calls ‘transport bedlam’ in the city. The construction of new roads, bridges and rail systems over the last decade has been an attempt to alleviate severe congestion exacerbated by one of the highest motorisation growth rates in the world, rapid suburban population increases, and the extension of the city both up and outwards (Sharma, Jain, and Singh 2011; United Nations 2009).

This paper, however, suggests that this spate of new transport construction projects should not be understood as simply a technocratic response and remedy to the pressures

and demands of the rapid urbanisation of Mumbai’s metropolitan region. The technologies, consultants, investment and imaginations involved in building new transport infrastructure have also played a significant role in assembling and asserting Mumbai as a global urban space. There are direct connections between the people and materials involved in recent transport construction activities and growing aspirations and visions of Mumbai as ‘world class’. Transport needs to be understood as centrally implicated in increasing attempts over the last 10 years at reconfiguring Indian cities to match the Asian—and global—reputations of Shanghai and Singapore (Batra 2009; Bunnell and Das 2010; Roy 2011).

In investigating the relationship between new transport projects and global Mumbai, the paper engages with post-structuralist understandings of ‘globalisation’ and the ‘global city’ that prioritise assemblages,

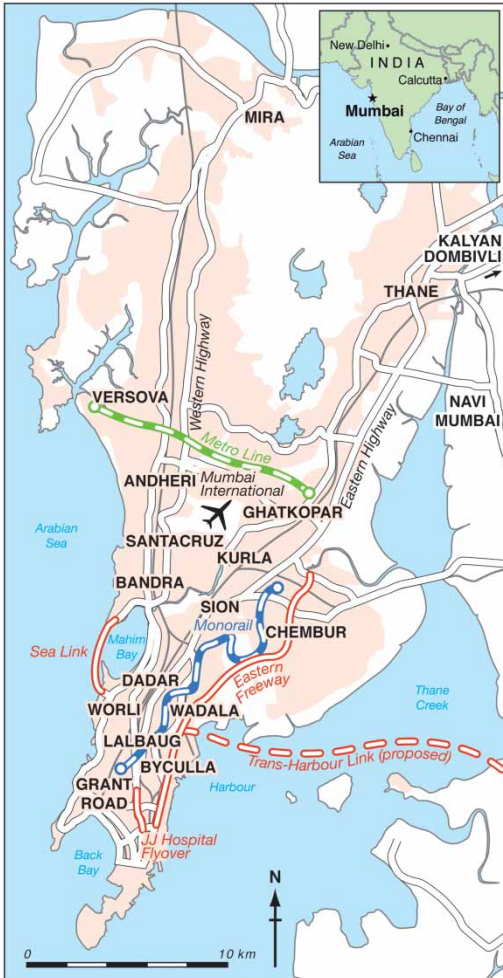


Figure 2 Selection of major transport projects recently completed or under construction in Mumbai (cartography by Miles Irving)

relations and connections rather than hierarchies, scales and boundaries in their analyses (Amin 2002; Latham 2002; Taylor 2004). Authors, such as Doel and Hubbard (2002) and Smith (2003b), have considered how 'global city-ness' has been generated by the topological clustering and dispersion of globally distributed actors, actions and encounters. There have also been attempts, particularly by Smith (2003a) and Farías (2010), to use actor-network theory (ANT) to challenge the way objects, scales and networks are conceptualised.

Exploring transport infrastructure, moreover, disrupts a dominant emphasis on multinational companies and financial and business services in global city research (e.g. Sassen 2001; Gordon 2002; Carroll 2007). Although the last decade has seen explorations of alternative attributes and connections in studies of the global city, such as media networks (Krätke 2003), disease (Ali and Keil 2006) and religious knowledge (Flusty 2005), there has been no concerted attempt to examine the links between transport, automobility and global city-ness (although, see Anand 2006). This is despite John Friedmann (1986, 72) identifying 'major transport nodes' as one of seven selection criteria of the 'world city' in his seminal 1986 hypothesis.¹

By focusing on the global relations of transport infrastructure in Mumbai, this paper seeks to fore-ground an actually existing urban situation rather than contributing to a tendency in a growing literature on urban assemblages to rely on meta-theoretical speculations (although, see McGuirk and Dowling 2009; Edensor 2011; Simone 2011). The need for more empirical research was one of the main points of consensus that emerged from the recent extended debates in this journal on the relationship between assemblage and critical urbanism. McFarlane (2011) talked repeatedly of the necessity of 'thick description', Brenner, Madden, and Wachsmuth (2011, 236) were sympathetic to assemblage's role in opening up 'empirical research agendas', while Acuto (2011, 558) emphasised 'in-depth fieldwork' and Farías (2011, 366) spoke of the need for 'open and exploratory inquiry'. This paper contends that if assemblage theory is going to have any critical analytical scope in urban studies, it is through its adoption and experimentation within in-depth empirical studies—such as those on global cities and transport—investigating specific actors, materials and contexts (and context of contexts). Not only will this assist in any future rounds of ontological squabbles but will help clarify and circumscribe the rather diffuse and imprecise way that assemblage,

and indeed critical urbanism, has often been marshalled by its proponents, and reduce a tendency towards what Tonkiss (2011, 588) calls 'template urbanism' where the assemblage approach 'might over-write the empirical contexts it seeks to describe'.

This paper's 'concrete research' foray (Brenner, Madden, and Wachsmuth 2011, 237) adopts a range of inter-related methods undertaken between April 2009 and January 2012 across an array of sites connected with new transport projects in Mumbai. These include 20 formal interviews with engineers, politicians, policymakers and transport consultants, archival analysis of planning reports, newspapers and engineering diagrams, and ethnographic and visual documentation of administrative offices, construction sites and spaces underneath new transport structures. By tracing out the workings of the 'given empirical context' (Tonkiss 2011, 588) of transport infrastructure construction in contemporary Mumbai, and offering a careful probing of the comparative imaginations and discursive categories used by particular social actors, this paper aims to provide an example of how micro-scale descriptions can be combined with analyses of urban restructuring and the key dynamics of contemporary global urbanism (Robinson 2011).

The paper begins by detailing how transport projects in Mumbai have established, sustained and strengthened the city's relations, associations and flows of global reach. It argues these have consisted not only of consultants, contractors, investors and investment but an assembling of materials, techniques and technologies. In this it draws on ANT-inspired approaches to explore how the 'mundane artefacts' (Latour 1992) of transport construction in Mumbai have played a role in articulating new relations of globality (see also, Merriman 2005; Jacobs 2006). The paper emphasises the importance of comparative practices and imaginations in bringing these transport assemblages in Mumbai into a global frame of reference. In particular, it suggests that the perception of recent transport

infrastructural projects as iconic, speedy and big has allowed Mumbai to be deemed suitably 'world class'.

This investigation of the diverse human and non-human constitutive elements of new transport projects in Mumbai aims to show how 'grammars of gathering' and 'relationalities of composition' are central in global city-ness (McFarlane 2011, 205–206). Nevertheless, although using assemblage theory as a research orientation and methodological stance to examine particular socio-material configurations and process-based ontologies of city-making, the paper does not seek to overload assemblage with 'analytical weight' (Brenner, Madden, and Wachsmuth 2011, 238). It emphasises the importance of specific elite coalitions in assembling recent transport projects in Mumbai and forging new global comparisons. These groups, it suggests, have deployed the discursive category of 'world class' to help instigate and normalise a specific financial and social agenda and aesthetic vision of the future city. This has prioritised improving the accessibility, connectivity and desirability of particular areas of Mumbai—such as the international airport—considered essential to attracting foreign investors and investment. The construction of new transport projects in Mumbai has not only created and consolidated globally extensive relations and networks but has cemented uneven geographies of power and connection (Anand 2006). Transport infrastructure in Mumbai, like water pipes, sanitation systems, housing policies and land markets, has been a key mediator in shaping an increasingly fragmented and polarised metropolitan landscape (Gandy 2008; Graham, McFarlane, and Desai 2013; McFarlane 2008; Harris 2008; Doshi 2012; Banerjee-Guha 2009).

Global relations of transport in Mumbai

Mumbai's transport infrastructure has always been characterised by expertise, investment and ideas from overseas. For example, Bombay's Presidency's Road and Tank

Department sourced ‘twelve iron rollers’ in 1845 from England because they were ‘better than those produced here’ and a London contractor was approached to carry out the works as ‘native firms were incapable’ as they had ‘unsuitable knowledge’.² Under British colonial rule, roads and railways were constructed to ensure easy access to cotton, opium and other goods from the city’s hinterland, and to help spatially divide colonial administrators and traders from the rapidly expanding ‘native’ population (Hazareesingh 2007). After Indian Independence in 1947, modernist aspirations for a more rational city of uninterrupted traffic grew. The Japanese firm Higashi and Tsujii was commissioned to make a preliminary geological study for a subway line in 1957. In the *Bombay Traffic and Transportation Study* from 1963, the Connecticut transport consultants, Wilbur Smith, in association with the London-based Freeman, Fox and Partners, recommended the construction of a ‘West Island Expressway’ and other programmes to provide fast and unimpeded movement to private motorists.

The last two decades have seen a strengthening and expansion in these connections to international transport consultants. In 1994, the Mumbai Metropolitan Region Development Authority (MMRDA) commissioned a report from the UK consultants WS Atkins on transport policy responses to rapid traffic growth in the city. Frischmann Prabhu, an Asian subsidiary of the London-headquartered engineering consultancy Pell Frischmann, were similarly commissioned in 2005 to explore the feasibility for elevated pedestrian walkways in the region. While the Canadian company LEA Associates were tasked by the MMRDA to carry out a Comprehensive Transport Study in 2007—the first major survey of traffic patterns since that orchestrated by Wilbur Smith in 1963.

As well as international consultants, the last 20 years have seen a greater number of foreign construction firms involved in large transport projects in Mumbai. The US company Louis Berger have been central in

the ongoing building of India’s first double-decker elevated expressway on the Santa Cruz–Chembur Road, with their senior staff visiting twice a year (Figure 3). This is their first project in India, and one that they were awarded not only on the price tendered but because ‘they had undertaken similar flyover projects on this scale internationally’ (interview with senior engineer, 2009). This reflects the view stated in the feasibility study prepared by Wilbur Smith in 2003 for the non-rail components of the Mumbai Urban Transportation Project II (MUTP-II) that ‘major highway schemes should be constructed by international contractors’ (Wilbur Smith 2003, section 6.8). Similarly, the 2.4 km J. J. Hospital flyover along Mohammed Ali Road (officially called the Makhdoom Ali Mahimi Flyover), which was completed in 2002, and the 5.6 km Bandra–Worli Sealink, which opened in 2009, were designed and project-managed by the London-based Dar Consultants, with extensive experience of projects in the Middle East.

Transport projects in Mumbai have also increasingly received international investment. In the early 1980s, the Chief Minister of Maharashtra (the Indian state of which Mumbai is the capital city) visited Dubai to try to secure support for transport upgrading in Mumbai but was forbidden by Prime Minister Indira Gandhi who restricted the use of foreign funds for infrastructure projects (Save Bombay Committee 1999). However, many of these capital restrictions were lifted with liberalisation reforms of the Indian economy in 1991 and the dismantling of the socialist ideological roots in the politico-administrative apparatus (Srinivasan and Tendulkar 2003). This has opened up new circuits of capital and financial institutional innovations in infrastructural investment (Kundu 2001). Many Indian firms have new international ownership. The Mumbai flyover and skywalk consultancy specialists S. N. Bhohe and Associates are 51% owned by TPF, a Belgium consultancy group, while US-based Jacobs Engineering Group has a majority stake in Consulting



Figure 3 Signboard outside Kurla station for the forthcoming double-decker flyover along the Santa Cruz–Chembur Linking Road, July 2009. Photograph by the author.

Engineering Services (CES), one of the co-authors with Wilbur Smith of the MUTP-II report. In July 2011, the US-based private equity firm, Xander Group, acquired a 14.5% stake in HCC Concessions, a Mumbai-based company which designs, finances, builds and operates transport infrastructure, including the Bandra–Worli Sealink.

Assembled technoscapes of global transport

Mumbai's increasing entanglement in global transport expertise and ideas elsewhere has not only been through new flows of people and investment, but also through the assembling of materials, techniques and technologies. These 'technoscapes' have not only developed the scale and scope of transport projects in the city but, involving multi-sited networks of association, have helped increase Mumbai's global connections. For

example, the construction of flyovers over the last decade has involved enrolling of 'state-of-the-art' international machinery, with Liebherr cranes imported from Germany, concrete paving machines from Britain and piling rigs from Italy and the USA (Figure 4). The engineer in charge of constructing Bandra West skywalk proudly commented that 'we are using the best escalators in the world', referring to the proposed use of Schindler equipment from Europe (interview, 2010).

New techniques and materials from overseas have also been introduced in flyover and skywalk construction. These include ramp building design, cement polymer composite coating, mastic asphalt road surfacing and Italian sound reduction technology. One engineer working on the skywalk in Mira Road in Mumbai's Northwest suburbs proudly commented on how they were using German covering sheeting. This he



Figure 4 Mait piling equipment from the USA used in the construction of the flyover along Dr Babasaheb Ambedkar Road between Sion and Byculla, April 2009. Photograph by the author.

suggested was very good at keeping the walkway cool in strong sunshine and much better than the ‘Indian material’ used for Mumbai’s first skywalk at Bandra East (interview, 2009). Perhaps the most important international innovation in transport construction to be enrolled has been the use of pre-cast concrete segmentation techniques. First pioneered in Germany in the 1950s, Dar Consultants introduced them to Mumbai in 2002 to build the J. J. Hospital flyover (Figure 5). This allows flyovers to be built without bulky scaffolding enabling construction to proceed over busy existing roads and densely populated neighbourhoods.

Connections into international networks have been made and strengthened not only through the construction of transport projects but through their design and technological rendering. Although transport consultants in the city were using IBM machines to code traffic surveys during the early 1960s, the last

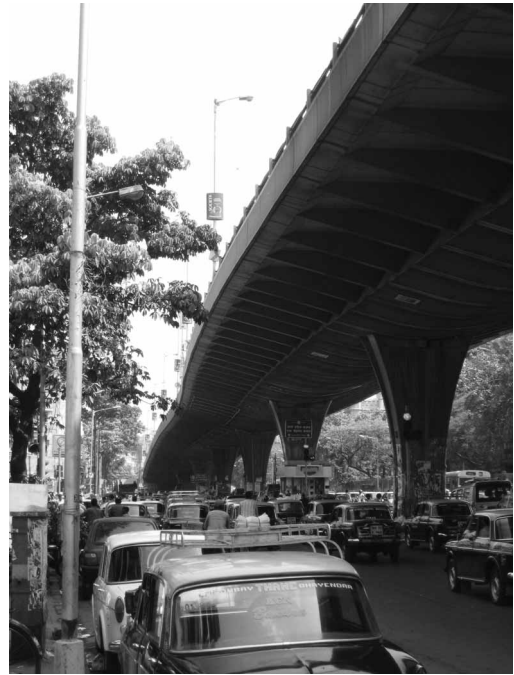


Figure 5 Pre-cast concrete segments of J. J. Hospital flyover over Mohammed Ali Road, April 2009. Photograph by the author.

decade has witnessed the extensive use of software packages and computer technology from overseas. As Atul Bhobe, managing director of Bhobe and Associates, suggests:

‘I would say it has changed from 1996/97. Until that point . . . there weren’t that many projects so you would typically be doing maybe three flyovers a year or four flyovers a year which means you had a lot of time on your hands which meant you could do manual calculations. Software was not so easily available in India. There were import restrictions; there were foreign exchange restrictions. You couldn’t just walk in and buy software off the shelf. So people in India used to be stuck . . . with programmes that you developed on your own . . . We are [now] working with the latest software that is available on the international market.’
(Interview, 2009)

Other new uses of international software include *Autocad* programs to model the

look and appearance of plant creepers up the sides of flyover structures.

The overall management of transport projects and systems in Mumbai has also become closely integrated into international standards and codes. As S. L. Dhingra, Professor in Transportation System Engineering at Mumbai's Indian Institute of Technology, suggests, 'the MSRDC's [Maharashtra State Road Development Corporation] style of functioning is not very different from the way infrastructure projects are executed abroad' (interview, 2009). This is evident in the design, typography and placing of new road signs along Mumbai's expressways over the last decade, which contrasts to the situation in 1993:

'Apart from being virtually invisible, road signs in India are usually placed at traffic junctions, not well before, so that it is too late to follow them ... This problem was solved years ago in the West, simply by placing these signs centrally over the road, overhead and well clear of the tallest vehicle.' (Desai 1993)

For the politician Nitin Gadkari, responsible for launching the '55-flyover' project in 1997, this new international transport 'know-how' in Mumbai has had important impacts on the approach to construction more generally in India: 'the technology has changed; the precast technology has improved; ready mix concrete is made mandatory, compulsory; five-drill machines are imported from abroad and because of that, [we have the] upgradation of the construction industry in India' (interview, 2009).

Global comparative frameworks of transport construction

Although new transport projects have increased the flow of international specialists, investment, materials and techniques into Mumbai, it is only through comparative practices and imaginations that the 'global-ness' of the city's transport infrastructure has been established and affirmed. Major

transport projects have allowed Mumbai to be framed as contiguous with the technology, ambitions and innovations of other more archetypal 'global cities'. For example, the Wilbur Smith report from 1963 suggested 'the staggering proportions of all modern highway programmes are in evidence everywhere; Bombay is no exception' (205). Although the report offers a proviso that 'when related to the design of American systems' the proposed highways for Bombay are 'about one tenth as great, based on projected populations' (209).

The last decade has been filled with similar comparative gestures made between Mumbai and the transport characteristics of cities outside India. The Frischmann Prabhu (2005) report on skywalks compiled data on projects from Minneapolis and St Paul—described as 'forerunners in developing the modern skywalk system' (5)—as well as Cincinnati, Des Moines in Iowa, Calgary, Hong Kong and Singapore, with an 'Interesting Pedestrian Bridges' appendix including examples from Anchorage, Seattle, London and Sheffield. The LEA study from 2010 compared Mumbai with Delhi, Mexico City, São Paulo, Tokyo, Seoul and Cairo, contrasting traffic patterns and facilities within a 20 km radius of the city centre—with no acknowledgement of differences in coastline or topography.

Overseas visits undertaken by Indian engineers, architects and politicians have also facilitated and encouraged Mumbai to be situated in an international comparative framework of transport construction and provision—continuing and developing engineers' status as 'perhaps the first modern professional group whose movements became truly "global"' (Hazareesingh 2009, 29). Atul Bhoje remarks how his international travels to other cities are likely to have shaped his design and consultancy work on skywalk projects in Mumbai:

'One travels the world and one sees, [and] one learns from what one sees ... Personally I have seen the skywalks in Hong Kong which

has got a lot of areas with skywalks, I've seen Singapore, I've seen U.K. where there are skywalks, but you know these are assimilated at the back of your minds when you implement these projects.' (Interview, 2009)

Comparative learning has also often been more formally implemented. A firm of Mumbai architects and planners, Aakar Abhinav Consultants, visited Singapore in 2009 specifically to study airport and multi-storey car parks. More prominently, the Minister of Public Works for the Government of Maharashtra, Nitin Gadkari, organised a South-East Asian study tour in 1997. Together with some of his chief engineers, he visited Singapore, Malaysia, Bangkok and Indonesia; countries that were 'treated as giants in the infrastructure market' (Bhobe 2000, 2). Gadkari (2009) was particularly impressed with Malaysia: 'this was the best experience I ever had which gave me a new direction to think. When I came back in Mumbai I started working on Mumbai-Pune Express Highway and flyovers' schemes.' Moreover, this comparative framing does not necessarily require international travel. Many offices of architectural and engineering firms in Mumbai responsible for transport projects in the city display images of buildings such as the Petronas Towers in Kuala Lumpur on walls or computer screensavers.

World-class dimensions of transport infrastructure in Mumbai

It is important to recognise how this comparative framing of Mumbai in relation to urban transport systems elsewhere has been articulated through specific registers, dimensions and imaginations. In particular, the construction of transport infrastructure over the last decade has been undertaken with widespread reference to Mumbai as a 'world-class city'. This phrase was popularised by a 2003 report entitled *Vision Mumbai: Transforming Mumbai into a World-Class City* commissioned from the

global consultancy firm McKinsey & Company by a corporate pressure group called Bombay First (founded in 1994 on the model of London First). Offering short 'benchmarking' studies of international cities such as Cleveland and Shanghai 'that became world-class' (Bombay First 2003, 10), this report inspired a Task Force set up by the Chief Minister of Maharashtra a year later, which argued that transportation is Mumbai's 'most pressing need in its bid to become a world-class city' (Government of Maharashtra 2004, 18). The rhetoric McKinsey's consultants established of achieving world-class 'standards', 'levels' and 'quality' now widely pervades documents, presentations and discussions around transport futures for the Mumbai Metropolitan Region.

This includes devices used to present and perform transport planning schemes. The foyer on the sixth floor of the MMRDA administrative headquarters in the Bandra-Kurla business district houses a series of models of new and proposed transport projects underneath a large brightly coloured poster. This proclaims the summary statement from the *Vision Mumbai* report: 'transforming Mumbai into a world class city with a vibrant economy and globally comparable quality of life' (Figure 6). Concrete technology in the city has also been shaped around a compulsion for 'world-class' standards and attributes. At a location just off the main road through the Bandra-Kurla Complex, I came across a slogan in capital letters written on a wall urging 'MAKE IT WORLD CLASS' (Figure 7). This is a site where testing has been undertaken to improve the strength and consistency of concrete used in piers for the double-decker elevated expressway next to Kurla Terminus.

'World class-ness' has been signified and supported through transport infrastructure in several distinct if overlapping ways. Firstly, transport projects have been projected through relational imaginaries of Mumbai as an *iconic* city. Iconicity in terms of groundbreaking architectural design and spectacular urban landscapes has become an

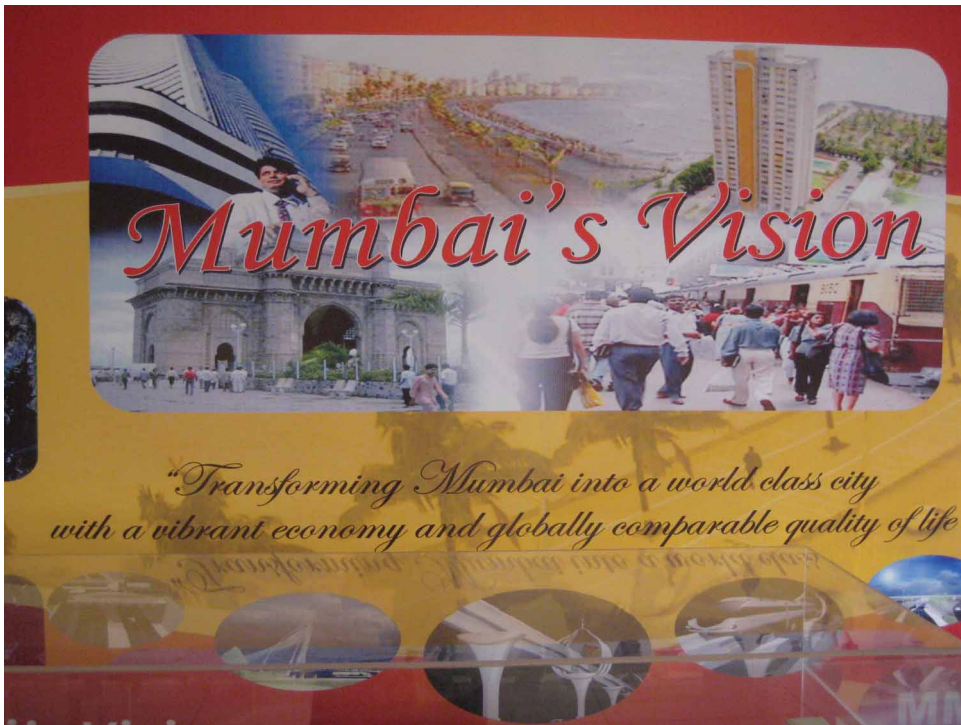


Figure 6 Transport project displays, MMRDA building, June 2009. Photograph by the author.

increasingly important aspect of claims to global competitiveness and relevance (Kaika 2010; Miles 2005). In the offices of Louis Berger at Kurla, I was shown a book entitled *Bridge Engineering* by S. C. Rangwala. The cover featured photographs of three internationally esteemed urban bridges: Sydney Harbour Bridge, the Golden Gate Bridge in San Francisco and the Puente de la Barqueta in Seville. In the bottom left, I was told, was an image of a flyover in Dadar in central Mumbai (Figure 8). This was a clear attempt to place transport structures in Mumbai in the same framework as iconic bridges around the world. Similarly, the bold colours, shapes and lighting of skywalks throughout the metropolitan region are often referred to in terms of their 'iconic' design. For example, the suspended circular form of the Grant Road skywalk is deemed to 'showcase the vibrancy of the city' according to the MMRDA's chief skywalk engineer, Anand Kumar Pahal (quoted in D'Mello 2009), with

LED lights³ and stress bars specially imported from the UK (Midday 2012). The new Bandra–Worli Sealink is perhaps the clearest example of a new iconic form of world-class transport infrastructure in Mumbai, featuring on the front cover of the June 2011 edition of the London-based lifestyle and design publication *Wallpaper Magazine*, as well as the Mumbai First website⁴ (Figure 9). However, a proposed tri-level structure on the Eastern Express Highway at Chembur is also deemed to be 'a source of pride for Mumbai' and, in particularly hyperbolic terms, 'one of the engineering wonders of the 21st Century' (*India Infoline* 2010).

As well as their iconic qualities, transport projects have allowed Mumbai to be viewed as sufficiently global in terms of the city's increased speeds and timings. This is not only in ambitions for quicker movement and circulation through the city embedded in the building of new transport infrastructure, but also in the increased pace of



Figure 7 Flyover pier test site, Bandra–Kurla Complex, June 2009. Photograph by the author.

construction. As Mr Nage, MSRDC chief engineer, comments:

‘A lot of machinery has been brought by a number of contractors. That is an amazing change, which is speeding up each and every work; otherwise it would have been very, very difficult to construct even a single flyover.’ (Interview, 2009)

Atul Bhoje similarly talks about how the speed of construction has noticeably accelerated:

‘A lot has changed, not so much in the way that the concepts are prepared but more in the way that concepts are implemented . . . People have now realized that time is money, you know 15 years back you would have a flyover project and the time period would be 36 months to complete; now the time period is 15 months.’ (Interview, 2009)

New construction techniques and managerial know-how have not only entangled Mumbai across longer global networks and facilitated

new construction routines and practices, but have also contributed to a globally comparable speeding up of the city, both in attempts to save time for motorists by building flyovers over busy junctions, and in the quickening of the pace of implementation of major transport projects.

Another important way that Mumbai’s ‘world-class’ status and comparative global position has been imagined and tested through transport infrastructure has been through ‘bigness’. Transport projects in Mumbai have been a way of meeting aspirations for scale and complexity that emerge from imaginations of, and desires for, global city-ness. During informal conversations, engineers working on transport construction sites would often talk excitedly of megaprojects in Dubai or China. One recounted how he always watched *Extreme Engineering* on the National Geographic TV channel, and another talked enthusiastically of a 26 km Chinese sea bridge. One transport planner spoke of Nerul in Navi

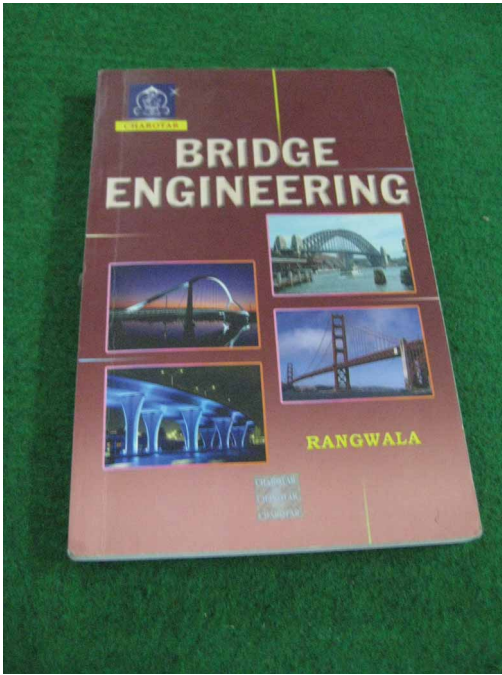


Figure 8 *Bridge Engineering* by S. C. Rangwala. Photograph by the author.

Mumbai becoming a transport hub that brings together sea, road, rail, metro and bus in an integrated way not seen anywhere else in the world. Another engineer spoke of his pride at how the 2.5 km Lalbaug flyover, which opened in 2011, would supersede the J. J. Hospital flyover as the city's longest elevated road by 100 m—although it will itself be superseded by the 'game-changing' 9.3 km Eastern Freeway in 2013 (Phadke 2013). Transport projects such as flyovers are, according to Santosh Desai (2004) writing in the *Times of India*, 'big bold projects' and 'tangible signs that suggest that, finally, India is serious about becoming world class'.

Another related aspect of bigness marshalled through transport infrastructure is its role in meshing together and 'co-producing' the metropolitan region—or what Allen Scott (2001) identifies as the 'global city-region'. Flyovers and skywalks have been constructed over the last decade not only in the traditional centre of the Island City but across the city's Western and Eastern suburbs and out into Navi Mumbai,

Thane and Kalyan-Dombivili. This helps create connections between residential colonies, malls and business districts and helps establish a level of coherence across the increasingly polycentric and distanced region. Similarly, the travel and movement of materials and workers involved in transport construction projects reinforces the new territorial dimensions of Mumbai. Cement and concrete segments are brought in from casting yards located in areas such as Wadala on the edge of the Island City, which in turn use sand and dirt dredged from creeks on the fringe of the metropolitan region. At the same time, rubble from transport construction is taken outwards. For example, the demolition in 2009 of the older flyover at Lalbaug in central Mumbai involved 250 trips a day using 50 dump trucks to a site in Navi Mumbai.

The political landscapes of Mumbai's transport assemblages

As well as being attentive to the ways that recently built transport infrastructure in Mumbai has involved a gathering of investment, expertise and technology from overseas, and a strengthening and reaffirming of Mumbai's global standing, it is crucial to recognise that these transport assemblages are not part of what Brenner, Madden, and Wachsmuth (2011, 236) identify as a 'world animated by passive interactions among actants'. They have been actively created, shaped and maintained by the practices, dreams and visions of (human) actors able to marshal resources and political decision-making at a range of scales. These are the 'sociopolitical agents' (Brenner, Madden, and Wachsmuth 2011, 236) who have lobbied for the dismantling of restrictions on inward investment into India, commissioned international consultants such as McKinsey, undertaken study tours of transport initiatives overseas and readily commented on the global status, or otherwise, of contemporary Mumbai.

Wallpaper*

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 What happens when the city of the future becomes a vintage treasure

Figure 9 *Wallpaper Magazine, June 2011 (Photographer: Bharat Sikka)*

Following sociologist Leslie Sklair (1998), it is possible to identify four overlapping groups of 'transnational capitalist classes' primarily responsible for assembling and remaking Mumbai's transport infrastructure: 'globalising state bureaucrats' of the MMRDA and MSRDC, transnational corporation executives and their local affiliates, globalising politicians and professionals, such as Nitin Gadkari, and other members of the car-owning middle classes. These actors, often through self-

serving nexuses between contractors and senior politicians and planners, have drawn together capital, ideas, materials, technology and ambitions to shape, coordinate and instil the system of transport provision in Mumbai.

A key component in this elite assembling of transport infrastructure has been the discursive mantra of the 'world-class city', as propagated and disseminated by the 24-page McKinsey report in 2003, conducted with 'the active participation of the government



Figure 10 Unfinished flyover at Barfiwala Lane, Andheri West, April 2009. Photograph by the author.

institutions that run the city of Mumbai' (Bombay First 2003, vii). The 'world-class city' has provided a compelling rallying point and conveniently elusive symbolic register to integrate a wide coalition of elite actors despite internal disagreements and intra-urban divergences (see also, Baviskar 2011 on 'world-class' Delhi). Moreover, the elite extolling of 'world-class' transport infrastructure and its seductive vision of a modern, free-flowing, 21st-century Mumbai has proved difficult to counter and challenge given its globally aspirational credentials and framing 'in the name of the greater metropolitan good' (Ong 2011, 18).

Yet, it is important to recognise how this emphasis on 'world-class' connectivity and urban modernity through new transport infrastructure in Mumbai has created if not necessitated new divides and disconnection (Anand 2006). The broad-based goal of achieving suitably world-class transport has involved prioritising the concerns and

demands of corporate leaders such as the British-educated Nasser Munjee, former CEO of the Infrastructure Development Finance Company and chair of the Physical Infrastructure sub-group in the *Vision Mumbai* task force:

'I meet many foreign investors daily who are interested in Mumbai. But they don't understand why we can't fix our roads. I had told the government just to restore the road leading to Sahar airport two years ago. That road is a disgrace but still there. I have given up on Mumbai and the endless meetings with officials which are never conclusive. Mumbai must re-plan completely but no one seems to be interested. No wonder CEOs of big companies are giving Mumbai the miss.'
(Quoted in Deshmukh 2005)

This concurs with the perspectives offered by senior transport planners Murthy and Viswanath (2006, 58) in *Mumbai Vision 2015: Agenda for Urban Renewal*:

'Mumbai region has attracted little Foreign Direct Investment (FDI) in comparison to other world cities. To make Mumbai world class, it needs to attract FDI in large amounts. State-of-the-art infrastructure, especially traffic management and transportation, is a prerequisite for attracting huge investments from both public and private institutional investors.'

In this logic, part of what Goldman (2011, 232) identifies as a new agenda of 'speculative government' in urban India, Mumbai's success as a world-class city relies on a new physical terrain being created that eases and quickens the travel of foreign investors through the city and accordingly facilitates an accompanying influx of capital.

The dominant emphasis in transport planning in Mumbai over the last decade has consequently been on the vehicles, routes and experiences deemed most appropriate for, and conducive to, potential investors. This has meant a frequent prioritising of private cars over public transport, despite recommendations from reports such as WS Atkins (1994) advocating improvements to Mumbai's bus and train systems. It has meant a focus on improving connections to business districts (such as the Bandra-Kurla Complex) and airports (such as the Sahar Elevated Road to Chhatrapati Shivaji International airport) and circumventing zones of less affluent housing and more informal commerce. It has also involved attempts at inculcating what Ghertner (2011) calls 'world-class aesthetics' in the elite experience of moving through the city. Flyovers are regularly cleaned and maintained while the spaces underneath are often fenced off or carefully landscaped to restrict informal uses such as sleeping and selling (Harris 2012). People squatting or begging under the Andheri flyover, where the road from the international airport meets the Western Express Highway, are regularly harassed and moved on. As Nasser Munjee explains, 'this cannot be the first sight for a foreign dignitary landing in Mumbai' (quoted in Deshmukh 2005).

Conclusions

The concrete and tarmac of large transport projects, despite their visibility and ubiquity, have largely been neglected in analyses of globalising cities and urban 'worlding'. This is because, compared to skyscrapers, airports, shopping malls or art galleries, they are not generally viewed as 'desirable icons of "world class" amenities' (Ong 2011, 18). Nor are they understood as part of 'socio-spatial technologies', such as slum evictions and special economic zones, seen as central in implementing the world-class city (Roy 2011). Yet this paper has illustrated how transport infrastructure has played an important role in entangling a city such as Mumbai into global relations of expertise, technology and planning. This is not only through new and increased flows of people, investment, materials and techniques but through comparative practices and imaginations, in both formal documents and everyday life, that have helped generate a sense of 'global city-ness'.

At the same time as investigating the networks, relations and comparisons that have produced and performed Mumbai's global city status, the paper has also signalled the importance of identifying the main human agents, city visions and discursive categories involved in assembling and remaking transport infrastructure. The paper argued that the rhetoric of the 'world-class city' has enabled huge state resources to be channelled into facilitating projects that prioritise the mobility of foreign investors and elite groups with access to private vehicles. The technocratic registers adopted in transport planning and engineering and the incontrovertibility of world-class-ness has meant this agenda has been difficult to dispute and disrupt.

While using an assemblage approach as a 'guiding sensibility' (Brenner, Madden, and Wachsmuth 2011, 229) to explore processes of composition across diverse human and non-human elements, the paper has emphasised the necessity of empirical research into concrete urban situations in order to sharpen

assemblage's analytical potential. As John Allen (2011, 156) suggests, 'the content of the relationships that hold assemblages in place have first to be specified in some way for us to grasp their looming shape and wider potential significance'. This does not necessarily mean simply counterpoising a socio-material objectivism with larger contexts and wider questions about power and inequality, as Brenner, Madden, and Wachsmuth (2011) posit, but instead requires carefully detailing and assessing of the 'often uneven and uncomfortable practices of composition' involved (Anderson et al. 2012, 173).

The assemblage approach pursued in this paper also allows infrastructure projects to be viewed as provisional and contingent achievements that demand constant attention to maintain their connections, performances and parameters (Doel and Hubbard 2002). This is particularly the case for the global city-ness of transport in contemporary Mumbai. The upgrading and construction of transport projects has yielded considerable difficulties and disconnections (Figure 10). Many projects remain incomplete, many quickly become obsolete, many exacerbate rather than disperse congestion, others create faster speeds through the city that require new capacity elsewhere, while imported materials and technologies frequently prove unsuitable or too costly to adequately maintain. The result is a new cycle of calls and proposals for more transport infrastructure, replacing or extending existing forms and systems, but this time bigger, bolder and more spectacular, and yet again never quite attaining or reaching sufficient global city-ness.

The heterogeneous actor-networks that produce the global city are similarly multiple and as Smith (2003a, 38) argues 'alive and brimming with movements, practices, performances and contingencies'. Notions and urban norms of 'world class' and 'global' are not fixed and can be reinvented and reworked, especially in the contemporary experimental ferment of Asian cities such as Mumbai (Ong 2011). Indeed the very success of the 'world-class city' rhetoric over the last decade has been dependent on its elusiveness and ambiguities.

For example, a presentation prepared by an international consultancy firm on transportation in the Mumbai metropolitan region in 2009 stated—with seemingly no recognition of the tautologies involved—that 'to be a world class city, we need to move in the direction of world class cities'. Possibilities exist for reframing world-class-ness, and imagining 'how urbanism might be produced otherwise' (McFarlane 2011, 211). More socially accessible and environmentally sustainable forms of transport such as buses and walking could be heralded, and new comparative models and references celebrated beyond the citadels of Shanghai, Dubai and Singapore, including cities in Africa and South America and other urban settlements in India and Maharashtra. In this way Mumbai might be used not only as a laboratory for rethinking urban transport planning, but also as a means for rethinking—and reassembling—the idea and ideals of the global city.

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Notes

- 1 Mumbai does not feature at all in Friedmann's (1986) hierarchy of world cities—however, interestingly he states 'no city from a country of the "peasant periphery" was included, though questions might be raised about Bombay' (72).
- 2 *Report on the Proceedings of the Road and Tank Department, Bombay Presidency*. Bombay: Government Press, 1841–46. British Library Shelfmark IOL.1947.a.411. My thanks to Peter Harrold for locating this.
- 3 In responding to the use of LED lights on this skywalk, Subhash Nage, chief engineer of the MSRDC, suggested, 'We always praise well-designed and illuminated skywalks and bridges when we visit places like Singapore and Shanghai, but when the MSRDC tries to do something similar here, citizens and the

media start criticising us. We received similar reactions when the Bandra–Worli Sea Link was being constructed, but today, the same place is an iconic structure in the city' (quoted in Midday 2012).

- 4 <http://www.mumbaifirst.org> (website accessed 21 February 2013). 'Bombay First' changed its name in 2005 to 'Mumbai First', 10 years after the city's name was officially changed. It is also revealing that Mumbai First's logo is designed to resemble an urban expressway.

References

- Acuto, M. 2011. "Putting ANTs into the Mille-feuille." *City* 15 (5): 552–562.
- Ali, H., and R. Keil. 2006. "Global Cities and the Spread of Infectious Disease: The Case of Severe Acute Respiratory Syndrome (SARS) in Toronto, Canada." *Urban Studies* 43 (3): 1–19.
- Allen, J. 2011. "Powerful Assemblages?" *Area* 43 (2): 154–157.
- Amin, A. 2002. "Spatialities of Globalisation." *Environment and Planning A* 34 (3): 385–399.
- Anand, N. 2006. "Disconnecting Experience: Making World-Class Roads in Mumbai." *Economic and Political Weekly* 41 (31): 3422–3429.
- Anderson, B., M. Kearnes, C. McFarlane, and D. Swanton. 2012. "On Assemblages and Geography." *Dialectics in Human Geography* 2 (2): 171–189.
- Banerjee-Guha, S. 2009. "Neoliberalising the 'Urban': New Geographies of Power and Injustice in Indian Cities." *Economic and Political Weekly* XLIV (22): 95–107.
- Batra, L. 2009. "Deconstructing the 'World Class' City." *Seminar*, no. 582 (February).
- Baviskar, A. 2011. "Spectacular Events, City Spaces and Citizenship: The Commonwealth Games in Delhi." In *Urban Navigations: Politics, Space and the City in South Asia*, edited by J. Anjaria and C. McFarlane, 138–161. New Delhi: Routledge.
- Bhobe, A. 2000. *The Story of the Sion Flyover*. Mumbai: Millennium.
- Bombay First. 2003. *Vision Mumbai. Transforming Mumbai into a World-Class City*. Mumbai: Bombay First and McKinsey.
- Brenner, N., D. Madden, and D. Wachsmuth. 2011. "Assemblage Urbanism and the Challenges of Critical Urban Theory." *City* 15 (2): 225–240.
- Bunnell, T., and D. Das. 2010. "Urban Pulse—A Geography of Serial Seduction: Urban Policy Transfer from Kuala Lumpur to Hyderabad." *Urban Geography* 31 (3): 277–284.
- Carroll, W. 2007. "Global Cities in the Global Corporate Network." *Environment and Planning A* 39 (10): 2297–2323.
- Desai. 1993. "A Crash Course on Concrete." *Economic Times*, July 22.
- Desai. 2004. "Semiotics of Space: Flyovers as Temples of Post-modern India." *Times of India*, June 12.
- Deshmukh, S. 2005. "Investors Giving Mumbai the Miss, Says India Inc." *DNA*, December 27.
- D'Mello, A. 2009. "Grant Road Set to get Unique Skywalk." *Times of India*, June 15. Last accessed August 20, 2011. http://articles.timesofindia.indiatimes.com/2009-06-15/mumbai/28184798_1_skywalk-projects-cable-stayed-bandra-worli-sea-link.
- Doel, M., and P. Hubbard. 2002. "Taking World Cities Literally." *City* 6 (3): 351–368.
- Doshi, S. 2012. "The Politics of the Evicted: Redevelopment, Subjectivity, and Difference in Mumbai's Slum Frontier." *Antipode* (Early View).
- The Economist. 2012. "Halfway to Paradise." *The Economist*, December 22.
- Edensor, T. 2011. "Entangled Agencies, Material Networks and Repair in a Building Assemblage: The Mutable Stone of St Ann's Church, Manchester." *Transactions of the Institute of British Geographers* 36: 238–252.
- Fariás, I. 2010. "Introduction: Decentering the Object of Urban Studies." In *Urban Assemblages: How Actor-Network Theory Changes Urban Studies*, edited by I. Fariás and T. Bender, 1–24. London: Routledge.
- Fariás, I. 2011. "The Politics of Urban Assemblages." *City* 15 (3–4): 365–374.
- Flusty, S. 2005. "Culturing the World City: An Exhibition of the Global Present." In *Global Cities Reader*, edited by N. Brenner and R. Keil, 346–352. London: Routledge.
- Friedmann, J. 1986. "The World City Hypothesis." *Development and Change* 17 (1): 69–83.
- Frischmann Prabhu. 2005. *Elevated Pedestrian Walkways: Pre-feasibility Study*. MSRDC, March.
- Gadkari, N. 2009. "Let Us have a Positive Approach for Development." Last accessed August 20, 2011. <http://nitingadkari.org/speeches/positiveapproches.html>.
- Gandy, M. 2008. "Landscapes of Disaster: Water, Modernity, and Urban Fragmentation in Mumbai." *Environment and Planning A* 40: 108–130.
- Ghertner, A. 2011. "Rule by Aesthetics: World-Class City Making in Delhi." In *Worlding Cities: Asian Experiments and the Art of Being Global*, edited by A. Roy and A. Ong, 279–307. Chichester: Blackwell.
- Goldman, M. 2011. "Speculating on the Next Global City." In *Worlding Cities: Asian Experiments and the Art of Being Global*, edited by A. Roy and A. Ong, 229–258. Chichester: Blackwell.
- Gordon, I. 2002. "Global Cities, Internationalisation and Urban Systems." In *Industrial Location Economics*, edited by P. McCann, 187–204. Cheltenham: Edward Elgar.
- Government of Maharashtra. 2004. *Transforming Mumbai into a World-Class City: First Report of the Chief Minister's Task Force*.
- Graham, S. R., C. McFarlane, and R. Desai. 2013. "Water Wars in Mumbai." *Public Culture* 25 (1): 115–141.
- Harris, A. 2008. "From London to Mumbai and Back Again: Gentrification and Public Policy in Comparative Perspective." *Urban Studies* 45 (12): 2407–2428.

- Harris, A. 2012. "Aerial Visions and Grounded Realities." *Seminar*, no. 636 (August).
- Hazareesingh, S. 2007. *The Colonial City and the Challenge of Modernity: Urban Hegemonies and Civic Contestations in Bombay 1900–1925*. Delhi: Orient Longman.
- Hazareesingh, S. 2009. "Interconnected Synchronicities: The Production of Bombay and Glasgow as Modern Global Ports c. 1850–1880." *Journal of Global History* 4 (1): 7–31.
- India Infoline. 2010. "Mumbai to Get its Tallest Flyover." *India Infoline*, June 28.
- Jacobs, J. M. 2006. "A Geography of Big Things." *Cultural Geographies* 13 (1): 1–25.
- Kaika, M. 2010. "Architecture and Crisis: Re-inventing the Icon, Re-imag(in)ing London and Re-branding the City." *Transactions of the Institute of British Geographers*. 35 (4): 453–474.
- Krätke, S. 2003. "Global Media Cities in a World-Wide Urban Network." *European Planning Studies* 11 (6): 605–628.
- Kundu, A. 2001. "Institutional Innovations for Urban Infrastructural Development: The Indian Scenario." *Development in Practice* 11 (2): 174–189.
- Latham, A. 2002. "Rethorizing the Scale of Globalization: Topologies, Actor-Networks and Cosmopolitanism." In *Geographies of Power: Placing Scale*, edited by A. Herod and M. Wright, 115–145. Oxford: Blackwell.
- Latour, B. 1992. "Where are the Missing Masses? Sociology of a Few Mundane Artefacts." In *Shaping Technology, Building Society: Studies in Sociotechnical Change*, edited by W. Bijker and J. Laws, 225–258. Cambridge, MA: MIT Press.
- McFarlane, C. 2008. "Governing the Contaminated City: Infrastructure and Sanitation in Colonial and Post-colonial Bombay." *International Journal of Urban and Regional Research* 32 (2): 415–435.
- McFarlane, C. 2011. "Assemblage and Critical Urbanism." *City* 15 (2): 204–224.
- McGuirk, P., and R. Dowling. 2009. "Neoliberal Privatisation? Remapping the Public and the Private in Sydney's Masterplanned Residential Estates." *Political Geography* 28: 174–185.
- Merriman, P. 2005. "'Operation Motorway': Landscapes of Construction on England's M1 Motorway." *Journal of Historical Geography* 31 (1): 113–133.
- Midday. 2012. "Mumbai's Most Expensive Skywalk to Cost Rs 50 Crores." *Mid-day.com*, June 5.
- Miles, S. 2005. "'Our Tyne': Iconic Regeneration and the Revitalisation of Identity in NewcastleGateshead." *Urban Studies* 42 (5–6): 913–926.
- Murthy, P., and S. Viswanath. 2006. "Urban Traffic and Transportation Management." In *Mumbai Vision 2015: Agenda for Urban Renewal*, edited by J. Goyal and R. Swaminathan. New Delhi: Macmillan India.
- Ong, A. 2011. "Worlding Cities, or the Art of being Global." In *Worlding Cities: Asian Experiments and the Art of being Global*, edited by A. Roy and A. Ong, 1–26. Chichester: Blackwell.
- Phadke, M. 2013. "'Game-Changer' Freeway likely to Open by March-End." *Indian Express*, February 21.
- Robinson, J. 2011. "Between Marx and Deleuze: Discourses of Capitalism's Urban Future." In *Urban Constellations*, edited by M. Gandy. Berlin: Jovis.
- Roy, A. 2011. "The Blockade of the World-Class City: Dialectical Images of Indian Urbanism." In *Worlding Cities: Asian Experiments and the Art of being Global*, edited by A. Roy and A. Ong, 259–278. Chichester: Blackwell.
- Sassen, S. 2001. *The Global City: New York, London, Tokyo*. 2nd ed. Princeton, NJ: Princeton University Press.
- Save Bombay Committee. 1999. "Elevated Driveway from Haji Ali to Wilson College." Press release from Save Bombay Committee.
- Scott, A. 2001. *Global City-Regions: Trends, Theory, Policy*. Oxford: Oxford University Press.
- Sharma, D., R. Jain, and K. Singh. 2011. "Growth Rate of Motor Vehicles in India: Impact of Demographic and Economic Development." *Journal of Economic and Social Studies* 1 (2): 137–153.
- Simone, A. 2011. "The Surfacing of Urban Life." *City* 15 (3–4): 355–364.
- Sklair, L. 1998. "Social Movements and Global Capitalism." In *The Cultures of Globalization*, edited by F. Jameson and M. Miyoshi, 291–311. Durham, NC: Duke University Press.
- Smith, R. 2003a. "World City Actor-Networks." *Progress in Human Geography* 27 (1): 25–44.
- Smith, R. 2003b. "World City Topologies." *Progress in Human Geography* 27 (5): 561–582.
- Srinivasan, T., and S. Tendulkar. 2003. *Reintegrating India with the World Economy*. Washington, DC: Institute for International Economics.
- Taylor, P. 2004. *World City Network: A Global Urban Analysis*. London: Routledge.
- Tonkiss, F. 2011. "Template Urbanism." *City* 15 (5): 584–588.
- United Nations. 2009. *World Urbanization Prospects: The 2009 Revision*. New York: UN Department of Economic and Social Affairs, Population Division.
- Wilbur Smith. 2003. *Feasibility Study for Non-Rail Components of MUDP-II*.
- WS Atkins. 1994. *Final Report for the Phase I Feasibility Study, Under the Road Transportation Study of Non-Rail Components of the MUDP-II*.

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