

8-2010

# SUSTAINABLE URBAN TRANSPORT: THE ISSUE OF EQUITY IN THE EMERGING BRIC COUNTRIES

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SUSTAINABLE URBAN TRANSPORT: THE ISSUE OF EQUITY IN THE  
EMERGING BRIC COUNTRIES

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A Thesis  
Presented to  
the Graduate School of  
Clemson University

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In Partial Fulfillment  
of the Requirements for the Degree  
Master of City and Regional Planning

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by  
Tâmara Valadares Freitas Tavares  
August 2010

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Accepted by:  
Dr. Anne E. Dunning, Committee Chair  
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## **ABSTRACT**

Although sustainable frameworks for transportation have been widely discussed in the transportation planning field in recent decades, the issue of equity in transportation systems is still relatively unexplored in comparison to the other pillars of sustainability. Globally, the concept of equity gains different nuances in developed and developing countries, and have yet new implications when considering fast emerging nations. The objective of this paper is to investigate how transit policies in fast emerging economies are used to distribute equitable access to benefits and opportunities; and to derive lessons that can orient future cohorts of emerging cities and countries to use transit as means to provide equitable improvements in accessibility.

Brazil, Russia, India and China (the BRIC countries) have been treated as a unit since the turn of the millennium when economic analysts noticed similar patterns of extraordinary productivity and growth, and are the forerunners of a group of nations expected to become major economic actors on the global stage in a few decades. Case studies on the most populous and prominent metropolises of the BRIC countries were conducted, exploring three aspects of transit systems as they impact equity: system ownership and planning processes; mode predominance and choices; and fare structures and collection methods. Sao Paulo, Moscow, Mumbai and Shanghai were selected as case studies subjects because of their location in those fast emerging nations and because of their status as recognized global cities.

This investigation revealed emerging nations are trying to equip their transit systems to deal with the pressures of growing population size and density, rising incomes, increasing rates of private automobile ownership and sprawling land use patterns. In order to cope with this new and fast changing environment, subjects sought to engage in long-range transportation planning, partnered with private entities for the provision of capital investment or operations, acted to strengthen (or implement) heavy rail as the anchor-mode, and moved towards automated fare collection methods. Lessons derived from these cities will serve to provide guidelines to equitable transit programs in fast emerging cities across the developed world that facing similar pressures, and to orient future research towards more complete economic efficiency evaluations of transit systems in emerging countries.

## **DEDICATION**

I will be eternally grateful to my mother for her unconditional love and support and to Fred Combs for being my solid ground when everything else was shaky.

Special thanks go to Dr. Anne E. Dunning for her guidance throughout this project and to Anna C. Brown for her contribution to the section on informal transit providers.

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## **CHAPTER 1: INTRODUCTION**

The concept of sustainability and sustainable development crystallized in 1987 with the publishing of the United Nations report entitled “Our Common Future – Report of the World Commission on Environment and Development” also known as “The Brundtland Report.” The Commission defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” The Commission also established that sustainability is a concept that rests on three pillars, or the three-legged stool, namely ecology, economy, and equity. Recognizing that the satisfaction of human needs is the primary objective of development, the report encourages the promotion of consumption levels that respect ecological carrying capacity, and emphasizes that economic growth is essential in areas where human needs are not appropriately being met.

Transportation planning and the planning field in general have strived to steer development in more sustainable directions in the past few decades. A preliminary review of recent transportation planning literature, however, reveals extensive exploration of strategies that address the ecological and economical legs of the sustainability stool, such as material technology, energy conservation, fiscal policies, information technology, and biotechnology, to name a few of the most common areas. The satisfaction of the equity requirement is so central to the objective of sustainable development that it seems incongruent that this third leg is less explored than the others in sustainable transportation planning research.

The objectives of this study are first, to investigate the different ways that equity is being explored in sustainable transportation planning research globally, with an emphasis on developing countries; second, considering vertical equity with regards to income and social class, to create a comparative framework of the state-of-the-practice equity strategies in transportation planning in the emerging BRIC nations: Brazil, Russia, India and China. The main concerns include, but are not limited to, transportation's effects on equity of opportunities, social costs, and changes in land use, safety, security, accessibility and mobility. This research meets its objective by characterizing public transportation systems in the most populated metropolitan areas of each of the BRIC nations through policy evaluation and case studies with data available in public documents.

The following chapter provides background on the broad concept of sustainability, its application to transportation and mobility planning, and equity. The third chapter discusses of the methodology used in this research and case selection, Summarized findings and interpretation of results appear in the fourth chapter, followed by recommendations and conclusions. Detailed information on each of the case studies appears in the appendix of the report.

## **CHAPTER 2: LITERATURE REVIEW**

This chapter provides background on the concept of sustainability and how it applies to transportation planning in developing countries. The following subsections outline the evolution of sustainability concepts and provide the latest concepts for planning for equity.

### **Sustainability defined**

Sustainability today is a widely accepted idea concerning the four E's: educational, ecological, economic, and social equity aspects; or the three P's: people, planet and prosperity (Herman, 2010). Current patterns of human production and consumption behavior are labeled unsustainable and seem to be leading the global village into a crisis, but that crisis can be ameliorated through the adoption of a new attitude at regional, local and individual levels. Sustainability and the pursuit of sustainable development orient policy choices towards the creation of green, growing and just places (Keiner, 2006).

Although sustainability is a new and evolving concept, the discussion on sustainability and environmental stewardship is an ancient one. In his work entitled *The Republic* (360 BC.), the classical Greek philosopher Plato demonstrated concerns related to excessive consumerism and its impacts on sustainability, especially on social equity and the natural environment. *The Republic* tells of a dialogue between Socrates and his friend Glaucon, in which they construct two theoretical cities – the healthy city and the luxurious or feverish city – in order to investigate where and why injustice might arise.

In the former, people lived according to what resources allowed, produced only what they needed, found pleasure in their labor and arts, and feasted only on rare festivities, alongside their peers. The healthy city was, therefore, sustainable and respecting of the boundaries of its natural resources, managing to avoid poverty and war. In the latter, however, people were allowed to give fruition to their desires of luxury and live beyond their means; production was escalated to provide for more than the strictly necessary, which in turn led to higher consumption of land and natural resources. As resources became scarce, not everyone's basic necessities were satisfied, which consequently led to the need to invade neighboring cities' territories for the acquisition of more land and resources. Socrates concludes that a city that allows for great wealth also allows for poverty and war. Through this work, Plato demonstrates a commitment to the idea of a broad and equitable distribution of resources – and the dangers of living beyond one's needs – as key to a city's sustainable future (DeWeese-Boyd, 2007).

Indigenous peoples of the Americas have developed the notion of the interconnectedness of human societies with other human societies, and of societies with nature for thousands of years. Among the main beliefs, is a moral mandate of guardianship of Mother Earth's land, water, and biodiversity, extending not only spatially over all the (then) known world, but also temporally, to protect future generations. Modernly, this ancient philosophy translated into the Bemidji Statement, through the collaboration between the Alaska Community Action on Toxics (ACAT), the Indigenous Environmental Network (IEN), and the Science and Environmental Health Network

(SEHN) in 2005 (Indigenous Environmental Network). The Bemidji Statement on Seventh Generation Guardianship reads as follows:

Who guards this web of life that nurtures and sustains us all?  
Who watches out for the land, the sky, the fire, and the water?  
Who watches out for our relatives that swim, fly, walk, or crawl?  
Who watches out for the plants that are rooted in our Mother Earth?  
Who watches out for the life-giving spirits that reside in the underworld?  
Who tends the languages of the people and the land?  
Who tends the children and the families?  
Who tends the peacekeepers in our communities?

\*\*\*\*\*

We tend the relationships.  
We work to prevent harm.  
We create the conditions for health and wholeness.  
We teach the culture and we tell the stories.

We have the sacred right and obligation to protect the common wealth of our lands and the common health of our people and all our relations for this generation and seven generations to come. We are the Guardians for the Seventh Generation.

Issues of intergenerational duties were also explored in the late eighteenth century by Thomas Jefferson, who, in a letter to James Madison, stated that “the Earth belongs to the usufruct of the living” (Ball, 2000). This statement implies two main principles: that every living human being has the right to derive economic benefit from the common pool of natural resources; and that there is a duty to sustain and preserve this common pool for the enjoyment of future generations. The second principle is made clear by the definition of the term *usufruct*, which concerns temporary enjoyment of property belonging to another, insofar as such enjoyment does not cause any damages to the property (Howarth, 2007). In the early 1900s, forester Gifford Pinchot adopted similar principle in his



famous utilitarian slogan that stated that a generation has the right to extract all it needs from the common pool of natural resources, but in doing so, it also has a duty see that future generations are not deprived of what they will need (Norton, 1989).

### **Sustainability as a political concept**

Sustainability is undoubtedly a widely accepted idea, but it lacks specificity, losing its integrity as a political concept (Keiner, 2006). This problem is approached with a certain melancholy by environmentalists, who would like to see the establishment of more defined concepts to serve as concrete guidelines to policymaking. “Making progress toward sustainability is like going to a destination we have never visited before, equipped with a sense of geography and the principles of navigation, but without a map or a compass.” (Hales and Prescott, 2002).

In recent decades, many attempts were made to give concreteness and specificity to the concept of sustainability, with varying levels of acceptance by the academic and political communities.

### **The World Conservation Strategy**

In 1980, the International Union for Conservation of Nature (IUNC) published the World Conservation Strategy report in collaboration with the *United Nations Educational, Scientific and Cultural Organization (UNESCO)*. The document says human society should march toward three main goals. These goals are the conservation of ecological processes and life support systems, preservation of bio-diversity and sustainable utilization of species and ecosystems. Principally, humans should not use

more or pollute more than the ecosystem's carrying or regenerative capacity. The World Conservation Strategy also delineates a series of priority strategic requirements for the achievement of those goals, at international, national and subnational levels, including guidelines to be considered by policy makers (International Union for Conservation of Nature, 1980). Shortly after its publication, the IUNC document received intense criticism and scrutiny, mainly because the strategies proposed were deemed too costly, creating unrealistic expectations that developing countries could not fulfill. Population pressure, heavy dependence on the exploration of raw natural resources and disjointed policymaking were causes that made meeting the strategic goals difficult for those nations (Hughes, 1983).

### **The Brundtland Report**

The definition of sustainability brought forth by the World Commission on Environment and development is perhaps the most widely used concept of sustainability since its publication in 1987. The document is entitled "Our Common Future" but is popularly referred to as "The Brundtland Report". It lays foundation for development of global initiatives and institutions to deal with the issue of sustainable development, defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition covers the main concerns around sustainable development at the time– the environment, the economy and social equity – and was received with a certain level of acceptance. Inevitably, criticisms arose regarding the call for global economic growth, and critics point to the problem of measuring prosperity through the increase of national incomes or production (i.e. gross

national product), arguing economic growth does not necessarily equate to better distribution of resources and amelioration of poverty, nor does it resolve the problem that environmental degradation is often a consequence of increased production (Huetting, 1990).

### **The Four System Conditions**

The Four System Conditions framework was put forth in 1989 by the Swedish organization The Natural Step, as a response to the Brundtland Report. Based on thermodynamic laws, the main purpose of the framework is to treat sustainability as an issue to be addressed in a systemic level, not simply by treating the symptoms, but by getting to the origins and cause of the system's imbalance. The framework translates the four conditions under which the environment will suffer irreparable stress into strategies that can help individuals and organizations move toward a more sustainable behavior. Three of those conditions concern the natural environment and one concerns the equitable nature of human society.

The Four System Conditions framework (Table 1) is adopted by several large companies worldwide, even though some criticism has arisen because this framework does not offer guidelines for profitable and economically sustainable implementation. Defenders of the idea, such as retailers IKEA and McDonald's argue that adoption of the Four Principles can secure a sound bottom line, but positive profit outcomes require considerable innovative thinking within companies (Natrass, 1999).

**Table 1: The Four System Conditions framework**

<b>The Four System Conditions...</b>	<b>... Reworded as The Four Principles of Sustainability</b>
<i>In a sustainable society, nature is not subject to systematically increasing:</i>	<i>To become a sustainable society we must...</i>
1. Concentrations of substances extracted from the earth's crust	1. Eliminate our contribution to the progressive buildup of substances extracted from the Earth's crust (for example, heavy metals and fossil fuels)
2. Concentrations of substances produced by society	2. Eliminate our contribution to the progressive buildup of chemicals and compounds produced by society (for example, dioxins, PCBs, and DDT )
3. Degradation by physical means	3. Eliminate our contribution to the progressive physical degradation and destruction of nature and natural processes (for example, over harvesting forests and paving over critical wildlife habitat)
4. And, in that society, people are not subject to conditions that systemically undermine their capacity to meet their needs	4. Eliminate our contribution to conditions that undermine people's capacity to meet their basic human needs (for example, unsafe working conditions and not enough pay to live on).

Source: The Natural Step

### **Ecological footprint**

A recent measure of sustainability adopted by scholars is that of the ecological footprint, which correlates a certain level of consumption – and the absorption of its respective waste and pollution – with a correspondent area of land necessary to sustain that activity level (Redefining Progress). The main idea of this framework is to make ecological limits and carrying capacity an issue of central consideration in policy making, and the impact of actions on the natural environment can be measured at individual,

company, city, and national levels. At a national level, the measuring of ecological footprints has led to development of the concept of ecological creditors and debtors, depending on whether a nation's level of activities can or cannot be supported by the natural capital within its borders (Global Footprint Network). Although popular, this concept is criticized for not considering the possibility of substituting natural resources with human-made capital, nor considering trade as a mitigating factor for scarcity (De Soyza, 2005).

### **Carbon neutrality**

The concept of carbon neutrality involves measuring the amount of carbon (and often other greenhouse gases) released through a certain production or otherwise economic process against the amount of carbon sequestered by the activity, offset in other location, or compensated through carbon credits to balance the equation (The Carbon Neutral Company). In its vision for 2015, the City of Copenhagen, Denmark states four broad goals will help the city become the "eco-metropolis of the world," one of which is the reduction of carbon emissions by twenty percent against a 2005 baseline (Municipality of Copenhagen, 2007). Although Copenhagen has no plan for zero emissions (or neutrality proper), policy-makers believe that local changes can help avert the global crisis, not only because of the reduction of impact per se, but also because the new ideas and strategies can be disseminated and emulated in other localities. Environmental economists generally view the pursuit of emission reductions favorably.

Despite these initiatives, the issue of offsetting carbon emissions is somewhat controversial. Carbon offsetting has become an economic niche based on the premise that the global system is affected by the total quantity of carbon emissions with equal impact regardless of the location of emission generation. Environmentally aware businesses that cannot achieve emission reductions through internal changes, hire carbon brokerages to implement carbon management plans by injecting cash into other businesses or projects with carbon emissions that can be reduced with the proper financial resources. In effect, the financial resources of the first businesses reduce the *net* carbon emission across the globe by financing emission mitigation for other businesses (The Carbon Neutral Company). The offsetting scheme is criticized for offering businesses the option to conduct business as usual, while the quest for sustainability demands profound changes in the contemporary way of life and ecological, economic, and social attitudes. Some environmentalists argue current carbon offsetting practices are dangerous because they delay necessary investments in urgent technologies and strategies that can actually reduce the emissions of businesses and localities through internal change (Smith, 2007).

### **Biophilia and Biomimicry**

In his 1985 book entitled *Biophilia*, Edward O. Wilson postulated the most tragic and irreparable damage humans can inflict on the natural environment is the loss of genetic diversity and fauna and flora species through the destruction of critical habitat. Furthermore, Wilson postulated humans are intrinsically connected to nature; therefore, human life is fulfilled by daily contact with natural environments, from which calm and regenerative powers can be derived. Adepts of Biophilia believe sustainability can be

achieved through the preservation and restoration of natural habitats, clean water and sound land, and by naturalizing human environments (Biophilia Foundation).

More recently, yet similarly, concepts of biomimicry have pervaded the sustainability discussion, derived from the ideas put forth by Janine M. Benyus in her book *Biomimicry: innovation inspired by nature*, published in 1997. Biomimicry is the pursuit for solutions for human issues through the observation of natural processes (Biomimicry Institute). By extracting principles from naturally occurring biological and chemical processes and using analogies, advocates for this line of thought say they can find solutions for a wide array of human needs, from new products and materials to new ways of dealing with waste and pollution. Biomimicry has been gaining adepts mainly among environmentally conscious designers, who propose it can create more sustainable places (Helms et al, 2009).

Scholars and specialists still wrestle with trying to find the best definition for sustainability and sustainable development. Despite wide acceptance of the definition established by the Brundtland report, the subsequent emergence of different concepts and attempts at making those concepts operational point to the fact that the sustainability discussion is not resolved.

### **Sustainability in a globalized era**

Besides attempts to operationalize the concept of sustainable development, specialists, academics and policymakers alike are turning their attention from the impacts of development to the different scales of sustainability. Sociologist Roland Robertson is

credited with popularizing the idea of *glocalization*, which concerns the simultaneity of impacts of globalization and policy choices on a global, national, subnational and local scale, but mainly on the two extremes: the global and the local (Lee and Stokes, 2009). Perversely, when international bodies make decisions regarding the path of development to be adopted by areas across the globe, little consideration is given to the local scale. A homogeneous set of rules is often presented to heterogeneous areas, and the adoption of those rules – derived from neoliberal theories – becomes the condition sine qua non for economic growth, especially in developing countries. This *isomorphism* includes fiscal discipline, reprioritization of public expenditures, implementation of tax reforms, financial and trade liberalization, institution of competitive interest rates, stimulation of foreign direct investment, privatization of state enterprises, deregulation of competition, and strengthening of property rights (Schwartzman, 2006).

### **Theoretical frameworks**

The emergence of international bodies that regulate the liberalization of markets globally fits with the paradigm of *institutionalism*, which theorizes a nation state accepts the restriction of its powers by adhering to conditions established by international institutions if it perceives participating in such arrangement accrues benefits . This paradigm rises as an alternative to *realism*, which postulates that states seek to assert their power and protect their security, emphasizing the anarchical nature of the international system. Under the framework of institutionalism, the global economic environment in general and trade in particular, are issues best addressed in a collective-bargaining process in the international community, due to the presence of overlapping interests and



opportunities (Brawley, 2003). Conversely, issues pertaining to the natural environment are increasingly subject to the scrutiny of international conventions, treaties, and agreements because of the understanding that the protection of the global commons and consequences of environmental degradation transcend national boundaries (Latouche, 1999).

The influence individual nation-states have in these transnational regulatory agencies depends on several factors, including wealth and economic prowess. In comparison to their developed counterparts, developing nations are less likely to be represented in such institutions, therefore becoming less able to protect their interests in instances of international negotiation (Lee and Stokes, 2009); for that reason, scholars highlight the role of coercion and consent, not consensus, on inter-state bargaining (Schwartzman, 2006)

### **Implications and impacts on developing countries**

There are two strongly opposing academic views on the issue of how contemporary globalizing forces affect sustainability in developing countries. On the one hand, conventional development economists believe economic growth – attained through globalization and liberalization of markets – is the key to satisfying most human needs globally; on the other hand, environmental economists argue production and consumption patterns spurred by the globalization process are detrimental to peripheral nations because they harm the environment and lead to excessive consumption of natural resources (DeSoyza, 2005).

In a statistical analysis that evaluated the growth of national genuine savings rates (GS rates), adopted as an indicator for weak sustainability, De Soyza (2005) found that trade, foreign direct investment dependence, and economic openness increase weak sustainability. Weak sustainability here was defined as the ability to sustain the aggregate value of manufactured, human, and natural capital in excess of its depreciation. The concept of strong sustainability postulates all natural capital should remain intact and there is no interchangeability between the forms of capital. The De Soyza study does not address this form of sustainability.

According to De Soyza, open trade and globalized markets benefit weak sustainability because they promote economic growth, and resource allocation is done more efficiently when a country can specialize in those activities in which it has comparative advantage, achieving maximum output for a minimum input. Better resource allocation then triggers domestic income growth, and an overall vibrant economy means critical technologies (which can contribute to environmentally friendly production processes) can be disseminated faster, increasing measures of sustainability.

Environmental economists who disagree with De Soyza's conclusions often distinguish between growth and development: while growth denotes the increasing of accumulation of capital by a country, development should mean changes that positively impact quality of life of its population (DeWeese-Boyd, 2007). Economic growth as created by globalization and liberalization might increase a country's gross national product, but it might not necessarily correlate to a better distribution of resources;

furthermore, according to this view, globalization allows the global North to exploit the global South to the point where the Southern ability to pursue economic development is hindered. In a globalized framework, developing countries are locking into their comparative advantage “trap” (Latouche, 1999), in which they have no choice but to keep producing what the world market demands. This paradigm reduces a nation’s autonomy and hinders pursuit of local solutions to address local problems. Sustainable development within the current norms of the globalized community is considered a “fraud” (Latouche, 1999) and only a massive change in the superfluity of the world’s rich can place developing countries on the path for sustainability (DeWeese-Boyd, 2007).

### **Transportation equity**

According to the European Commission Joint Expert Group on Transport and Environment, a sustainable transport system is one that:

1. “allows for basic access needs and development of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between generations;
2. “is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy and regional development; and,
3. “limits emissions and waste within the planet’s ability to absorb them, uses renewable resources at or below rates of generation, and, uses non-renewable resources at or below rates of development of renewable

substitutes and minimizes the use of land and the generation of noise” (Hull, 2008).

Transportation equity has historically been neglected as an object of investigation by sustainable transportation researchers and planners (Litman, 2002; Ahmed, 2008; Stanley and Vella-Brodrick, 2009). Only recently has the importance of research on equity been more recognized, and in 1999 an executive member of the National Academies’ Transportation Research Board called for “more analysis and discussion of the distribution of costs and benefits of transportation policies” to disadvantaged populations, predicting that equity would become one of the major themes in transportation policy studies in the subsequent decade (Wachs, 1999).

Equity – also referred to as environmental justice, with environment broadly defined to include social, economic and ecological effects – concerns the distribution of positive and negative impacts, as well as the degree to which that distribution is considered fair and just across racial, ethnic and income groups. An equitable transportation system is one in which those who benefit most pay a larger share of the costs, while it does not disproportionately favor or deny transportation improvements to certain demographics (Litman, 2002). Conversely, social impacts of transportation are changes in the transportation system that do, or might, “positively or negatively influence the preferences, well-being, behavior or perception of individuals, groups, social categories and society in general” at present or in the future (Geurs et al., 2009). Environmental justice advocates have started to focus on the distribution of transportation

impacts, benefits and costs, and have begun to seek transportation investments and community reinvestments that will increase social equity, improve access and mobility among disadvantaged populations, and help improve quality of life in low income and minority neighborhoods (Deakin, 2007).

### **Perspectives on transportation equity in selected developed countries**

The following brief discussion of the most commonly addressed themes in transportation equity in developed countries (namely in the United States, United Kingdom and Australia) serves not only to demonstrate the breadth and complexity of the subject, but also and most importantly to provide contrast between advanced developed economies and developing countries in regards to transportation equity issues.

#### ***Selected developed countries***

The development of environmental justice theories in the United States stems from the civil rights concerns over inequitable impacts of government projects and discriminatory outcomes of government actions, and from social demands for public participation in government decisions (Deakin, 2007). Presently the study of transportation equity centers primarily on the issues on job accessibility and the spatial mismatch hypothesis and secondarily on issues pertaining to racial minorities (Sanchez et al. 2003). The spatial mismatch hypothesis documents the decentralization of employment resulting from the suburban sprawl phenomenon in America. As companies and other employment centers have relocated to the suburbs, following the flight of middle and upper classes, low-income groups have remained living in the central cities

with limited access to job opportunities. The spatial mismatch is further complicated by the fact that executive and managerial jobs remained in the old central business districts, so commuter transportation designed for suburb-to-city travel serves to bring highly paid workers from their suburban houses into the city in the morning and back out to the suburbs in the evening. Low-income workers living in central cities who need to access entry-level jobs in the suburbs are then inequitably served by commuter transit arrangements (Holzer, 1991).

In America, it is difficult to disentangle issues of low-income groups from those of racial minorities, and this entanglement applies to transportation. Minorities are less likely to own cars than whites and more likely to be transit dependent. African Americans and Latinos are also more likely to walk to work (US Census, 2000), and therefore, they have a rate of pedestrian fatalities almost twice as high as whites' (Sanchez et al. 2003). Low-income pedestrians and cyclists do not live in areas conducive to walking and biking, and they have to share dangerous high-speed highways with automobiles to reach their destinations. Although trends point to the emergence of more sustainable alternative means of transportation in American cities, the needs of automobile users are still the overwhelmingly dominant driver of transportation planning (Jones, 2008).

The United Kingdom offers another example of where collaboration and integrated working practices between transportation planners and other public policy professionals is not widely developed. Local transportation planners and politicians rarely turn to policy tools that address social impacts of transportation although such policies

are well known and stated in the broader agendas of local transportation plans (Hull, 2008). Transport priorities of local politicians are often narrow, catering to automobile penetration, speed of motorized access, road infrastructure, and vehicle safety; funding for mass-transit is difficult to secure. Hull declares the first step for a more sustainable transport system in the United Kingdom is to establish a shared paradigm of sustainability to be adopted, implemented, and enforced across all public policy sectors. Once the sustainability framework is in place, the government can choose the most viable mobility and accessibility alternatives to advance the transportation system towards clear objectives, and finally the legal and financial framework can be delivered.

Instead of investigating the sustainability of the transportation system as a whole, Preston and Raje (2007) focus their efforts on the study of social exclusion and the role of transit as a tool to mitigate inequitable accessibility in the United Kingdom. Postulating that each individual requires a set of accessible facilities and social contracts, Preston and Raje's study attributes social exclusion not to a lack of opportunities of social interaction, but to the lack of access to such opportunities. A person's set of social contacts and facilities can be divided into two groups: contacts and facilities that are close, where accessibility is barely affected by transportation costs and times; and those that are distant, where transportation becomes an important factor of accessibility. The authors suggest three planning approaches that could contribute to mitigating the inequitable accessibility of basic contacts and facilities for those who cannot afford the transportation costs in the United Kingdom. The first approach is to reduce transport costs, consequently promoting physical mobility (thus accessibility) because cheap and fast

transport permits distant contacts to be accessed almost as easily as proximate contacts. The reduction of costs in this context will require a reformulation of transportation funding policies, which often proves to be difficult. The second approach is to increase social contact through information technology, promoting communication as a mobility substitute. Although viable for some professions, especially in developed nations, virtual mobility – or telecommuting – is unrealistic for those who suffer with transportation costs the most: low-income entry-level workers who frequently have limited access to communications technology. Finally, the third approach is to increase proximate facilities and contacts by promoting accessibility through land-use measures, which goes back to the issue of integration and collaboration between land use and transportation policy-making processes (Preston and Raje, 2007).

The social impacts of transportation, although included in the transport appraisal process guidance in the United Kingdom, challenge policy makers because transport objectives and impacts are multi-faceted. Besides being broadly defined and caused by a multiplicity of factors, the impacts reinforce each other: for example, in the absence of public transit, socially excluded groups might have limited access to jobs and educational facilities, which in turn reinforces social exclusion. Policy makers must continue working on an operational set of social impacts to be included in the appraisal processes through qualitative and quantitative assessments, because the current appraisal guidelines do not provide a sufficient framework to evaluate the distribution of impacts of transport across demographic groups (Geurs et al. 2009).



A final example comes from Australia, where scholars mention the notion of ‘social transit,’ proposing the transit can alleviate social exclusion by integrating people and daily activities. In this context, social exclusion is defined as the barriers to one’s participation in societal activities of which one would otherwise like to be part. Stanley and Vella-Brodrick (2009) make a distinction between two levels of poverty: absolute and relative. Absolute poverty means one’s financial means do not suffice to cover even basic needs, such as proper nutrition, shelter and clothing. In relative poverty, although basic needs might be satisfied, one does not have access to the same resources as one’s peers. Both forms of poverty are, in different degrees, encompassed by the definition of ‘social exclusion’ and must be addressed by a myriad of governmental social policies, because treating isolated symptoms of poverty is not likely to address the root of the problem. Social transit can be one of the tools to mitigate social exclusion, by providing the means to enable people to access employment, education, healthcare, and housing; they can also engage and associate with other people and groups. Social transit policies can aid in the removal of barriers related to availability and physical accessibility of transportation, cost of transportation, spatial mismatch, and economic opportunities. Transit can ameliorate social exclusion if policies ensure that besides providing simple mobility between two points, it also serves destinations that people need to, or want to, access (Stanley and Vella-Brodrick, 2009).

The state government of Victoria in Australia, in fact, makes a policy distinction between “mass transit” and “social transit.” The goal of mass transit is related to the extent that people use public transport, and it includes objectives such as financial return,

efficiency, and private-car trip reduction; the goal of social transit is to be available in order to improve accessibility regardless of patronage. Mass transit service is frequent in dense and walkable areas, supporting high volumes of choice riders; it connects major attractors, guaranteeing high demand, and it provides frequent peak-period service in commuter routes, where a large number of passengers can be served in a short period of time. The main goal of social transit, on the other hand, is to cater to the transportation needs of disadvantaged populations. Although only a relatively small number of people will suffer if the social transit routes were cut, this population will suffer severely and face tremendous difficulty in finding transportation alternatives to access locations and services they need on a daily basis. Social-transit service is geographically dispersed, spread over the largest possible coverage area, to include neighborhoods where ridership is always potentially low; furthermore, service is infrequent and routes are long and circuitous because area coverage is more important than travel time or efficiency of operations (Walker, 2008).

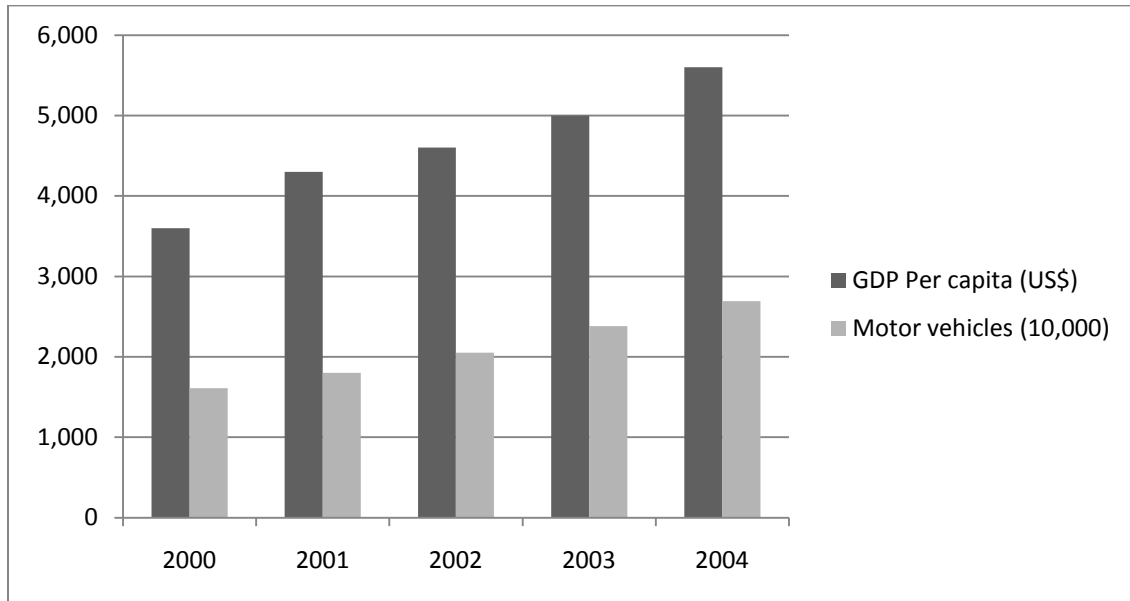
### **Equity in transportation in developing countries**

Although particularities vary by region, some characteristics that contribute to inequitable mobility and accessibility are generally present in most urban transport systems across the developing world. Environmental pollution, noise, congestion, traffic fatalities and injuries, and mobility and accessibility problems are much more severely observed in developing countries, making the issues of North America, Europe, and Australia pale in comparison (da Silva et al. 2008). The most commonly cited issues are discussed in the following subsections.

## **High rates of motorization**

Vehicle registrations are growing markedly in emerging economies because of several different factors. Natural population growth is enhanced by large portions of surplus rural labor that migrates into cities in search of better economic opportunities and potentially higher incomes, causing a sudden jump in travel demand to support the fast pace of urbanization (Pucher et al. 2005). Even in times of heated economy, however, extreme income inequality and distribution continue to prevail in developing countries. The wealthiest tenth of the population typically earns over half of total national income (Vasconcellos, 2001). In emerging economies, the increase in middle and upper class incomes creates a strong desire for comfortable, flexible, and convenient personal vehicles, stimulated not only by higher living standards and urban distances (Ahmed, 2008) but also by the pervasive idea that the private car is an essential lifestyle item as portrayed by developed countries (Gakenheimer, 1999). Because the poor lack the political and economic power to influence policy makers, transport policies generally focus on the needs of the automobile-owning elite, in the form of exclusionary road infrastructure and increased subsidies to foster the commercial penetration of the automobile. In India, for example, the national government set targets for increasing automobile ownership as a key goal for economic development and modernization (Pucher et al. 2005). Figure 1 illustrates the speed of the increase in motorization rates in China, a country that presented the factors described above in recent decades.

**Figure 1: Growth of motorization and GDP per capita, China**



Source: Ahmed, 2008

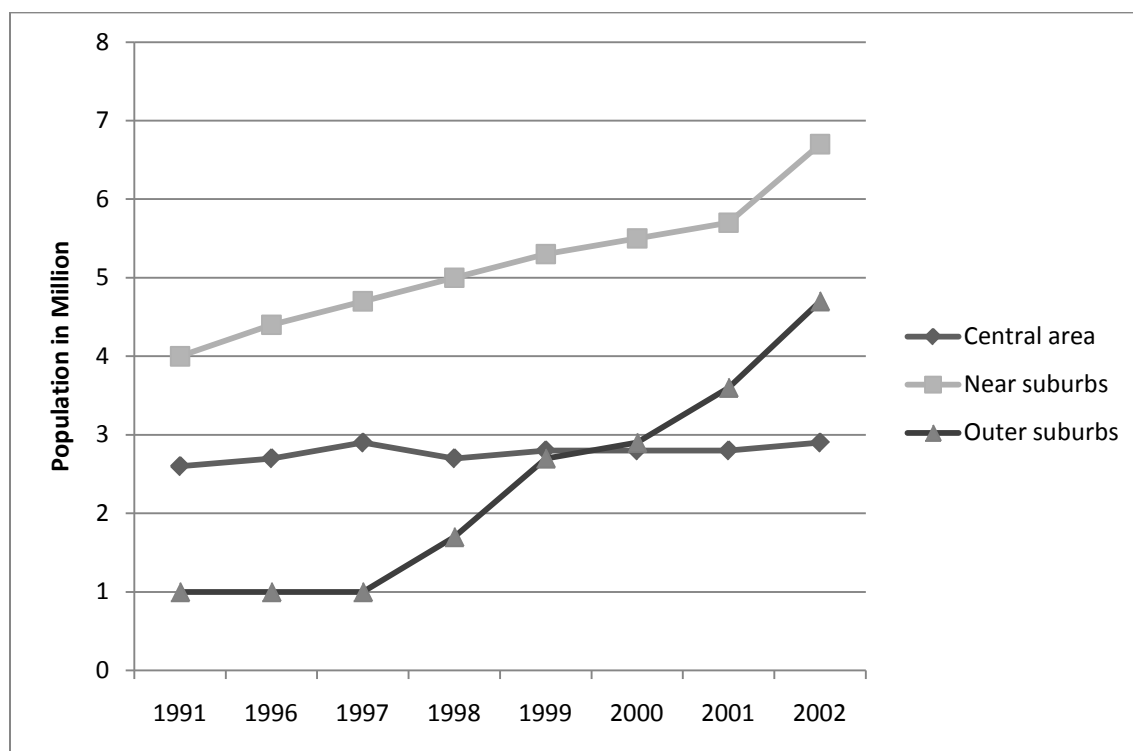
### **Infrastructure capacity**

The increase in urbanization, motorization, and economic growth places enormous pressure on transportation infrastructure (Ahmed et al. 2008). Vehicular facilities are used far beyond their design capacities and facilities for pedestrian and cyclists are rare, forcing them to share the crowded roads unsafely with motor vehicles (Pucher et al. 2005). The rate of construction of new infrastructure and enhancement of old infrastructure capacity depends on slow, complicated, and insufficient funding systems (Gakenheimer, 1999).

## **Trends in land use**

The growth in population, combined with the fast pace of motorization, led to urban planning policies that encourage sprawl into the surrounding countryside. Different in nature from the patterns seen in North America, sprawl in developing countries tends to push the poorest away from the cities into peripheral settlements usually not served by basic city amenities such as water, sewer, public lighting, and public transit (Vasconcellos, 2001). Figure 2 shows how the number of suburban dwellers in Beijing has increased in the 1990s and early 2000s. It is clearly noticeable that outer suburbs have experienced much steeper growth than inner suburbs. Living on the outskirts of urban centers, low-income populations are negatively affected by policies created to accommodate the needs of the motorized elite. Where public transit is present, some residents of the low-income communities live in such poverty that they cannot afford transit fares, and the distances between peripheral settlements and employment, education, healthcare, and other services are too long to traverse on foot or by bicycle (Ahmed, 2008). Perversely, as cities grow and motorization increases, mobility and accessibility for most sectors of the city-dwelling population decline (Pucher et al. 2005).

**Figure 2: Trends of sprawl in Beijing, China**



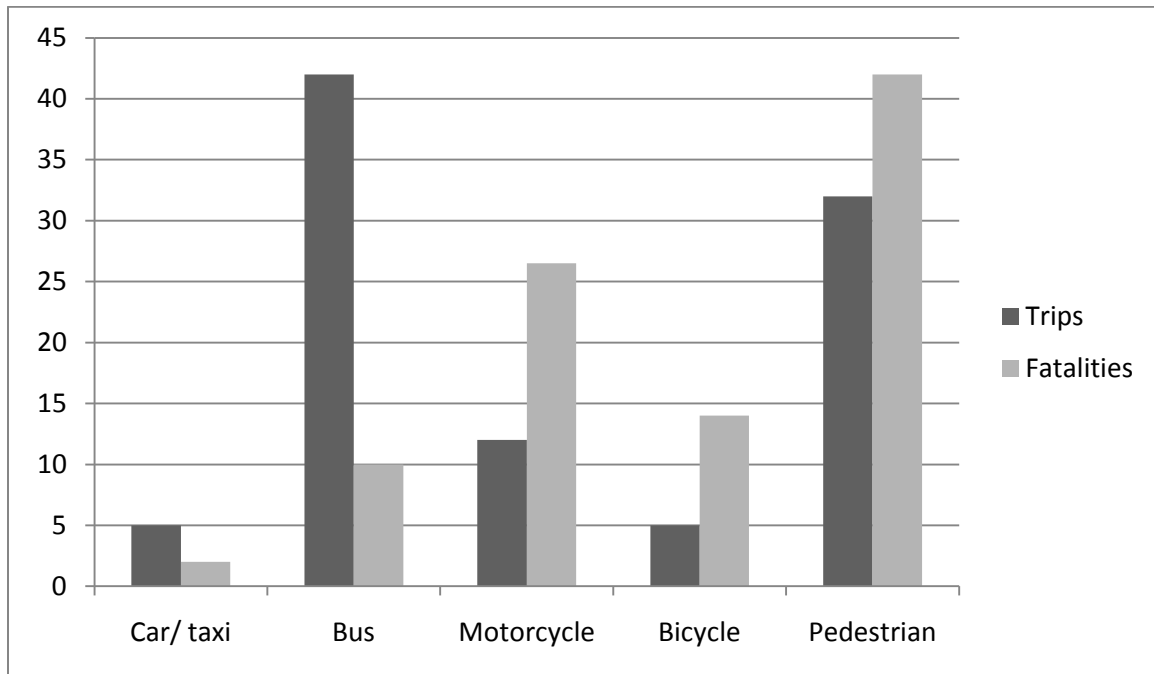
Source: Ahmed, 2008

## Safety

Motorized modes of transportation share roads with pedestrians, bicyclists, and animal-traction vehicles in some cases. There are sixteen modes of passenger transport in the streets of India, ranging from human-traction vehicles to new coach buses (Gakenheimer 1999). The different operability of all the modes on the road makes traffic management more difficult than in developed countries because the modes have different sizes, maneuverability, speeds, and capacities (Pucher et al. 2005). Such modal diversity sharing the same road infrastructure disproportionately affects the safety of users of non-motorized transportation, who are usually the lowest-income sectors of the population. In cities where many cannot afford any kind of private vehicle at all and some

cannot afford to pay transit fares, the lack of dedicated infrastructure to non-motorized transportation users represents great danger to pedestrians and cyclists. In 2004, pedestrians and cyclists made up more than half of all traffic fatalities in Indian cities, while vehicle occupants represented five percent. The rate of non-motorized user fatalities is inequitably high even after considering the most split in most Indian cities (Pucher et al. 2005). During the same year in the United States, 78 percent of all traffic fatalities were vehicle occupants, while pedestrians, pedalcyclists, and other non-occupants made up about thirteen percent (National Highway Traffic Safety Administration, 2004).

**Figure 3: Modal split of trips and fatalities (%) - Delhi, India 2004**



Source: Pucher et al. 2005

## **Transit**

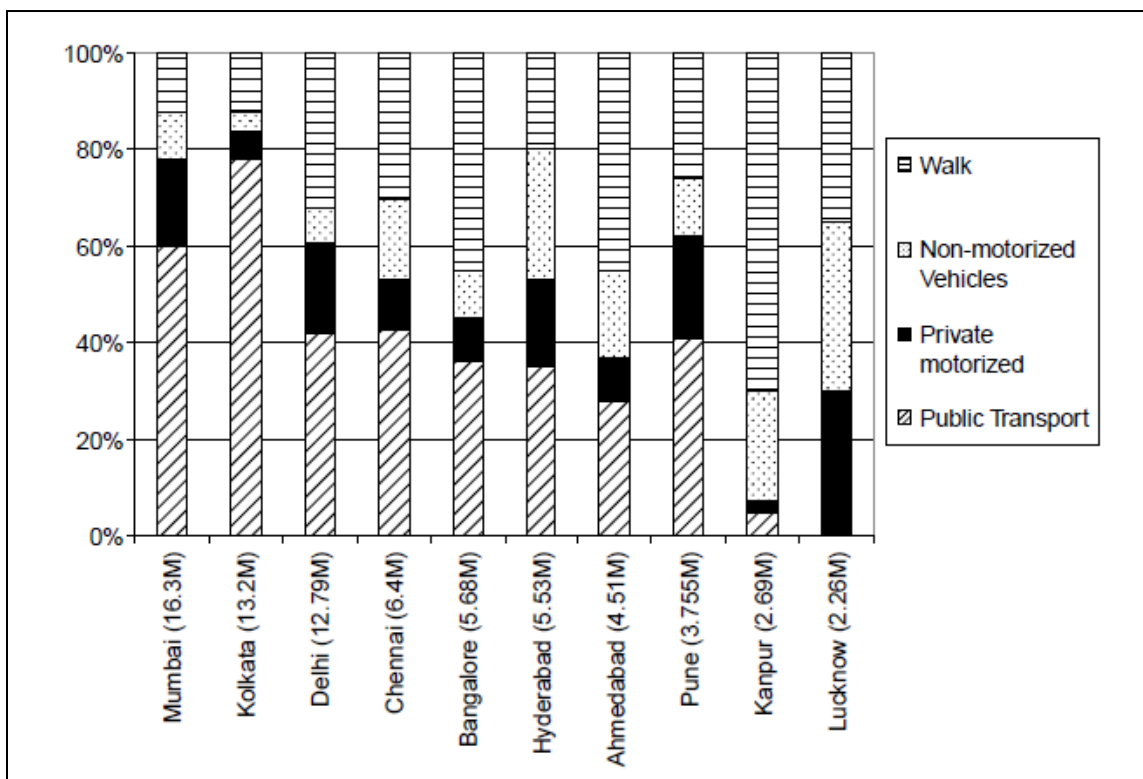
Throughout the developing world, trips by public transit comprise about 75 percent of all vehicular trips (Gakenheimer, 1999). For example, despite the astronomical automobile ownership and use in Beijing, walking, biking, and bus transit combined account for a share of about sixty percent of the mode split (Ahmed, 2008).

Even with the majority use and need resting with non-motorized movement and public transit provision, public transport is not treated as a high priority. The transit policy-making process is replete with political and institutional problems that complicate possibilities for improvement (Gakenheimer, 1999).



Throughout the developing world, trips by public transit comprise about 75% of all vehicular trips. Figure 4 exemplifies the modal share in Indian cities in 2002. Public transport, however, is not considered a high priority and its policy-making process is replete with political and institutional problems that complicate the possibilities for improvement (Gakenheimer, 1999).

**Figure 4: Urban trips by mode (%) for Indian cities, 2002**



Source: Pucher et al. 2005

In Beijing also, walking, biking and bus transit combined account for a share of about sixty percent of the mode split, despite the astronomical numbers of auto-ownership and auto use (Ahmed, 2008).

Despite the diverse array of vehicles populating the streets of urban centers in developing countries, buses are still the dominating transit mode. More susceptible to traffic congestion than the other modes, bus riders are inequitably affected by crowded roads. Assertive management and planning that could mitigate the problem are lacking across the developing world (Gakenheimer, 1999). Instead of facilitating and furthering the modes that move most of the people, policies focus on modernizing auto-oriented infrastructure, benefiting only a small portion of the overall city population. Due to the lack of resources and planning, public transit fails to meet the mobility needs of transit-dependent populations.

### ***Informal transit providers***

Because formal transit systems fail to meet demand, informal transit modes, which are characterized by unregulated operations and fragmented private ownership, enter markets and compete for the share of unmet travel needs (Cervero and Golub, 2007). Although a certain level of self-regulation – in the form of associations, for example – contributes to the integration of these informal services to the formal system, the lack of formal regulatory constraints allows informal public transport systems to function unreliably, cause safety and congestion problems, and contribute to noise and air pollution (Torres-Montoya, 2008).

As part of the private sector, unregulated providers aim to minimize costs and maximize profit while maintaining the affordability demanded by the clientele they serve. Without official inspections, informal transit normally employs old and noisy vehicles

with low performance, high emissions, and outdated or non-existent safety equipment (Sohail et al., 2006). Vehicles tend to be uninsured; operators are often unlicensed and have unsafe driving habits. Drivers can also be fatigued because employers can hire fewer operators and make them work longer hours to minimize labor costs (Valenzuela, 2005).

Despite their gap-filling function in developing areas of the globe, informal transit is mostly seen as part of the problem, not the solution (Torres-Montoya, 2008). Scholars seem to agree the transportation system and the safety and welfare of the population at large will benefit from regulation of informal services, but governments in most of the regions studied lack resources or political willingness to enforce regulatory policies.

### **Ecological externalities**

Rapid introduction of personal vehicles contributes to noise, air, and water pollution. In developing countries, lax or non-existent regulation of emission levels, allied to the prevalence of poorly maintained vehicles and older engine technology, exacerbate the environmental impacts of transportation compared to developed countries (Pucher et al, 2005). The negative externalities of motorized transportation disproportionately affect the health of the poor, who, despite their small contribution to the problem, are more exposed to air pollution while walking or biking along congested roads. Furthermore, when the price of petroleum products hikes, transit users are also inequitably affected by the increase in fares in the transit system, despite their reduced

contribution to high levels of energy consumption when compared to automobile users (Ahmed, 2008).

### **Transportation planning**

In developed countries, where there is a tradition of professional transportation planning, there is some consensus on planning approaches to solve the most basic transportation issues (Table 2), while only limited agreement is seen in developing countries (Gakenheimer, 1999). Where land use and transportation planning exists as a professional field, it often neglects the importance of public input and community impact assessment. Policy-makers in emerging economies choose policies when outcomes will appear to advance economic development and modernization, while largely ignoring the social, economic, and environmental impacts on communities (Ahmed, 2008). Although unconventional thinking and problem solving exposes a need for professional education and leadership, investment in developing planning capacity for transportation equity has the potential to open the door to innovative thinking, which might be easier to achieve in less structured professional environments (Gakenheimer, 1999).

**Table 2: Contrasting approaches to transportation planning**

<b>Traditional Approach</b>	<b>An Alternative Approach – Sustainable Mobility</b>
Physical dimensions	Social dimensions
Mobility	Accessibility
Traffic focus, particularly on the car	People focus, either in (or on) a vehicle or on foot
Large in scale	Local in scale
Street as a road	Street as a space
Motorized transport	All modes of transport, often in a hierarchy with pedestrian and cyclist at the top and car users at the bottom
Forecasting traffic	Visioning on cities
Modeling approaches	Scenario development and modeling
Economic evaluation	Multicriteria analysis to take account of environmental and social concerns
Travel as a derived demand	Travel as a valued activity as well as a derived activity
Demand based	Management based
Speeding up traffic	Slowing movement down
Travel time minimization	Reasonable travel times and travel time reliability
Segregation of people and traffic	Integration of people and traffic

Source: Banister, 2008

## Summary of common policy recommendations in literature

The following bullet list summarizes prominent and common recommendations that can be applied to integrate equity considerations into transportation planning for developed countries.

- *Improve infrastructure for non-motorized vehicles.* The lowest income sectors of society are often the only ones utilizing non-motorized transportation in developing countries; consequently, they will benefit the most from investments on dedicated space for pedestrians and bicycles on the road.
- *Improve integration between transportation and land use planning.* Where transportation planning exists as a professional field, it lacks integration with other public policy sectors, most importantly land use planning. A reversal on the nascent sprawl trend fostered by the rapid pace of motorization will not only mitigate the displacement of the poor to outskirts that lack basic city services, but also keep distances to an extent that is feasible by non-motorized transportation means, improving accessibility and mobility of low-income demographics.
- *Improve traffic management.* With modernization and the emergence of some developing countries' economies, various new types of vehicles are sharing road space with traditional human- and animal-traction vehicles, as well as old motorized vehicles of diverse safety and pollution characteristics. Drivers have similarly diverse levels of discipline and inclination to comply with traffic rules.

Such diversity poses a traffic management challenge that must be addressed to secure more safety on the road.

- *Improve motorized transit management.* : Buses are the most widely utilized transit mode, and scholars have suggested improving the management of existing transit systems rather than investing in entirely new systems with different modes, probably for reasons related to capital funding. Transit should be more subsidized to become a viable alternative with service areas, schedules, and fares accessible to the people who cannot afford fares and having been displaced to distant suburban locations where non-motorized modes cannot cover distances to fulfill travel needs. Planning and management efforts can help integrate formal and informal transit systems, advancing towards better service and safety records.
- *Improve motor vehicles technology and fuels.* Developing countries with emerging economies can leap-frog the technological implementation of developed countries and invest in cleaner fuel and engine alternatives. Improved motor vehicle technologies and more rigid regulation of externalities, such as emissions, will ameliorate the inequitable impacts of the transportation system on the ecological environment and the population's health.
- *Enhance inter-agency cooperation.* Integration and collaboration between agencies in different sectors of urban planning is an issue also observed in developed countries, but it appears more severe in developing countries where bureaucracy is more complex and bureaucrats can often operate on their own turfs

without proper systems of checks and balances. Being able to make policy decisions without the interference of external agents is a measure of power that most agencies are hesitant to relinquish; growing urban centers, however, will benefit from more holistic planning approaches that consider social, economic, and ecological impacts from decisions regarding transportation, land use, and natural-resource management.

- *Foster public participation.* Input from users enhances the planning process by providing professional planners and policy makers with ‘real-world’ information. Public participation is not fostered in the developing world to the same extent that it is in developed nations. Transportation policies are tailored to the interests of the automobile industry and the motorized elites; the poor cannot find time away from their daily struggles to engage in civic participation, which combines with the prevalent sentiment that their voices will not be heard due to their lack of economic and political influence. Low-income groups are thus steered away from the policy-making process.
- *Impose financial constraints on personal automobile use.* To reverse motorization trends, middle and upper classes must feel constrained in their use of private vehicles. Governments in developing countries have recently turned to automobile subsidies as a tool towards modernization, but literature shows the rapid rate of motorization in booming urban centers is detrimental to the sustainability of their transportation systems. Governments will find it difficult to



formulate policies that counter the consumption desires of the elites, but the reversal of motorization trends can improve the quality of the overall system by reducing the need for new investment in auto-oriented infrastructure, mitigating congestion, improving air-quality, and forcing energy consumption levels down.

In conclusion, structural political and economic conditions perpetuate poverty, unemployment, and transportation-related social exclusion, granting privileges to elite social groups in the decision-making process. Private transportation has historically been favored, while public transit and non-motorized means of transportation have been neglected (da Silva, 2008). Literature points to insufficient funding and complex political and institutional structures as forces driving transportation policy in its current direction. Based on these findings, policies might turn in more equitable directions if more capital becomes available to developing countries.

## **CHAPTER 3: RESEARCH QUESTIONS AND OBJECTIVES**

As some economies emerge and more capital becomes available to selected developing countries, what transit policies are put in place to employ transportation as means to equitable opportunities? This research aims to answer this question. In particular, the objectives of this study are:

- to investigate how transit policies in fast emerging economies are used to distribute equitable access to the benefits related to economic growth and
- to derive lessons from the cases studied and recommend transit policy guidelines to orient future cohorts of emerging cities and countries to use transit as means to provide equitable improvements in accessibility.

## CHAPTER 4: METHODOLOGY

There is no single correct way to evaluate transportation equity. Various perspectives and methods for policy analysis in regards to equity are presented in the literature. This project starts from the definition of vertical equity with regard to income and social class presented by Todd Litman, as transcribed below, to analyze the progressiveness of transportation policies in a select group of emerging economies.

“Vertical equity (also called ‘social justice’, ‘environmental justice’ and ‘social inclusion’) is concerned with the distribution of impacts between individuals and groups that differ in abilities and needs, in this case, by income or social class. By this definition, transport policies are equitable if they favor economically and socially disadvantaged groups, therefore compensating for overall inequities. Policies favoring disadvantaged groups are called *progressive*, while those that excessively burden disadvantaged people are called *regressive*. This definition is used to support affordable modes, discounts and special services for economically and socially disadvantaged groups, and efforts to ensure that disadvantaged groups do not bear an excessive share of external costs.”

Litman (2002)

### Policy evaluation

Policy or program evaluation can be broadly defined as “any information obtained by any means on either the conduct or outcome of interventions, treatments or social programs” (Rossi et al., 1979). Because such broad definition can lead to less rigorous investigations and to common-sense analyses and conclusions, policy evaluation scholars tend to narrow the definition to what is known as ‘systematic evaluations’, those “which employ the basic approaches to gathering valid and reliable evidence that have been developed in the social sciences” (Rossi et al., 1979) and “an evaluation [that] offers

systematic evidence about the program in specified domains and leaves it to the reader to draw conclusions about its merits” (Weiss, 1998).

Policy evaluation can be quantitative or qualitative. Its main objective, like that of other research methods, is to describe and understand interactions between variables and, if possible, to identify causal relationship. Furthermore, evaluations and other research methods are also similar in matters of planning, design, measurement and analysis. The process of formulating hypotheses, however, is what sets policy evaluation apart: while basic researchers formulate their own hypotheses as a primordial condition for conducting the research, evaluators can adopt a more fluid and opportunistic framework, dealing mainly in the currency of program concerns as they are uncovered (Weiss, 1998). Whyte emphasizes that “research has to be opportunistic because you don’t know what you are going to discover. The things you discover may not be the things you set out to do” (Whyte, 1991).

Qualitative program evaluation is concerned with words and narratives in detriment of counts and statistical analyses, therefore relying on a flexible perspective rather than on prepared instruments. Ambiguities, when they arise, should be highlighted, not suppressed (Weiss, 1998). The idea is to show society what the programs are really doing, not to judge whether they are doing it right or wrong. In dealing with the fluidity of a policy evaluation process, the evaluator must seek to learn what is happening and be able to combine linear and nonlinear approaches: having a plan for what knowledge the research is aiming to gather, while at the same time viewing problems configuratively,

“moving back and forth over steps as various pieces of the puzzle become apparent and begin to fall into place” (Weimer, 1989). Finally, policy evaluators can emanate from many diverse professional settings, as long as they have basic social research training (Wholey, 1994). Evaluators are aware of the fact that they study programs that intervene in the lives of large populations; they want to understand the interactions resulting from a social program in its natural setting, and they take pride in having a chance to contribute to improvements in society through the wise use of evaluation results by competent authority (Weiss, 1998).

With vertical equity analysis as framework, this study closely examines current transit policies in four selected cities to investigate their progressiveness. An exhaustive examination of how a given transit policy touches the issue of equity is nearly impossible; therefore, the following initial selection of questions helps delineate possible indicators explored by this research.

- Does the transit policy favor affordable modes?
- How do low income groups benefit from the transit policy compared to middle and upper classes?
- Are there any special discounts for selected groups of people? How do discounts relate to income levels?
- To what extent are investments directed to low-income areas?
- How does land use serve non-motorized access?

- How well do policies provide for access to basic services, such as medical attention, education, job training and opportunities?

## **Case studies**

As an exploratory investigation focused mainly on a “what” question, this research uses case studies to address its objectives. The four case studies aim on examining “a contemporary phenomenon in depth and within its real-life context [and are justifiable] especially when the boundaries between phenomenon and context are not clearly evident” (Yin, 2009). While no specific hypothesis is being tested, this work studies the effects of three aspects of transit systems on equity in four major metropolitan areas; these aspects are, namely:

- institutional structure and system ownership,
- mode predominance, and
- fare structure.

The exploration will be judged successful if it can make connections between the three cited aspects of transit systems to favorable or detrimental effects on equity (as delimited above) and if it can draw conclusions and recommendations that can be later related to other groups of emerging countries and/or cities.

## **Selected subjects**

This study is intended to examine model transit policies for developing countries. Presumably, these policies are most advanced where economies have a long-standing

record of economic stability and growth. Cases were selected for metropolitan areas in countries on the brink of establishing themselves in the developed global economic system. The main cities in a small group of countries were selected: Sao Paulo in Brazil, Moscow in Russia, Mumbai in India and Shanghai in China. The following subsections explain why these four countries were determined to qualify as forerunning economies and why these four metropolitan areas were selected within these countries.

### ***BRIC Countries – Overview***

Brazil, Russia, India, and China are known collectively as the BRIC countries (Wilson and Purushothaman, 2003). Besides figuring among the largest and most populous countries on the globe, the BRIC countries present a unique combination of strong presence in global economy and internal economic inequities (Table 3).

**Table 3: BRIC Countries in Global Economic Context**

	<b>Brazil</b>	<b>Russia</b>	<b>India</b>	<b>China</b>
<b>Land Area World Ranking</b>	5	1	7	4
<b>Population World Ranking</b>	5	9	2	1
<b>2008 GDP (US\$ Trillion) (world ranking)</b>	US\$ 1.998 (10)	US\$2.271 (7)	US\$ 3.304 (5)	US\$ 7.992 (3)
<b>2008 GDP Per Capita (world ranking)</b>	US\$ 10, 200 (102)	US\$16,100 (73)	US\$ 2,900 (167)	US\$ 6,000 (133)
<b>2008 Human Development Index<sup>1</sup> (world ranking)</b>	0.813 (75)	0.817 (71)	0.612 (134)	0.772 (92)

<sup>1</sup> The human development index is a summary composite index that measures a country's average achievements in three basic aspects of human development: health, knowledge, and a decent standard of living. The closer a country's HDI is to 1, the better are the standards of living in that country (Source: UNDP – Human Development Reports)

Sources: CIA – The World Fact book and United Nations Development Program – Human Development reports

Analysts predicted that over the next fifty years the BRICs will become a larger force in the world economy, presenting significant growth in employment, in capital stock and technical progress. Projections also show, however, that individuals within the BRICs will remain poorer than their G6 counterparts, that human development indexes will remain significantly lower than the top twenty nations, and that political corruption might continue to be a problem. The controversial socio-economic scenery in the four subject countries and their top cities should yield interesting findings in the realm of transportation equity.

### ***Origin of the acronym***

It is not new for economic analysts to create tags to refer to groups of markets, even those that are not homogenous. The term *emerging markets*, for example, was created in 1981 by Antoine van Agtmael to introduce a more positive and optimistic quip to refer to the same group of countries that had been called the *third world*. Similarly, when Singapore, South Korea, Taiwan and Indonesia experienced extraordinary growth momentum in the 1990s, they were dubbed the Asian Tigers (Armijo, 2007). In 2001, Jim O’Neill of Goldman Sachs introduced the “BRIC” tag to refer to Brazil, Russia, India, and China, the largest and most promising emerging markets globally. The study highlights the need for a better representation of emerging nations on the world stage, more specifically making the case for the reformulation of the G-7 (composed by France, Italy, Germany, United States, Canada, United Kingdom, and Japan) to incorporate BRIC representatives. Two important factors made updated representation necessary: first, the



fact that the economies of the BRIC countries had surpassed those of some G-7 members by measures of purchase power parity (PPP), and share in world gross domestic product (Table 4); and second, that most of the world's economic changes (positive and negative) in the decades preceding the study involved mainly countries outside the G-7, exposing the need for better knowledge of those areas in global economic policy making.

**Table 4: Economic size of the world, 2000**

	GDP (PPP weights) : US\$ 2000bn	Share of the world total (%) (1)	GDP (Current prices): US\$ 2000bn	Share of the world total (%) (2)	Difference in share (1-2)	Population (millions)	GDP per capita (current prices)
United States	9,963	23.98	9,963	33.13	-9.15	281.42	35,401
<b>China</b>	<b>5,230</b>	<b>12.59</b>	<b>1,080</b>	<b>3.59</b>	<b>9</b>	<b>1,266.80</b>	<b>852</b>
Japan	3,319	7.99	4,760	15.83	-7.84	126.87	37,515
<b>India</b>	<b>2,104</b>	<b>5.06</b>	<b>474</b>	<b>1.58</b>	<b>3.49</b>	<b>1,002.14</b>	<b>473</b>
Germany	2,082	5.01	1,878	6.25	-1.23	82.02	22,898
France	1,458	3.51	1,289	4.29	-0.78	58.89	21,890
UK	1,425	3.43	1,417	4.71	-1.28	59.5	23,810
Italy	1,404	3.38	1,077	3.58	-0.2	57.53	18,719
<b>Brazil</b>	<b>1,214</b>	<b>2.92</b>	<b>588</b>	<b>1.96</b>	<b>0.97</b>	<b>167.72</b>	<b>3,507</b>
<b>Russia</b>	<b>1,120</b>	<b>2.7</b>	<b>247</b>	<b>0.82</b>	<b>1.88</b>	<b>145.49</b>	<b>1,696</b>
Canada	903	2.17	699	2.33	-0.15	30.75	22,747
Mexico	890	2.14	574	1.91	0.23	97.36	5,901
Spain	797	1.92	560	1.86	0.05	39.47	14,190
Korea	770	1.85	457	1.52	0.33	47.27	9,678
Indonesia	696	1.68	154	0.51	1.16	210.49	730
Australia	523	1.26	382	1.27	-0.01	19.16	19,933
Taiwan	477	1.15	310	1.03	0.12	22.32	13,899
Turkey	437	1.05	203	0.67	0.38	67.38	3,007
Thailand	430	1.04	122	0.41	0.63	62.32	1,956
Netherlands	416	1	370	1.23	-0.23	15.86	23,334
World	41,552	100	30,073	100	#####	6,073.00	4,952
of which G7	20,555	49	21,082	70	-20	692.66	30,437
Euro land	7,231	17	6,072	20	-3	304.07	19,820

Source: O'Neill, 2001

***A formal BRIC alliance and future developments***

Despite its beginning as a marketing term, the BRIC group quickly became a genuine political and financial coalition. Subsequent to the publication of the Goldman Sachs reports, policy makers from the four countries – such as finance ministers and

central bank heads – started meeting with increasing regularity (Drezner, 2009), culminating with the Yekaterinburg Summit on June 16 2009, which convened the countries’ heads of state. The first BRIC Summit served more for the group to kick off a formal alliance than to produce concrete resolutions, and therefore was perceived by many analysts as a meaningless event (The Economist, 2010). However, when the second summit happened in Brasilia on April 15, 2010, the countries started establishing a record and moving forward with pledges and commitments to concrete actions to further develop the coalition and its relationship with other developing countries.

The communiqué of the second BRIC summit expressed the groups’ support of the G-20<sup>2</sup> as a more “inclusive, diverse, representative and effective” arrangement for the discussion of global financial issues, and pleaded for an increase in the roles of Brazil and India in the United Nations. Still according to the 2010 communiqué, future developments of the BRIC coalition include the following.

- The first meeting of ministers of agriculture and agrarian development, plus the creation of an agricultural information base system of the BRIC countries
- The meetings of ministers of finance and governors of central banks
- The meetings of high representatives for security issues

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<sup>2</sup>Established in 1999, the G-20 is formed by the major advanced and emerging economies in the world. Their Finance Ministers and Central Bank heads convene annually to discuss matters of global economic growth and strategies to financial stability. (Source: Group of Twenty)

- The first exchange program for magistrates and judges of BRIC countries
- The first meeting of development banks
- The first meeting of the heads of the national statistical institutions
- The conference of competition authorities
- The first meeting of cooperatives
- The first business forum
- The conference of think tanks
- The joint publication by each country's national statistical institutions
- A feasibility study for developing a joint BRIC encyclopedia

***Economic importance: size***

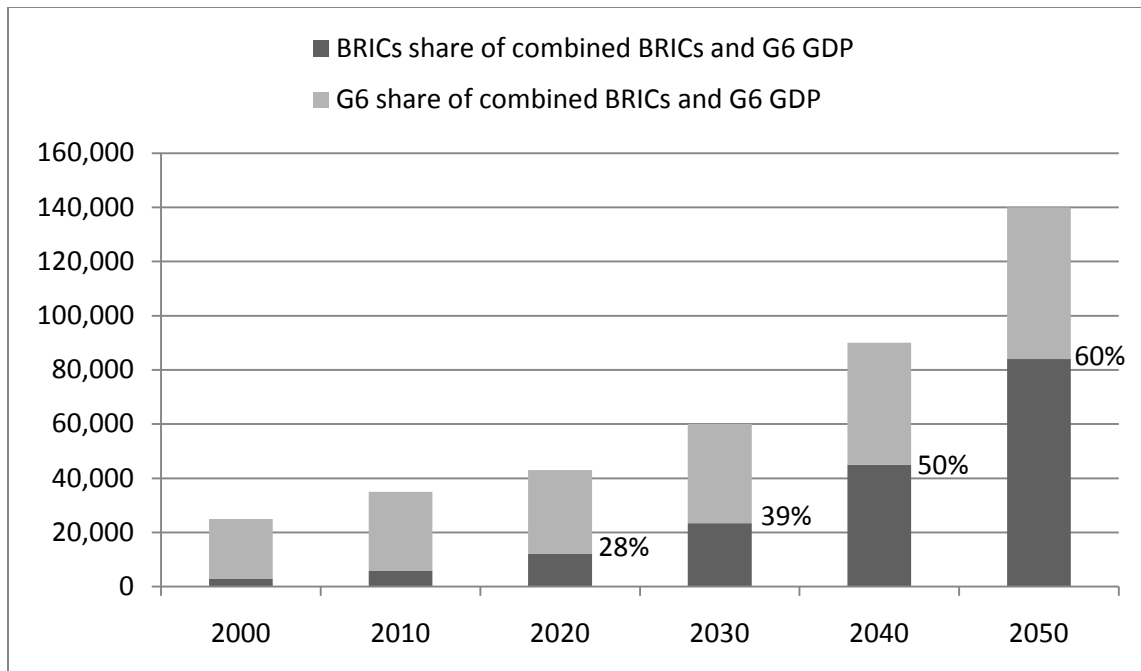
In 2003, a new Goldman Sachs study on the BRICs presents those countries' growth forecasts in finer detail, being cautiously optimistic about predictions, while asserting that they were "economically sensible" and in line with predictions also put forth by the International Monetary Fund. The study predicted the BRICs to become a large economic force in the following decades with combined economies larger than the combined economies of the G-6<sup>3</sup> in dollar terms in less than four decades (Figure 5 and Figure 6), even though in 2003 they accounted for less than fifteen percent of the size of

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<sup>3</sup> The G-6 is composed by United States, Japan, United Kingdom, Germany, France and Italy.

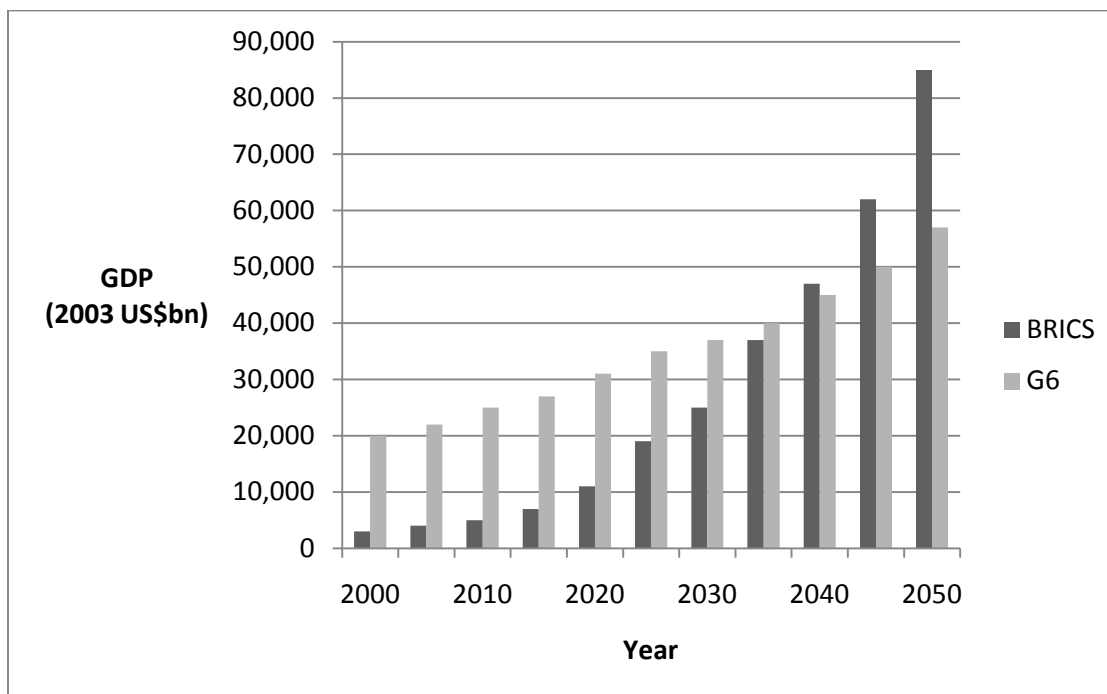
the G-6. The BRIC countries were also forecast to replace all G-6 members but the United States and Japan as the largest economies in the world by 2050. Despite the fact that spectacular changes in gross domestic product will be necessary for the BRIC countries to escalate to anticipated high positions in the global market, past experiences in countries as Japan (between 1955 and 1985) and Korea (between 1970 and 2000) demonstrated similarly extraordinary growth is possible within a few decades (Wilson and Purushothaman, 2003). Two years later, another Goldman Sachs report celebrated how BRIC countries had effectively grown stronger than initial projections. The case of the inclusion of the BRICs in the highest level of global economic policy making, then, was stated to be “overwhelming” (O’Neill et al, 2005).

**Figure 5: BRICs share of G6 GDP, 2003**



Source: Wilson and Purushothaman, 2003

**Figure 6: Comparative GDP growth - BRICs and G6, 2003**



Source: Wilson and Purushothaman, 2003

The economic significance of the BRIC countries has been discussed in many other venues since the Goldman Sachs reports. Among the factors that contribute to the stature of these nations are the fact that in 2010, they were the only countries outside the traditional circle of developed countries to account annual gross domestic products of over one trillion dollars and that figured among the ten largest world accumulators of foreign exchange reserves, amassing over 40 percent of them globally. Those reserves served to stabilize the global economy during the 2009/2010 disturbances (The Economist, 2010). Moreover, in their 2010 Summit, the BRICs themselves declared that they have significantly contributed to the increase of resources available to the

International Monetary Fund to benefit developing countries during economic crises (2010 Summit communiqué). The BRIC coalition also demonstrated itself to be resourceful, and although the BRICs and the United States are “on the same side economically” (The Economist, 2010), the countries in the BRIC coalition constantly looked for ways to trade with each other by relying on currencies other than the dollar (Drezner, 2009) and to continue to deliver growth that is not dependent on foreign sources of capital (Armijo, 2007).

***Political importance: multipolarity***

Since World War II, international governmental organizations (IGOs) like the BRIC coalition, forged on both state-to-state and private financial cooperation, have significantly altered important characteristics and increased the multipolarity of the international system, according to liberal *institutionalist* scholars (Armijo, 2007). Although multipolarity has been increasing in recent decades, important actors continue to call for more openness of international fora to developing countries: French President Nicholas Sarkozy, also representing the European Union at the 2008 United Nations General Assembly stated that an enlargement of the United Nations Security Council and the Group of Eight to include China, India and Brazil, among others, would be “necessary condition for acting responsibly” and to ensure that the “twenty-first century would not be governed by twentieth century institutions.” Russia is already part of the G-8, alongside the United States, Canada, France, Britain, Germany, Japan and Italy (UN General Assembly, 2008). In fact, Luiz Inacio Lula da Silva, President of Brazil, has declared that to increase multipolarity in the world and to help developing countries to be

heard in the international decision-making processes were among the main objectives of international governmental organizations (IGOs) such as the BRIC countries, the India, Brazil and South Africa Initiative (IBSA), the G-20 at the World Trade Organization, and the Union of South American Nations (UNASUR), to cite a few (UN General Assembly, 2008). That notion was corroborated by the official communiqué of the 2009 BRIC Summit which underlined the BRIC countries' quest for a more multipolar world, emphasizing the "rule of international law, equality, mutual respect, cooperation, coordinated action and collective decision-making of all states".

Created in 1999, the Group of Twenty became the principal forum where advanced and developing countries alike could discuss matters of global economy and financial markets, with the endorsement of the United States, who also encouraged the inclusion of the BRIC countries in the group. By creating a group of their own, however, the BRICs wanted to demonstrate that large emerging countries can create avenues for debate independently of the United States, European Union and Japan (Andrew Weiss, 2009). Furthermore, the creation of coalitions like the BRIC, even when they seem clumsy and improbable, can keep the international community safe from what would be considered a "nightmare": a G-2 of United States and China (The Economist, 2010).

Despite their willingness to rise to the world stage in matters of soft power, international economy and finance, the BRIC countries "are not interested in causing trouble" concerning hard power and security (Andrew Weiss, 2009). The formal statements that emerged from the two BRIC summits did not touch on security issues



besides a reproach to international terrorism and a call for reforming the UN Security Council, which demonstrated that the coalition was probably not looking to turn their soft balancing into “something harder” (Drezner, 2009). Although much of the speculation in the United States and Europe surrounding the BRIC countries originated from *realpolitik* fear of the emergence of non-traditional and non-European powers (Armijo, 2007), analysts say that the economic success of Brazil, Russia, India and China depends the smooth functioning of the international system, and therefore they are not interested in provoking any dramatic changes (The Economist, 2010). In summa, in regards to military prowess the world is still undoubtedly unipolar, with the United States exerting its leadership by accounting alone for over 45 percent of world military spending in 2006 (Britain was the next largest spender, contributing with just over five percent), a situation that is not likely to change unless western European countries moved towards combining their capabilities (Armijo, 2007).

### ***Theoretical criticisms***

It is important to highlight that the legitimacy of the BRIC unit has been challenged. The fact that BRIC countries form a heterogeneous group, a group of non-equals, lacking coherence and consistency, has made scholars and specialists question whether they deserve to be treated as an analytical unit or category (Armijo, 2007). Because they have diverse political, cultural and economical structures, and pursue different interests in the international arena, the BRIC countries are sometimes seen as another of a series of harmless and ineffective international groupings, whose formal statements show little evidence of a common policy agenda (Weiss, 2009), and whose

pledges will hardly lead to concrete action (Drezner, 2009). At different moments, the legitimacy of one or another member is challenged, with analysts wondering how each of them fits in, and what would happen to the group if other emerging countries such as Mexico, South Africa or Indonesia joined the coalition (The Economist, 2010).

### ***Sustainability and the BRICs***

Despite criticisms to the coherence (or lack thereof) of the BRIC unit discussed above, it is important to consider the position of these countries in a conversation about the notion of sustainability in general, and about the social facet of that notion in particular, because the group has overtly expressed its views and commitment to a leadership role among less developed countries in regards to sustainability in the communiqués that resulted from both the 2009 and the 2010 BRIC Summits. In 2009 the group's pledges for cooperation touched on broad issues such as international humanitarian assistance and reduction of risk of natural disasters, as well as exchanges in science and education to strengthen research and development of advanced technologies. In the following year the pledges were directed to more specific issues, including research and development of new technologies in the fields of energy and climate change, the achievement of the UN Millennium Development Goals (MGDs)<sup>4</sup> and the strengthening of sustainable social programs.

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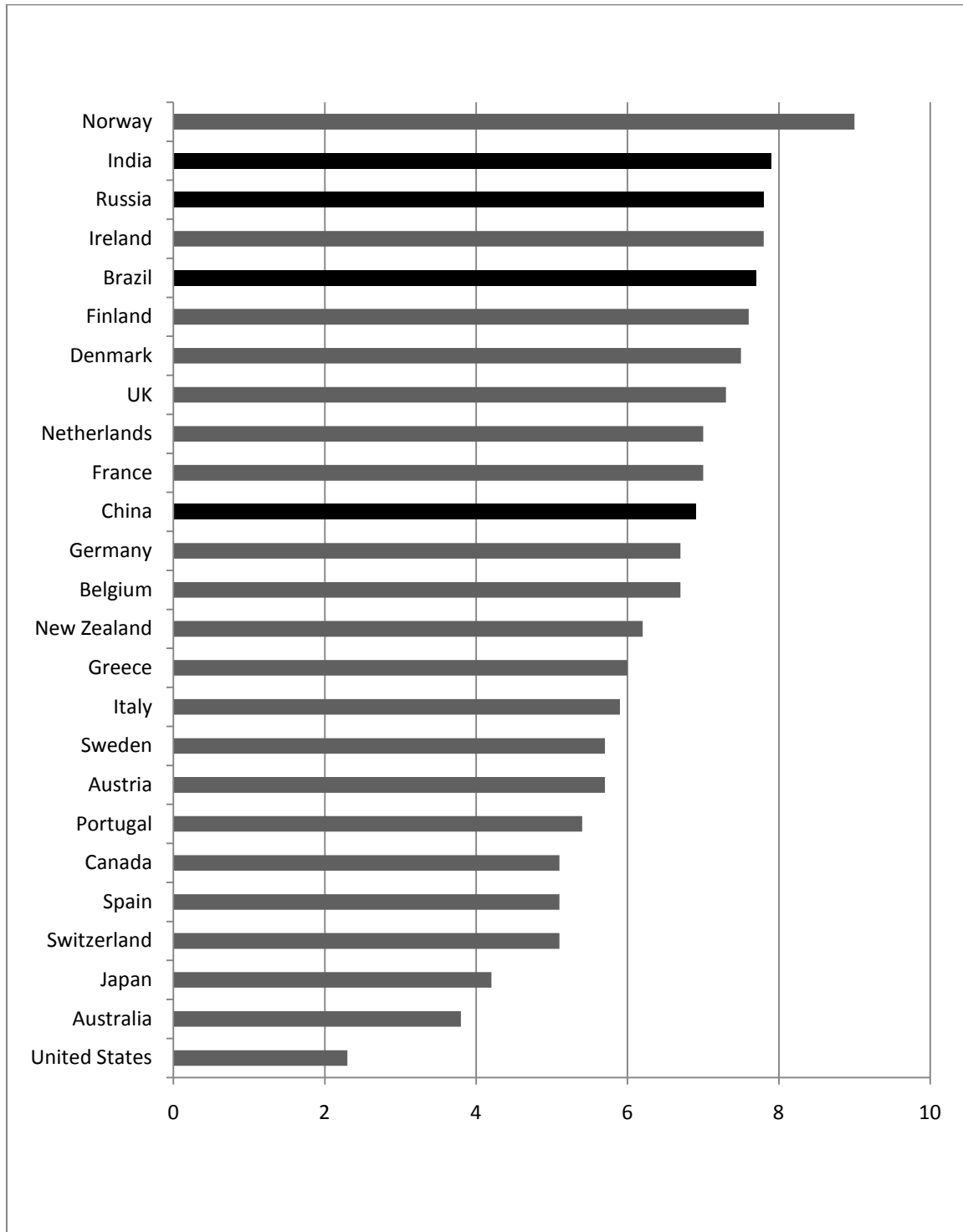
<sup>4</sup> The Millennium Development goals are to end poverty and hunger, provide universal education, foster gender equality, protect child and maternal health, combat HIV/AIDS, promote environmental sustainability and support global partnership. These goals were established as part of the UN Millennium Project in 2005 and partners committed on achieving specific targets and objectives by 2015 (Source: United Nations Millennium Development Goals).

The communiqué from the BRIC group's first summit mentioned the issue of energy en passant, with the countries simply pledging to cooperate in the field; however, more detailed considerations to energy came out of the 2010 Summit communiqué, which stated that "Access to energy is of paramount importance to economic growth with equity and social inclusion". The development of cleaner, cheaper, and more sustainable systems, technologies, and practices are among the goals of the group to be achieved through cooperation, alongside more efficient uses of fossil fuels and the encouragement of production and consumption of sustainably developed biofuels. Moreover, the BRIC coalition also made it explicit on its communiqué its support for the UN Framework Convention on Climate Change and the Kyoto Protocol as the appropriate paradigms for climate change talks and negotiations, keeping in mind concerns for "equity and common but differentiated responsibilities between developed and developing countries".

In fact, a 2007 study affirmed that if India, Russia, Brazil and China were considered among the 21 members of the Development Assistance Committee (DAC) for their standing as global environmental stewards, they would rank second, fourth, fifth and eleventh respectively (Roodman, 2007). The study calculated the environmental component of the Commitment to Development Index (CDI), which ranks how policies in the 21 DAC members are beneficial or detrimental to developing countries. A complete lack of "good" scores a zero, and a complete lack of "bad" scores a ten; a score of five means "average". Roodman found the BRIC countries are better global environmental stewards than most of their developed counterparts. According to the author, the findings of this study serve first, to "put a mirror to the truly affluent nations",

and second, to solidify the BRIC countries stature as actors influencing the lives of millions of people globally, inside and outside their borders, even though they operate outside the traditional group of developed countries (Roodman, 2007).

**Figure 7: BRIC's environmental component of CDI, 2007**



Source: Roodman, 2007

In matters of social sustainability, in 2010 the BRIC countries extended their intentions to cooperate not only with each other but also with other developing nations. In regards to millennium development goals (MDGs), besides stating they will make efforts to achieve the goals by 2015, the countries in the BRIC coalition also committed to provide technical and financial support to less developed countries to aid them in formulating policies for development and social protection of their peoples. Furthermore, in its 2010 Summit communiqué, the group emphasized its support to sustainable social development, underlining the importance of social protection and employment programs, and citing “the poor, women, youth, migrants and persons with disabilities” as “the most vulnerable groups”, therefore deserving special attention of policymakers in poor countries. This leadership demonstrated by the BRIC countries in relation to sustainability makes them subjects worth investigating on this project, and lessons can be learned and later applied to new cohorts of countries with “BRIC-like characteristics” that are predicted to emerge in the future (O’Neill et al, 2005).

### **Selected metropolitan areas**

Due to the absence of comprehensive public transit policies at a national level in the countries being considered here, the major metropolitan area in each of the BRIC countries was selected as case study subjects. In the last decade, Sao Paulo, Moscow, Mumbai, and Shanghai were included among world mega-cities for the sizes of their populations (Table 5) and among global cities for the sizes of their economies. World city rankings have exposed the trend that most emerging cities are located in fast emerging markets, such as Brazil, India, and China, and that they can rival traditional leading cities

like New York, Tokyo, Paris and London in a few decades (Price Waterhouse Cooper, 2009).

**Table 5: Main cities in BRIC countries**

<b>Country</b>	<b>Greater Urban Agglomeration</b>	<b>2007 Population</b>
BRAZIL	Sao Paulo	18.8
RUSSIA	Moscow	10.5
INDIA	Mumbai	19.0
CHINA	Shanghai	15.0

Source: United Nations Population Division

Of the selected cities in the BRIC countries, only Moscow is expected to experience an accentuated decline in population size and growth rate, which corroborates with the discussion above that the selected subjects are not a homogeneous group. Besides population, however, rankings of global cities take into account economic factors like gross domestic product and average income per capita. Contrasting the pure population projections (Table 6) with the gross domestic product estimates (Table 7), it was interesting to notice that although 22 of the top 30 urban agglomerations in the population category were located in developing countries, only seven of those were also among the top 30 gross domestic product ranking, including the four selected BRIC cities (Sao Paulo, Moscow, Shanghai and Mumbai), plus Mexico City, Buenos Aires and Rio de Janeiro.

**Table 6: Population trends in top urban agglomerations, 1950-2015**

<b>Ranking in 1950</b>	<b>Pop. (m) 1950</b>	<b>Ranking in 1990</b>	<b>Pop. (m) 1990</b>	<b>Ranking in 2007</b>	<b>Pop. (m) 2007</b>	<b>Projected Ranking in 2025</b>	<b>Projected Pop. (m) 2025</b>
1. New York	12.3	Tokyo	32.5	Tokyo	35.7	Tokyo	36.4
2. Tokyo	11.3	New York	16.1	New York	19	Mumbai	26.4
3. London	8.4	Mexico City	15.3	Mexico City	19	Delhi	22.5
4. Shanghai	6.1	Sao Paulo	14.8	Mumbai	19	Dhaka	22
5. Paris	5.4	Mumbai	12.3	São Paulo	18.8	São Paulo	21.4
6. Moscow	5.4	Osaka-Kobe	11	Delhi	15.9	Mexico City	21
7. Buenos Aires	5.1	Kolkata	10.9	Shanghai	15	New York	20.6
8. Chicago	5	Los Angeles	10.9	Kolkata	14.8	Kolkata	20.6
9. Kolkata	4.5	Seoul	10.5	Dhaka	13.5	Shanghai	19.4
10. Beijing	4.3	Buenos Aires	10.5	Buenos Aires	12.8	Karachi	19.1
11. Osaka/Kobe	4.1	Rio de Janeiro	9.6	Los Angeles	12.5	Kinshasa	16.8
12. Los Angeles	4	Paris	9.3	Karachi	12.1	Lagos	15.8
13. Berlin	3.3	Cairo	9.1	Cairo	11.9	Cairo	15.6
14. Philadelphia	3.1	Moscow	9.1	Rio de Janeiro	11.7	Manila	14.8
15. Rio de Janeiro	3	Delhi	8.2	Osaka-Kobe	11.3	Beijing	14.5
16. St Petersburg	2.9	Shanghai	8.2	Beijing	11.1	Buenos Aires	13.8
17. Mexico City	2.9	Manila	8	Manila	11.1	Los Angeles	13.7
18. Mumbai	2.9	London	7.7	Moscow	10.5	Rio de Janeiro	13.4
19. Detroit	2.8	Jakarta	7.7	Istanbul	10.1	Jakarta	12.4
20. Boston	2.6	Chicago	7.4	Paris	9.9	Istanbul	12.1
21. Cairo	2.5	Beijing	7.4	Seoul	9.8	Guangzhou	11.8
22. Manchester	2.4	Karachi	7.1	Lagos	9.5	Osaka-Kobe	11.4
23. Tianjin	2.4	Istanbul	6.6	Jakarta	9.1	Moscow	10.5
24. Sao Paulo	2.3	Dhaka	6.5	Chicago	9	Lahore	10.5
25. Birmingham	2.2	Tehran	6.4	Guangzhou	8.8	Shenzhen	10.2
26. Shenyang	2.1	Bangkok	5.9	London	8.6	Chennai	10.1
27. Rome	1.9	Lima	5.8	Lima	8	Paris	10
28. Milan	1.9	Tianjin	5.8	Tehran	7.9	Chicago	9.9
29. San Francisco	1.9	Hong Kong	5.7	Kinshasa	7.8	Tehran	9.8
30. Barcelona	1.8	Chennai	5.3	Bogotá	7.8	Seoul	9.7

Source: PricewaterhouseCoopers UK Economic Outlook, November 2009



**Table 7: Top urban agglomerations by estimated GDP, 2008**

GDP rank in 2008 (with 2005 rank in brackets)	City	Estimated GDP in 2008 (\$bn at PPPs)*	Components of estimated GDP	
			Population (millions)	GDP per capita (\$k at PPPs)
1 (1)	Tokyo	1,479	35.83	41.3
2 (2)	New York	1,406	19.18	73.3
3 (3)	Los Angeles	792	12.59	62.9
4 (4)	Chicago	574	9.07	63.3
5 (6)	London	565	8.59	65.8
6 (5)	Paris	564	9.92	56.9
7 (7)	Osaka/Kobe	417	11.31	36.9
8 (8)	Mexico City	390	19.18	20.4
9 (9)	Philadelphia	388	5.54	70.1
<b>10 (19)</b>	<b>Sao Paulo</b>	<b>388</b>	<b>19.09</b>	<b>20.3</b>
11 (10)	Washington DC	375	4.38	85.5
12 (11)	Boston	363	4.51	80.5
13 (13)	Buenos Aires	362	12.9	28
14 (12)	Dallas/Fort Worth	338	4.86	69.5
<b>15 (25)</b>	<b>Moscow</b>	<b>321</b>	<b>10.47</b>	<b>30.7</b>
16 (14)	Hong Kong	320	7.28	44
17 (16)	Atlanta	304	4.58	66.4
18 (15)	San Francisco/Oakland	301	3.48	86.5
19 (17)	Houston	297	4.52	65.8
20 (18)	Miami	292	5.65	51.6
21 (20)	Seoul	291	9.78	29.7
22 (21)	Toronto	253	5.29	47.7
23 (22)	Detroit	253	4.13	61.1
24 (24)	Seattle	235	3.11	75.5
<b>25 (32)</b>	<b>Shanghai</b>	<b>233</b>	<b>15.24</b>	<b>15.3</b>
26 (23)	Madrid	230	5.64	40.8
27 (36)	Singapore	215	4.49	47.9
28 (26)	Sydney	213	4.36	48.9
<b>29 (37)</b>	<b>Mumbai (Bombay)</b>	<b>209</b>	<b>19.35</b>	<b>10.8</b>
30 (30)	Rio de Janeiro	201	11.89	16.9

Source: PricewaterhouseCoopers UK Economic Outlook, November 2009

## **Generalizability**

The BRIC coalition is being observed by other developing countries for several reasons. Their demonstrated leadership in sustainability is one of them, but there are other factors that command global attention, such as their sheer economic size (Roodman, 2007), and the fact that economic success was achieved without the full compliance with the terms of the Washington Consensus<sup>5</sup>, which provides other developing countries with different models to be emulated. In the words of an executive of the Centre for International Governance, “the [BRIC] tag seems to have permeated that public domain and become synonymous with change, emerging markets and growth” (The Economist, 2010).

Furthermore, the trend in international economic development points to the emergence of countries with BRIC-like characteristics, and therefore, other countries can benefit from lessons learned from the BRICs. Jim O’Neill, the analyst responsible for the BRIC tag, called these countries, which appear in Table 8, the Next Eleven (N-11). While only Mexico and Korea show the true potential to rival the BRICs in the future, they all can, and several probably will, “achieve their own BRIC-like aspirations” (O’Neill, 2005).

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<sup>5</sup> The Washington Consensus (term introduced for the first time in 1989) established neoliberal policies in the form of Structural Adjustment Programs (SAPs), or economic reform packages to be implemented by less developed countries who accepted international economic aid. Measures to administer the debt included tightening of fiscal discipline, reprioritization of public expenditures, implementation of tax reforms, financial and trade liberalization, institution of competitive interest rates, stimulation of foreign direct investment, privatization of state enterprises, deregulation of competition and strengthening of property rights. (Source: Center for International Development at Harvard)

**Table 8: The Next-Eleven, 2005**

<b>The N-11 Snapshot</b>				
<b>Country</b>	<b>Population 2005 (m)</b>	<b>2005 GDP (US\$ bn)</b>	<b>Average GDP Growth Rate (2000-2005)</b>	<b>2005 GDP per capita (US\$)</b>
Bangladesh	144	61	5.40%	422
Egypt	78	91	4.00%	1,170
Indonesia	242	272	4.60%	1,122
Iran	68	203	5.70%	2,989
Korea	49	814	5.20%	16,741
Mexico	106	753	2.60%	7,092
Nigeria	129	94	5.10%	733
Pakistan	162	120	4.10%	737
Philippines	88	98	4.70%	1,115
Turkey	70	349	4.30%	5,013
Vietnam	84	47	7.20%	566

Source: O'Neill et al, 2005

Although the notion of the BRIC group has been criticized as cumbersome, new and emerging coalitions seem to have, if nothing else, better geographical coherence than the BRICs. Some countries expected to emerge in groups include some East Asian nations (The Economist, 2010), African countries such as Nigeria and South Africa, former communist bloc countries in East and Central Europe, some Gulf nations including Saudi Arabia (Armijo, 2007), and the nascent Union of South American Nations (UNASUR). UNASUR was created in May 2008, and Brazilian President Luis Inacio Lula da Silva remarked before the 2008 United Nations General Assembly that as the first treaty after 200 years of independence to involve all of South American countries, UNASUR will allow them to cooperate in areas of infrastructure, energy, social policies, finance, and defense (2008 UN General Assembly).

## **Theoretical Replication**

Subjects for the case studies were chosen using the *theoretical replication* logic, which “predicts contrasting results, but for anticipatable reasons” (Yin, 2009). The BRIC coalition deserves merit as an analytical unit because it might “have a similar type of influence in, or equivalent implications for, the international political and economic system and might alter the conditions of international interactions for other players in parallel ways” (Armijo, 2007), the enormous diversity within the group predicts that results will be dissimilar. In sum, this study used the BRIC countries’ status as pioneers and trend-setters among emerging countries to investigate issues of social sustainability. Such choice can yield results that, albeit different, can be later extrapolated and generalized to other countries in each geographic region. In this fashion, emerging Latin American countries can benefit from learning lessons from Brazil; Eastern and Central European countries from Russia; Southern Asian countries from India, and East Asian countries from China.

On a local level, lessons learned from the main metropolises in the BRICs can also be related to other emerging cities both within the BRIC countries and beyond their borders. Future world cities, also known as “climbers” (PWC 2009) include Istanbul, Beijing, Delhi, Guangzhou, Cairo, Manila, Kolkata, Bangkok, and Jakarta, among others. These cities and their associated metropolitan regions are experiencing similar patterns of population growth, accumulation of wealth, and the associated increase in global importance; therefore, important socio-economic aspects, such as the focus areas for this study, should continue to be observed and investigated.

## **Data collection**

Engaging in data collection with rigor is an important step for quality control and contributes to the reliability of the case studies (Yin, 2009). The data collection for this project abode by the principles prescribed by Yin.

### **First principle: Use multiple sources of evidence**

This project used two sources of evidence: documentation and archival records.

Documentation included:

- announcements, minutes of meetings, reports of events, administrative documents, and internal records;
- news clippings from media outlets; and,
- formal studies and evaluations of the same cases studied here from institutions and organizations like (but not limited to) the United Nations, World Bank, International Monetary Fund, World Resources Institute, Transportation Research Board, and Federal Transit Administration.

Archival records included:

- public use data including statistical data, service records, organograms, budgets, and maps and charts of service areas;
- survey data previously collected about the cases; and,
- pieces of legislation.

Public use data came from transit providers and other governmental divisions, departments, institutes, and bureaus at the local, state/provincial and federal/national levels.

### **Second principle: create a case study database**

Besides the case study reports that present all the relevant information about the cases with support from the appropriate data, an electronic case study database was created with all the “raw” data archived in separate folders. This database makes data easily retrievable should the need for further investigation arise.

### **Third principle: Maintain a chain of evidence**

The reader should understand how the data presented leads to the conclusions of the study. Although such ability will also depend on factors like organization and writing style, the intention of this project is to present the data such that readers can follow the steps from research questions to conclusions.

### **Validity, reliability and limitations**

Four design tests have been traditionally applied to inform the quality control of empirical social research: construct validity, internal validity, external validity, and reliability (Yin, 2009). Table 9 shows by what method each test should be addressed in case studies, and at which phase of research each method occurs.

**Table 9: Case study tactics for four design tests**

<b>Test</b>	<b>Case Study Tactic</b>	<b>Phase of research</b>	<b>Addressed</b>
Construct validity	Use multiple sources of evidence	Data collection	✓
	Establish chain of evidence	Data collection	✓
	Have key informants review draft case study report	Composition	✓
Internal validity	Do pattern matching	Data analysis	✓
	Do explanation building	Data analysis	✓
	Address rival explanations	Data analysis	✓
	Use logic models	Data analysis	✓
External validity	Use theory in single-case studies	Research design	Not applicable
	Use replication logic in multiple-case studies	Research design	✓
Reliability	Use case study protocol	Data collection	✓
	Develop case study database	Data collection	✓

Source: Yin, 2009

It is realistic to expect that some issues of practicality (such as time, money, capabilities of the evaluator, and existence of, or access to, data) might foreclose some potential avenues of investigation (Weiss, 1998) and as a consequence some of the aforementioned questions might remain unanswered in regards to one or more of the subject test-beds. Limitations of this study have included:

- language barrier, where the evaluator could not read and understand documentation and archives without translation services;
- aging data concerning rapidly changing environments;

- inability to establish personal communication with policy-makers or transit users in studied locations;
- distance and unfamiliarity with areas under study; and,
- informality and lack of documentation common in developing countries, where recordkeeping is usually less rigorous.

### **Data analysis: cross case synthesis**

Data analysis was approached under the *cross case synthesis* method prescribed by Yin. Each case study was developed isolatedly, and tables were created to display the data in determined categories across all cases. Visualizing the data in this fashion allowed similarities and differences to emerge, further leading to the analysis of whether some typology (for example, the emergence of subgroups or subcategories within the cases studied) was possible. Yin advises that this kind of analysis relies heavily on “argumentative interpretation” rather than quantitative tallies, so the development of “strong, plausible and fair arguments that are supported by the data” is indispensable for the success of this technique (Yin, 2009).



## **CHAPTER 5: RESULTS**

### **How studied transit systems distribute access**

Case study findings were organized to expose the implications of system characteristics on the issue of equity according to three main transit program aspects: transit system ownership and planning processes, mode predominance, and fare structure and collection methods. The different policy choices found across systems were evaluated on how they directly and indirectly affected their environments, transit users, and non-users. Some themes that arose recurrently in the evaluation of the four selected areas include land use, land values, rates of motorization, transportation affordability, integration of modes, ecological externalities, and safety of users, especially in regards to lower-income groups.

## Overview

Table 10 enumerates the agencies and modes analyzed in this project:

**Table 10: Overview of transit agencies in selected metropolitan areas**

<b>Metropolis</b>	<b>Transit Agency</b>	<b>Modes</b>
<b>Sao Paulo</b>	SPTrans (Sao Paulo Transportes)	Bus
	Metro (Companhia do Metropolitano)	Subway
	Companhia Paulista de Trens Metropolitanos (CPTM)	Suburban rail (train)
<b>Moscow</b>	Moscow Metro	Subway and monorail
	Mosgortrans (Moscow Government Transport)	Bus, trolley, and trams
<b>Mumbai</b>	Mumbai Metro One	Subway
	BEST Undertaking (Brihammumbai Electric Supply and Transport)	Bus
	Indian Railways	Regional rail
<b>Shanghai</b>	Shanghai Metro Authority	Subway
	Shanghai Urban Transportation Bureau	Bus

## Institutional structure and planning process

There is a fundamental relationship between the institutional structure and planning processes of a transit system and the goals such system upholds, generating important implications to the equity issue at hand. The cases studied showed a mix of models (Table 11), and the tangible results vary from system to system, each with advantages and disadvantages. Public ownership of transit systems were the norm with public-private partnerships gaining ground especially in recent decades. Where formal private providers were present, they operated under the management and supervision of public entities.

**Table 11: Studied transit systems ownership and planning, 2010**

<b>Metropolis</b>	<b>Transit Agency</b>	<b>System Ownership</b>	<b>Planning</b>
<b>Sao Paulo</b>	SPTTrans (Sao Paulo Transportes)	Public-private Partnership	Local level (municipal)
	EMTU	Public	State level
	Metro (Companhia do Metropolitano)	Public	State level
	Companhia Paulista de Trens Metropolitanos (CPTM)	Public	State level
<b>Moscow</b>	Moscow Metro	Public	Local with central/federal approval
	Mosgortrans (Moscow Government Transport)	Public	Local with central/federal approval
<b>Mumbai</b>	Mumbai Metro One	Public-private partnership	Local
	BEST Undertaking (Brihammumbai Electric Supply and Transport)	Public	Local
	Indian Railways	Public	Central
<b>Shanghai</b>	Shanghai Metro Authority	Public-private partnership	Central
	Shanghai Urban Transportation Bureau	Public-private partnership	Local

### **System ownership, planning processes and equity**

The most apparent advantage of a public transit system is that its goal is generally to transport passengers regardless of cost and funding, contrasted with the main goal of a private provider, which is to derive profit from the operation. Regarded as the best metro system in the world in terms of quality and reliability, and operating almost at capacity on a worldwide record for daily ridership (Cain and Kolpakov, 2007), the Moscow Metro is a matter of national priority for the Russian government, and federal funding is secured on a three-year plan basis. While transportation officials in Moscow admit they are not oblivious to success stories of public-private partnerships in other Eastern and Central

European cities that until recently also had completely public transit systems, they remain suspicious of the idea to involve private providers in a service the government has always offered, and they are even more uncomfortable with the idea of using federal and state taxes to allow private companies to profit. Similarly, the Sao Paulo metro system is publicly owned and operated and there are no plans of opening it for private investment in the near future.

The Shanghai metro system, on the other hand, was state owned and operated from its opening year in 1995 to 2002, when opened for private investment. Without the issuance of bonds and the concession of design, construction, and operation contracts to private companies, the Shanghai metro would be unlikely to reach its objective of serving 12 million riders a day by 2020, surpassing the world's current transit leader – the Moscow metro. Private and foreign capital is also making Mumbai's aspirations of building its own metro system possible. Future investigations will show whether these models will reach their targets.

When transit becomes unfeasible by the coffers of the government alone, the introduction of private partners can be positive, as experienced by the Shanghai metro to date and the Sao Paulo bus system. The apparent incongruence between the needs of the transit dependent population and the desire of private providers to profit can be circumvented by strong partnerships and public policies. The city of Sao Paulo, for example, was divided in several zones to be served by different private consortiums and cooperatives. The areas were ingenuously delineated to include both *social routes* and

*commercial routes*: social routes are established in areas where demand is not high enough to generate profit but transit is still necessary. In Sao Paulo, these areas are called the local subsystems. There, the government provides a subsidy for private provider to operate, within a predetermined frequency and fare level. On the other hand, in downtown areas where the demand is high enough to support commercial routes, private providers are free to set their own fare levels and frequencies of service, still yielding profit without government subsidy. All providers are responsible for providing transit in an assigned local subsystem and to connect said area to the downtown region. In the downtown region they can compete with other providers for lucrative routes and passengers, called structural subsystems. The Sao Paulo approach not only aims on making the system more easily manageable through delegation to small entities that are easily adaptable to new demands, but the concession of contracts to cooperatives is also inspired by ideals of ‘economic democracy,’ which proposes that the extension of decision-making power and participation in profits to a larger portion of the public is a positive step towards equity (National Cooperative Business Association).

While government can cut costs by transferring service provision to private entities, the model is not fool-proof. Generous injection of resources in managing and supervision are necessary because unregulated providers aim to minimize costs and maximize profit, while maintaining the affordability demanded by the low-income clientele they serve. They can cut costs by employing old, noisy, low-performance, high-emissions vehicles with outdated or non-existent safety equipment; by not purchasing insurance or not hiring qualified drivers; they can also engage in “cream skimming”:

clustering their service around the most profitable routes and times of day. These practices create an unsafe transit experience and an erratic schedule; sometimes service at off-peak times and on low-demand routes simply disappears, consequently depriving the most vulnerable groups in society of service. On the other hand, drivers on lucrative routes behave aggressively in an attempt to reach stops before their competitors, overloading vehicles and causing crashes and congestion.

The importance of strong policies and sound planning processes in the provision of equitable transit service permeates all models of ownership. The cities under study have found out that the level and rate of growth they are experiencing cannot be sustained without the adoption of local long-range transportation plans that consider how transit can and should enhance access to the growing economic opportunities, even when state or federal approval of plans is still a requirement.

- In Sao Paulo, reforms and system updates started in 2001 moving towards the capital intensive PITU 2020 (Integrated Urban Transport Plan), which foresees the expansion of the metro system and rail routes to the two international airports in the metropolitan area.
- In Moscow, the Metroplan 2015 aims on creating more at-grade rail connections to the traditional downtown and newer suburbs.
- Shanghai's 2020 Master Plan intends to rival Moscow metro's supremacy with heavy and light rail line expansion, as well as decentralize the city through strong transit-oriented development policies.

- The Mumbai Urban Transport Project-I, one of the efforts of the Mumbai Transformation Support Unit (MTSU), is driving the construction of the new metro system, whose first phase is expected to be completed by 2011.

By engaging in land use planning concomitantly with transportation planning for 2020 in order to promote controlled and sustainable nodal and corridor growth, anchored in mixed use patterns, Shanghai is working against an increasingly clear division of labor between local and central government in the provision of metro systems in China (with central government in charge of planning and local government in charge of acquiring right-of-way and creating a favorable investment environment, for example). However, of the cities studied here, the case of Mumbai is the most striking, because the 2005 MTSU initiative was the first instance of transportation planning in the city. Mumbai illustrates how the absence of local knowledge and input in transit planning can be detrimental to the system as a whole.

The major provider of transit in Mumbai is Indian Railways, which is owned and operated by the national government. Several issues arose from this arrangement. Of the case study metropolises, Mumbai presented the largest share of transit passengers utilizing the regional/ suburban rail infrastructure which is mostly elevated or at grade (with only one underground route in the traditional downtown district). Even where they carry a relatively small number of passengers, these radial routes are essential for the poorer portion of the population who cannot live closer to the city center. Because they were built before the period of intense motorization, and car infrastructure takes up

increasingly more space on the road, trains see their capacity diminished at grade crossings and are susceptible to congestion – which is primarily detrimental to suburban dwellers trying to reach their jobs and services in the city center. Capacity is also reduced due to the sharing of tracks between long-haul freight trains and local transit provider trains. Still because of the recent period of intense motorization, centers of activity in the inner city areas have shifted according to the needs of the private automobile, and stations are no longer well-located to provide accessibility to desired destinations, which negatively affects the transit dependent population. Furthermore, the land under some underutilized rights of way becomes improvised living quarters, in public national land, is a situation that cannot be addressed by local authorities due to the lack of jurisdiction. Situations like the ones just described are just examples of issues that could be alleviated if more knowledge of local conditions were taken into consideration in national level planning processes involving Indian Railways as a transit provider in Mumbai.

Recognizing the nature and extent of problems in the provision of suburban rail by the long-distance rail transportation system, Indian Railways expressed interest in creating segregated administrative units to be responsible for the management of transit in some metropolitan areas, including Mumbai. These units will not only work to find solutions for issues of overcrowding, excessive travel times, safety and security (among others), but also to secure local sources of funding for the upgrade of high-demand routes and for to guarantee the financial sustainability of routes that present low demand but are socially necessary because they serve transit-dependent populations. If the IR-Mumbai



administrative unit comes to fruition, it can potentially strengthen the collaboration between local and national planning entities, and improve coordination between the suburban rail system and other modes, particularly if engaging with the MTSU for visioning and planning. The improvement of the suburban rail fabric and services can bring substantial benefits to low-income riders that live in the outskirts of the city and will continue to rely on trains even with the new metro system in place. Table 12 synthesizes the findings on system ownership in regards to equity.

**Table 12: Synthesis of findings- equity and system ownership**

<b>Type of system</b>		<b>Advantages</b>	<b>Disadvantages</b>
<b>Public systems</b>		<ul style="list-style-type: none"> <li>• Service regardless of profitability</li> <li>• Integrated planning</li> </ul>	<ul style="list-style-type: none"> <li>• Complex Bureaucracy</li> <li>• Scarce funds</li> </ul>
<b>Public-Private Partnerships</b>	<i>Private capital</i>	<ul style="list-style-type: none"> <li>• Availability of funds</li> <li>• Feasibility of more expensive modes (ex. Metro)</li> </ul>	<ul style="list-style-type: none"> <li>• System indebtedness</li> <li>• Allure of metro causing excessive expenses</li> </ul>
	<i>Private operators</i>	<ul style="list-style-type: none"> <li>• Creation of jobs (economic democracy)</li> <li>• Adaptability to changes in demand</li> <li>• Reduced city's expenses with operations and maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Quest for maximization of profits</li> <li>• Necessity of strong management and supervision</li> </ul>

### **Mode predominance**

The main objective of the analysis of mode presence and predominance was to evaluate the systems' reliability and efficiency, the extent of investment in affordable modes and coverage of low-income areas, the relationship between modes and land use, the potential to attract choice riders, and how all of these factors affect the mobility and accessibility of low-income and transit dependent groups. The four studied areas

presented a mix of modes, though the emerging trend of systems seeking ways to increasingly rely on the metro to serve the dense, congested, and high-demand downtown areas did not go unnoticed. The predominant mode in each of the areas studied is shown in Table 13; Table 14, 15 and 16 present a snapshot of each mode in each analyzed area.

**Table 13: Mode predominance in selected metropolitan areas, 2006**

Metropolis	Predominant mode	Mode share of transit passengers
Sao Paulo	Municipal bus	62%
Moscow	Metro	56%
Mumbai	Regional rail	61%
Shanghai	Bus	66%

**Table 14: Bus systems in selected metropolitan areas**

Metropolis	Supervision	Transit units	System lines	Average weekday ridership (millions)
Sao Paulo	SPTrans	15,000	1,344	5.7
Moscow	Mosgortrans	4,715	632	2
Mumbai	BEST	3,391	354	4.1
Shanghai	Shanghai Urban Transportation Bureau	18,000	942	7

**Table 15: Snapshot of metro systems, 2009**

Metropolis	Supervision	Transit units	System lines	Length of tracks (miles)	Average weekday ridership (millions)
Sao Paulo	Companhia do Metropolitano	768	4	38.7	2.4
Moscow	Moscow Metropolitan	5,000+	12	185.3	9
Mumbai	Mumbai Metro One*	-	3	39.9	-
Shanghai	Shanghai Metro Authority	1,070	11**	356	3.6

(All figures are self-proclaimed)

\*The Mumbai Metro Transit System was under construction in 2010. Numbers correspond to the Phase 1 of the project, expected to be completed in 2011.

\*\*Including the Shanghai Maglev Train

**Table 16: Snapshot of suburban rail systems**

<b>Metropolis</b>	<b>Supervision</b>	<b>Transit units</b>	<b>System lines</b>	<b>Track Length (miles)</b>	<b>Average weekday ridership (millions)</b>
<b>Sao Paulo</b>	Companhia Paulista de Trens Metropolitanos	869	6	162	2.2
<b>Moscow</b>	Mosgortrans	864	38	94.4	1.8
<b>Mumbai</b>	Mumbai Suburban Rail System	1,656	5	92.5*	6.4
<b>Shanghai</b>	-	-	-	-	-

\* Plus 95.6 miles of tracks shared with Indian Railways long distance trains

### **Mode predominance and equity**

The idea of having a metro system is enticing to many developing cities globally, and such sentiment is not at all unfounded. Practice demonstrates that the metro system is superior in reliability to surface systems due to the lack of interaction with traffic and other delaying factors; it can move the highest number of passengers at once, contributing to the productivity and cost opportunity of the urban system; and, it enjoys a more positive overall image when compared to other modes. Of the systems under study, only Moscow's metro system carries the highest share of transit riders, although all the other cases are planning to either expand the existing metro system or adopt a brand new one. The reliance on the metro of the dominant mode raises some issues related to equity.

Metro fares are often more expensive than those of other modes. Where other modes are treated as subsidiaries to the metro, for example, with buses feeding metro stations but not travelling trunk routes, there is no affordable alternative to the metro along those routes. This scenario can be problematic to those who cannot afford metro fares. The metro works well in Moscow because the city has the traditional European land use pattern that emphasizes compactness and the incidence of improvised housing

arrangements (or slums) is considerable lower than the other three cases studied. In the past, residential areas were developed first and then Metro was extended to meet the demand. The new municipal government is making attempts to reverse that procedure by planning Metro extensions before permission is given to develop. Although the new model is commendable for its strong integration of land development and transportation planning, the fact that the planned housing stock will start at a higher price point for being on a transit line than it would be priced otherwise brings up concerns related to housing affordability. This conundrum relates to the discussion in literature that low income populations in developing cities, those who need transit the most, are pushed away to the outskirts because they cannot afford housing prices in areas served by transit, and perversely they cannot afford the cost of motorized transportation to reach the city center where jobs and services are. Rail (and other modes moving on dedicated right-of-way) tends to influence land prices upward more than modes without them, making the situation even more complicated.

In Sao Paulo, Shanghai and Mumbai, land use and housing patterns are more similar to those of other emerging cities globally, where the portions of the population with the lowest incomes are pushed to the outskirts of the city. The most transit dependent households remain out of the reach of the metro. Furthermore, proximity with rail systems in general, and metro in particular, is associated with an increase in land value. Households located in relatively affordable and relatively accessible areas near the city center are likely to relocate to further out with the advent of the rail line, because they might not be able to withstand such increase in housing value.

It would be out of line to derive from these considerations that the metro is an undesirable mode from an equity standpoint. It is important to notice, however, that every mode choice is a delicate issue and every choice will have positive and negative aspects. Modes must complement each other, and affordable alternatives should be available. Buses for example, are fit for the function of feeder and distributor of passengers as subsidiaries to rail lines, and all cases studied rely on buses for that function. Conversely, buses are the most susceptible of the modes to the interferences of traffic, causing them to be unreliable, especially in congested cities such as Mumbai. The bus service provided by BEST is plagued with heavy delays, which results in waiting times of over thirty minutes and force commuters to walk to their destinations instead. In Mumbai the poorest people are the most affected by bus delays and by the disruption in connectivity that they cause because they live the furthest away from rail routes, therefore are most likely to need the bus to reach a train station to ultimately reach the center of the city for jobs and services.

Buses, however, do not always have to be considered a subpar option. When services are segmented to attend market needs, opportunities for segregated right-of-ways and express routes can emerge as feasible options for the urban area that is not yet ready for a metro line. EMTU, the bus provider of the metropolitan region of Sao Paulo created a few opportunities for differentiated bus services in the outer areas of the region, where metro is not available. For example, the regular service is divided into common – routes connecting at least two municipalities within the Sao Paulo metro region, served by common buses that accommodate passengers sitting and standing; and selective service – routes connecting at least two municipalities within the Sao Paulo metro region, served

by coach buses that accommodate only sitting passengers, those who are willing to pay a slightly higher fare for comfort. Moreover, the Sao Mateus-Jabaquara Metropolitan Corridor moves on 20.5 miles of dedicated lanes linking five municipalities within the Sao Paulo metropolitan region. This system counts on 9 transfer terminals, 111 stops and its own 200-vehicle fleet, and it comfortably serves around 200 thousand passengers daily in outer areas of the metropolitan area.

To respond to a declining ridership due to the increase in private automobiles in the Moscow area and to pose some competition to them, Mosgortrans introduced a new service in 2002 to cater to middle-class choice riders who live in new suburban-style housing outside the city. The special service bus counts with televisions, magazines and refreshments. Although the fare for these express buses is about thirty percent higher than those of regular service, riders are willing to pay for the extra amenities and for the comfort of stopping only at approximately one-third of the locations of local service. Express service buses are generally a good addition to the surface system for a few reasons: they can stir some travelers to switch from private cars to transit; add capacity to high-demand routes; contribute to ameliorate pollution and congestion caused by reducing the number of cars on the road; and offer reduced travel times in comparison to stop-and-go local service options. If the provision of higher scale service indeed attracts choice riders and increases revenue, the whole system become more financially sustainable and all riders can stand to benefit. However, if these upscale lines become very lucrative and consequently lead to the shift of investment from transit dependent areas to serve wealthy suburbs, then the initiative is disastrous from an equity stand point.

Further investigation of this specific service would determine its implications to equity.

Table 17 synthesized the equity implications found in regards to transit mode.

**Table 17: Synthesis of findings- equity and transit modes**

<b>Predominant mode</b>	<b>Advantages</b>	<b>Disadvantages</b>
<b>Bus</b>	<ul style="list-style-type: none"> <li>• Coverage area</li> <li>• Creation of jobs in operation</li> <li>• Adaptability</li> <li>• Low fares</li> </ul>	<ul style="list-style-type: none"> <li>• Small Capacity</li> <li>• Loss on reliability for interaction with traffic</li> <li>• High costs of operation/maintenance</li> <li>• Pollution</li> <li>• Image</li> </ul>
<b>Upgraded bus service</b>	<ul style="list-style-type: none"> <li>• Speed/travel times in express routes or dedicated lanes</li> <li>• Lucrative high demand routes and full-fare passengers bring money into the system</li> <li>• Switches choice riders from automobile</li> <li>• Reduction in congestion</li> </ul>	<ul style="list-style-type: none"> <li>• Higher fares</li> <li>• Service area tailored to higher income riders</li> <li>• More lucrative, can pull investment from regular lines that serve the transit-dependent</li> </ul>
<b>Metro</b>	<ul style="list-style-type: none"> <li>• Capacity</li> <li>• Reliability</li> <li>• Travel times</li> <li>• Image</li> </ul>	<ul style="list-style-type: none"> <li>• Higher fares</li> <li>• More affordable modes become subsidiary and receive less investment</li> <li>• Increase in housing prices along routes</li> <li>• Indebtedness of localities</li> </ul>
<b>Suburban rail</b>	<ul style="list-style-type: none"> <li>• Connectivity with out-lying areas of metropolitan region</li> <li>• Capacity</li> <li>• Low fares</li> </ul>	<ul style="list-style-type: none"> <li>• Poor local planning where transit provider was also long distance national provider</li> <li>• Difficulties to adapt to changing local environment where planning was done at a national level</li> <li>• Lack of funding to upgrade heavily subsidized, socially needed but financially unsustainable routes</li> <li>• Loss in reliability for interaction with traffic</li> </ul>

## **Fares**

Transit systems in emerging cities are trying to catch up to their developed counterparts in regards to fare collection technologies. All of our subjects are equipped with the smartcard collection method, a plastic contactless card that, depending on the system, retains varying amounts of information on passengers. The advantages of automatic fare collection have been known in advanced cities, and they include better data on travel patterns that can lead to improvements in passenger service, development planning, forecasting of market trends and management of fleet, among many others. Having access to this data can be priceless for systems in such shifting environments such as emerging cities. The rapid growth experienced by the cities studied allowed them to invest capital in fare collection technology and they stand to benefit from that decision in the long run. Table 18 shows the fare structure and fare collection method by mode in the areas analyzed.



**Table 18: Fare structures and collection methods by mode**

<b>Metropolis</b>	<b>Transit agency</b>	<b>Type of fare</b>	<b>Fare collection method</b>
<b>Sao Paulo</b>	SPTTrans – Municipal bus	Flat fee	Automatic fare collection available
	EMTU – Metropolitan bus	Based on distance and type of service	Automatic fare collection available
	Companhia do Metropolitano – Subway	Flat fee	Automatic fare collection available
	CPTM – Regional trains	Flat fee	Automatic fare collection available
<b>Moscow</b>	Moscow Metro – Subway	Flat fee	Automatic fare collection available
	Mosgortrans – Surface transportation	Flat fee	Automatic fare collection available
<b>Mumbai</b>	Mumbai Metro One – Subway	Distance based	Automatic fare collection available
	BEST Undertaking (Brihammumbai Electric Supply and Transport) – Bus	Distance based	Automatic fare collection available
	Indian Railways	Distance based and peak/off-peak season fares	Automatic fare collection available
<b>Shanghai</b>	Shanghai Metro Authority	Distance based	Automatic fare collection available
	Shanghai Urban Transportation Bureau	Both distance based and flat, depending on the line	Automatic fare collection available

**Fare structure, collection methods and equity**

Sao Paulo’s smartcard can be used in all modes, and it allows the rider to receive discounts for changing vehicles or modes in one trip (determined by the length of time between the ingress in one vehicle and the next). As mentioned previously, the lowest income people, those who live in the outer areas of the metropolitan region, are the most likely to need to change modes or vehicles during a trip downtown to work or service. Discounts applied for connections not only benefit the most transit dependent system, but

it also benefits the system itself for enhancing multimodality and complementarities of modes, which serves to increase ridership.

Moscow took the use of the smart card media to broader social dimensions with the adoption of the Moscow Social Card in 2001. This card, branded by Visa Electron, combines a series of social benefits under one medium, from pension to medical insurance, transportation and retail discounts. The card contains a chip with information about the card holder and it can also be used as a regular debit card to access money in one's checking account. Since its implementation, over 7 million Social Cards have been distributed among welfare recipients. Both Moscow Metro and Mosgortrans had been searching alternatives for better fare collection for a few decades, culminating with the Moscow Social Card, due to high levels of fare evasion. The installation of turnstiles on buses, for example, resulted in revenue increases of up to 250% in some routes.

Smart cards, both in Sao Paulo and Moscow make it easier for the government to subsidize the trips of special populations of riders. In Sao Paulo, they include Elderly citizens, disabled persons, students and expectant mothers whose pre-natal care is being performed by a public municipal Basic Health Unit (Unidade Basica de Saude) (utilizing the public health system is used as a proxy for low income). Smart cards are distributed to these populations as passes, so they proper discounts can be applied at the time of fare payment. With the Moscow Social Card, the recipient of the benefit can choose to receive monetary compensation rather than discounts. Special populations in Moscow include

students, municipal workers, members of the armed forces, service veterans, pensioners and disabled people. Children under seven enjoy gratuity in both systems.

With the issue of special populations of riders, at first glance, it might seem that higher numbers of fare-exempt or discounted classes will always benefit low-income riders. Russia was an example of that extreme rationale before the elimination of most transportation privileges in public systems in 2005. Previously, over 60 percent of the transit riders nationwide enjoyed some kind of privilege, most in the form of fare exemption. The change caused systems nationally to lose riders, but policy makers are satisfied with the resulting increase in revenue. By deciding to cut the 50-some classes of passengers that enjoyed gratuity, planners chose to make the system more financially sustainable as a whole and better equipped to serve its riders. Keeping the classes was onerous to the transit system and to paying riders, and even though the previous classes looked like a measure towards equity, they were based on political privileges rather than social need.

It was not clear from data collected whether Mumbai and Shanghai offered discounted and fare-exempt categories or if these metropolises are moving towards the adoption of such categories in their systems. If they are, different populations can be considered. For example, Mumbai has a clear division in income, living conditions, and residential areas between skilled workers and non-skilled workers. Skilled workers are more likely to receive benefits from their employers in form of housing subsidies, resulting in more disposable income than non-skilled workers. As non-skilled workers get

pushed away from city center by market forces, they create networks of non-skilled, low-paying jobs in the outskirts of the city because they cannot afford the cost of transportation to areas where they could find better employment. As a consequence, their income drops, and they might even be forced to relocate again, this time further, restarting the cycle. Workers in this condition could benefit from transit discounts.

Conversely, the distance-based fares in Mumbai and Shanghai might be reinforcing such inequities. In the developed world, land use patterns characterized by higher housing values in the suburbs and lower housing values in the city center support the notion that those who live farther away have higher incomes and should pay the cost of transportation to the city center. Under objective lenses, distance-based fares are sensible because it prompts the riders that use the system the most, i.e. for longer trips, to pay more. In cities such as Shanghai and Mumbai, which present the housing value patterns already presented here, distance-based fares make areas of low accessibility even less accessible by increasing the cost of transportation to those who can afford it the least. This fare structure is a point that deserves to be reexamined by transit planners in those cities soon. Table 19 synthesizes findings in regards to fares and their equity implications.

**Table 19: Synthesis of findings- equity and fares**

		<b>Advantages</b>	<b>Disadvantages</b>
<b>Fare structure</b>	<i>Flat-fee</i>	<ul style="list-style-type: none"> <li>• Favorable to those who travel further – the poorer</li> <li>• Predictability of trip cost</li> </ul>	<ul style="list-style-type: none"> <li>• Inequitable distribution of the cost of transportation among users</li> </ul>
	<i>Distance-based</i>	<ul style="list-style-type: none"> <li>• Equitable distribution of transportation costs</li> </ul>	<ul style="list-style-type: none"> <li>• Disproportionately affects the poorest, because they travel further</li> </ul>
<b>Fare collection</b>	<i>Farebox</i>	<ul style="list-style-type: none"> <li>• Practicality</li> <li>• No minimum value for acquisition of card</li> </ul>	<ul style="list-style-type: none"> <li>• Fare evasion</li> <li>• Slows down embarking in crowded stations or vehicles</li> </ul>
	<i>Automated fare collection</i>	<ul style="list-style-type: none"> <li>• Practicality</li> <li>• Increase in fare-paying passengers</li> <li>• Data collection which facilitates improvements in service</li> <li>• Can facilitate intermodality if same card can be used across modes</li> </ul>	<ul style="list-style-type: none"> <li>• Minimum value for purchase of cards</li> <li>• Loss in privacy</li> </ul>
<b>Special population discounts</b>		<ul style="list-style-type: none"> <li>• Benefits populations with traditionally lower incomes</li> <li>• Makes transit possible for those who otherwise could not afford any motorized option</li> <li>• Increases accessibility of disadvantaged groups</li> </ul>	<ul style="list-style-type: none"> <li>• Costliness to the system</li> <li>• Complex bureaucracy for acquisition of passes</li> <li>• Burden transferred to full fare passengers</li> <li>• Threats to long-term financial sustainability</li> <li>• Fare evasion</li> <li>• Complex decision of who should benefit and how much</li> </ul>

## **Transit policy guidelines**

This case-study research found similarities and explainable differences between the transit provisions in major cities of the BRIC countries. The following guidelines can be generalized from the research findings.

### **Visioning and planning**

Emerging cities like the ones studied are in a pivotal moment of development, when planning becomes a necessity. The subjects showed that careful choice in transit planning and early investments, even when it seems costly, can be more financially sound than having to implement large scale changes to existing systems in the long run. Developing cities in similar positions – supported by forecasts of sustained growth in the next few decades – should consider the possibility of mirroring the initiatives of the subjects in setting a long-term vision for transit that will support the economic growth of their cities while ensuring that transit serves the populations that need it the most.

### **Partnering with the private sector**

Decentralizing the provision of bus service with large coverage areas was an idea that worked for the city of Sao Paulo and can be emulated by other emerging cities globally. The system of consortia and cooperatives created in Sao Paulo guarantees transit service will reach even low-demand areas of the metropolitan region through the establishment of local subsystems and social routes. The organization of transit according to market needs proved to be feasible by private providers and can become an alternative to be considered by cities with transit systems overwhelmed by the competition of erratic

informal transit providers. The concession of contracts to private providers, however, requires serious investment in planning, managing ,and supervising resources, regardless of whether those private entities are former informal transit providers or newcomers. Public-private partnerships are also increasingly becoming a way for emerging cities to realize their transit aspirations, especially towards capital intensive models like the metro. Moscow runs a high-ridership publicly owned and operated metro, and it does not plan to engage in any public-private partnerships in the near future. Moscow’s decision public autonomy is backed up by heavy federal funding and by incomparably high ridership numbers, a situation uncommon in most transit systems in developing cities.

### **Choosing transit modes**

Before incurring excessive debt for private capital to finance metro systems, emerging cities should carefully consider whether their urban systems can generate the ridership necessary to support the metro. Indicators that cities are ready to look at metro as a feasible alternative will vary from case to case, but some factors can include

- complete overwhelming of the surface transportation infrastructure in the central area of the city, resulting in constant congestion;
- high rates of motorization that indicate that a private vehicles are no longer just a symbol of economic status but a necessity for mobility because existing transit proves insufficient; and,
- increase in incomes that sign to the fact that more people can pay for the higher fares related to the metro system.

Mode choice and land use also have a mutually reinforcing relationship, in which high-capacity rail systems contribute to high-density nodal-corridor development patterns that reinforces the need for high capacity systems. What makes buses excellent collectors and distributors is that they can reach lower-density and low-demand areas, but a regular bus line seldom has the effect of increasing density along a route, even when that pattern is desirable. Conversely, land values tend to increase dramatically with the introduction of a rail line, causing the displacement of low-income and transit-dependent populations to areas that are not served by rail transit, while a bus line can provide the mobility and accessibility the residents of a certain area need, without raising land values to the point where they would have to move. In summa, for the benefit of low-income groups and of the system as a whole, the introduction of modes and their routes is one that should necessarily be made in conjunction with land use planning, with visioning that clarifies what kind of development is desirable, and with the adoption of appropriate palliative policies, such as the provision of housing subsidies, mixed income housing opportunities

### **Upgrading existing services to compete with cars and generate revenue**

If cities realize they are not ready to start planning the metro or if implementation is expected to be a long process, bus services can be an ally if carefully managed to attend to market needs of those willing to pay a fare equivalent to that of the metro. In Sao Paulo, expressways linking the metropolitan region's two international airports to regional destinations and each other serve the needs of a market segment while the metro expansion is under construction. In Moscow, comfortable express service with television and beverages was offered as alternative to the private-vehicle middle-class suburbanites



who live in areas without metro service. While modes should be complimentary to each other and affordable alternatives should always be made available to transit dependent populations, the offering of upgraded services in routes that attract full-fare paying choice riders can generate important revenue to the transit system. Furthermore, when travelers choose transit – regardless of the mode – instead of a private vehicle, the entire transportation system experiences reduction in congestion and pollution, two issues worsened by the intense motorization to which low income groups do not contribute, but disproportionately suffer the adverse affects.

### **Adopting automated fare collection (AFC) methods**

As capital becomes available, transit systems should choose to invest in automated fare collection methods, which benefit the public sector, transit providers, and passengers. In rapidly changing environments such as emerging cities, automated fare collection can be an invaluable tool making the system more efficient and accountable because the system can collect and generate data that identify needs for new routes, re-scheduling of services, capacity adjustments, and even population served, depending on what kind of information the media used can store. Local policies and political culture concerning privacy issues should govern how much data should be collected and used by the transit system, and public participation can also inform this decision.

### **Choosing discounted and fare-exempt riders**

Transit system planners must conduct detailed and careful demographic analyses before determining who transit-dependent populations are and which of them need assistance in

copied with the cost of transportation to maintain the travel patterns necessary to support their sustenance and well-being. Classically, groups like disabled people, children, elderly, and students are expected to live on a considerably lower income than the average citizen, and they tend to receive benefits. Sao Paulo has used the condition of being a patient of the network of public clinics for pre-natal care as a proxy for low income, awarding expectant and recent mothers in that situation free transit trips through the baby's first birthday. Moscow decided to cut back on the classes of privileged riders to make the system more financially sustainable for all riders. Orphans, for example, used to be a privileged class, due to the country's involvement in the two world wars, but such privilege was revoked in 2005, along with over fifty other classes. There are several important economic, historic, social, and cultural factors that are involved in who special riders should be – the sustainability of the system and the equitable treatment of riders depends on this analysis.

## **CHAPTER 6: FUTURE RESEARCH**

The issue of sustainable transportation equity in developing countries can and should be explored by future research endeavors in ways that are beyond the scope and capabilities of the current project. Further investigation on the subject can include policy monitoring (whether the transit programs in these BRIC metropolises reach specified populations or areas), impact evaluation (the extent to which the transit programs causes desirable or undesirable impacts on specific populations or areas), and economic efficiency evaluation – including cost-benefits and cost-effectiveness analyses, among other economic instruments. Ideally, a complete evaluation of the policies under study here, with quantitative as well as qualitative elements, will yield results towards determining whether or not the programs in practice work as planned, whether they produce changes in accordance with the desired outcomes, and whether funds are used efficiently. A new investigation in that direction can result in recommendations of inestimable value to the next cohort of emerging global metropolitan areas that are considering reforms on their transit systems to adapt to the demands of new and accelerated economic and population growth.

## **CHAPTER 7: CONCLUSION**

The quest for sustainability has permeated discussions in transit planning for a few decades, but the issue of equity in sustainable transportation deserves more attention from researchers, specialists, and decision makers. Globally, when considering equity in transit systems, the subject acquired varied facets because the needs of people were substantially different depending on their environments: while equity concerns in developed countries related to the well-being of racial minorities or of small pockets of low-income groups, in developing countries those issues related to vast portions of the population who depend on transit programs in order to secure even minimal access, however precarious, to jobs, education, and essential services.

Among developing countries, some nations have been experiencing accelerated rates of economic growth. Within this group, Brazil, Russia, India, and China have presented such extraordinary performances that economic analysts around the globe have recognized them as a unit that should be analyzed under special lenses. BRIC countries can serve as harbingers of examples and lessons that can be generalized to future cohorts of emerging nations. Despite striking political, geographic, and cultural differences, these countries share characteristics of global economic giants with sizeable gross domestic products, increasing productivity, and rising incomes; however, in their main metropolitan areas, growing levels of motorization and pollution, sprawling land use patterns, and overwhelmed transportation infrastructure are some of the issues that stemmed from those economic improvements. Transit programs in all four metropolitan

areas studied underwent recent changes to cope with the new issues and needs while providing for the majority of the motorized trips of the population they serve.

Some similarities in strategies adopted were seen across all cases. Sao Paulo, Moscow, Mumbai, and Shanghai were all engaging in long-range transportation planning, although they were in different stages of visioning or planning implementation. To different extents, all systems counted on the participation of private partners for investment and funding, the provision of services, or both. All systems were also moving toward the strengthening of existing metro systems, and in the case of Mumbai where the metro is not yet implemented, the system was in final phase of construction. The tendency to place greater reliance on the metro as the anchor-mode of a transit system is a reflection of population growth, increased travel demand, availability of funds for implementation on the locality side, and the rise in incomes that will allow riders to choose the metro for their trips and be able to afford its fares, which are usually higher than the fares of other modes.

Besides the investment in metro systems, the programs under study strived to create other alternatives that will attract choice riders in order to compete with the growing share of travelers shifting from transit to private automobiles. The provision of upgraded bus services with that objective was common to all subjects, although what was 'special' in each service varied. Subjects presented options ranging from express routes and dedicated lanes to provision of air conditioned vehicles and light refreshments on board. Furthermore, all four systems adopted automated fare collection (AFC) methods,

although their entire transit fleets were in different stages of being equipped and compatible with smart cards. AFC methods not only contribute to the practicality of fare paying, but they also aid in the reduction of fare evasion, while collecting and generating important data that can later be used to prompt upgrades in the system and feed future planning efforts.

Some divides were also observed, as expected from the differences between the selected subjects. While some systems adopt flat fees in all modes, some adopt distance-based fares and others yet a mix of the two methods. Other factors that served to calculate fare costs included peak and non-peak periods of the day, days of the week, or seasons of the year. The establishment of categories of special riders was also a point of dissimilarity between systems. While one system did not grant any riders – except children – the privilege of being fare-exempt, another granted such privilege to too many categories, bringing the system close to a financially unsustainable situation; however, the middle-ground was also present, in which system designers carefully picked some societal groups that could benefit the most from discounts or free rides. For practical reasons, an assessment of specific needs of each individual passenger is unfeasible; therefore, a few demographic categories have traditionally served as proxy for low-income groups, including students, senior citizens, non-skilled workers, and frequent users.

Overall, equity in transportation planning for developing countries can emulate the progress that has been made in developed countries, but developing nations have

unique characteristics. Forerunning developing nations have demonstrated ways of implementing programs and systems designed to support equitable access to resources and services amid the peculiarities of the vibrant and rapidly changing environment of cities in emerging nations. Strategies discussed can serve as a starting point for implementation of programs and for future research. Fundamentally, transportation planning should address long-range land-use and transportation planning, the adoption of private partners, the choice of modes, and the design of fare structures. Further research concerning policy monitoring, impact evaluation, and economic efficiency of the systems studied here can add specificity and value to these general findings and provide future emerging transit systems with valuable guidelines.

## **APPENDICES**



## A: METROPOLITAN TRANSPORTATION FOR SAO PAULO, BRAZIL

Sao Paulo is the largest city in South America and the main center of commercial, financial and industrial activity in Brazil. In 2001, the Sao Paulo Metropolitan Region generated approximately 30 million trips, 67 percent of which were taken on motorized vehicles. Of all trips taken on motorized means, 53 percent were provided by formal transit modes (Hidalgo, 2009).

**Table 20: Sao Paulo- urban agglomeration characteristics**

<b>2007 Urban agglomeration population</b>	18.8
<b>2009 Metropolitan area (sq. mile)</b>	3,067.1
<b>2009 GDP per capita (PPP US\$)</b>	20,300

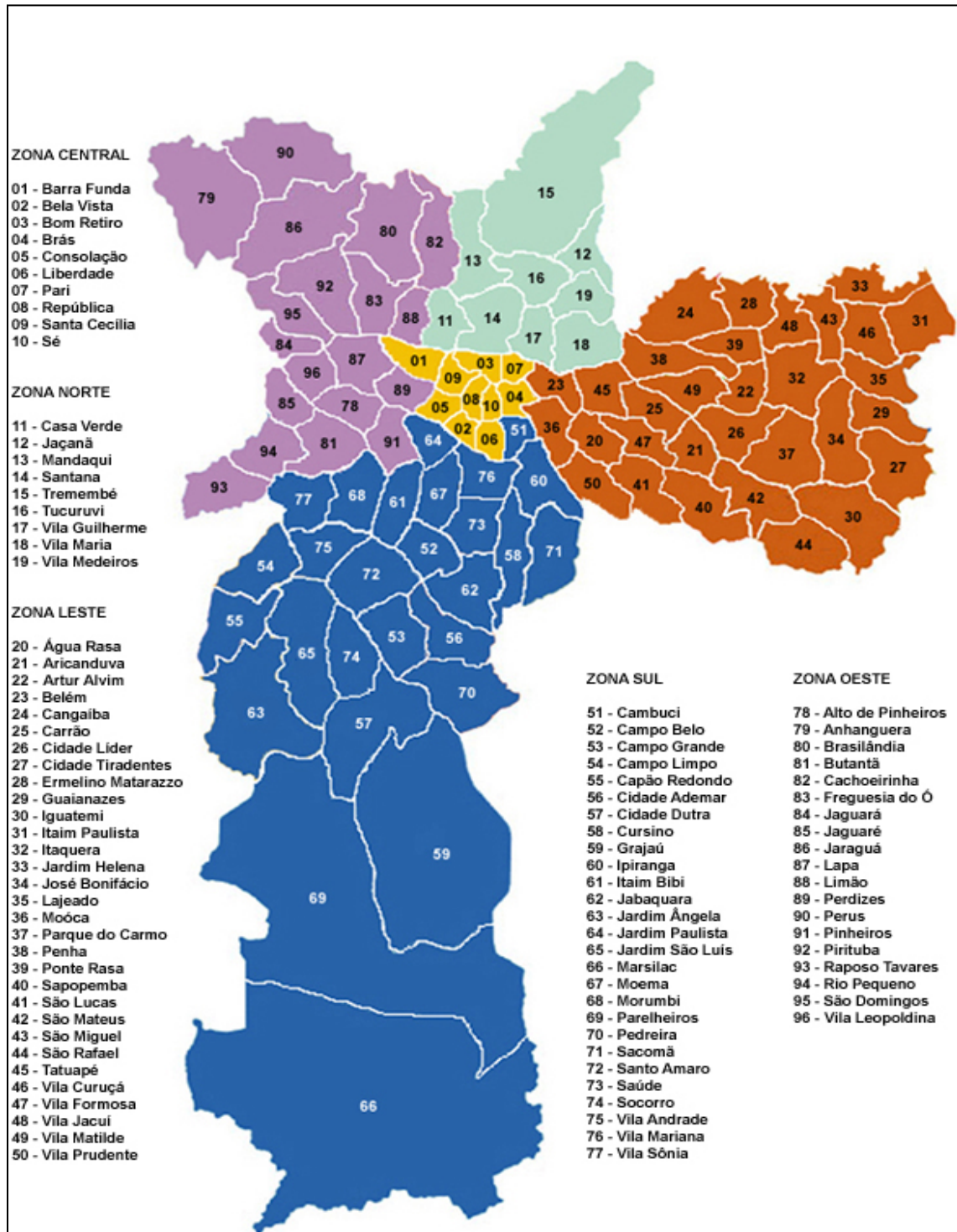
Source: United Nations Population Division; Price Waterhouse Coopers Global city GDP rankings 2008-2025

**Figure 8: Map of Brazil**



Source: World Guides

Figure 9: Map of the City of Sao Paulo



Source: Nucleo Paz e Amor

**Table 21: Sao Paulo transit mode share, 2009**

<b>Planning and supervision</b>	<b>Provider</b>	<b>Mode</b>	<b>Average daily ridership (millions)</b>	<b>Share of transit riders (%)</b>
Local government	SPTrans	Bus	5.7	62
State government	Companhia do Metropolitano	Metro (subway)	1.7	18
	EMTU	Bus	1.2	13
	Companhia Paulista de Trens Metropolitanos	Suburban rail (trains)	0.6	7

Source: Hidalgo, 2009

## **Municipal bus system – SPTrans**

### **Institutional**

Sao Paulo Transportes S.A. (SPTrans) operates the municipal bus service under the management, planning and supervision of the Sao Paulo Municipal Secretary of Transportation (local government). The bus transit system in the city of Sao Paulo is operated by sixteen concessionaries, among private consortiums and cooperatives. The cooperative movement has been fueled globally by ideas of economic democracy. Economic democracy is a socioeconomic philosophy that suggests an expansion of decision-making power from a small minority of corporate shareholders to a larger majority of public stakeholders.

## System characteristics

**Table 22: Municipal bus transit in Sao Paulo, 2010**

Number of routes	1,348
Number of transit units	15,909
Average weekday ridership (millions)	5.7

Source: SPTrans

SPTrans counts on 15,909 vehicles (8,929 structural vehicles and 5,908 local vehicles) serving 1,348 lines. The metropolitan region outside of the city of Sao Paulo is served by the metropolitan bus transit provider (Empresa Metropolitana de Transportes Urbanos-EMTU, more info below). For bus service purposes, the city of Sao Paulo is divided into sub-systems

**Figure 10: Sao Paulo municipal bus transit subsystems, 2010**



Source: SPTrans

**Table 23: Sao Paulo municipal bus transit concessionaries**

Designation on the map	Sub-system name	Consortium Name	Cooperatives
1	Northwest	Bandeirante de Transportes	Transcooper, Fenix
2	North	Sambaiba Transportes Urbanos	Transcooper, Fenix
3	Northeast	Plus	Associacao Paulistana, CooperNova Alianca
4	East	Leste 4	Transcooper
5	Southeast	Via Sul Transportes Urbanos	Coopertranse, CooperNova Alianca
6	South	Unisul	Cooperpam
7	Southwest	Sete	Cooperpam
8	West	Sudoeste de Transportes	Unicooper, Cooperalfa
Centro	Downtown	All	All

Source: SPTrans

This system was implemented in 2003 to allow for a faster and more integrated network within the city. Bus service in each area is provided by their respective concessionaries (forming the *local subsystems*), which are also responsible for providing the connection between their area and the city center (forming the *structural subsystem*). Local subsystems are served by regular and minibuses, while the structural subsystem is served by regular and large buses such as articulated and bi-articulated vehicles.

## Fares

The city bus fare cost R\$2.70 (approximately US\$1.52 in June, 2010) per person per trip (flat fee). However, SPTrans offers different options to special populations and riders who use the city bus in connection with the metro, metropolitan trains and metropolitan buses.

**Bilhete Unico and Bilhete Unico Amigao:** The single fare ticket (Bilhete Unico) allows the user to make up to four weekday trips within a 3-hour period being charged

the cost of only one trip. The friendly single fare ticket (Bilhete Unico Amigao) can be used on weekends and holidays, allowing the user to take up to three trips in an 8-hour period for the cost of one trip; within the first three hours the connection with the metro or metropolitan trains can happen under a reduced fare. Both tickets can be acquired by anyone.

Automated fare collection is available through the use of plastic, no contact, smart cards, which are issued to special populations in the form of ‘passes’ or to the general population as multiple-trips tickets.

***Special populations:***

Elderly citizens (men over 65 and women over 60 years old) have gratuitous access to the municipal bus service after they register for a pass in their local subsystem agency, but a different pass is necessary for the free utilization of metropolitan transit services – which can make connection more difficult and cause the elderly to have to deal with excessive bureaucracy in the process of getting registered. Eligible disabled persons also have gratuitous access to the city bus after they register for a pass in the designated centers that serve special passengers, and this pass can be used in both municipal and metropolitan services.

Although they have to pay full fare, expectant mothers and obese passengers are allowed to enter vehicles through the front door (while all other passengers enter through the rear door), therefore avoiding the need to go through the turnstile. Expectant mothers whose pre-natal care is being performed by a public municipal Basic Health Unit

(Unidade Basica de Saude) have gratuitous access to any municipal or metropolitan transit service. Mothers must be registered under the Mae Paulistana<sup>6</sup> health program and they can request a pass in the Basic Health Unit where are receiving medical care.

Students of institutions recognized by the National Ministry of Education (Ministerio da Educacao – MEC) can acquire a pass that allows them to make up to four trips in any 2-hour period for half the cost of one trip in any municipal or metropolitan transit service. Students must live at least 1kilometer (0.62 miles) away from school on a transit line in order to be able to register for a pass with their educational institution.

Workers who utilize SPTrans services in their daily commute can benefit from the Vale-Transporte, which allows them to make up to four trips in any 2-hour period. Employers must request the pass for their employees.

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<sup>6</sup> Mae Paulistana is a program of the Sao Paulo Municipal Health Secretary to provide free pre-natal health care to low income expectant mothers from pregnancy up to the baby's first birthday. (Source: City of Sao Paulo – Mae Paulistana)

## Metropolitan bus system – EMTU

### Institutional

Figure 11: Entities in the Sao Paulo metropolitan transit system



Source: EMTU

The Empresa Metropolitana de Transportes Urbanos (EMTU) is a closed joint-stock company controlled by the Sao Paulo state government. Founded in 1986 (Decree no. 24.675, Jan. 30, 1986), its main function is to manage, plan and supervise low and medium capacity intermunicipal bus systems within the three metropolitan areas of the state of Sao Paulo: Sao Paulo Metropolitan Region, Baixada Santista Metropolitan Region and Campinas Metropolitan Region. Together, these three areas comprise 67 municipalities inhabited by 23 million people, generating 1.5 million EMTU transit users daily (only services provided within the Sao Paulo Metropolitan Region are considered in this project). Bus Service is provided by private companies under the supervision of EMTU.



Figure 12: Sao Paulo Metropolitan Region



Source: EMTU

## System characteristics

**Table 24: Sao Paulo metropolitan bus service, 2009**

Number of routes	813
Number of transit units	6,000
Average weekday ridership (millions)	2.078

Source: EMTU

### *Types of service*

Common service – Routes connecting at least two municipalities within the Sao Paulo metro region. Served by common buses, accommodates passengers sitting and standing.

Selective service – Routes connecting at least two municipalities within the Sao Paulo metro region. Served by coach buses, accommodates only sitting passengers

ORCA system – Composed by routes that connect at least two municipalities within the Sao Paulo metro region. Under EMTU’s supervision, this system is served by small individual autonomous providers – Operadores Regionais de Coletivo Autonomos (ORCAs), each one operating one single small capacity vehicle (van or minibus of up to 20 seats).

Sao Mateus-Jabaquara Metropolitan Corridor – 20.5 miles of dedicated lanes linking five municipalities within the Sao Paulo metropolitan region. This system counts on 9 transfer terminals, 111 stops and its own 200-vehicle fleet, serving around 200 thousand passengers daily. It has been operated by a private concessionary called METRA since 1997.

Airport Bus Service – Links the Guarulhos International Airport and the Congonhas International Airport to each other and to important urban bus terminals, hotels and malls. It is served both by common and coach vehicles.

ORCA-Zoo service – Linking the Jabaquara Metropolitan to the Sao Paulo Zoo, operated by ORCAs.

### **Fares**

Fares range from R\$1,95 (US\$ 1.06) for local service, to R\$31,00 (US\$ 17.17) for airport bus service, between the two major international airports of the Sao Paulo Metropolitan Region. Students, senior citizens, workers and disabled persons have the same privileges of users of the municipal service. Smart card collection is available.

### **Metro system – Companhia do Metropolitano**

#### **Institutional**

Part of the Sao Paulo Metropolitan Transit system, under the management and supervision of the Secretary of Metropolitan Transportation of the State of Sao Paulo. Planning for the transit of all three metropolitan regions is done at the state level.

## System characteristics

Table 25: Sao Paulo Metro system- physical characteristics, 2010

	<b>1-Blue Line</b>	<b>2- Green line</b>	<b>3- Red line</b>	<b>5-Purple line</b>	<b>Network</b>
<b>Year of launching</b>	1974	1991	1979	2002	-
<b>Stations</b>	23	12	18	6	56
<b>Length of tracks (mi)</b>	12,5	7,2	13,6	5,2	38,7
<b>Transfer stations</b>	3	2	1	-	3
<b>Connection with metropolitan trains</b>	1	2	4	1	8
<b>Connection with bus terminals</b>	6	1	10	5	22
<b>Total number of cars*</b>	306	132	282	48	768
<b>Number of cars used during peak periods</b>	246	90	252	30	618
<b>Minimum headway (seconds)</b>	109	145	101	307	-
<b>Maximum speed (mph)</b>	62	62	62	49	-
<b>Commercial speed (mph)</b>	20	22	26	24	-

\*Each train has a fixed six-car formation (Source: Companhia do Metropolitano)

Table 26: Demand by metro line, 2009

	<b>1-Blue Line</b>	<b>2- Green line</b>	<b>3- Red line</b>	<b>5-Purple line</b>	<b>Network</b>
<b>Total</b>	270,199	76,963	319,716	38,929	705,806
<b>Weekday average</b>	914,778	275,530	1,078,332	131,816	2,400,456
<b>Saturday average</b>	513,233	108,669	610,072	75,898	1,307,871
<b>Sunday average</b>	294,699	59,774	359,233	39,148	752,853
<b>Daily maximum</b>	1,032,545	322,619	1,193,986	159,972	2,683,989

Source: Companhia do Metropolitano

## Fares

Full fare, flat fee is US\$2.25. Same discounts of the municipal system apply, and riders can count on discounted passes when connecting between different modes, rather than paying full fare in each one.

## Train system – Companhia Paulista de Trens Metropolitanos

### Institutional

Companhia Paulista de Trens Metropolitanos (CTPM) is the third of the agencies that provide transit services to the Sao Paulo Metropolitan Region under the supervision of the Secretary of Metropolitan Transportation of the state of Sao Paulo. The suburban rail is an important connector between the far suburbs and the central areas served by the metro system.

### System characteristics

Table 27: Sao Paulo suburban rail system characteristics, 2010

<b>Transit units</b>	869
<b>System lines</b>	6
<b>Number of stations</b>	89
<b>Length of tracks</b>	162
<b>Average weekday ridership</b>	2.2

Source: CPTM

## Fares

The train system operates on a flat fee. Full fare cost US\$1.46 in June, 2010. Frequent travelers can benefit from discounts by buying passes with the valid for 8, 20 and 50 trips. Same special populations of all other modes apply, and there are discounts

available for off-peak travelers and for those who integrate the train ride with other modes.

### **Informal transit providers**

In 2003, under Mayor Marta Suplicy, the City of Sao Paulo made attempts to initiate the process of regularization of over 5,000 vehicles – mostly vans and minibuses – that operated in the informal provision of transportation of passengers in the municipality. The process of regularization was planned to take place through bidding for an official permit, and preference would be given to providers affiliated to self-regulating cooperatives, those who could demonstrate that they had been operating for more than five years, and those who could demonstrate good labor practices in their operations. Even though there were claims of fraud in the bidding process under Mayor Suplicy, the municipal government awarded a total of 2.7 billion Reais (1.8 billion Dollars) in contracts to 5,789 vehicles under eight different cooperatives. The contracts were valid for seven years and the terms are currently under renegotiation with the municipal legislative body, according to reports from the second largest newspaper of the state of Sao Paulo (Zanchetta, 2009).

In an interview aired on March 8, 2010 (Roda Viva TV Cultura), the Transportation Secretary for the City of Sao Paulo, Alexandre de Moraes, stated that the city is mainly concerned with improving the coordination of the van and microbus services with the existing formal transit system, in order to offer better service to riders. He emphasized that transportation planning personnel is studying the possibility to

impose stricter hours and routes as conditions for the new permitting process, as well as alternatives for terminal locations and methods to guarantee that special riders of vans and microbus (such as students and senior citizens) can enjoy the same benefits they would enjoy if using the existing formal system. In sum, formalizing illegal transit services is an intricate process, and often there is no simple solution.

## Data Sources for Sao Paulo

United Nations Populations Division:

[http://www.un.org/esa/population/publications/wup2007/2007\\_urban\\_agglomerations\\_chart.pdf](http://www.un.org/esa/population/publications/wup2007/2007_urban_agglomerations_chart.pdf)

PriceWaterhouse Coopers

Global City GDP Rankings 2008-2025:  
<https://www.ukmediacentre.pwc.com/Media-Library/Global-city-GDP-rankings-2008-2025-61a.aspx>

World Guides

<http://www.brazil.world-guides.com/>

Nucleo Paz e Amor

<http://www.nucleopazeamor.org.br/centrosmapacapital.asp>

Sao Paulo Transportes S.A.

[www.sptrans.com.br](http://www.sptrans.com.br)

Institutional, system characteristics: [http://www.sptrans.com.br/a\\_sptrans/](http://www.sptrans.com.br/a_sptrans/)

Fares, special populations: [http://www.sptrans.com.br/bilhete\\_unico/](http://www.sptrans.com.br/bilhete_unico/)

Empresa Metropolitana de Transportes Urbanos

<http://www.emtu.sp.gov.br>

Sao Paulo Metropolitan Region Map:

[http://www.emtu.sp.gov.br/institucional/imagens/mapa\\_subregiao.jpg](http://www.emtu.sp.gov.br/institucional/imagens/mapa_subregiao.jpg)

System numbers: <http://www.emtu.sp.gov.br/institucional/pdf/balanco2009.pdf>

Institutional: <http://www.emtu.sp.gov.br/institucional/>



Types of service: <http://www.emtu.sp.gov.br/institucional/sistemas.htm>

Fares: [http://www.emtu.sp.gov.br/regular/pdf/tarifario\\_RMSP\\_21\\_06\\_10.pdf](http://www.emtu.sp.gov.br/regular/pdf/tarifario_RMSP_21_06_10.pdf)

#### City of Sao Paulo

Mae Paulistana:

[http://www.prefeitura.sp.gov.br/portal/a\\_cidade/noticias/index.php?p=8192](http://www.prefeitura.sp.gov.br/portal/a_cidade/noticias/index.php?p=8192)

#### Companhia do Metropolitano

<http://www.metro.sp.gov.br>

Physical Characteristics:

<http://www.metro.sp.gov.br/empresa/numeros/estrutura/numeros.shtml>

Demand:

<http://www.metro.sp.gov.br/empresa/numeros/indicadores/indicadores.shtml>

Fares: [http://www.metro.sp.gov.br/informacao/cartoes/cartao\\_unico.shtml](http://www.metro.sp.gov.br/informacao/cartoes/cartao_unico.shtml)

#### Companhia Paulista de Trens Metropolitanos

<http://www.cptm.sp.gov.br>

System characteristics: [http://www.cptm.sp.gov.br/e\\_companhia/gerais.asp](http://www.cptm.sp.gov.br/e_companhia/gerais.asp)

Fares: [http://www.cptm.sp.gov.br/e\\_tarifas/default.asp](http://www.cptm.sp.gov.br/e_tarifas/default.asp)

#### Informal transit provision:

Roda Viva- TV Cultura: Interview with Alexandre de Moraes, Municipal Secretary of Transportation, City of Sao Paulo. Aired on March 8<sup>th</sup>, 2010, accessed in April, 2010

(<http://www.tvcultura.com.br/rodaviva/programa/pgm1165>)

HIDALGO, Dario. "Citywide transit integration in a large city: the Interligado system of Sao Paulo, Brazil." *Transportation Research Record: Journal of the Transportation Research Board*, No. 2114, Transportation Research Board of the National Academies, Washington D.C. 2009 pp. 19-27

ZANCHETTA, Diego. "Kassab vai mudar os repasses das lotacoes." *O Estado de Sao Paulo* October 2, 2009, accessed in April 2010.  
<http://www.estadao.com.br/busca/Kassab%20vai%20mudar%20os%20repasses%20a%20lota%C3%A7%C3%B5es>)



## **B: METROPOLITAN TRANSPORTATION FOR MOSCOW, RUSSIA**

Moscow is the largest and most important financial, commercial, and economic center of Central and Eastern Europe. In recent decades, Moscow has been experiencing population growth (mostly through immigration) and an expansion of city limits, without the reduction of city density expected from sprawling scenarios in traditionally developed cities. Soviet-era planning emphasized the separation of land uses such as residential and industrial zones, which intensifies the demand for travel; and in the 2000s, the sprouting of large scale suburban communities on the edges of the city made that separation even more apparent. Muscovites turned to private automobiles to serve their new mobility needs, overwhelming the transportation infrastructure of the city, which was planned to accommodate about two-thirds of the number of cars that were in the streets of Moscow in 2005 (Dunning, 2005).

The increase in car ownership and the decrease of transit's share of riders added to the pressure suffered by newly created municipal transit enterprises, entities that used to be state enterprises (subdivisions of the federal government) up until the early nineties. Under the responsibility of the local government, transit had to compete with other priority city services for resources and compete with the car for the preference of travelers, and consequently create strategies to deal with the new predicament (TCRP 62, 2003).

**Table 28: Moscow- urban agglomeration characteristics**

<b>2007 Urban agglomeration population (millions)</b>	10.5
<b>2009 Metropolitan Area (sq. mile)</b>	417.4
<b>2009 GDP Per Capita (PPP US\$)</b>	30,700

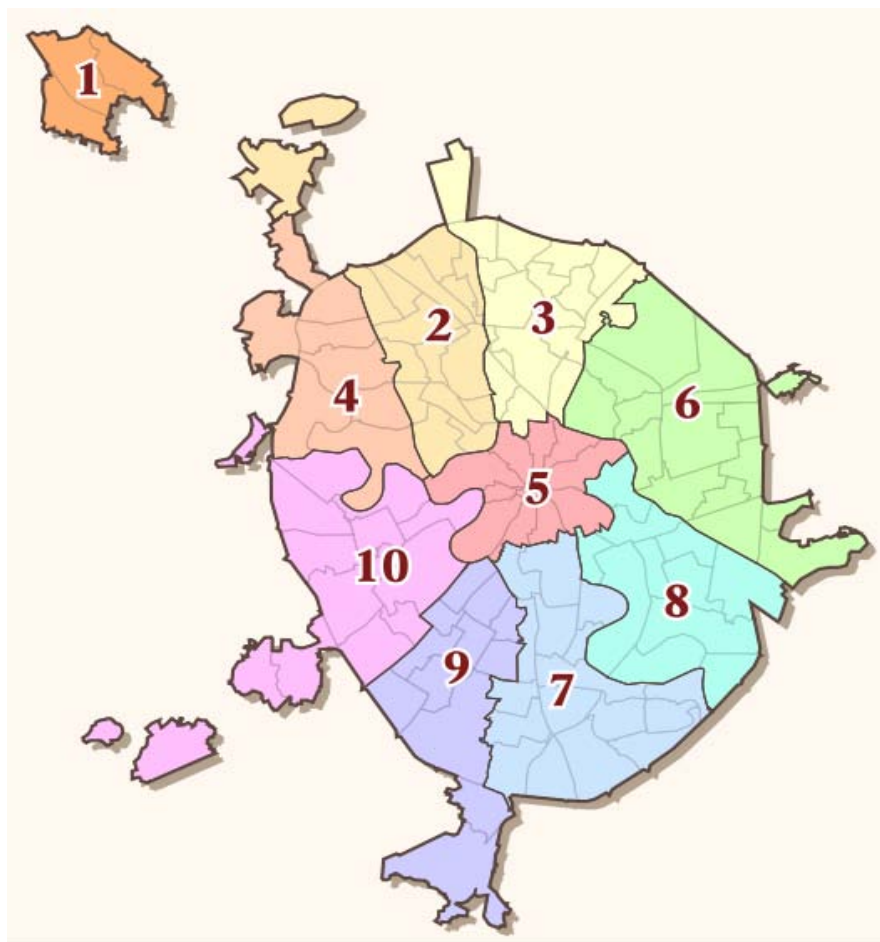
Source: United Nations Population Division; Price Waterhouse Coopers Global city GDP rankings 2008-2025

**Figure 13: Map of Russia**



Source: World Guides

**Figure 14: Map of Moscow administrative subdivisions**



Source: Maps of the World

**Table 29: Moscow administrative subdivisions**

1. City of Zelenograd	6. Eastern
2. Northern	7. South
3. North-eastern	8. South-eastern
4. North-western	9. South-western
5. Central	10. Western

Source: Maps of the World

## **Metro and Monorail – Moscow Metro**

### **Institutional**

The Moscow Metro is commonly considered the best in the world in terms of reliability and the largest in terms of ridership (Cain and Kolpakov, 2007). The metro system is owned and operated by the city of Moscow, but it receives substantial funding from the federal government. The mayor of Moscow has significant authority in planning metro routes and extensions, but general transportation planning, including transit planning, is the responsibility of the Institute of General Planning. Traditionally, metro routes or services were extended or modified to serve the demand of residential areas as they developed. However, metro planners looked to reverse this model by making development permits dependent on metro extensions plans (TCRP 62, 2003). The Metroplan 2015, fully adopted in 2008 (receiving approval and funding from the Duma, the national legislature) is the long-range comprehensive plan for the city of Moscow and it includes a transportation element that provides for further phased expansions of the metro system.

### **System characteristics**

A number of passengers equivalent to roughly half of the world population travels in the world's largest subway system annually. Headways of 90 seconds are also among the shortest in the world, making the Moscow Metro a model of efficiency (Cain and Kolpakov, 2007).

**Table 30: Moscow Metro system characteristics**

<b>Date of launching</b>	May 15, 1935
<b>Number of lines</b>	12
<b>Number of stations</b>	180
<b>Number of trains</b>	500+
<b>Number of cars</b>	5,000
<b>Total length of tracks (mi)</b>	185.2
<b>Average weekday ridership</b>	9 million passengers
<b>Average annual ridership</b>	3.2 billion passengers
<b>Average trip length (mi)</b>	8
<b>Average train speed (mph)</b>	25.8
<b>Minimum headway (seconds)</b>	90
<b>Number of employees</b>	36,000

Source: Moscow Metro

## Fares

**Table 31: Moscow Metro fare system**

<b>Ticket type</b>	<b>Number of rides</b>	<b>Period of validity</b>	<b>Price (US\$)*</b>
Limited Rides	1	5 days, including day of purchase	0.83
	2		1.66
	1 passenger luggage		0.83
	1 ride and 1 passenger luggage		1.66
	5 rides	45 days, including day of purchase	3.99
	10 rides		7.66
	20 rides		14.68
	60 rides		34.48
	Metro Travel Card (70 rides)	Calendar month	34.16
Monthly travel card for 4 kinds of transport (number of rides in metro being 70)	68.33		
Smart Cards (Unlimited rides)	Smart card for students of Moscow universities	Calendar month	10.25
	A 30-day smart card	30 days, including day of purchase	47.26
	A 90-day smart card	90 days, including day of purchase	96.43
	A 365-day smart card	365 days, including day of purchase	316.75

\*Exchange rate from Rubles in US Dollars in June 29, 2010 (Source: Moscow Metro)



**Table 32: Moscow monorail fares**

<b>Ticket Type</b>	<b>Price (US\$)</b>
1 ride	0.83
Monorail transport system travel card	34.16
Smart card for students eligible for concessionary fares	10.25

\*Exchange rate from Rubles in US Dollars in June 29, 2010 (Source: Moscow Metro)

With the rise in income and motorization that Moscow experienced in the 1990s, the metro system enjoyed higher ridership rate increases than surface modes, mainly because the speed and reliability of trips taken by buses, trolleybuses and trams are susceptible to traffic interference (Dunning, 2005).

### ***Moscow Social Card and special populations***

In an attempt to modernize and better control the distribution of welfare benefits, including transportation privileges, the city of Moscow instituted the Moscow Social Card in 2001. Since the implementation of the program, up to 7 million of these contactless smartcards have been issued to Muscovites, who can use them to collect government pension, manage health insurance benefits, accrue discounts in retail stores and enjoy reduce fares or receive reimbursements for their privileges as public transit users (Rosan, 2010). Furthermore, the cards are branded Visa Electron and can be used as a regular debit card to effectuate purchases. Currently, beneficiaries of the Moscow Social Card program include elderly, students, disabled persons, members or veterans of the armed forces, government pensioners and municipal workers, in a population that makes up to 30 percent of all transit users. Children under the age of seven can use public transit free of charge. All transit providers in Moscow should be equipped with automated fare collection devices compatible with the Social Card (Marchenko, 2009).

On January 1<sup>st</sup>, 2005, the federal government enacted legislation to reform the system of privileges of users of public transit. Prior to the 2005 reforms, 56 classes of riders enjoyed fare exemption in Moscow, leaving the transit system in a financially unsustainable situation that reflected in declining quality and reliability (TCRP 62, 2003). Nationally, up to 60 percent of all riders received some kind of discounts or subsidies. Most privileges were eliminated, and the consequent increase in revenue was directed to measures to modernize and improve the system (Cain and Kolpakov, 2007).

### ***Revenue***

In 2003, the farebox revenue covered 75 percent of the operational budget and has been increasing since the introduction of automated fare collection methods. Other revenue sources of the Moscow Metro include local and federal subsidies, real estate and advertising incomes, and amortization incomes. The Metro has expressed its preference to be able to charge riders the fares necessary to cover the operating and maintenance costs in their entirety, while the city and state should reimburse riders directly in lieu of providing subsidies to the metro (TCRP 62, 2003). The Moscow Metro has been operating close to capacity for a few years, and officials have stated they would rather raise fares and have fewer riders in order to provide more comfortable and efficient service (Cain and Kolpakov, 2007).

## Surface passenger transportation – Mosgortrans

### Institutional

Moscow Government Transportation (Mosgortrans), a state holding company, is the major transit operator in the city of Moscow, providing all its surface transit services (Cain and Kolpakov, 2007). Mosgortrans is composed of 52 separate enterprises, each one responsible by one aspect fundamental for the functioning of the transit agency: operation, maintenance, power supply, fare collection and planning, to name a few. The planning enterprise is in charge of service and route planning, including designating stops and number of vehicles on each route, but plans for Mosgortrans can also be modified by the Institute of General Planning, which manages and coordinates scheduling of surface transit (TCRP 62, 2003).

### System characteristics

Table 33: Moscow surface transit system

Type of vehicle	Transit units	System lines	Length of routes/ tracks (mi)	Average weekday ridership (millions of passengers)
Bus/ trolleybus	4,715	632	3,472	2
Trams	854	38	94.4	1.8

Source: Cain and Kolpakov, 2007; TCRP#62, 2006

With increases in income and private automobile ownership, Mosgortrans experienced a decline in ridership. One of the strategies adopted to cope with the changes was the introduction of a “premium” bus service to attract middle class and new suburbanites who have been turning to cars for their travel needs. This service cost roughly 30 percent more, but these buses run on an express route, with less stops and

shorter travel times than regular bus service. Furthermore, vehicles were equipped with televisions, magazines and light refreshment options, and middle class costumers stated that they are willing to pay a higher fare for the improved amenities and comfort (TCRP 62, 2003).

Mosgortrans also faces the competition of independent and private companies that operate minibuses throughout Moscow, in approximately 600 routes. Private providers carry only full-fare paying costumers and serve the busiest routes, skimming the most lucrative passengers away from Mosgortrans, who is obliged to carry all passengers (subsidized or not) in all routes (social or commercial) (TCRP 62, 2003).

## **Fares**

Mosgortrans charges users a flat fee per trip. An automated fare collection system was introduced in February 2003, which substantially increased revenues, although combating fare evasion was not enumerated as one of the reasons for the adoption of the new technology. Besides ensuring the collection of full-fares from regular passengers, automated fare collection also allowed Mosgortrans vehicles to be compatible with the Moscow Social Card, therefore modernizing the recording and accounting of fare-exempt and other privileged riders. Besides fare revenues, Mosgortrans counts on a city subsidy (Smart Technologies Group, 2010).

## Data sources for Moscow

### World Guides

<http://www.russia.world-guides.com/>

### Maps of the World

<http://mapsof.net/moscow/static-maps/png/msk-all-districts-abc-eng>

### United Nations Populations Division

[http://www.un.org/esa/population/publications/wup2007/2007\\_urban\\_agglomerations\\_chart.pdf](http://www.un.org/esa/population/publications/wup2007/2007_urban_agglomerations_chart.pdf)

### PriceWaterhouse Coopers

Global City GDP Rankings 2008-2025:

<https://www.ukmediacentre.pwc.com/Media-Library/Global-city-GDP-rankings-2008-2025-61a.aspx>

### Moscow Metro

Institutional, system characteristics: <http://engl.mosmetro.ru/>

Metro and Monorail fares: [http://engl.mosmetro.ru/pages/page\\_0.php?id\\_page=8](http://engl.mosmetro.ru/pages/page_0.php?id_page=8)

### Moscow Social Card

Visa: <http://www.visacemea.com/av/moscow.jsp>

Rosan: [http://www.rosan.ru/en/products/public/moscow\\_social/](http://www.rosan.ru/en/products/public/moscow_social/)

Smart Technologies Group:

<http://www.smartek.ru/en/solutions/afcs/advantages/city.aspx>;

<http://www.smartek.ru/en/solutions/afcs/advantages/transportcompanies.aspx>;

<http://www.smartek.ru/en/solutions/afcs/advantages/passengers.aspx>

Mosgortrans

Fares: Smart Technologies Group:

<http://www.smartek.ru/en/solutions/afcs/afcsprojets/mosgortransafcs.aspx>

CAIN, Alasdair and Kolpakov, Alexander: “Developing effective mass transit systems”  
Proceedings of the 5<sup>th</sup> International Workshop on Public Transportation. Moscow,  
Russian Federation, May 28 and 29, 2007. Prepared by the Center for Urban  
Transportation Research, University of South Florida

DUNNING, Jacqui: “World cities research: summary report” Prepared by MVA  
Consultancy for Commission for Integrated Transport, March 2005

MARCHENKO, Alexander: “Moscow Social Card: Accessibility and Social Inclusion.”  
Public Transport International Volume 58 No. 4 2009

(TCRP 62) International Transit Studies Program Research Results Digest 62: Report on  
the fall 2002 Mission - Transit Operations in Central and Eastern Europe. Transit  
Cooperative Research Program, sponsored by the Federal Transit Administration.  
September, 2003



## **C: METROPOLITAN TRANSPORTATION FOR MUMBAI, INDIA**

Mumbai, the capital of Maharashtra State, is India's main center of trade and finance. Public transit has traditionally enjoyed a high modal share (11 million daily, or 88 percent of all travelers in 2009), but the rapid increase in population and travel demand are exerting substantial pressure on the existing suburban rail and bus services. Overwhelmed road and rail infrastructure results in traffic congestion, environmental pollution and overcrowding of vehicles to highly unsafe levels (Mumbai Metropolitan Region Development Authority - MMRDA, 2010).

The Mumbai Transport Project I is the first transportation planning initiative of the city, and it is one of the project of the Mumbai Transformation Support Unit (MSTU), an organization in charge of visioning and long range comprehensive planning for the Greater Mumbai region. The construction of the Mumbai Metro, expected to open its first phase in 2011, is one of the strategies adopted by Mumbai in an attempt to cope with its new and complex transportation needs (MSTU, 2010)

**Table 34: Mumbai- urban agglomeration characteristics**

<b>2007 Urban agglomeration population (millions)</b>	19.0
<b>2009 Metropolitan area (sq. mile)</b>	1,681
<b>2009 GDP per capita (PPP US\$)</b>	10,800

Source: United Nations Population Division; Price Waterhouse Coopers Global city GDP rankings 2008-2025

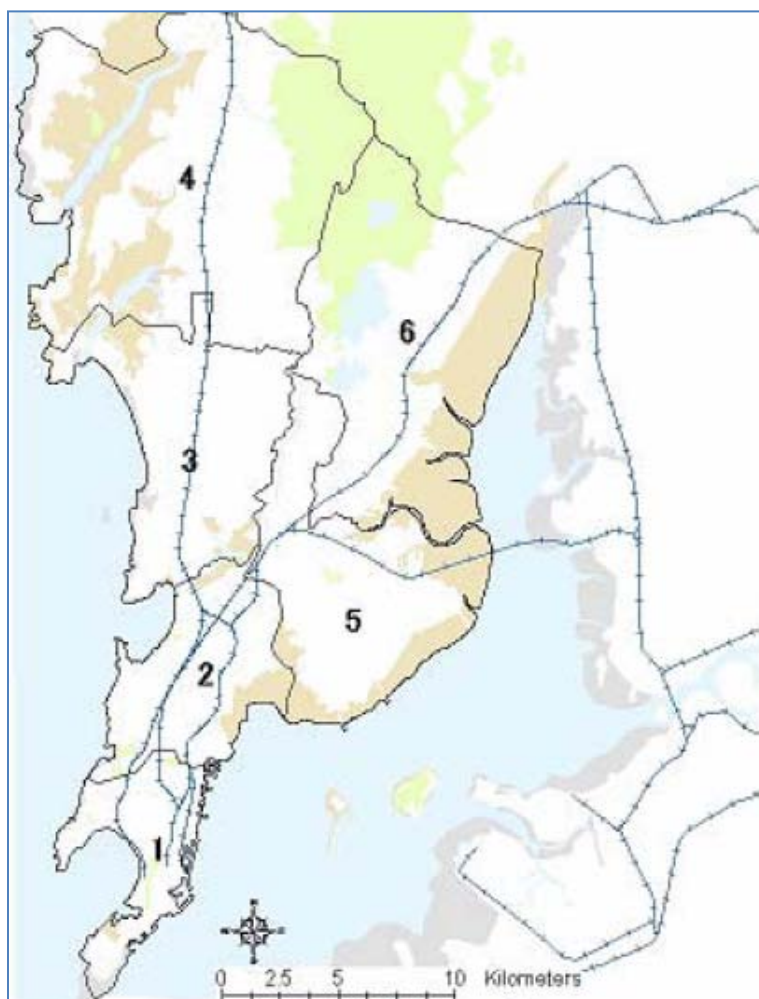


Figure 15: Location of Mumbai in India



Source: Maps of the World

**Figure 16: Map of Mumbai and its zones**



Source: Baker et al, 2005

**Table 35: Zones of Mumbai**

<b>Zone</b>	<b>Characteristic</b>
1	Traditional city center
2	Traditional city center
3	New commercial and employment center
4	Suburban area
5	Suburban area
6	Suburban area

Among the discernible patterns concerning household location and income in Mumbai, Baker emphasizes that more ‘poor’ households are located in zones 5 and 6 than any other income category; a larger proportion of ‘middle income’ households is located in zone 2; and zone 1 presents more households in the highest income category than any other zone (Baker, 2005).

## **Metro – Mumbai Metro One**

### **Institutional**

Mumbai Metro One Private Limited is Special Purpose Vehicle established in the form of a joint venture composed by: Reliance Energy Limited, a major private company in India, in charge of generation, transmission and distribution of electricity; Reliance Anil Dhirubhai Ambani Group, a top three business group in India, engaged in such areas as power, infrastructure, communications and natural resources, to name a few; Veolia Transport, part of Veolia Environment Group, the leading private public transit operator in Europe; and the MMRDA (Mumbai Metro One, 2010).

Planning for the Mumbai Metro is one of the responsibilities of the Mumbai Metropolitan Region Development Authority (MMRDA), which is the concessionary authority for the Versova - Andheri – Ghatkopar (VAG) corridor (phase 1) and is also in charge of general and economic development planning for the Mumbai Metropolitan Region.

## System characteristics

**Table 36: Mumbai Metro- Phase 1 proposed characteristics**

<b>Length of tracks (miles)</b>	7
<b>Number of stations</b>	12
<b>Average trip time (minutes)</b>	21
<b>Headway (minutes)</b>	3 to 3.5

Source: MMRDA

The proposed corridor is expected to cut travel time between Versova and Ghatkopar from 71 minutes to 21 minutes and improve the connectivity of the western and central suburbs by providing intermodal connections between the metro and suburban rail in two stations.

## Fares

The proposed metro system intends to have a distance-based fare structure, priced as follows, according to 2003-2004 values:

**Table 37: Mumbai Metro proposed fare structure**

<b>Length of journey</b>	<b>Fare*</b>
Up to 3 km (1.8 mi)	6 Rupees (US\$ 0.13)
3-8 km (1.8 – 4.9 mi)	8 Rupees (US\$ 0.17)
Beyond 8 kilometers ( 4.9 mi or more)	10 Rupees (US\$ 0.12)

\*Conversion rates on June 28, 2010 (Source: Mumbai Metro)

Fares will be established by the Government of Maharashtra and can be revised at 11 percent rate every four years. Automated fare collection systems will be available from phase 1, along with compatible contactless smartcards, magnetic tokens and automatic ticketing system. Furthermore, single-ride, multi-ride, tourist and stored-value tickets are among the proposed options for purchase (Mumbai Metro).

## **Bus service – BEST**

### **Institutional**

Brihammumbai Electric Supply and Transport (BEST) is responsible for the bus transit service in the Greater Mumbai Region. BEST is an autonomous body operating under the form of an undertaking of the Municipal Corporation of Greater Mumbai since 1947. A department called the Traffic Planning Section is in charge of planning schedules and routes. Plans are reviewed every four months, and routes considered financially unsustainable are eliminated after the proper reviews at the depot and at the headquarter levels.

The Traffic Planning Section continuously receives and entertains route and scheduling suggestions from riders, considering some main points before deciding whether a route should be made available: that the road on which the bus will traffic is a municipal road; that it is wide enough, allows for maneuverability and provides the proper turning radii at terminating points; that there is enough clearance (absence of cables or tree branches, for example) throughout the proposed route; and that the route counts with enough lighting. However, where transportation options are needed but the operation of conventional buses is impossible or unsafe due to road width, which happens especially in the farthest suburban areas and outskirts of the city, BEST considers the option to have mini buses operating on the route.

## System characteristics

**Table 38: Mumbai BEST bus transit system characteristics, 2007**

<b>Number of transit units</b>	3,400
<b>Number of routes</b>	354
<b>Headways</b>	5 to 30 minutes
<b>Average commercial speed</b>	10 mph
<b>Bus capacity</b>	74 to 90 passengers

Source: Baker et al, 2007

Bus transit in Mumbai is divided into 4 types of basic routes: the feeder routes connect suburban residential and commercial areas to railway stations; East-West connectors link the eastern and western suburbs, which are not connected by rail lines; trunk routes run north-south in routes also served by railways, therefore serving as an alternative to them; and bus rapid transit service (BRTS) running express routes on Western and Eastern Express Highways. BEST's main goal is to be the feeder and collector mode to the suburban rail system, therefore the feeder routes are a priority before the east-west and the trunk routes (BEST, 2010).

In order to better compete with the car in face of the recent increase in private automobile ownership, BEST has turned its attention to a number of strategies and differentiated services. One initiative was to introduce air conditioning in the vehicles running the express routes. Another strategy, the Zero Waiting Time Plan, starts from the assumption that long bus waiting times are a deterrent to choice riders and operates on the premise that a bus should be waiting for passengers, and not vice-versa, during morning and evening peak hours in busy residential, commercial and downtown areas. Besides the private car, this system is also expected to compete with taxis and auto

rickshaws. The Excursion Action plans and the Festival Action plans aim on attracting riders on routes that are most heavily traveled on weekends and holidays, and on festivals, respectively. The Mumbai National Park is one of the favorite weekend destinations, and New Years Eve is one of the dates that require pre-planned Festival Action operations. To reduce traffic congestion cause by the excessive number of personal vehicles and to increase revenue during these destinations and occasions, BEST creates or alters routes, schedules and vehicle fleet in consultation with the organizers of the event at hand (BEST, 2010).

Further differentiated options include the Ladies Special and Ladies First, which introduced ladies only trips on the busiest routes and ladies' preference on boarding at starting points, in order to make the transit experience more comfortable for female users; new low floor buses to improve the accessibility of disabled passengers; and the open deck buses, acquired in a partnership with the Maharashtra Tourism Development Corporation to accommodate tourists. Finally, BEST also offers service to three areas outside of the municipal boundaries of Mumbai, namely to Navi Mumbai, Mira-Bhayander and Thane, in order to cater to the travel needs of those who face long commutes into Mumbai every day (BEST, 2010).

## **Fares**

BEST applies a distance-based fare system, and passes can be acquired for each individual trip, or for weekly, fortnightly (15 days), monthly (30 days) and quarterly (3 months) periods. Zonal passes are also available, allowing riders to purchase passes for

an unlimited number of trips within pre-determined geographical areas of the city. Different priced passes grant access to different services, such as express routes and air conditioned buses. Discounts are available to students and senior citizens. Because BEST also operates as the electric utility for the city of Mumbai, it is able to utilize electricity revenues to subsidize bus fares (Cropper and Bhattacharya, 2007).

**Table 39: Mumbai BEST bus fares, 2010**

Distance in miles (km)	Fare cost in US Dollars*				
	Single trip	Weekly	Fortnightly	Monthly	Quarterly
1.24 (2)	0.06	0.64	1.29	2.57	7.07
1.86 (3)	0.09	0.86	1.71	3.43	9.43
3.1 (5)	0.11	1.07	2.14	4.28	11.78
4.34 (7)	0.13	1.29	2.57	5.14	14.14
6.2 (10)	0.17	1.71	3.43	6.86	18.85
9.3 (15)	0.21	2.14	4.28	8.57	23.56
12.4 (20)	0.26	2.57	5.14	10.28	28.28

\*Conversion rates in June 2010 (Source: BEST, 2010)

## **Suburban Trains – Indian Railways**

### **Institutional**

Indian Railways (IR) is the national public surface heavy rail system that provides long distance freight and intercity passenger transport, also serving as the suburban rail transit provider in major metropolitan areas in India, including Mumbai, Kolkata and Chennai. Planning for all aspects of Indian Railways services is done at a national level. The absence of local knowledge and input in the metropolitan areas where the company also serves as suburban rail transit provider has notoriously caused operational issues. To deal with these problems, IR is considering the creation of segregated administrative units to be responsible for the suburban business in some metropolitan areas, including



Mumbai. These separate administrative units would also be able to explore different option to deal with fares and revenues, such as finding local sources of subsidy and strategies for the fixation of tariffs for upper class passengers (Banerjee, 2009).

### System characteristics

**Table 40: Characteristics of Indian Railways in Mumbai, 2007**

<b>Daily ridership (millions of passengers)</b>	6
<b>Number of trains*</b>	184
<b>Rail corridors</b>	5
<b>Length of tracks – transit and long distance travel (miles)</b>	188
<b>Length of exclusive mass transit tracks (miles)</b>	92.5
<b>Daily transit service hours</b>	4:00 am to 1:00 am
<b>Average headways during peak periods (minutes)</b>	3
<b>Headways during non-peak periods (minutes)</b>	5 to 10
<b>Headways during late night service (minutes)</b>	20 to 30

\*Trains usually operate in 12-car (peak periods) and 9-car formations. Source: Cropper and Bhattacharya, 2007

Among the issues experienced by Indian Railways in Mumbai are the overcrowding of trains, fare evasion, excessively long travel times, and safety and security of passengers. Some other constraints experienced in suburban areas – mainly because of the highly subsidized nature of suburban transport – include difficulties to introduce more trains on popular routes, to service and upgrade passenger terminals and to double congested lines. Socially desirable but financially unsustainable services in suburban areas are often brought to the headquarters’ attention but implementation proves unfeasible. Nationally, IR considers insufficient capacity and inadequate infrastructure to be the biggest constraints faced by the system, especially given the fact that freight and passenger transport share tracks.

## **Fares**

Indian Railways adopts a distance-based system in which a fixed fare is charged for any distance within a 5-kilometer (3.1 miles) “distance slab”, depending on what type of train, different classes in the train, time of year (peak or non-peak seasons) and sometimes also varying if the trip is inbound or outbound. In this fashion, for example, the cost of any trip between 1 and 20 kilometers (0.6 to 12.4 miles) on 1A class in the Mail/Express during peak season is 367 Rupees (US\$ 7.86)(2010-2011 prices); if another trip with the same characteristic is between 21 and 100 kilometers long, it costs 374 Rupees (US\$ 8.01). The largest possible “distance slab” is between 4, 951 and 5000 kilometers (3,076 to 3,106 miles), and is available only for trips taken in the Mail/Express train. Peak seasons are from February 1<sup>st</sup> to March 31<sup>st</sup> and from August 1<sup>st</sup> to August 31<sup>st</sup>. Non-peak seasons run from April 1<sup>st</sup> to July 31<sup>st</sup> and from September 1<sup>st</sup> to January 31<sup>st</sup>. Children under five year of age travel gratis, and children between five and twelve years of age are charged half of one adult fare (Indian Railways, June 2010 values and currency conversion rates).

In the mid-2000s, unprecedented levels of demand for both passenger and freight transportation has led to an increase in revenues, but more recently IR’s finances have suffered impacts of the global recession and the rate of increase of revenues has slowed down (Banerjee, 2009).

## **Data sources for Mumbai**

### United Nations Populations Division

[http://www.un.org/esa/population/publications/wup2007/2007\\_urban\\_agglomerations\\_chart.pdf](http://www.un.org/esa/population/publications/wup2007/2007_urban_agglomerations_chart.pdf)

### PriceWaterhouse Coopers

Global City GDP Rankings 2008-2025:  
<https://www.ukmediacentre.pwc.com/Media-Library/Global-city-GDP-rankings-2008-2025-61a.aspx>

### Maps of the World

[http://www.world-guides.com/images/india/india\\_country\\_map.jpg](http://www.world-guides.com/images/india/india_country_map.jpg)

### Mumbai Metropolitan Region Development Authority (MMRDA)

About Mumbai, metro characteristics:  
[http://www.mmrdaumbai.org/projects\\_metro\\_rail.htm](http://www.mmrdaumbai.org/projects_metro_rail.htm)

Metro Planning: <http://www.mmrdaumbai.org/index.htm>

### Mumbai Transformation Support Unit (MTSU)

<http://visionmumbai.org/>

### Mumbai Metro One

Institutional: <http://www.mumbaimetro1.com/HTML/aboutus.html>

Fares: <http://www.mumbaimetro1.com/HTML/faqs.html#q5>

## Brihammumbai Electric Supply and Transport (BEST)

Institutional: <http://www.bestundertaking.com/>

Planning, system characteristics:

[http://www.bestundertaking.com/organization\\_setup.asp](http://www.bestundertaking.com/organization_setup.asp)

Fares: <http://www.bestundertaking.com/pdf/BusPass2009.pdf>

## Indian Railways

<http://www.indianrailways.gov.in>

Institutional:

<http://www.indianrailways.gov.in/indianrailways/evolution/evolution.jsp>

Fares:

[www.indianrailways.gov.in/directorate/coaching/pdf/ExplanatoryNotes.pdf](http://www.indianrailways.gov.in/directorate/coaching/pdf/ExplanatoryNotes.pdf);

[www.indianrailways.gov.in/indianrailways/directorate/coaching/pdf/Fares.pdf](http://www.indianrailways.gov.in/indianrailways/directorate/coaching/pdf/Fares.pdf)

BAKER, Judy; Basu, Rakhi; Cropper, Maureen; Lall, Somik; and Takeuchi, Akie:  
“Urban poverty and transport: the case of Mumbai” World Bank Policy Research  
Working Paper No. 3693, September 2005

BANERJEE, Mamata (Minister of Railways): “White paper on Indian Railways”  
presented to the members of the Parliament by the Ministry of Railways on  
December 2009.

CAIN, Alasdair: “FTA Mission to India – Delhi, Ahmedabad, Mumbai.” Department of  
Transportation, Federal Transit Administration, International Mass Transportation  
Program, March 2008

CROPPER, Maureen and Bhattacharya, Soma: “Public Transportation Subsidies and  
Affordability in Mumbai, India.” World Bank Policy Research Working Paper  
No. 4395, Development Research Group – Sustainable Rural and Urban  
Development Team. November, 2007



## D: METROPOLITAN TRANSPORTATION FOR SHANGHAI, CHINA

Shanghai is the principal center for finance and trade in mainland China. Extraordinary economic growth in recent decades has led to rapid increase in incomes, urbanization and suburbanization of the city. Chinese national policy encourages car ownership both to give the country a more modernized image and to stimulate further economic growth, leading local transportation planning to focus on implementing rapid mass transit, accommodating the automobile and alleviating congestion. Such posture is detrimental to the mobility and accessibility of the urban poor, who continue to rely on walking, biking and on the bus for their travel needs (Peng, 2004).

**Table 41: Shanghai- urban agglomeration characteristics**

<b>2007 Urban agglomeration population</b>	15.0
<b>2009 Metropolitan area (Sq. mile)</b>	2,717
<b>2009 GDP per capita (PPP US\$)</b>	15,300

Source: United Nations Population Division; Price Waterhouse Coopers Global city GDP rankings 2008-2025

**Table 42: Modal split trends in Shanghai (percent of trips)**

Year	Walking	Bicycle	Public transit	Employer commuter bus	Private automobile	Taxi	Motorcycle	Other
<b>1986</b>	41	31	24			4		
<b>1995</b>	30.11	41.18	17.42		11.29	NA	NA	NA
<b>1999</b>	30.74	39.01	15.16		15.09	NA	NA	NA

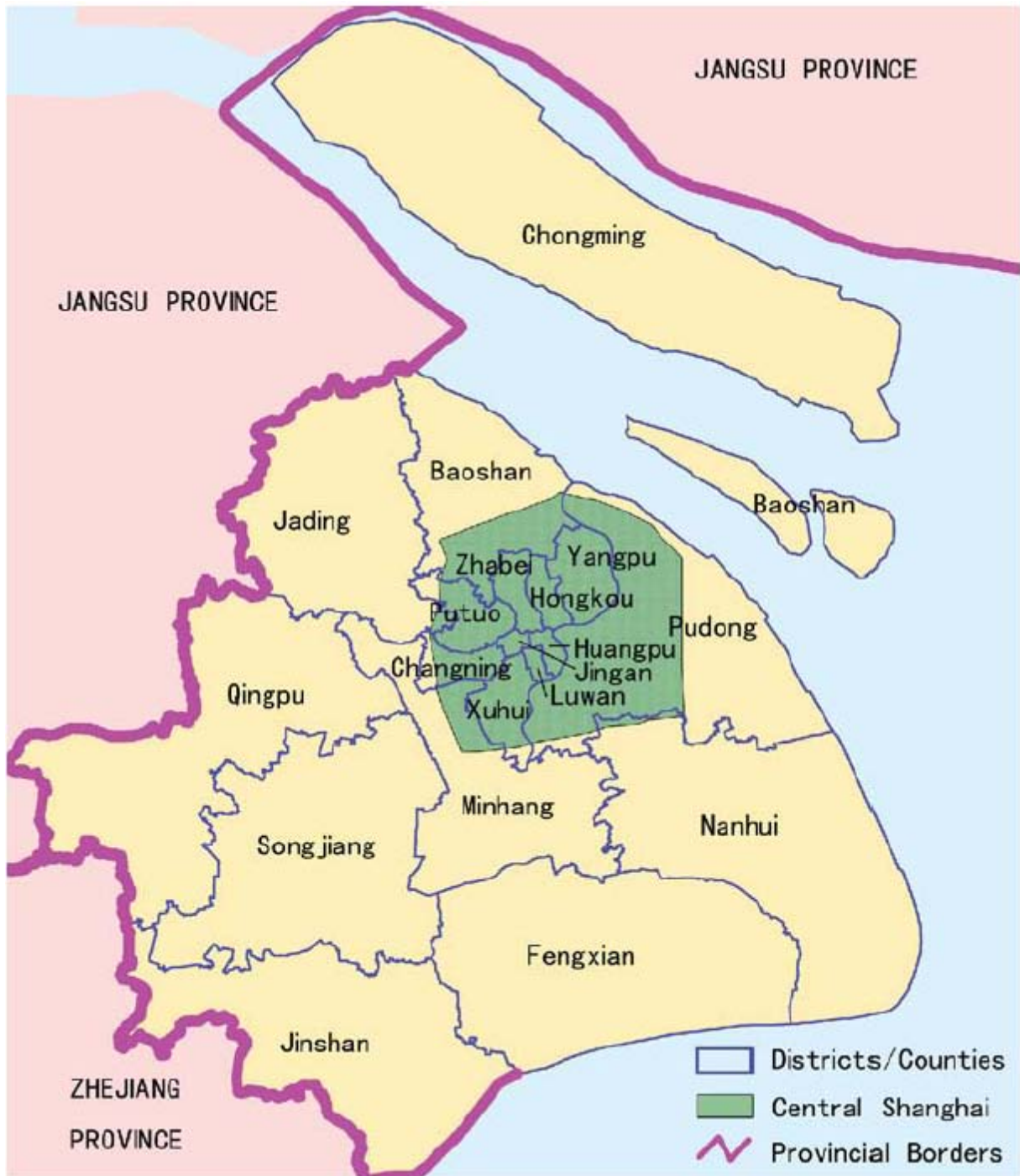
Source: Peng, 2004

Figure 17: Location of Shanghai in China



Source: World Guides

Figure 18: Map of Shanghai and its administrative districts



Source: Pan & Zhang, 2007



## **Metro – Shanghai Metro Transit Corporation**

### **Institutional**

The Shanghai Metro started operating in 1995, making Shanghai the third city in mainland China to have a metro system, after Beijing and Tianjin. Although Beijing's metro started operating in 1969, other cities did not start planning for their own systems until the 1980s, due to the economic reforms of that era and the ensuing widespread commitment with modernizing the country (Loo & Li, 2006). The Shanghai Metro is owned and operated by Shanghai Shentong Metro Co Ltd, a division of state-owned Shanghai Jiu Shi Corps (Shanghai Metro, 2010). In order to finance the major upgrades and expansions planned for the system, in 2002 transit officials issued individual lines “design, build, operate and maintain” contracts for private companies, opening the rail system to private capital under the management and supervision of Shanghai Metro Transit Corporation (TCRP, 2006).

Although financing methods are increasingly reliant on private investments, planning for the metro system is done centrally, i.e. at a national level. Local governments are in charge of initiating, funding and sustaining a healthy financial environment for the implementation of the metro and the provisions for the system must approved by the national executive, the State Council. Approval for construction of new metro systems is founded basically on two factors: an analysis of whether the population size of the locality can generate enough demand, and of whether the economic size of the locality can sustain its costs. Once the system is in place, localities are also the regulators

and managers of the metro (Loo & Li, 2006). Local officials expect the Shanghai metro system to gather a higher modal share and to achieve the mark of 12 million daily metro trips, surpassing the current metro system leader – Moscow (TCRP 77, 2006).

### **System characteristics**

**Table 43: Shanghai metro system characteristics, 2010**

<b>Number of lines</b>	11*
<b>Number of stations</b>	266*
<b>Length of tracks (miles)</b>	254.7*
<b>Minimum headways (minutes)</b>	2
<b>Average weekday ridership (millions of passengers)</b>	3.6

\*Excludes the Maglev Demonstration Line (Source: Shanghai Metro)

### ***Maglev***

In 2004, Shanghai opened the world’s first magnetic-levitation train for commercial use as an example of its commitment to modernization. The maglev connects the Longyang Station, miles away from downtown Shanghai, to Pudong Airport Station, in an eighteen-mile route on speeds of over 260 miles per hour. Maglev trips are considerably more expensive than conventional metro trips, starting at 50 Yuan (US\$ 7.38) for a single trip and up to 900 Yuan (US\$132.85) for 30 trips within 365 days. Fare prices have been subjected to several decreases since the system opened (June 2010 values and conversion rates, Maglev Transportation Development Co.). Besides the fare cost that proves too high for the Shanghai population to use the maglev for their daily transit needs, other constraining factors have been noticed, including the low demand of the route and bad interconnectivity with other transit modes (Peng, 2004)

## Metro Fares

The Shanghai Metro adopts a distance-based fare structure and electronic ticketing (Loo & Li, 2006). Three fare collection options are available: for single trips, riders can deposit the amount of money relative to the cost of their trip and receive a contactless IC card, which can be returned and recycled in the metro system after its use. Another option is to use the Shanghai Public Transportation Card, which can also be used on some public buses, ferries and taxis. After a 20 Yuan (US\$ 2.95 in June, 2010) deposit, the user can add value to the card and use it repeatedly, recharging it as needed. Discounts are given to users of the Shanghai Public Transportation Card, and a one-time only overdraft of 8 Yuan (US\$ 1.18) is allowed. Finally, a third option is the Souvenir Ticket, aimed specifically at tourists. The ticket is valid for one year after the date of validation and it is returned to the user as a keepsake (Travel China Guide, 2010).

**Table 44: Shanghai Metro Fares, 2010**

Route	Fare cost is US Dollars*		
	0 to 3.7 miles	Between 3.7 and 9.9 miles	Over 9.9 miles
All lines except Line 5	0.29	0.44	0.14 for every extra 3.7 miles
Line 5**	0.44	0.59	0.14 for every extra 6.2 miles
Transfer among lines	0.44	0.59	0.14 for every extra 6.2 miles

\*Conversion rates in June, 2010 (Source: Travel China Guide, 2010)

\*\*Line 5 extends from the end of Line 1 in Xinzhuang to the Minhang Development Zone

## **Bus – Shanghai Urban Transportation Bureau**

### **Institutional**

The bus transit system in Shanghai is the most widely used transit mode in the city in 2006, despite heavy investment and planning directed into the rail system. Shanghai Urban Transportation Bureau (SUTB) is in charge of planning, managing and supervising the bus service, which is operated by private sector contractors under pre-established targets. All plans are subject to the approval of the State Council (national executive branch), but local officials enjoy a certain level of autonomy in giving direction to future development. The 2020 Master Plan for Shanghai envisions a renewal of fleet, the introduction of clean technology vehicles and an improvement to rapid bus transit infrastructure, especially in congested downtown areas. Also, the bus system is expected to reach the mark of 9 million daily trips by 2020 (TCRP, 2006)

### **System characteristics**

**Table 45: Shanghai bus transit system characteristics**

<b>Number of transit units</b>	18,000
<b>Number of routes</b>	942
<b>Coverage area</b>	13,679
<b>Average commercial speed (mph)</b>	9.3
<b>Average weekday ridership (millions)</b>	7

Source: TCRP 77, 2006

**Fares**

The Shanghai bus adopts a distance-based fare system. Users are normally charged a minimum of 1 Yuan (US\$ 0.14) per person and the cost of fare increases thereafter depending not only on distance traveled, but also on the route and kind of vehicle. Most buses are equipped to be compatible with the use of the Shanghai Public Transportation Card, which can grant discount to users; otherwise, exact change must be deposited in coin boxes upon embarking (China Travel Guide, 2010).

## **Data sources for Shanghai**

United Nations Populations Division

[http://www.un.org/esa/population/publications/wup2007/2007\\_urban\\_agglomerations\\_chart.pdf](http://www.un.org/esa/population/publications/wup2007/2007_urban_agglomerations_chart.pdf)

PriceWaterhouse Coopers

Global City GDP Rankings 2008-2025:  
<https://www.ukmediacentre.pwc.com/Media-Library/Global-city-GDP-rankings-2008-2025-61a.aspx>

World Guides

[http://www.world-guides.com/images/china/china\\_country\\_map.jpg](http://www.world-guides.com/images/china/china_country_map.jpg)

Shanghai Metro

<http://www.shmetro.com/EnglishPage/EnglishPage.jsp>

System characteristics:  
[www.shmetro.com/node155/node159/201004/con103744.htm](http://www.shmetro.com/node155/node159/201004/con103744.htm)

Shanghai Maglev Transportation Development Co.

<http://www.smtdc.com/en/>

Institutional information: <http://www.smtdc.com/en/gycf.asp>

Fares: <http://www.smtdc.com/en/jszl.asp>

## Travel China Guide

Metro fares:

<http://www.travelchinaguide.com/cityguides/shanghai/transportation/subway-ticket.htm>

Bus fares:

<http://www.travelchinaguide.com/cityguides/shanghai/transportation/town-bus.htm>

CHERRY, Chris: “China's Urban Transportation System: Issues and Policies Facing Cities.” UC Berkeley Center for Future Urban Transport: A Volvo Center of Excellence, Institute of Transportation Studies, UC Berkeley. August, 2005

GAN, HongCheng; Sun, LiJun; Chen, Jian Yang; and Yuan, WenPing: “Advanced traveler information system for metropolitan expressways in Shanghai, China” *Transportation Research Record: Journal of the Transportation Research Board* No. 1944, Transportation Research Board of the National Academies, Washington D.C. 2005, pp. 35-40

LOO, Becky P.Y. and Li, Dennis Y.N.: “Developing metro systems in the People’s Republic of China: Policy and Gaps.” *Transportation* No. 33, 2006 pp. 115-132

PAN, Haixiao and Zhang, Ming: “Rail transit impacts on land use: evidence from Shanghai, China.” *Transportation Research Record: Journal of the Transportation Research Board* No. 2048, Transportation Research Board of the National Academies, Washington D.C. 2008, pp16-25

PENG, Zhong-Ren: “Urban Transportation Strategies in Chinese Cities and Their Impacts on the Urban Poor.” Woodrow Wilson International Center for Scholars: Forum on Sustainable Urban Infrastructure and Service Delivery for the Urban Poor. June, 2004

(TCRP 77) International Transit Studies Program: Report on the Fall 2005 Mission. Research Results Digest 77 of the Transit Cooperative Research Program, sponsored by the Federal Transit Administration. May 2006





## **BIBLIOGRAPHY**

- ARMIJO, Leslie E. The BRICs countries (Brazil, Russia, India and China) as analytical category: mirage or insight? *Asian Perspective*, Vol. 31, No. 4, 2007
- AHMED, Qureshi I., Lu, H. & Ye, S. Urban transportation end equity: a case study of Beijing and Karachi. *Transportation Research Part A*, No.42 2008
- BALL, Terrence. 'The earth belongs to the living': Thomas Jefferson and the problem of intergenerational relations. *Environmental Politics*, Volume 9 Issue 2 2000
- BANISTER, David. The sustainable mobility paradigm. *Transport Policy*, No. 15 2008
- BELL, Simon. *Sustainability indicators: measuring the immeasurable?* Earthscan Publications. London, United Kingdom; Sterling, VA, 2008.
- BRAKE, Jenny, Mulley, C., Nelson, J. D. & Wright, S. Key lessons learned from recent experience with flexible transport services. *Transport Policy*, No.14 2007
- BRAWLEY, Mark. *The politics of globalization: gaining perspective, assessing consequences*. Peterborough, Ontario; Orchard Park, N.Y.: Broadview Press 2003
- CERVERO, Robert. *Informal Transport in the Developing World*. Nairobi: United Nations Publications, 2000.
- CERVERO, Robert & Golub, A. Informal transport: A global perspective. *Transport Policy* No. 14 2007

CIOBANU, Ceslav & Bejou, D. Forging new alliances: Emerging markets and advanced economies. *Journal of Relationship Marketing*, No.8 pp. 280-298 2009

DALKIE, Harold & Soberman, R. M. Achieving Sustainable Urban Transportation: The Decision Making Challenge. *Conference Proceedings: 2008 Annual Conference of the Transportation Association of Canada*

DA SILVA, Antonio, Costa, M. & Macedo, H. Multiple views of sustainable urban mobility: the case of Brazil. *Transport Policy*, No.15 2008

DEAKIN, Elizabeth. Equity and environmental justice in sustainable transportation: toward a research agenda. *Institutions and sustainable transport: regulatory reform in advanced economies*. Editors: Rietveld and Stough. Edward Elgar Publishing. Cheltenham, UK; Northampton, MA 2007.

DE SOYZA, Indra & Neumayer E. False prophet or genuine savior? Assessing the effects of economic openness on sustainable development, 1980-99. *International Organization* 59, Summer 2005

DE-WEESE-BOYD, Ian & DeWeese-Boyd, M. The healthy city versus the luxurious city in Plato's Republic: lessons about consumption and sustainability for a globalizing economy. *Contemporary Justice Review* Volume 10, No. 1, March 2007

DOWALL, David & Shalizi, Z. Economics, Financing and Pricing. *Proceedings of the Conference on Transportation in Developing Countries, University of California, Berkeley, 17-18 April 2008*. Ed. Robert Cervero and Jonathan Mason. (<http://www.uctc.net/papers/387.pdf>)

DREZNER, Daniel W. Loose BRICs. *Foreign Policy Online* ([http://drezner.foreignpolicy.com/posts/2009/06/17/bric\\_a\\_brac](http://drezner.foreignpolicy.com/posts/2009/06/17/bric_a_brac)) accessed in June, 2010

- GAKENHEIMER, Ralph. Urban mobility in the developing world. *Transportation Research Part A*, No.33 1999
- GEURS, Karst T., Boon, W. & Van Wee, B. Social Impacts of Transport: Literature Review and the State of the Practice of Transport Appraisal in the Netherlands and the United Kingdom. *Transport Reviews*, Vol. 29 No. 1 2009
- GUESS, George M. & Farnham, P.G. *Cases in public policy analysis*. Second Edition. Georgetown University Press, Washington, D.C. 2000
- HALES, D. & Prescott, A.R. Flying blind: assessing progress toward sustainability. *Global Environmental Governance: Opportunities and Options* (Editors: Esty DC and Ivanova MH) Yale School of Forestry and Environmental Studies, 2002.
- HARRIS, Graham P. *Seeking sustainability in an age of complexity*. Cambridge University Press. Cambridge, United Kingdom 2007.
- HELMS, M., Vattam, S. & Goel, A. Biologically inspired design: process and products. *Design Studies*, Volume 30, Issue 5, September 2009
- HERMAN, Benjamin A. Embracing sustainability in community plans: how to undertake the newest – and greenest – planning efforts. *Planning – The Magazine of the American Planning Association*. Volume 17, No. 4, April 2010
- HIDALGO, Dario. Citywide transit integration in a large city: The Interligado System in Sao Paulo. *Transportation Research Record: Journal of the Transportation Research Board* No. 2114, 2009
- HOLZER, H.J. The spatial mismatch hypothesis: what has the evidence shown? *Urban Studies* No.28 1991

- HOWARTH, Richard B. Towards an operational sustainability criterion. *Ecological Economics* Volume 63, Issue 4, September 2007
- HUETING, Roefie. The Brundtland Report: A matter of conflicting goals. *Ecological Economics*, Volume 2, Issue 2, June 1990
- HUGHES, Francine M.R. Helping the World Conservation Strategy? Aid agencies in Kenya. *Area (The Royal Geographical Society & Institute of British Geographers)*. Cambridge, 1983
- HULL, Angela. Policy integration: What will it take to achieve more sustainable transport solutions in cities? *Transport Policy*, No. 15, 2008
- International Union for Conservation of Nature and Natural Resources. *World Conservation Strategy: living resource conservation for sustainable development* 1980 (<http://data.iucn.org/dbtw-wpd/edocs/WCS-004.pdf>) Accessed in April 2010
- JONES, David W. *Mass motorization and mass transit: an American history and policy analysis*. Indiana University Press. Bloomington, IN 2008
- KEINER, Marco (Editor). *The future of sustainability*. Springer Publishing. Dordrecht, Holland 2006
- LATOUCHE, Serge. The paradox of ecological economies and sustainable development. *Democracy and Nature* Volume 5, No. 3, 1999
- LEE, Robert & Stokes, E. Environmental governance: reconnecting the global and local. *Journal of Law and Society* Volume 36, No. 1, March 2009

LIGUANG, Feng. Transportation related socio-economic issues in China. *World Transport Policy and Practice, Special Edition: Transportation in China*, Volume 12 No. 4, 2006

LITMAN, Todd. Evaluating Transportation Equity: Guidance for incorporating distributional impacts in transportation planning. *World Transport Policy and Practice*, Volume 8, No.2, Summer 2002, pp.50-65

National Highway Traffic Safety Administration. Traffic Safety Facts, 2004 Data (<http://www-nrd.nhtsa.dot.gov/Pubs/809911.PDF>)

Municipality of Copenhagen, Technical and Environmental Centre. Eco-Metropole: Our vision for Copenhagen 2015. ([http://www.kk.dk/~media/Files/PolitikOgIndflydelse/Byudvikling/Miljoe/kk\\_brochure\\_gb\\_09.ashx](http://www.kk.dk/~media/Files/PolitikOgIndflydelse/Byudvikling/Miljoe/kk_brochure_gb_09.ashx)) Accessed in April 2010

NATRASS, Brian & Altomare, M. *The Natural Step for Business: wealth, ecology and the evolutionary corporation*. New Society Publishers, Gabriola Island, Canada 1999.

NICHOLS, Jenna, Garrick, N. & Atkinson-Palombo, C. Framework for Developing Indicators of Sustainability for Transportation Planning. *Conference: Transportation Research Board 88th Annual Meeting 2009*

NORRIS, Christopher. Moving Towards Sustainability with Public Transit for a Better Future. *2008 Annual Conference of the Transportation Association of Canada 2008*

NORTON, Bryan G. Intergenerational equity and environmental decisions: A model using Rawls' veil of ignorance. *Ecological Economics*. Volume 1, Issue 2, May 1989.

- O'NEILL, Jim. Building better economic BRICs. *Goldman Sachs Global Economic Papers* No. 66 November 30<sup>th</sup>, 2001
- O'NEILL, Jim, Wilson, D., Purushothaman, R. & Stupnytska, A. How solid are the BRICs? *Goldman Sachs Global Economic Papers* No.134 December 1<sup>st</sup>, 2005
- PUCHER, John. Urban transport crisis in India. *Transport Policy*, No.12 2005
- PRESTON, John and Raje, F. Accessibility, mobility and social-related social exclusion. *Journal of Transport Geography*, No.15 2007
- Price Waterhouse Coopers. Global city GDP rankings 2008-2025. UK Economic Outlook, November 2009 (<https://www.ukmediacentre.pwc.com/Media-Library/Global-city-GDP-rankings-2008-2025-61a.aspx>) accessed in June 2010
- RIETVELD, Piet and Stough, R. *Institutions and sustainable transport: regulatory reform in advanced economies*. Edward Elgar Publishing. Cheltenham, UK and Northampton, MA 2007
- ROSSI, Peter H., Freeman, H. E. & Wright, S. R. *Evaluation: a systematic approach*. Sage Publications, Inc. Beverly Hills, CA 1979
- ROODMAN, David. How do the BRICs stack up? Adding Brazil, Russia, India and China to the environment component of the Commitment to Development Index. Center for Global Development. October, 2007
- SANCHEZ, Thomas W., Stolz, R. & Ma, J. S. Moving to equity: addressing inequitable effects of transportation policies in minorities. *The Civil Rights Project at Harvard University*, Cambridge, MA, 2003

SCHILLINGER, Gerhard. Eco-Thinking, Economic and Social Action: Sustainability is Multi-Layered. *Public Transport International*, Vol. 58 No. 1 2009

SCHIPPER, Lee. Sustainable Urban Transport in the 21st Century: A new agenda. *Transportation Research Record*, No. 1792, 2002

SCHWARTZMAN, Kathleen. Globalization from a world-system perspective: a new phase in the core – a new destiny for Brazil and the semiperiphery? *Journal of World Systems Research* XII, December 2006

SMITH, Kevin. Carbon Neutral Myth: offset indulgences for you climate sins. The Transnational Institute, Amsterdam 2007.  
([http://www.carbontradewatch.org/pubs/carbon\\_neutral\\_myth.pdf](http://www.carbontradewatch.org/pubs/carbon_neutral_myth.pdf)) Accessed in April 2010

SOHAIL, M., Maunder, D.A.C. & Cavill, S. Effective regulation for sustainable public transport in developing countries. *Transport Policy*, No. 13 2006

SPERLING, Daniel and Gordon, D. *Two billion cars: driving toward sustainability*. Oxford University Press. Oxford, NY 2009.

SPETH, James Gustave. *The bridge at the edge of the world: capitalism, the environment, and crossing from crisis to sustainability*. Yale University Press. New Haven, CT 2008.

STANLEY, Janet and Vella-Brodrick, D. The usefulness of social exclusion to inform social policy in transport. *Transport Policy*, No. 16 2009

TORRES-MONTOYA, Mariana. Innovative urban transport cooperation by public and private sectors in India. *Transportation Research Record: Journal of the Transportation Research Board* No. 2063 Washington D.C. 2008

- VALENZUELA, Abel Jr.; Schweitzer, L. & Robles, A. Camionetas: Informal travel among immigrants. *Transport Research Part A*. February, 2005
- VASCONCELLOS, Eduardo A. *Urban transport, environment and equity: the case for developing countries*. Earthscan Publications, London, UK, 2001
- WACHS, Martin. New expectations for transportation data. Address at the Transportation Research Board Conference on Personal Travel, June 29, 1999
- WALKER, Jarrett. Purpose-driven public transport: creating a clear conversation about public transport goals. *Journal of Transport Geography*, No. 16 2008
- WEIMER, David L. & Vining, A. R. *Policy analysis: concepts and practice*. Prentice Hall, Inc. Englewood Cliffs, NJ 1989
- WEISS, Andrew. BRIC-a-Brac: Does a club that includes countries as radically different as Brazil, China, India and Russia make any sense? *Foreign Policy* June 15, 2009
- WEISS, Carol H. *Evaluation: Methods for studying programs and policies*. Prentice Hall, Inc. Upper Saddle River, NJ, 1998
- WHOLEY, Joseph S., Hatry, H. P. & Newcomer, K E. *Handbook of practical program evaluation*. Jossey Bass, Inc. San Francisco, CA 1994
- WHYTE, William F. *Participatory action research*. Newbury Park, CA 1991
- WILSON, Dominic and Purushothaman, R. Dreaming with BRICs: The path to 2050. *Goldman Sachs Global Economics Paper*, No.9 October, 2003



YIN, Robert K. *Case study research – Design and methods*. Sage Publications, Inc. Thousand Oaks, CA 2009

## **Helpful websites**

### **Biomimicry Institute**

<http://www.biomimicryinstitute.org/> (Accessed in April 2010)

### **Biophilia Foundation**

<http://www.biophiliafoundation.org/index.html> (Accessed in April 2010)

### **Center for International Development at Harvard University**

<http://www.cid.harvard.edu/cidtrade/issues/washington.html> (Accessed in February, 2010)

### **Central Intelligence Agency World Factbook**

About Brazil: <https://www.cia.gov/library/publications/the-world-factbook/geos/br.html> (Accessed in October, 2009)

About Russia: <https://www.cia.gov/library/publications/the-world-factbook/geos/rs.html> (Accessed in October, 2009)

About India: <https://www.cia.gov/library/publications/the-world-factbook/geos/in.html> (Accessed in October, 2009)

About China: <https://www.cia.gov/library/publications/the-world-factbook/geos/ch.html> (Accessed in October, 2009)

### **Global Footprint Network**

[http://www.footprintnetwork.org/en/index.php/GFN/page/ecological\\_debtors\\_and\\_creditors/](http://www.footprintnetwork.org/en/index.php/GFN/page/ecological_debtors_and_creditors/) (Accessed in April, 2010)

## Government of India

Press Information Bureau. 2010 BRIC Summit official communiqué:  
<http://pib.nic.in/release/release.asp?relid=60398> (Accessed in April 2010)

## Group of Twenty

<http://www.g20.org/> (Accessed in March, 2010)

## Indigenous Environmental Network

<http://www.ienearth.org/sustainablecommunities.html>;  
<http://www.ienearth.org/docs/TheBemdjiStatementOnSeventhGenerationGuardianship.pdf> (Accessed in April, 2010)

## National Cooperative Business Association

<http://www.ncba.coop/ncba/about-co-ops/co-op-principles> (Accessed in June, 2010)

## President of Russia: Official Web Portal

2009 BRIC Summit official communiqué:  
<http://eng.kremlin.ru/text/docs/2009/06/217963.shtml#> (Accessed in April, 2010)

## Redefining Progress

[http://www.rprogress.org/sustainability\\_indicators/about\\_sustainability\\_indicators.htm](http://www.rprogress.org/sustainability_indicators/about_sustainability_indicators.htm) (Accessed in April, 2010)

## The Carbon Neutral Company

<http://www.carbonneutral.com/knowledge-centre/offsetting-explained/> (Accessed in April, 2010)

### The Natural Step

<http://www.naturalstep.org/en/usa/principles-sustainability>;  
<http://www.naturalstep.org/en/the-system-conditions> (Accessed in April, 2010)

### The G-8 Information Center

The G-8 Research Group: <http://www.g7.utoronto.ca/> (Accessed in June, 2010)

### The Group of Twenty

<http://www.g20.org/index.aspx> (Accessed in June, 2010)

### United Nations Millennium Development Goals

<http://www.un.org/millenniumgoals> (Accessed in October, 2009)

### United Nations Development Program

Human Development Index Rankings <http://hdr.undp.org/en/statistics/> (Accessed in October, 2009)

Human Development Reports - <http://hdr.undp.org/en/reports/> (Accessed in February, 2010)

### United Nations Population Division

Urban Agglomeration Statistics  
[http://www.un.org/esa/population/publications/wup2007/2007\\_urban\\_agglomerations\\_chart.pdf](http://www.un.org/esa/population/publications/wup2007/2007_urban_agglomerations_chart.pdf) (Accessed in May, 2010)