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An arterial grid of dirt roads

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Between 2000 and 2030, cities in developing countries will double their population from 2 to 4 billion and at least *triple* their total built-up area. This essay assesses the state of preparedness for the projected urban expansion. The available anecdotal evidence suggests that areas needed for expansion are typically underestimated, that enforcement of land use regulations is relatively weak and cannot protect open space from development, and that essential arterial roads are commonly in short supply. The author proposes adopting a proactive strategy that does not overly rely on land use regulation, focusing instead on the layout and early acquisition of the right-of-way for an arterial road network, a 1-km-wide urban grid covering the entire area of expected expansion. This article reports on seven intermediate cities in Ecuador that are engaged in implementing this strategy, and examines the merits and pitfalls of pursuing it in Ecuador and elsewhere.

Keywords: Developing countries, urbanization, urban expansion, arterial roads, land acquisition, affordable housing

The challenge

Between 2000 and 2030, cities in developing countries are expected to double their total population, from 2 to 4 billion, and to at least *triple* their total built-up area.

UN projections indicate that the population living in developing-country cities will increase from nearly 1.97 billion in 2000 to 2.25 billion in 2005 and to 3.90 billion in 2030 (United Nations Population Division, 2006, Fact Sheet 5, Table 4). And while the urban population doubles, the area occupied by these cities is likely to much more than double. A World Bank study of a global sample of 120 cities by the author and his colleagues concluded that urban built-up area densities are in significant decline almost everywhere: 6 out of 7 developing-country cities in this sample experienced a decline in density during this period. Preliminary calculations suggest that between 1990 and 2000, the decline in densities averaged 1.7% per annum in developing-country cities, from an average of 96 to an average of 81 persons per hectare (Angel et al., 2005, Table IV-2, p. 57).[1]

At that rate of decline, given the projected population growth, the built-up area of an average developing-country city is likely to more than *triple* between 2000 and 2030. Many cities will, in fact, *more than triple* their land areas. To give a concrete example: between 1985 and 2000, Accra, the capital of Ghana and one of cities in the global sample, increased its population and decreased its density at the rates of 2.7% and 3.7% per annum, respectively. As a result, its built-up area increased at the annual rate of 6.6% during this period (see *Figure 1*). At that rate of expansion, its area will grow by *five* times in 25 years and by *seven* times in 30 years.

If the land area of cities is about to triple in a single generation then we can assume that, on average, the new areas added to cities in developing countries will be *twice as large* as the existing areas of cities. In other words, a typical city will encompass new areas for expansion that

[1] According to the same table, densities in industrialized countries declined from 36 to 28 persons per hectare during the same period, at an annual rate of decline of 2.2%.

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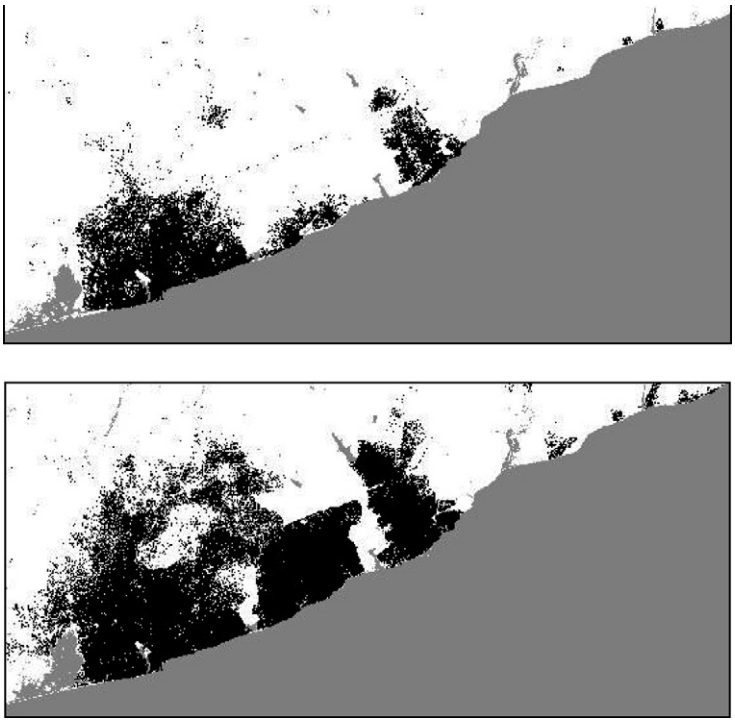

Figure 1 The expansion of the built-up area of Accra, Ghana, 1985–2000. *Source*: Angel et al. (2005), City Data Sheets.

are twice as large as its present area in a time span that is roughly equivalent to the length of a professional career of a planner in a municipal planning office.

In more general terms, we can safely say that all cities are likely to grow and expand substantially and that the planet's human population as a whole will become more and more urbanized until it reaches an equilibrium where some three-quarters of this population lives in cities. This equilibrium has already been reached in industrialized countries. Developing countries are still urbanizing and—except in a few higher-income Latin American countries—substantial rural–urban migration is still taking place. With increased democratization, most people who are free to move will likely move to cities. Attempts to curtail or reverse this migration flow or to direct it away from large cities into smaller ones—whether by coercive means or by focusing development efforts on villages or frontier regions—have typically ended in utter failure. China, to take a recent example, still lays claim to strict rural–urban migration controls, but now has more than 100 million illegal migrants—people without a proper residence permit (*Hukou*)—in its cities. For the time being, the urbanization taking place in developing countries is indeed unstoppable and, for the purposes of the foregoing analysis, can be taken for granted.

So is the decline in urban densities, a decline that—although not surprising at all—may still be a grave concern to many. Average urban densities have, in fact, been in decline in industrialized-country cities for the past two centuries, going hand in hand with economic growth, increasing household incomes, and steady improvements in the standard of living. London, to take one example, had 845,000 people living in a built-up area of 40 km^2 in 1800 and 10.3 million people living in an area of 1,855 km^2 in 2000. Its average density thus declined from 211 to 54 persons per hectare during this period. To take a more recent example: Portland, Oregon, which adopted an urban growth boundary in the early 1970s to contain its outward sprawl, has also experienced a serious decline in densities in recent years. Between 1990 and 2000, for example, its built-up area density declined by as much as 6% per annum.[2] In general, the richer the people become, the more land they consume: dwellings, workplaces, shopping and entertainment areas, roads and parking areas, public facilities, all take up more space. And this is true not only in industrialized countries. As we noted earlier, it is true in developing countries as well, as well it should be.

The decline in densities, in the US in particular, has been decried as *sprawl* and has been blamed for a variety of ills.[3] Should we be concerned about the decline in densities in developing-country cities? There are many proponents in industrialized countries for *compact cities*, and they advocate increasing urban densities so as to reduce car dependency, rebuild dilapidated neighborhoods, regenerate city centers, and to conserve open space on the fringe of cities. But even those who are in favor of compact cities question the merit of this strategy for developing-country cities:

> What is the sense, it is frequently asked, of further densification given that densities are already high and associated

[2] Preliminary estimates from *Landsat* imagery by A. Chabaeva, Department of Natural Resources Management and Engineering, University of Connecticut.

[3] For an enlightening historical discussion of the issue, see Bruegmann (2005).

> with a range of problems including infrastructure overload, overcrowding, congestion, air pollution, severe health hazards, lack of public and green space and environmental degradation?[4] The sustainability gains from further densification will be limited under conditions where densities are already high. Under these circumstances the merits of urban densification postulated for developed country cities seem far less convincing in the context of developing countries (Burgess, 2000, p. 15).

If we agree on *optimal* densities for cities—densities that can sustain effective systems of public transport, for example, as we shall see later, or allow for sufficient porous surfaces to avoid flooding—typical urban densities in developing countries are still much higher that this optimum, and there are considerable benefits to be gained from their gradual decline. We should not, therefore, be overly concerned with the decline of densities in most developing-country cities at the present time. From an environmental perspective, we would stand a much higher chance of success if we focused on actively protecting well-circumscribed open spaces from urban encroachment rather than on a containment policy that seeks to prevent cities from expanding outwards altogether.

We would do well to assume, as a starting point, that a typical developing-country city should expect to triple its land area in a generation and to concern ourselves with the immediate implications of this expected expansion. Surely, some cities will grow in population and expand in area faster than others and each city should make its own calculations to determine both its actual rate of population growth and its actual rate of physical expansion. This is indeed the working assumption underlying this essay. Given this assumption, the challenge confronting *cities*—to be distinguished from their individual citizens—is straight forward: cities in developing countries need to *prepare* ample room for their coming expansion, and they need to do it now while the urbanization process—the movement of rural people to cities and the natural growth of the urban population—is still in full swing. Once the transformation of the planet into a planet of cities is complete or nearly complete, it will have been too late.

What are the minimal preparations, if any, that municipal, provincial or central governments in developing countries—taking action for the common good of their citizens—have to make now? Can urban communities avoid all concerted action now and simply *evolve*, like anthills or corals, gradually taking shape through the cumulative building decisions of their individual citizens, firms, and institutions?

In an important sense, cities can continue to evolve through individual actions. Cities are built and rebuilt over time through thousands and thousands of small projects. But as they grow, they need more fresh water and produce more sewage and solid waste, for example, and their capacity to handle these needs must gradually increase. Urban communities have build complex infrastructure systems and have adopted regulatory regimes that both restrain and guide individual building decisions for the common good. Indeed, the forms of cities typically evolve in response to these regulatory systems: some builders comply with them, some subvert them to their advantage, and some circumvent them or ignore them altogether.

Hand-in-hand with the evolution of regulatory regimes we have also witnessed the evolution of private property rights to land:

> As competition for a resource raises the cost of conflict over it, the conflict itself comes to seem costlier than the effort of setting up a property regime. We then try to establish a system of clear entitlements in the resource so that we can barter and trade for what we want instead of fighting (Rose, 1994, p. 200).

Property rights to land facilitate the building of cities because they allow owners to use their lands and to construct structures on them without having to coordinate such construction with all other owners. At the same time they limit the ability of the urban community as a whole to control the character of such construction in the common interest, to prevent building in areas that the community believes should remain free of construction, or to appropriate private land for essential common uses, such as arterial roads—the roads that carry people and goods across the city.

Generally speaking, the more valuable the urban properties become, the more difficult it is for urban authorities to keep them free of construction in the public interest or to appropriate them for public use. Over time, eminent domain laws governing such appropriation increasingly demand the payment of full market value for appropriated lands, and property owners are increasingly able to demand legal protection from regulations that deflate the value of their lands by preventing them from putting them to profitable use.

Still, there are planning departments in all municipalities that have, as one of their principal goals, the management of orderly urban expansion in the public interest. All cities and metropolitan areas in the developing countries have public bodies that engage in planning for their land use and transportation networks in one way or another. *City planning* in its most basic sense is, after all, making preparations in advance. Its very essence involves thinking ahead and acting now so as to lead the urban community—both as an entity and as a collectivity of individuals—into a better future outcome.

What is the state of preparedness, we may ask, for the coming urban expansion? Is it adequate and, if not, why not? What do urban communities need to do now, at the very minimum, to prepare for the coming urban expansion? And, if we knew what needed to be done now, can it really be implemented given the complex conditions facing central, provincial, and local governments in developing-country metropolitan areas?

In gauging the adequacy of preparations for urban expansion, we can assume that many decisions affecting city building—specific land uses, densities, subdivision plans, and building designs, for example—need not be taken now. These myriad decisions can be taken over time as the city evolves, builds, and rebuilds. We should only con-

[4] Paraphrasing Hardoy et al. (1990).

cern ourselves with what urban communities need to do *now*, before it is too late, in the sense that some decisions, once taken, are largely irreversible. Once construction takes place, mass demolitions to make way for avenues that can carry bus rapid transit, are virtually impossible except in the most autocratic and merciless of societies. To take another example: If an urban community does not come together and act in unison to protect sensitive natural habitats before they are invaded, such places are likely to be lost forever.

The state of preparedness

We should ask ourselves three more specific questions about the present state of preparedness for the coming urban expansion in developing countries: first, are adequate lands being designated for conversion from rural to urban use? Second, are the commonly available regulatory tools—more specifically *zoning*—adequate to ensure that lands that should *not* be developed—wetlands, riverbeds, flood plains, steep slopes subject to landslides, or nature parks, to take a few examples—remain free of construction as cities expand outwards? And third, are municipalities able to reserve adequate rights-of-way for arterial road networks that can carry public transport and trunk infrastructure into the areas of projected expansion? If we could answer these three questions in the positive for most developing-country cities, then we could be assured that adequate *minimal* preparations for expansion are indeed taking place.

Unfortunately, given the present state of urban comparative research in developing countries, robust scientific answers to these important questions are not yet forthcoming. At this point, our answers must therefore be provisional, relying as they must on anecdotal evidence. As noted earlier, the author and his colleagues did collect data that may help lay the foundations for answering these questions in a global sample of 120 metropolitan areas, 80 of which were located in developing countries. We now have good estimates of the built-up areas of these cities in two time periods, one circa 1990 and one circa 2000. Using these estimates, we could calculate the rate of urban expansion in each city and determine the amount of built-up area at a given date.

If we had land use plans for these cities for a specified target date, we could, in principle, begin to assess whether they allocated adequate lands for accommodating the expected expansion by that date. We could also assess how much of the area designated to remain green was invaded by urban development, and at what rate it was invaded over time. We could also sample points in the built-up areas of these cities and determine—using the high-resolution satellite imagery now available[5]—what is their average distance from arterial roads and what percentage of the built-up area is within walking distance of arterial roads. These questions form part of a broader research agenda, now being pursued by the author and his colleagues, aimed at gauging the state of preparedness. Unfortunately, we cannot provide reliable statistics to answer these questions at the present time, and the reader is asked to wait until research on these questions is complete. For now, therefore, we must content ourselves with *anecdotal* evidence from individual cities. On the whole, as we shall see below, the available anecdotal evidence—incomplete as it is—already suggests that current preparations for urban expansion in developing-country cities are woefully inadequate.

The failure to designate sufficient land for planned urban expansion

From a planning perspective, the most important preparation for urban expansion is the designation of sufficient lands to accommodate the expected population growth, so that urban land is not in short supply and so that lands can quickly be brought into urban use when demand for land increases. Such preparation entails changing the designation of lands from rural or agricultural to urban use, expanding the jurisdictional boundaries of cities to contain adequate urban lands for expansion, and laying out plans for the provision of urban infrastructure on these lands. Failure to prepare adequate lands for expansion in a timely fashion typically leads to haphazard development, to development that is too compact—leaving too little land for road right-of-way or for open space—to inefficient non-contiguous development, and to land supply bottlenecks that increase land speculation and in turn make housing less affordable.

In 1998, the city of Zhengzhou, the capital of Henan province in China, prepared a land use plan for the year 2010. The plan projected the population of the city to reach 2.3 million and its area to reach 189 km^2 by that year. By 2003—less than half the plan's time horizon—Zhengzhou's population was already 2.8 million and its area 212 km^2. By 2006, its population reached 3 million and its urban area expanded to 282 km^2. Based on this experience, its new plan, recently submitted to the central government for approval, projected the city's population to reach 5 million and its area to reach 500 km^2 by the year 2020. Municipal planners do worry, however, that the plan will not be approved and there are indications that *any* land use plans that project significant urban expansion are being held up by central government authorities. The central government in Beijing has placed strict quotas on conversion of cultivable land to urban use in the name of ensuring China's food security. Beijing's own plan was recently approved, and rather quickly too, but Zhengzhou's planners suspect that it was only because it projected almost *no expansion* (!) of its built-up area in the coming years.

The author has searched for cities that did, in fact, prepare for their expansion at a substantial scale and at the time of writing found only two such cities, places that were clearly the exception rather than the rule. In 1811, when New York City had only 100,000 people crowded into the southern tip of the island of Manhattan, three city commissioners—Morris, de Witt Clinton and Rutherford—introduced an expansion plan based on a regular street grid, to prepare for a *10-fold* increase in the city's

[5] Google Earth now has high-resolution imagery circa 2005 for 109 of the 120 cities in the global sample.

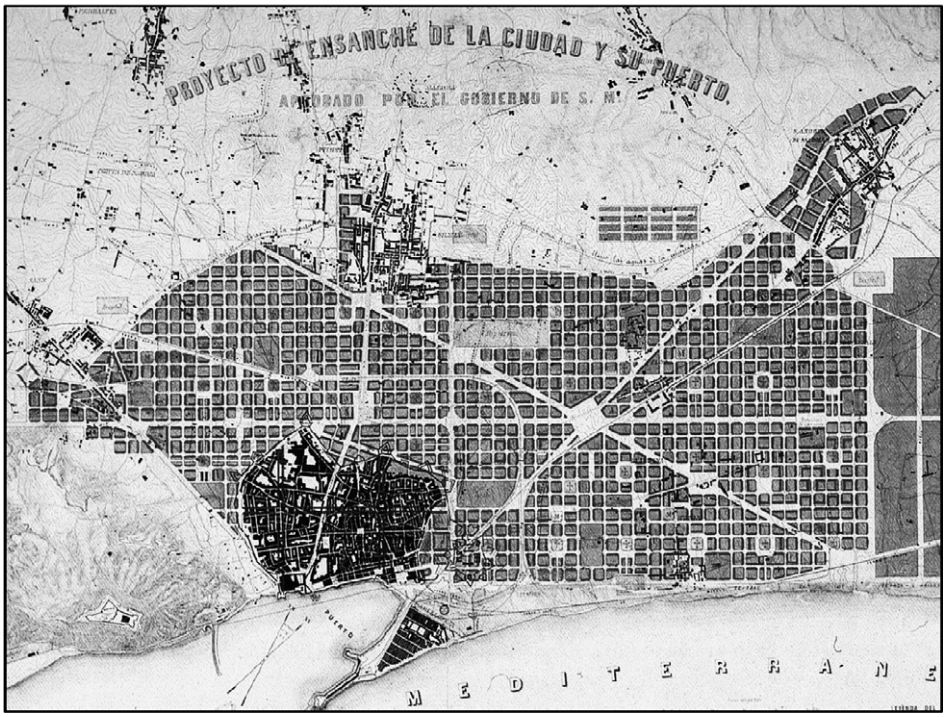

Figure 2 Ildefons Cerdá's *Ensanche* plan for Barcelona, 1859. *Source*: Arturo (1999, Fig. 19, p. 279). The existing city is shown in black at the bottom left corner.

population. In presenting their now-famous grid plan, the commissioners remarked:

> To some it may be a matter of surprise that the whole island has not been laid out as a city. To others it may be a subject of merriment that the commissioners have provided space for any population that is collected at any spot on this side of China (Mackay, 1987, p. 20).

The city council of Barcelona, Spain, organized a competition for a similar plan to expand the city in 1859, and selected the visionary plan submitted by Ildefons Cerdá as its winning entry (Arturo, 1999). Cerdá also envisioned a 10-fold expansion of the area of the existing city that, at the time, had a population of 150,000 (see *Figure 2*).

Neither Cerdá's plan nor the New York commissioners' plan was a utopian dream. They were quickly implemented and both cities soon outgrew them. In other words, they were not visionary enough! Still, they went a lot further than the great majority of urban land use plans in assigning areas for expansion that were many multiples of their spatial extent at the time. Why there are not many more examples like New York and Barcelona remains a quandary.

There are some 4000 cities with populations of 100,000 or more in the world today, and two-thirds of them are in developing countries.[6] Few, if any, appear to be making even *minimal* preparations to accommodate their projected population growth. While there are many reasons for neglecting to make such preparations and many objections to actively pursuing them, none of them withstand close scrutiny. Abstaining from preparing for urban expansion in countries that are still undergoing rapid urbanization in the full knowledge that it is about to take place is inexcusable, imposing great economic and environmental costs on societies that can ill afford them.

> The mistakes of the past stare us all in the face. They need not be repeated. Humanity has indeed been given a second chance: we now need to build new urban areas yet again that are at least equivalent in size to the cities that we have already built, we need to do it better, and we need to do it in a very short time (Angel et al., 2005, p. 102).

The failure of zoning to protect open space in developing-country cities

Consider the following example: The planning authority of San Salvador (OPAMSS) published a land use plan in the late 1990s designating various zones as 'urban', 'agricultural', 'rural 1' and 'rural 2', 'maximum protection', and 'unsafe to build' (see *Figure 3*).

Table 1 provides estimates of the built-up area in each one of the planning zones in the map shown in *Figure 3* in two time periods, 1999 and 2001. The expansion of the built-up area of the city in areas designated 'agricultural', 'maximum protection', and 'unsafe to build' was *more than triple* the expansion in areas designated 'urban'. Clearly, the zoning map was not binding and was largely ignored by formal developers, by informal developers, and by municipal officials charged with the enforcement of land use regulations.

[6] Angel et al., 2005, Table II-1, p. 18.

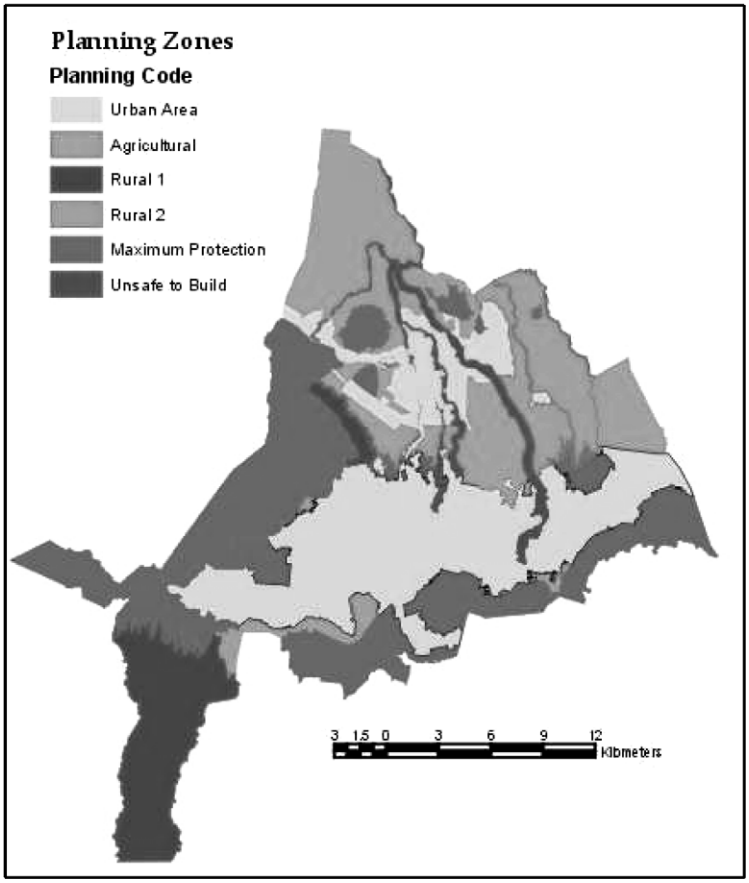

Figure 3 Planning zones in San Salvador, El Salvador, 1999. *Source*: Oficina de Planificacíon del Area Metropolitana de San Salvador (OPAMSS), 1999.

Table 1 Urban expansion by planning zone is San Salvador, 1999–2001

Planning zone	Built-up area 1999 (ha)	Built–up area 2001 (ha)	Change 1999–2001 (ha)	Change in built–up area 1999–2001 (%)
Urban	8632	8783	151	1.7
Agricultural	48	271	222	458.7
Rural (type 2)	74	92	18	23.8
Maximum protection	116	336	220	190.4
Unsafe to build	140	255	115	82.1

Source: Calculated by Sheppard from the classification of satellite imagery and the OPAMSS map in *Figure 3*.

In Guatemala City in 2000, to take another example, 30% of the population (some 750,000 people) lived in 150,000 illegally-built dwelling units constructed with good-quality materials on the steep slopes of the canyons intersecting the city. According to a US engineering study, only some 5% of these units were in serious danger of landslides and needed to be relocated (International Land Systems Inc., 1997). Still, the 2010 development plan for the metropolitan area recommended declaring *all* these settlements as areas of high risk and endangerment to their inhabitants, and transferring all their residents to dormitory communities outside the metropolitan area (Municipality of Guatemala, 1995, p. 64). In the process, it promised to increase the amount of land in the metropolitan area devoted to green areas, forests, and protected areas to 46.1% of the total: ''the existing canyons (*barrancos*) in the metropolitan area should be utilized as forested areas that will create the ecological green belt'' (Municipality of Guatemala, 1995, p. 9). It should come as no surprise that to-date the municipal land use plans have been dutifully ignored and no relocation has taken place.

Even in China, where the central government allocates strict conversion quotas to provinces and municipalities—quotas that severely restrict the amount of arable land that can be acquired by municipalities and converted to urban use—the land use regulatory system is beginning to show signs of failure. Informal direct transactions between villagers and developers on the periphery of Zhengzhou, for example, are already taking place and are likely to gather momentum in the future in light of the exorbitant prices of official 'urban' lands acquired by the municipality from villagers and auctioned to developers. Pragmatic county, municipal, and provincial governments have not been particularly diligent in preventing informal land transactions on the urban periphery from taking place. On a recent visit, the author witnessed several instances where developers bought or leased land directly from village communes, and the Director of the Zhengzhou Urban Planning Bureau estimated that

developers building on village agricultural lands—in the face of central government regulations strictly forbidding it—now provide up to 20% of new residential floor space.

Unfortunately, San Salvador, Guatemala City and Zhengzhou are not unique. In 2005, for example, the percentage of development without permits in developing-country cities in our global sample, 21.7 ± 7.1%, was found to be much higher than in industrialized-country cities, 1.4 ± 1.7%. The percentage of squatters in developing-country cities, 13.8 ± 4.5%, was also found to be much higher than in industrialized countries, 0.1 ± 0.0%. Both types of development clearly ignored municipal land use, land subdivision, and zoning regulations. We can safely assume that large segments of the urban population will continue to effectively ignore zoning regulations for years to come, and we must plan accordingly, not putting too much trust in the ability of municipal authorities to effectively regulate land use.

Generally speaking, the open space on the fringe of growing developing-country cities can never be protected from development in its entirety. The edge of the town keeps moving further and further away as areas that used to be fields, farms, and forests are built upon to accommodate the burgeoning population. The term *sprawl*, in its most basic and original sense and in much of the popular literature on the subject, refers to the vast and ''limitless'' extent of the large metropolitan areas of today. In this sense, it describes a major transformation of the landscape during the last two centuries. To quote Gottmann and Harper:

> Breaking out of the old bounds, walls, boulevards, or administrative limits which set it apart, the city has massively invaded the open country, though parts of the countryside may have kept their rural appearance. The growth in size of population has also meant a spectacular growth in area for the modern metropolis (Gottmann and Harper, 1990, p. 101).

Open space in the form of a green belt on the urban fringe cannot function as a wall that can contain a city bursting at the seams indefinitely. The greenbelts of London and elsewhere have not held back urban expansion. Even in exceptional cases, as in Seoul, Korea, for example, where construction was effectively prohibited inside the greenbelt for three decades, the city leapfrogged across it. Pressures from landowners and developers are now mounting, Korea's green belt policies are weakening, and there are good reasons to expect that only parts of Seoul's green belt will be kept green in the years to come.

In short, the regulatory regime, as we observed earlier, cannot be relied upon to prevent the conversion of fringe open space from agricultural to urban use, and there is no good reason to require it to do so. In preparing for urban expansion, we should not seek to place barriers in its way so as to contain it, nor should we insist that expansion be strictly contiguous, encroaching as little as possible into farmland on the urban fringe.[7] Evidence from the global sample of cities suggests (1) that the built-up areas of cities are becoming fuller over time as the amount of fragmented open space they encompass declines; and (2) that the share of scattered development on the urban fringe is in decline as well. The findings are reported on in summary form below.

We defined *fullness* as the percentage of the area of a 1-km^2 circle about any built-up pixel in a given urban area that is built-up. Given this definition, we can say with 99% confidence that the average fullness in our global sample of 120 cities—both in industrialized and in developing countries—increased by as much as 5.7 ± 1.7% between 1990 and 2000, from 52.1% to 57.8%. On average, in other words, cities lost 5.7% of their internal open space during that decade.

We defined *scattered development* as consisting of patches of built-up pixels, where more than 70% of the area of a 1-km^2 circle surrounding each pixel was open space. We can say with 99% confidence that the share of scattered development as a percentage of the built-up area in our sample of 120 cities declined by 4.5 ± 1.7% between 1990 and 2000, from 21.6% to 17.1%. Both these findings confirm Peiser's contention (Peiser, 1989) that leapfrogging or scattered development on the urban fringe is a temporary phenomenon and that eventually cities become fuller as more and more vacant lands are built upon. In 2000, for example, there was almost no open space left within the vast built-up area of 1,550 km^2 of Saõ Paulo, Brazil (see *Figure 4*).

The anecdotal evidence presented here suggests that zoning and its enforcement cannot be relied upon as effective tools for guiding urban expansion in many, if not most, developing-country cities at the present time. Neither open space nor lands needed for public utilities can be set aside and protected from development—whether by the formal or the informal sector—simply by drawing land use maps and giving them official status. The day-to-day enforcement system governing land use is simply not reliable enough, and the fact that the levels of corruption in developing-country cities (6.6 ± 0.3 on a score of 10 in 2007)[8] are much higher than the corresponding ones in industrialized-country cities (2.1 ± 0.8) makes it even less reliable.

The failure to protect open space in and around cities stems, at least in part, from the confusion between open spaces destined for permanent use as green spaces and vacant land that is kept temporarily off the market with the expectation on the part of its owners that sooner or later it could be built upon. The two may *look* the same but are not the same at all. To keep open space *in permanent use* as green space we must remove all incentives to develop it by transforming it into a nature conservancy in public or civic ownership, for example, and then protecting it actively from encroachment by unscrupulous developers, as well as from invasion by squatters. Open spaces designated for permanent use must therefore be well-defined,

[7] Insistence on strict contiguity restricts the supply of land and allows owners of land in close proximity to built-up areas to reap exorbitant profits from the sale of their lands.

[8] Calculated from Transparency International, *Corruption Perceptions Index – 2007*, online on 13 February 2008 at www.transparency.com/policy_research/surveys_indices/cpi/2007. A score of 10 indicates maximum corruption.

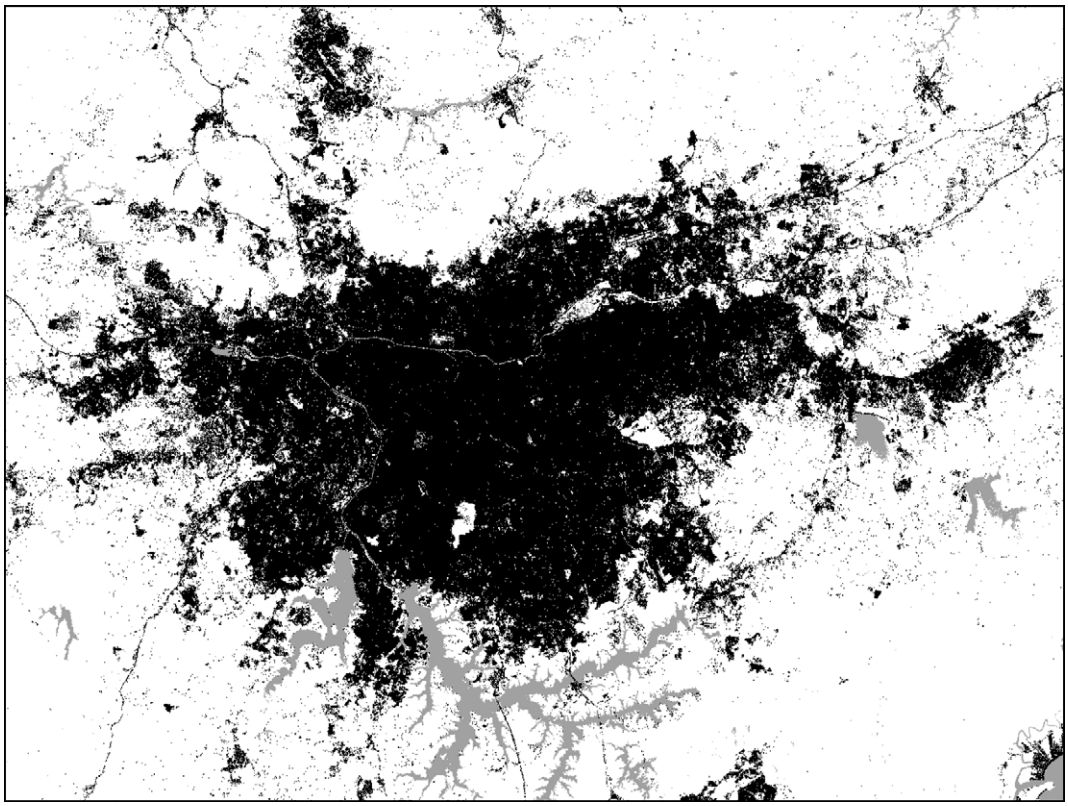

Figure 4 The built-up area of Saõ Paulo, Brazil, 2000 showing the absence of internal open space. *Source*: Angel et al. (2005), City Data Sheets.

properly circumscribed, marked with the attributes of open spaces that are in active public use, fenced off, and even guarded day and night if necessary.

Preparation for urban expansion should, therefore, entail the creation of an open space acquisition program, jointly led by the public and civic sectors. Such a program would seek to acquire—be it outright or through the acquisition of development rights—well-circumscribed open spaces of varying sizes across the entire urban area. Realistically, these open spaces, including both sensitive natural habitats and a system of nature parks and playgrounds that are within walking distance of every home, must be acquired in advance of development. Surely, such a program can only be undertaken early on, when land prices on the urban fringe are low and open land is plentiful. In this sense, it must form one of the essential components of a minimal strategy for preparing for urban expansion.

The failure to allocate adequate rights-of-way for arterial roads

Given that land for open space and public utilities cannot be kept from being built upon simply by regulatory fiat, it has to be obtained by other means. Municipalities in all developing-country cities have a ready legal instrument that can be employed to set aside land for public use, especially for roads and public utilities: *eminent domain*, the expropriation of private property for public use with or without the owner's consent, and typically with the payment of appropriate (market-value or near-market-value) compensation. In some countries, there are laws that mandate that when a plot is subdivided for urban use, a certain percentage share of the plot—in some cases up to 40%—must be transferred to the municipality free of charge for public use. We can then ask: Are there enough *arterial roads*, municipal roads that carry public transport and trunk infrastructure and connect the city together? More specifically, if arterial roads were to be the main roads that carry public transport, are the built-up areas of cities within walking distance of arterial roads? From the perspective of preparing for urban expansion, we should also ask: Are sufficient lands[9] being acquired through eminent domain in developing-country cities for arterial roads in advance of development? Again, we cannot provide reliable statistics to answer these questions at the present time, and the reader is asked to wait until the research on these questions is complete.

In theory, it is not difficult to understand why arterial roads are generally in short supply. The road network in every country typically forms a three-tier hierarchy of primary, secondary, and tertiary roads. At the national level, central or state governments usually plan, finance, construct, and maintain the *primary* inter-city road network. Municipalities typically plan, finance, construct, and main-

[9] The emphasis in this essay is on land for arterial roads, not on the quality of the roads themselves. There is no suggestion that roads need to remain as dirt roads, but we do need to consider that the implicit preference of engineers and transport departments for the construction of complete, fully-paved roads, with sidewalks, drainage, signage, and lighting also works to reduce the total amount of land acquired for roads and eventually the total available quantity or density of arterial roads.

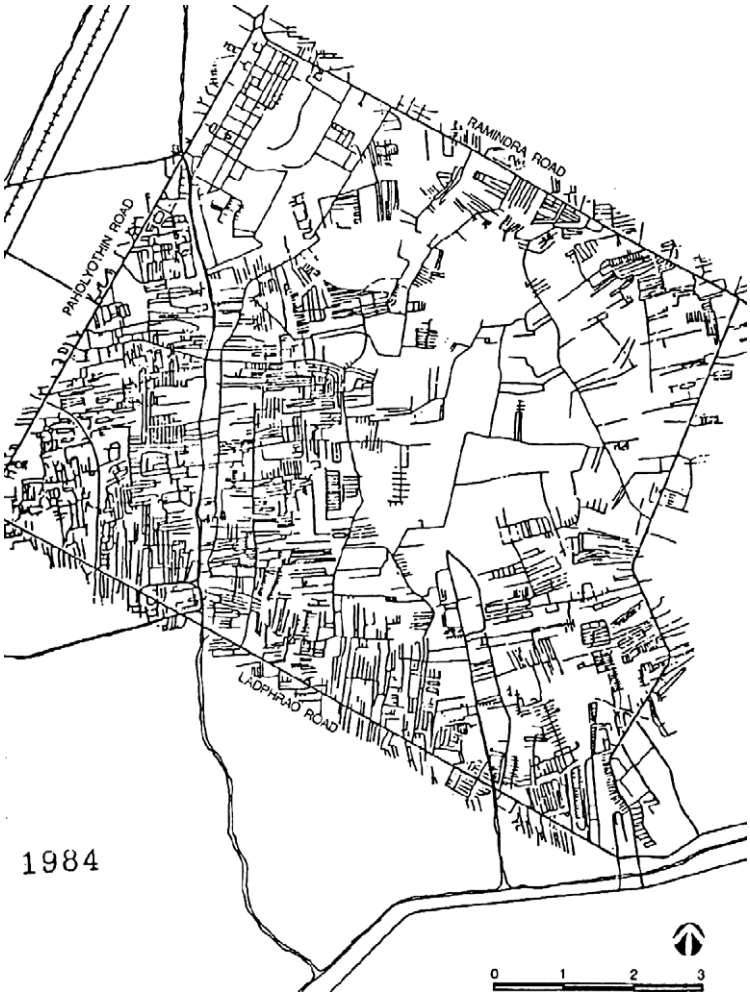

Figure 5 The absence of arterial roads in Bangkok, 1984. *Source*: Dowall (1987) Map 4–13, 1.65.

tain the arterial or *secondary* road network within their jurisdictions.[10] Private developers of residential neighborhoods or of commercial and industrial projects typically plan, finance, and construct the *tertiary* roads that serve each and every building within their projects.

Primary inter-city roads are an important national priority: They are critical for national economic development, national defense, and national political integration. They are therefore paid for by the central government and part of their cost may be recovered from tolls. The cost of tertiary roads that provide access to individual properties is normally included in the price of these properties and is typically recovered when the land is sold to its future occupants. In stark contrast, municipalities typically provide secondary roads free of charge and their cost cannot be recovered from tolls or from land sales. Secondary roads are classic *public goods*[11] and they need to be financed by municipal budgets. Given the strained budgets of developing-country municipalities and their limited ability to borrow funds, it is no wonder that the arterial road network in urban areas is typically under-supplied. The undersupply of arterial roads has serious consequences as the case of Bangkok demonstrates.

The hands-off, laissez-faire approach to urban development that characterizes Bangkok, the capital of Thailand, illustrates how the absence of minimal proactive planning for arterial roads creates large efficiency losses and stymies organized expansion. In Bangkok, local 'village' headmen—the lowest-tier Interior Ministry officials—determine the location of roads with no input from municipal planners. Typically, landowners ask a headman to negotiate access to his or her land parcel from a lane already connected to a main road. The headman then approaches pairs of landowners with adjacent parcels closer to that lane and asks them to donate (or part with, for some payment) a 3-m-wide strip along the edge of their land for a 6-m-wide lane. If some refuse, he approaches others, until he manages to connect the parcel in question to a lane connected to the main road. The process is swift and efficient, and village headmen have been known to negotiate for an entire kilometer of road in 6 weeks.

[10] The right-of-way of this road network also carries trunk infrastructure services—water mains, sewers and storm drains, and cable and telephone networks.

[11] In economics, a public good is defined as a good that people cannot be effectively excluded from consuming, and, as a result, cannot be effectively priced.

Figure 6 Traffic congestion on arterial roads in Bangkok.

This process of road construction creates a chaotic pattern of lanes that lacks the necessary arterial infrastructure that cities require to function properly. *Figure 5* shows the pattern of lanes in a 60 km^2 area of a northeastern inner suburb of Bangkok that was developed during the 1960s and 1970s. This example underscores one of the drawbacks of laissez-faire development: the arterial roads are spaced some 8 km (5 miles) apart. Congestion is increased as the longer intra-city trips are crowded into a small number of main roads.

Not surprisingly, Bangkok is one of the most congested cities in the world (see *Figure 6*).[12] Informal transit operators have to meander through side streets to carry passengers to the main roads, resulting in longer travel times. Increased congestion on arterial roads results in increased air pollution, increased energy use, and decreased labor productivity.

The absence of adequate networks of arterial roads in developing-country cities has serious consequences for the efficiency, equity, and sustainability of these cities, consequences that will be discussed in greater detail in the following section of this essay.

An arterial grid of dirt roads

It is not especially difficult to project the population of a given metropolitan area to 2020 or 2030, for example, and to estimate—within a reasonable margin of error—the amount and the location of lands that will be needed to accommodate urban expansion. Once this projection is made, the administrative boundaries of this metropolitan area (or the cities comprising it) need to be enlarged to encompass the expected expansion, while designating and acquiring green conservancies that need to be aggressively protected from urban encroachment.

The limited length of this essay does not allow for further elaborating on these two essential elements of a minimal urban expansion strategy. Assuming that the various objections to expansion can be overcome, that the obstacles to putting a new urban boundary into place can be surmounted, and that designated green areas can be effectively protected from urban encroachment, a question arises: what needs to be done, *at the very minimum*, to prepare new lands for urban use? The answer to this question in poor developing-countries is straight forward: securing the rights-of-way for an entire arterial road and infrastructure grid within these new administrative boundaries, and securing it now.

What is an *arterial* grid? The arterial grid pertains only to the network of *major arterial roads*—the urban roads that typically carry intra-urban traffic, public transport, and trunk infrastructure. The main difference between an arterial grid and the local street grid can be clearly seen by examining the section of the Detroit map shown in *Figure 7*. In Detroit, the arterial grid encompasses 1.6 km-wide urban *superblocks*, and within those superblocks there are local streets that can be arranged in various ways to provide access to all plots.

To accommodate urban expansion, an arterial grid on the urban fringe must have five essential properties:

Total coverage: The grid must cover the entire area designated for expansion in the next 20–30 years and not just a segment of that area;

[12] Of 53 cities surveyed in 1990, for example, the average travel time to work in Bangkok was the second longest found—more than 90 min (Angel, 2000, Table A13, p. 360).

Figure 7 The Detroit arterial grid. *Source*: Google, online at maps.google.com.

Connectivity: The arterial grid should be a mesh of long, continuous roads that crisscross the expansion area and connect it to the existing road network;
One kilometer spacing: To ensure that public transportation is within a 10-min walk, these roads should be spaced no more than 1 km apart;
Wide right-of-way: The width of the roads should be of the order of 20–30 m, so that they can have designated bus lanes, bike paths, a median, and several lanes to carry intra-city traffic; and
Progressive improvement: Initially, only rights-of-way for the grid should be acquired by municipal authorities; selected segments should then be improved over the years but only as demand requires and as budgets become available.

In an attempt to prepare their cities for accommodating their expected population growth, municipal officials from seven intermediate cities in Ecuador recently proposed different types of arterial grids in the expansion areas. These cities are currently making basic preparations for their projected expansion. They are: Eloy Alfaro Durán, a rapidly-growing outer suburb of Guayaquil, the largest city in Ecuador; Machala, an agricultural exporting center on the Pacific coast; Manta, a port city on the coast; Milagro, an agricultural center about an hour east of Guayaquil; Santo Domingo de los Colorados, a transport hub in the center of the country; Sangolqui, an outer suburb of Quito, the capital of Ecuador; and Riobamba, a provincial center on the Andean plateau. To help these seven cities prepare for expansion, the World Bank and the Cities Alliance helped organize a 2006 workshop in Quito. This workshop assembled officials from these cities, as well as international experts (including the author), to discuss the legal, financial, planning, and governmental actions required to prepare them for expansion. The workshop culminated in a day of design work, during which municipal officials sketched arterial grid schemes for their cities. Four of these are shown in *Figure 8*.[13]

As *Figure 8* demonstrates, the arterial road network need not follow a strictly geometrical north–south–east–west grid, like the Detroit grid. The plan for the city of Machala (top left) follows such a strict geometric grid. The plan for Milagro (top right) is a series of radial and circumferential roads. The plan for Eloy Alfaro Durán (bottom left) is a modified grid, designed to connect to existing primary roads. And the plan for Rio Bamba (bottom right) is based on the widening and streamlining of existing rural roads, and thus on minimizing new land acquisition.

An early introduction of an arterial grid into expansion areas would help attain five important objectives:

An anti-poverty objective: Ensuring an adequate supply of land so that housing remains affordable;
A planning objective: Laying the foundations for an effective city planning regime;
A transport objective: Introducing a basic network of arterial roads that carry public transport into expansion areas;
An environmental objective: Encouraging urbanization and improving the distribution of infrastructure services in newly-urbanizing areas; and
A financial objective: Substantially reducing the cost of putting the arterial grid in place through advance land acquisition.

These objectives are complementary and mutually reinforcing. Indeed, the arterial road strategy addresses a simultaneity of challenges that could be met in a synergistic manner, bringing together a broad coalition of interested parties to solve a set of problems that would be difficult to solve individually. In the following sections, we discuss these objectives one by one.

The anti-poverty objective

In an important sense, the proposed introduction of the arterial grid in expansion areas is the missing element in many of the current housing strategies in developing countries. An effective housing strategy must, of necessity, be a two-pronged strategy, with one prong focusing on the improvement of the existing stock and the other on enabling the effective production of new stock. While a number of countries have embarked on upgrading programs in slums and squatter settlements that operate at a significant scale, virtually no effective strategies have been developed for enabling sufficient quantities of new affordable housing to come into being.

It has been argued elsewhere (e.g. Angel et al., 1983) that to solve the housing problem of the urban poor we must solve their land problem and then let them solve

[13] Since that time, more developed plans and cost estimates were prepared in each city by local officials.

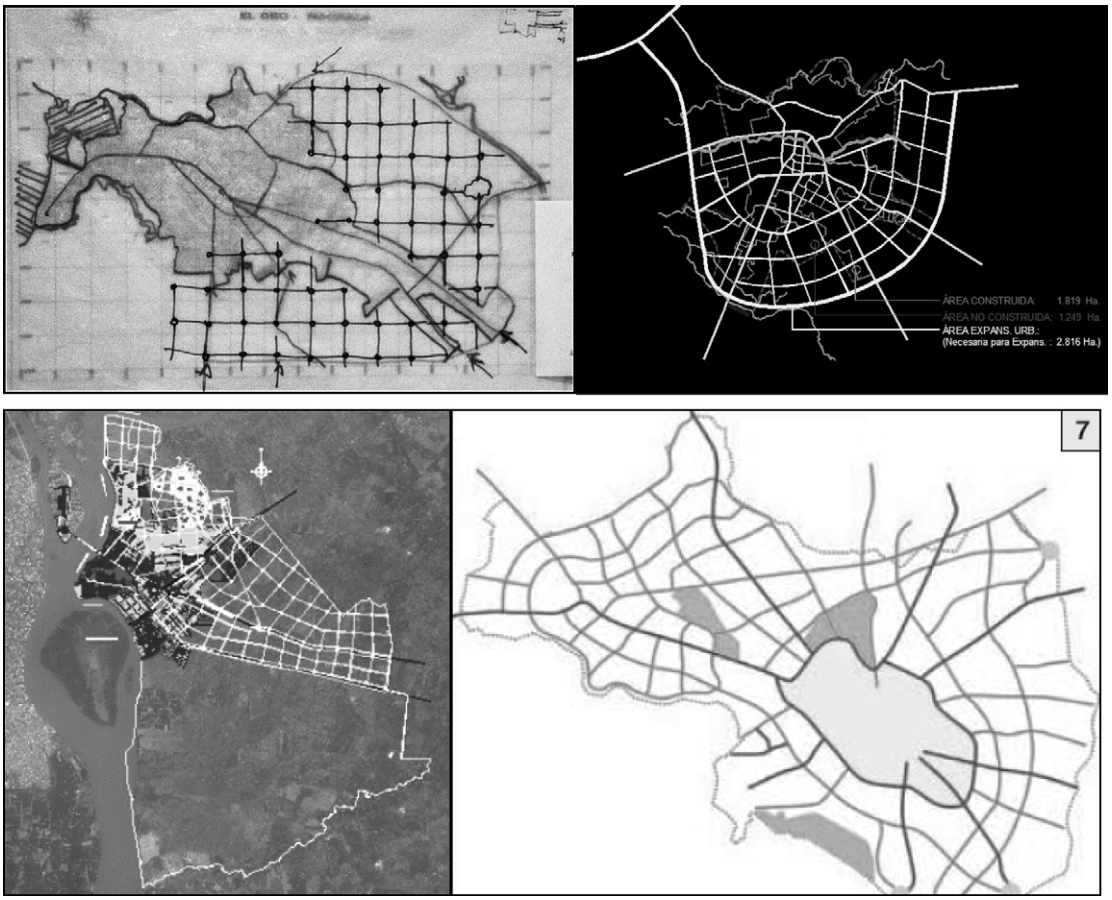

Figure 8 Preliminary sketch plans for arterial grids in four intermediate cities in Ecuador, 2006. *Source*: prepared by municipal officials from the planning, cadastre, legal, and finance departments of Machala, Milagro, Eloy Alfaro Durán and Rio Bamba during a project workshop sponsored by the World Bank, Quito, 16–20 December, 2006.

their housing problem themselves. A key enabling strategy for the creation of affordable housing in developing-country cities is the one that makes available *land* on which people can progressively build their homes, and where services can gradually be provided. Indeed, where land markets and public policies have allowed the poor access to a plot of land, the poor have built millions of homes that are now worth many billions. In contrast, in places where land markets were choked or the regulatory environment proved too strict, the poor have been overcrowded or pushed into leftover lands, only to build homes and neighborhoods that are not really sustainable.

In essence, the proposed arterial grid is meant to open up sufficiently large areas for urban expansion, so as to ensure that the land supply is not constricted, and that large numbers of residential plots remain affordable. In contrast to earlier housing strategies that focused on the provision of a limited supply of *individual* plots—commonly referred to as 'sites-and-services' strategies—the proposed strategy aims at providing a large number of *superblocks* that can then be subdivided by formal and informal developers into individual plots.

There is now considerable evidence that restricting the amount of land for residential development has had a detrimental effect on housing affordability. A recent study of residential land markets in 159 cities concluded that ''[w]here there are significant constraints on the supply of land for residential development, housing cost inflation has occurred. Where there are no such constraints, housing cost inflation has not occurred'' (Demographia, 2007, pp. 3–4). Choking residential land supply either through planning restrictions or through infrastructure shortages is particularly detrimental in cities that are still growing rapidly.

To ensure that residential land remains affordable, it is of paramount importance to bring the *entire* arterial road network into being at the present time. If only a portion of the rural periphery is converted to urban use and a full complement of infrastructure services is introduced there,[14] land prices increase dramatically, rendering it out of reach for the urban poor. Only a comprehensive approach to the land supply issue can keep land prices in metropolitan areas everywhere from rising steeply, especially in growing areas where there is strong demand for land.

[14] In a public-private land development partnership or in a land pooling and readjustment scheme, for example. For an explanation of land pooling and readjustment, see Larsson (1993).

The planning objective

In poor developing countries, as we saw earlier, simply designating peripheral lands for urban expansion and fixing their zoning and permitted use on official maps cannot be expected to ensure that development proceeds according to the plan. New construction typically circumvents or ignores zoning and land use regulations.

By and large, planning departments in developing-country municipalities are not engaged in *planning* the city, because both their regulatory and financial powers are inadequate for that task. Without the proper resources, they can do little to prepare their cities for the future. Urban infrastructure plans and investments in these cities typically follow rather than guide urban development, as developers pressure municipalities to extend infrastructure services in piecemeal fashion to areas that *they* have chosen for settlement, often in blatant disregard of municipal plans. The arterial road grid would function as a basic framework for planning the city. Participatory planning would be considerably more effective if it focused on an individual superblock rather than on the metropolitan area as a whole. By locating the grid now, municipalities can actively shape future growth. They will then be ahead of developers, leading them into new development areas rather than following them.

The arterial grid plan simply assumes that, no matter how the city develops, it will need an underlying network of arterial roads to carry its traffic and trunk infrastructure. Unlike a typical master plan, it does not designate land uses or densities, nor does it recommend strategies for the economic, social, or cultural development of the city. Its planning and implementation does not, therefore, require great expertise or brilliant ingenuity. In most cases, it can be undertaken by municipal planners without outside help.

The transport objective

For an arterial grid to function as the road network for a public transport system three conditions must hold: first, residential densities must be sufficiently high to sustain public transport. Second, the roads need to be spaced not more than 1-km apart, so that the great majority of people can walk to a bus stop from any location in less than 10 min; and third, the width of the rights-of-way for the roads needs to be of the order of 20–30 m.

As Bertaud notes, paraphrasing (Holtzclaw, 1994), ''there exists a density threshold around 30 people per hectare (p/ha) for intermediary bus service, 35 p/ha for light rail, and 50 p/ha for metro'' (Bertaud, 2002, p. 9). And as we saw earlier, average densities in developing-country cities were in excess of 80 persons per hectare in 2000, and are likely to remain above the necessary threshold for sustaining public transit for years to come. The first condition is, therefore, likely to be satisfied in large areas of most developing-country cities, and especially in poor areas where density is typically higher than average.

The width of the right-of-way to be acquired for the roads in the arterial network should be of the order of 20–30 m. The minimal width of an arterial corridor that will carry four lanes of two-way traffic, two designated bus lanes, two bicycle lanes, two sidewalks and a median was calculated to be 26.60 m.[15] That said, the width of the roads should not exceed a certain threshold—probably in the lower range of the width proposed here, if they are to function as commercial thoroughfares. Successful commercial streets need heavy pedestrian traffic to move freely across the street. A study of *great streets* in industrialized countries suggests that their width varies from 24 to 70 m (see *Table 2*).

Table 2 The width of *great streets* in industrialized countries

Arterial Road/Boulevard	City	Country	Width (m)
Castro Street	Mountainview, CA	USA	24
Banhof Strasse	Zurich	Switzerland	25
Via Cola de Rienzo	Rome	Italy	25
Regent Street	London	England	25
Princes Street	Edinburgh	Scotland	29
Boulevard Saint-Michel	Paris	France	30
Rambla de Catalunya	Barcelona	Spain	30
Fifth Avenue	New York, NY	USA	31
Market Street	San Francisco, CA	USA	37
Avenue Montaigne	Paris	France	38
Monument Avenue	Richmond, VA	USA	40
Cours Mirabeau	Aix de Provence	France	46
Viale de Terme di Caracalla	Rome	Italy	46
Korfurstendam	Berlin	Germany	47
Ringstrasse	Vienna	Austria	57
Champs Elyssé	Paris	France	70

Source: Calculated from Jacobs (1993).

To create the desired impact of the proposed arterial grid on the urban land market, the entire network should be *initiated* now, and individual road segments would be improved to higher standards as demand for travel along them increases. This strategy minimizes the risk of land speculation that typically occurs when only a few fully-paved roads are put in place, as well as the risk of paving roads at the wrong time and in the wrong places.

Readers should note that, while the absence of an arterial grid may prevent the introduction of an effective public transport system that extends far into the urban fringe, putting in place an arterial road grid is not a guarantee, in and of itself, that the grid would be used effectively to carry public transport. Unless strong and enduring political alliances in cities take effective steps to introduce and strengthen public transport alternatives to individual automobile travel, the appropriation of the arterial grid by cars and trucks—to the exclusion of busses, bicycles, or other environmentally-friendly forms of transport—should come as no surprise.

[15] Preliminary estimates by an international consultant to the Ecuador project, Professor Ralph Gakenheimer of MIT, in private communication to the author, 15 February 2007. Six 3.0 m-wide lanes, two 1.6 m-wide sidewalks, two 1.2 m-wide bicycle lanes, and one 3.0 m-wide median add up to 26.6 m.

The environmental objective

A key environmental strategy common to industrialized countries has been challenged in this essay: the active preservation of rural lands on the periphery of cities through the application of urban containment policies of one kind or another: green belts, compact cities policies, and various other anti-sprawl restrictions. There is good evidence to suggest that urban containment policies, such as London's or Seoul's green belts, are not able to contain urban expansion, and that new urban development in rapidly-growing cities simply leapfrogs across them. While strict containment policies may sometimes lead to increased densities, this is by no means always the case: Even Portland's urban growth boundary is *not* leading to denser urban development there. It is more likely that containment policies lead to inflated land prices and to unaffordable housing. More important is the fact that densities in developing-country cities are typically high enough to sustain public transport and are likely to remain so in the years to come. Surely, opening up new areas for urban expansion will initially increase leapfrog development and scattered development, but these will only be temporary in nature and the remaining open spaces between them are most likely to fill in soon enough.

Making active preparations for urban expansion through an arterial grid network that vastly increases the spatial extent of urban areas at realistic densities is an inherently pro-urban strategy. It suggests that there are economic, social, political, cultural, and *environmental* advantages to concentrating people in cities and it encourages and supports urbanization and urban concentration rather than resisting it. From an environmental perspective, there is no question that cities—because of their high densities—reduce the overall human footprint on the global ecosystem; that wilderness areas and rainforests are threatened by agricultural expansion into them, not by urban expansion; and that it is the urban population that does most to protect and save endangered habitats and endangered species worldwide.

In the previous section, it was already noted that the arterial grid is an essential element of an effective public transport system, one of the most important elements in any urban strategy that aims to reduce our carbon footprint. To the extent that a good public transport system can reduce our future reliance on private automobile travel in the cities of the future, the arterial grid provides an essential building block in meeting that important goal.

The arterial road grid is designed to provide for an efficient and equitable distribution system for the basic water supply and sewerage trunk infrastructure. The provision of these basic environmental amenities on an arterial grid makes it possible to plan them more effectively, to organize them in a transparent hierarchy so that priorities can be readily assessed, to operate and maintain them more efficiently, and to focus on the provision of these key environmental amenities at the urban level rather than concentrating on services in a limited number of preferred communities.

The organization of the urban periphery in a set of superblocks will increase the chances that environmental justice concerns will be adequately addressed. With the superblock system created by the arterial road network, it becomes possible to demand and ensure that each and every superblock contains an adequate amount of public open space; that environmentally-unfriendly facilities are evenly distributed; and that human-scale communities and neighborhoods have a say in the planning, designing and making of their physical environment.

Finally, to the extent that location within the planned superblocks with access to arterial roads is perceived of as an advantage by formal and informal developers alike, the arterial grid will provide planners with an effective tool for directing urban development away from low-lying areas that will be vulnerable to future flooding as sea levels rise, or away from sensitive natural habitats that are likely to be encroached upon otherwise. This will be particularly important in cities where the regulatory regime by itself is incapable of preventing the conversion of rural peripheral lands to urban use.

The financial objective

Budget constraints typically prevent putting in place a completed arterial road network—a system of well-paved, well-drained, and well lit and signed roads—in advance of development. That said, developing-country cities can *acquire the land* needed for such a network now.

What does initiating the advance acquisition of the arterial road network now mean in practice? There is no global ready-made answer to that question. It is possible to answer it, however, in the case of the seven intermediate cities in Ecuador that are currently engaged in preparing for urban expansion. Ecuador's Municipal Law provides two important legal tools that enable municipalities to acquire land for roads and other public uses *without compensation*. One is a regulation that allows municipalities to obtain for public use up to 35% of any land being urbanized at no cost, once landowners decide to develop their land (Government of Ecuador, 2004, Art. 237.3.b).

Municipalities can determine in advance which specific areas of a given parcel they will need in the future, and require landlords to mark these areas on their land titles. The advance marking of areas for future public use[16] is, in essence, a lien on the property title. The land only reverts to public use once the owner decides to develop it. No one can develop the land ignoring that lien or, for that matter, sell the land (Bossano, 2006, 20). The second legal tool is a regulation allowing the municipality to obtain up to 10% of the area of any land parcel, free of charge, for use as right-of-way for public works.[17] Different legal tools for acquiring road right-of-way, both with and without compensation, are available in different countries.

After considerable debate and discussion during the Quito workshop mentioned earlier, it was agreed that forced expropriation of lands for arterial roads, even with compensation at market prices, was to be avoided. It was also agreed that 1-ha areas will be acquired for all intersections through negotiation or marked as liens on prop-

[16] Referred to in Spanish as *afectacíon*.
[17] This is referred to as a servitude (*servidumbre*) in Government of Ecuador, 2004, Art. 238.

erty titles, and that 3-m-wide strips along both edges of each road will be obtained, typically free of charge in large land parcels and at market value in smaller ones.[18]

Initiating the establishment of the arterial road network in the intermediate cities in Ecuador will now involve the following six stages: (a) planning the network and its approval by the city council; (b) an engineering survey of the actual location of the road network and its approval by the council; (c) marking the designated rights-of-way as *liens*—restrictions on future use or sale—on the title deeds of all properties that are to be dissected by arterial roads; (d) market-value acquisition of 1-ha areas of all (or most) the intersections of the arterial grid; (e) acquisition and transfer of all easements by the municipality; and (f) bulldozing of 3-m-wide paths on both sides of the arterial road right-of-way. These narrow paths will then serve both as signs to deter potential developers and as a means of patrolling the roads to ensure that no illegal developments take place there.

What will be the cost of the proposed advance acquisition of the intersection areas and the easements for the narrow paths in a typical intermediate city in Ecuador participating in the project? Six of the seven cities (with the exception of Riobamba) have large *haciendas* or banana plantations on the urban periphery that are many hectares in size. The average size of rural properties is 5.6 ha and the average size of small rural properties is 2.7 ha. In the rural areas surrounding Eloy Alfaro Durán, for example, the average size of rural properties is 12.7 ha.[19]

In mid-2006, the price of 1 ha of agricultural land on the rural periphery of the cities studied ranged from $4000 per hectare in Milagro and $10,000 per hectare in Sangolqui, with a weighted average of $6000 per hectare. Subdivided land cost almost 10 *times* as much. The median price for the land needed for the intersections may be of the order of $15,000 per hectare. The cost of the outright purchase of 1-ha plots for, say, 100 intersections may thus be of the order of $1.5 million, but many of these areas need not be purchased outright since municipal law permits the government to register liens on the relevant titles. In short, the costs involved in bringing this project to fruition in Ecuador are miniscule in comparison to its projected benefits. The time involved is certainly within a single term of elected mayors and city councils.

The road ahead

This essay takes it as given that the rate and the extent of urban expansion that can be expected in the coming decades, like the process of urbanization itself, will be impossible to control; that it will be useless to try to prevent people who are free to move anywhere within their national boundaries from locating in the cities they choose; and that it will be very difficult and counter-productive to squeeze people into cities at densities that are above those necessary for the efficient use of public transport. Given these assumptions, the most sensible strategy is to accept urban expansion as all but inevitable, to calculate its projected magnitude, and to actively prepare for it in one way or another.

It should not be too difficult to project urban population growth as well as urban expansion. Projecting alternative urban expansion scenarios, for individual cities and metropolitan areas, for countries and regions, and for the world, is now within our reach. These projections, at the city or metropolitan level, can assist municipalities in calculating the areas needed for accommodating growth, in establishing new city limits, and in acting to designate and protect specific green areas—the most basic strategies for preparing for urban expansion.

While this essay focused mainly on the arterial road strategy as a key tool for preparing for urban expansion, this strategy may not be a stand-alone one in some national contexts. In China, for example, arterial infrastructure provision may be less of a problem, but orderly urban expansion is constrained by quotas determined by the central government on the conversion of agricultural lands to urban use. These quotas often accelerate the destruction of affordable rental housing in villages within, or on the periphery of, metropolitan areas to make way for new development, because built-up villages are not considered to be part of the agricultural land quota. The quotas also lead to non-contiguous urban development and to agricultural land fragmentation. In China, the parallel existence of two planning regimes within metropolitan areas (one for municipal lands and one for communal, village lands), the non-existence of land markets on the urban periphery, and the preference for industrial land use as against residential land use in municipal plans further distort orderly urban expansion. In such a context, preparing cities for the coming urban expansion will likely involve more extensive institutional and political reforms.

In other countries, the multiplicity of municipal governments within metropolitan areas, jurisdictional disputes between different government agencies, unclear divisions of responsibility among different levels of government, bureaucratic cynicism and inertia, the undue influence of landowners and developers, resistance from farmer and conservation groups, opposition to further urban growth from established residents, municipalities tottering at the edge of bankruptcy, the persistence of day-to-day crises, and the lack of leadership, vision, and political support may all mitigate against making the essential minimal preparations for the inevitable expansion now facing the most developing-country cities.

We must not forget that the success of the 1811 New York grid discussed earlier was predicated, to an important extent, on the ability of the Commissioners to get the government of the State of New York to agree that their plan, once published, will become State law. In this

[18] It may not be necessary to acquire (or mark for future transfer) all the parcels for the entire grid immediately, but it is necessary to acquire or mark most of it, leaving individual parcels that present special difficulties for future acquisition. It is very clear to everyone that each and every parcel must eventually be acquired, and that any single parcel not acquired will greatly reducing the effectiveness of the entire arterial road network.

[19] Information obtained by the author in interviews with municipal officials in December 2005.

manner, they were able to overcome any and all resistance, both to its initial formulation and to its effective implementation. In today's more pluralistic institutional environment, where large numbers of interest groups vie for the control of urban development decisions, where the power to locate roads or acquire their rights-of-way may rest with numerous competing government agencies, and where plans are expected to offer a broad array of benefits to a broad array of interested parties to gain the necessary political support, implementing the proposed arterial grid strategy may be a tall order. President Theodore Roosevelt is rumored to have said: ''You convinced me. Now go out there and make me do it''. The fact that the arterial road strategy may be a good *idea* is no guarantee that it can be or will be implemented anywhere, unless those convinced of its merits can muster the political support needed to bring it into being.

This essay is written in the belief that in the difficult institutional and political context that the developing-country cities face today, the proposed arterial grid strategy may act as a rallying point for a new, proactive approach to planning and development in developing-country cities.

Pilot projects, like the one in Ecuador, will provide important lessons for other cities. Intermediate-size cities in Ecuador have already developed careful population projections, built-up area projections, and urbanized-area projections. Municipal officials in these cities, with the full support of their mayors and within the available legal framework, have made plans to expand their city limits, plan an arterial grid, and estimate the costs of advance land acquisition of grid intersections. They are now estimating the costs of engineering surveys of the arterial roads, preparing to mark them and to bulldoze strips of land along their edges. Each municipality needs to borrow some $2 million—either from the World Bank or from the State Bank—to implement this project, not a very large amount by any standards.

That said, the effective implementation of the arterial road strategy in Ecuador, given the progress made to-date, still faces numerous obstacles and may fail in the end. And even if it is successful, or even partially successful, its success may not mean that it can be implemented everywhere. Surely, Ecuador is by no means a *representative* developing country, and in many ways its demographic, economic, legal and institutional conditions are unique.

There are now calls for similar projects like that initiated in Ecuador in cities in other countries, and the broad dissemination of this essay and of other writings on preparing for urban expansion is likely to generate more and more such calls. We can only hope that in the years to come municipalities in numerous countries—with different demographic, economic, legal and institutional contexts—will implement successful urban expansion strategies, and that this will encourage more cities to follow suit. To make room for a planet of cities, a thousand cities will need to start making such preparations, and the sooner they start, the more efficient, equitable and sustainable their future prospects will be.

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