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Compact City Policies: Towards Low-Carbon Economic Development

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COMPACT CITY POLICIES:

TOWARDS LOW-CARBON ECONOMIC DEVELOPMENT

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1. OVERVIEW

1.1 Background: relevance of "Compact City"

1. This report, as the initial output of the OECD's "Compact City" policy project, illustrates why and how "Compact City" policies can help achieve urban green growth goals under growing concerns of climate change and economic uncertainty. In the first section in this chapter, we describe the background of our report. As we observe below, the idea of "Compact City" has clear relevance in the current urban context, and it is quite timely to re-examine this concept today in light of the need of green growth.

Trends in urban spatial development

2. The worldwide urbanisation process continues (Figure 1). By 2050, 70% of world population – and 86% for OECD countries – will live in urban areas (Kamal-Chaoui and Robert (eds.), 2009). The fact implies that most cities will have to find room to accommodate growing population, and that urban policies will be at the centre of attention of policymakers.

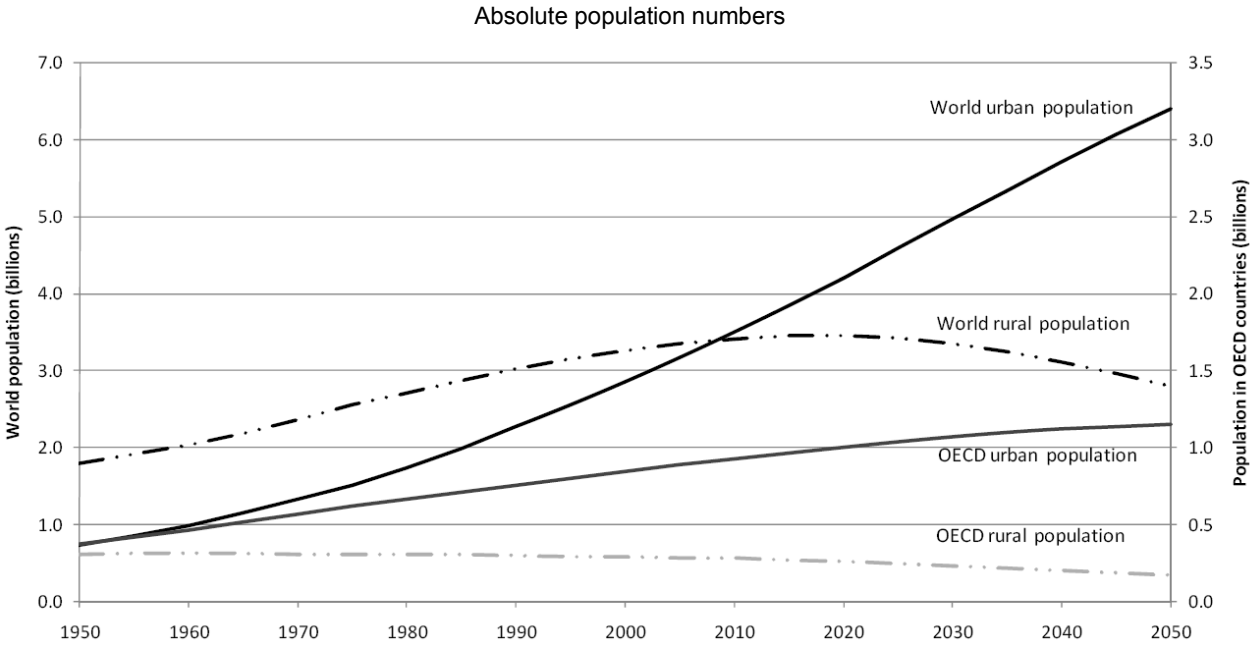
3. With the continuous trend of urbanisation, urban sprawl also continues. The current trend toward rapid expansion of urban areas, or "urban sprawl", can clearly be seen by the fact that urban land expansion has been faster than population growth (Figure 2). Urban areas expanded by 171% worldwide between 1950 and 2000, whereas world population grew by only 142%. In particular, the extent of urban areas in OECD countries increased by 104% while the population increased by only 66%. The significance of this trend is that, on average, each person consumes more space (OECD, 2008).

4. Changes in the average density of urban areas further highlight the current trend toward urban sprawl. An analysis of 90 cities around the world between 1990 and 2000 found decreases in average urban area density both in the developed countries and the developing countries (Angel *et al.*, 2005). Moreover, the rate of the average decrease in density of urban area was faster in the developed countries than in the developing countries, although the average density was already three times higher in developing countries (Table 1).

5. Urban sprawl is regarded as one of the major pressures on the urban environment. Sprawling cities consume larger amounts of arable land, require more transport, transport-related infrastructure, and more energy. This results in land use stress, fragmentation of natural habitats, increased greenhouse gas emissions, and long-term soil degradation (OECD, 2008). Both the continuous trend of urban sprawl and its recognised negative impacts underline an immediate need for effective spatial-development policies against urban sprawl.

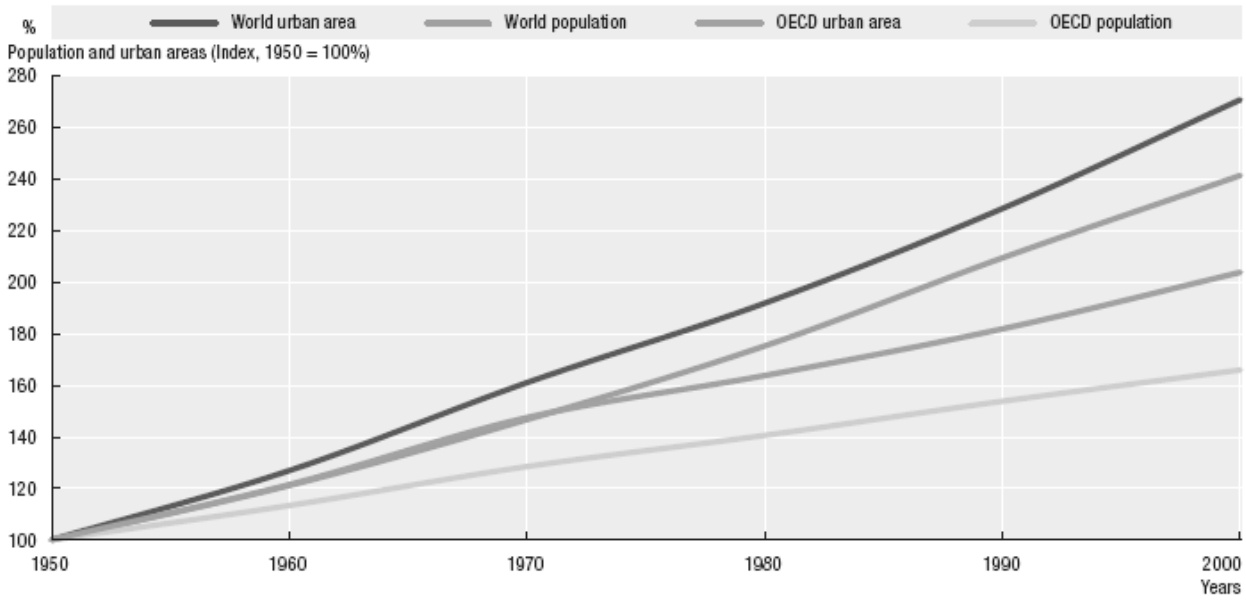
6. While most countries face such an urban expansion, some developed countries foresee a more complex picture, with a trend of rapid ageing, decreasing household size, and decreasing population.

Figure 1. Urban and Rural Population in the World and the OECD



Source: Own calculations based on data from the UN population Database (2009).

Figure 2. Incremental increases to population and urban areas, 1950 - 2000



Source: OECD (2008)

Table 1. Average density and built-up area per person, 1990 - 2000

Category	Average urban area density (person per km2)			Average built-up area per person (m2)		
	1990	2000	Annual % change	1990	2000	Annual % change
Developed countries	3545	2835	- 2.2%	280	355	2.3%
Developing countries	9560	8050	- 1.7%	105	125	1.7%

Source: Angel *et al*. (2005).

Growing concern over environment

Cities' role to play in climate change challenges

7. Climate change has become one of the most pressing issues of our new century. The OECD projects that, if we continue on the present trajectory, global GHG emissions will increase by more than 50% by mid-century, causing world temperatures to rise from 1.7 to 2.4 degrees Celsius (°C) above pre-industrial levels by 2050, and from 4 to 6 °C or more in the long-term (OECD, 2009a).

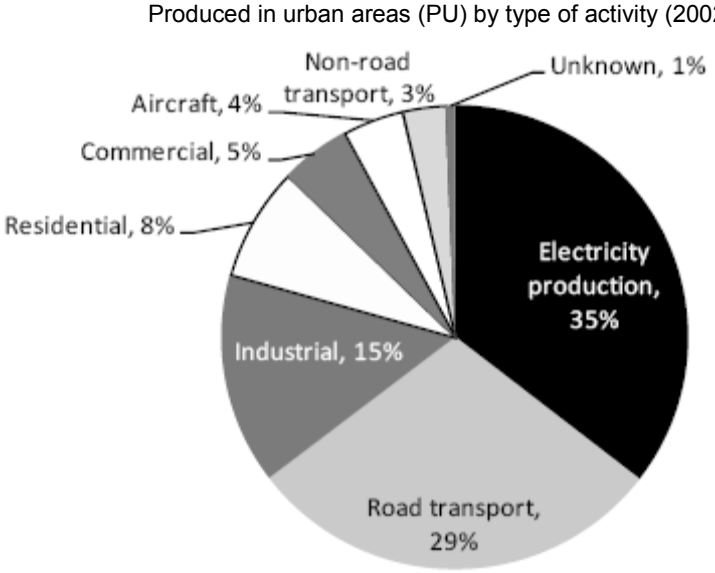
8. Cities are directly related to the climate change in two ways. First, they are major contributors to CO2 emissions. As key centres of economic activity and production, cities are the primary consumers of energy worldwide (OECD, 2006; OECD, 2008a), consuming an estimated 60-80% of the world's total energy output (IEA, 2008a), and accounting for a roughly equal share of global GHG emissions. All projections indicate that this trend will continue as urban populations grow, which illustrates that cities have a key role to play in addressing the challenge of climate change (Kamal-Chaoui and Robert (eds.), 2009). Second, urban population and infrastructure are vulnerable to climate change. Coastal cities are particularly exposed to rising sea levels and storm surges due to climate change (Kamal-Chaoui and Robert (eds.), 2009).

9. With respect to urban policies, they have natures that can contribute to addressing a global climate agenda. First, urban policies are concerned with most of the activities that influence climate change, including land use, transportation, buildings, and waste and water services. Second, urban policies can be taken in a holistic approach in seeking policy complementarities among and within different sectors that enhance each other's effectiveness. For example, land use policies that allow higher densities and greater mixing of residential and commercial uses can contribute to achieving transportation climate goals by reducing trip distances while strategic mass transit linkage can attract developments at strategic nodes and thus promote compact growth (Kamal-Chaoui and Robert (eds.), 2009).

10. Moreover, urban spatial policies can target considerable amounts of CO2 emissions in their scope. As is indicated in US cities data, CO2 emissions are chiefly driven by electricity production, road transportation, industrial activities and the use of energy in buildings (residential and commercial). Of these, emissions by road transportation (29%), by the use of energy in residential buildings (8%), and by the use of energy in commercial buildings (5%) – more than 40% in total – are closely linked with urban forms (Figure 3).

11. In sum, urban policies are highly expected to contribute to addressing a global climate agenda. In other words, no urban policies could be designed without taking climate change challenges into account.

Figure 3. Carbon Emissions in US Cities



Source : Kamal-Chaoui and Robert (eds.) (2009)

Environmental risks caused by urban sprawl

12. Urban sprawl takes place at the expense of agricultural land, forest, open space or wetland, with a concomitant loss in the economic, recreational and ecological values that those ecosystems provided (OECD, 2008). Land consumption by sprawled urban development has impacts not only within the built-up area but also for considerable distances around it in terms of how land surfaces are reshaped, with valleys and swamps being filled, large volumes of clay and rock being extracted, and sometimes rivers and streams re-channelled. This increases stress on ecosystems and species (OECD, 2008).

The uncertainty of urban economy

Need for sustainable economic growth

13. Since the recent economic crisis, grave concerns about the world economy casts a shadow on the future of urban economic growth. More and more citizens around the world have been feeling uncertainty of their future caused by the financial shock and ensuing economic difficulty, and many policy makers are seeking for more reliable ways to raise and support their levels of economy more sustainably.

14. On the other hand, the importance of cities' economy is increasing in a national economy in many developed countries, which means that raising the level of cities' economy leads to benefit not only the citizens of the cities but also all the rest of the nation.

Urban finance under constraints

15. The economic crisis had negative impacts not only on private economic activities but also on local governments' finances. In many countries, sub-central government deficits and debt levels are

expected to rise considerably due to a "scissors" effect: revenues fall as a consequence of the fall in activity, while spending soars due to the need for social welfare programmes (Blochlinger *et al*., 2010). There is a need to develop policies that can help improve current severe situation on urban economy in general as well as local public finances.

16. In addition, climate change puts additional pressure on city budgets. Local governments in OECD countries are already responsible for 70% of public investment and 50% of public spending in environment (Kamal-Chaoui and Robert (eds.), 2009). Cities will need additional revenue sources to finance new mass transit solutions, building retrofits and protections for the built environment.

17. Urban sprawl tends to cause population de-concentration in urban centres and generates brown-field sites – abandoned, vacant or under-used former industrial areas (Greenberg *et al.*, 2001; Savitch, 2003). Increasing brown-field generation can lead to insufficient use of established social infrastructures. Furthermore, the segregation of land uses associated with low density and spread-out urban development tends to result in a relatively high level of infrastructure construction – roads, water and sewer systems, schools and privately owned utility systems – that would not be necessary under more compact development (TRB, 2002). Under the fiscal constraint that most cities are facing, such inefficient investment would become a severe financial burden.

Green Growth: a way to pursue economic and environmental goals

18. Since June 2009, the OECD has been mandated to develop a Green Growth Strategy that defines green growth and the policy responses it offers (Box 1). In the "Interim Report of the Green Growth Strategy", just published in May 2010, green growth is seen as a way to pursue economic growth and development, while preventing environmental degradation, biodiversity loss and unsustainable natural resource use (OECD, 2010b). The report points out a clear link between environmental quality and economic growth, by stating that 'growing concerns about the environmental unsustainability of past economic growth patterns and increased awareness of a potential future climate crisis have made it clear that the environment and the economy can no longer be considered in isolation' (OECD, 2010b).

19. Cities have a key role to play in the new green growth model. When designed at the urban level, policies to reduce greenhouse gas emissions, resource use and waste are more effective and cost-efficient (OECD, 2010a). Complementarities between environmental and economic growth policies are stronger at the local level, where addressing the negative impacts of urban concentration (e.g. congestion, pollution) can both reduce environmental impacts and increase economic efficiency. Urban policies that reduce energy consumption can be applied without harming economic growth in the long-term, when innovation is taken into account (OECD, 2010a). Overall, green growth calls for well-designed urban policies that can pursue environmental and economic goals at the same time.

Box 1. Launching of the OECD Green Growth Strategy

In June 2009, Ministers of Economy, Finance, Trade and Foreign Affairs from 34 countries, including both OECD and non-OECD members, met at the OECD to adopt a Declaration on Green Growth. They agreed to develop frameworks for economic growth that would minimise environmental deterioration and enhance quality of life, and mandated the OECD to develop a Green Growth Strategy, which will be presented in June 2012.

The aim of the Strategy is to provide clear recommendations for how countries can achieve economic growth and development while at the same time moving towards a low-carbon economy, reducing pollution, minimising waste and inefficient use of natural resources and maintaining biodiversity. This entails developing specific tools and policy recommendations across a range of relevant areas from investment and taxes to innovation, trade and employment. The OECD Green Growth Strategy is being prepared through a multi-disciplinary inter-governmental process and is based on the work of the 25 OECD Committees engaged in its development. It will be a fundamental contribution from the OECD to support countries' transition to greener growth in the coming years.

Further information on the Green Growth Strategy is available at: www.oecd.org/greengrowth.

Source : OECD (2010a)

Re-emergence of "Compact City" policies

20. "Compact City" as a spatial development strategy has a long history (Annex 1). Policy attempts to limit urban sprawl and manage suburban growth started as far back as the 1930's, when the UK introduced the Green Belt in London (Department of Environment, 1995). In the 1960's, Jacobs argued the importance of cities with its vitality and mix of uses although she did not use the term "compact" (Jacobs, 1962). The term "Compact City" was first introduced in the 1970s (Dantzig and Saaty, 1973). From the late 1980's, it gained widespread political support in many Western countries, along with the concept of sustainability (Fulford, 1996). For example, the European Communities' Green paper on the urban Environment (CEC, 1990) strongly promotes dense development and mixed use. In the United States, Smart Growth, consisting of a combination of transport alternatives, updated infrastructure, a wider choice of housing options, better environment protection, and greater reinvestment in city centres, has gained popularity.

21. What is important with regard to this history is its changing objectives. Initially, the objective was mainly preventing urban expansion. In the 1960's, the quality of life in cities added to it. From the late 1980's, on top of these, global environmental concern was added to the discussion. "Compact City" now is relevant to even more diverse perspectives, including climate change and regional growth. In contrast with this change and evolution in policy objectives, however, there is one thing that has not changed about "Compact City" throughout its history, *i.e.* the difficulty of real implementation despite its theoretical beauty (Breheny, 1997). It was so in the past, and it still is the case.

22. Therefore, the "Compact City" policies are worth being focused today from the following two viewpoints. First, as we discuss in the paper, they should be taken in a holistic policy approach to achieve the goals of environmental and economic sustainability at the same time, which perfectly fits the context of green growth strategy. Second, how to cope with the difficulty in real implementation should be highlighted.

1.2 Outline of the project

Objective

23. Against the background described above, this project aims to answer the following questions:

i) What are the impacts of "Compact City" policies? How can they influence greenhouse gas (GHG) emissions from urban areas? What is their contribution to regional innovation, labour productivity, access to jobs and services, reducing costs of infrastructure investment and maintenance, household/business costs for energy and water, and quality of life in general?

ii) What are the key issues for effective and feasible policy implementation? What are the main obstacles for policymakers and how can they overcome these obstacles? What are the key issues for good governance including good finance?

24. An analytical report on "Compact City" policies, our final output, should help national governments to develop spatial development strategies and policies in accordance with each country's circumstances, so that they can better address climate-change problems as well as regional economic growth. It will be one of the contributions to the OECD Green Growth Strategy.

Timeline

25. This work was initiated after positive responses from delegates at the TDPC in December 2009. The planned timeline is as follows:

- Literature reviews and development of research methodology (January - June 2010)

  By reviewing literature, a theoretical framework, including research methodology, will be explored. This paper illustrates initial findings from the review and to propose research areas for the future.

- Analysis and case studies (July – December 2010)

  Based on the discussions among delegates, analysis and case studies will be conducted. Several missions could be planned to collect necessary information and exchange ideas. An interim working paper will be presented to the TDPC in December based on initial analysis and case studies for discussion.

- Drafting of the report (January - June 2011)

  The final report will be presented to the WPURB and the TDPC in June 2011 for approval, and will be published by the end of 2011.

1.3 Structure of the paper

26. The aim of this paper is to report our initial findings and propose further analysis. The structure of the paper is as follows.

- Chapter 1 (this chapter) provides the background and the outline of the project.
- Chapter 2 describes our initial findings. First, the impacts of "Compact City" policies are described from the environmental and economic point of view. Second, the challenges for policy design and implementation are identified.
- Chapter 3 indicates future studies, including an analysis of the policy impacts and case studies.

2. INITIAL FINDINGS

2.1 Impacts of "Compact City" policies

27. First, we sought some evidence of the impacts of "Compact City" policies, mainly from the environmental and economic perspectives as our preliminary research. Before doing this, we extracted the following key characteristics of compact cities: **higher densities**, **mixed land uses**, and **mass transit linkages** from existing studies (see Annex 1 for further discussion). In other words, we defined "Compact Cities," for the convenience of coherent argument in this paper, as cities that have minimally these three characteristics. Then, we analysed compact cities' impacts along with these characteristics. Table 2 summarises the discussion.

Table 2. Impacts of Compact City policies

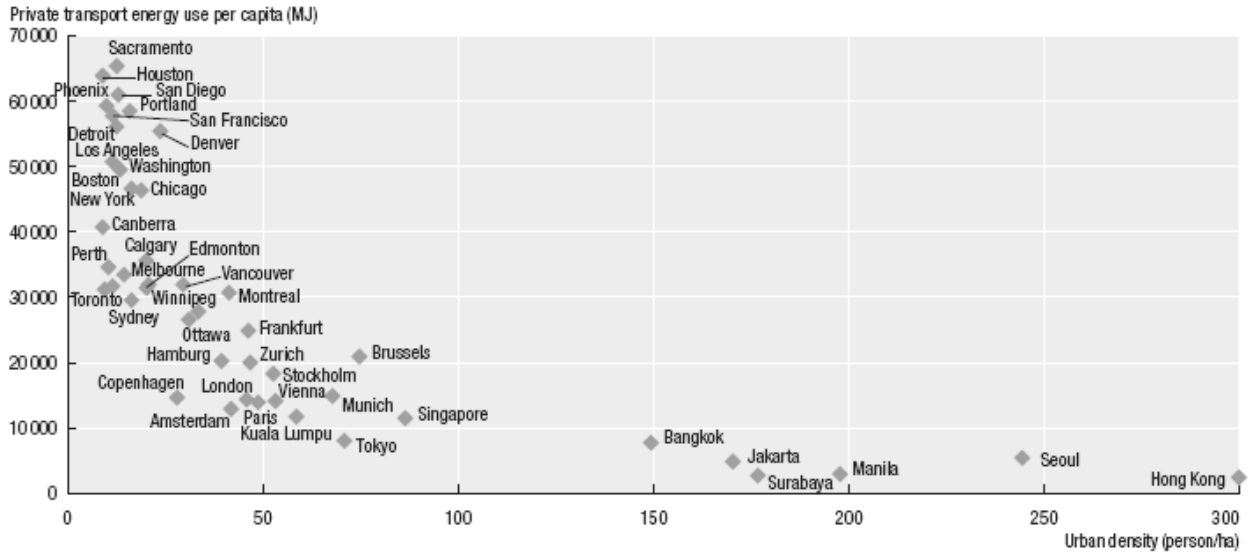
Key Characteristics	Impacts on environment	Impacts on economy
Higher densities	• Shorter trip length, thus less transport energy consumption per capita • Lower electricity demand per capita • Less energy consumption per capita for residential activities, due to energy efficiency in multi-family houses • Preservation of most productive agricultural land	• More frequent exchange of ideas, thus increased knowledge • More efficient infrastructure management (e.g., road, water) • Less time for commuting, shopping, schools and day-care • More walking and biking will contribute to better health • More cultural diversity, higher quality of life
Mixed Land uses	• Shorter trip length, thus less energy consumption per capita	• More frequent exchange of ideas, thus increased knowledge • More cultural diversity, higher quality of life
Mass transit linkages	• Shorter trip length, thus less energy consumption per capita	• Lower travel cost, thus higher mobility

Impacts on environment

Transport energy consumption and GHG emissions

28. Density is the most important physical variable in determining transport energy consumption (Banister *et al.*, 1997). A strong relationship can be seen between low-density cities and high fuel consumption for private transportation (Newman and Kenworthy, 1999) (Figure 4). This happens when higher densities are linked with shorter trip length, as more people live closer to their activities such as work and shopping. People drive shorter distance and more trips are made by bike or walk.

Figure 4. Energy use per capita in private passenger travel versus urban density, selected world cities



Source : Newman and Kenworthy, Copyright © 1999 by the authors. Taken from OECD (2008).

29. U.S. National Research Council reported that increasing population and employment density in metropolitan areas could reduce vehicle travel, energy use, and CO2 emissions from less than 1 percent up to 11 percent by 2050 compared to a base case for household vehicle usage (U.S. National Research Council, 2009). If 75 percent of new and replacement housing units in the U.S. were developed at twice the density of current new development, and individuals drove 25 percent less (upper-bound scenario), personal travel, fuel use, and CO2 emissions would be reduced by 7 percent to 8 percent, relative to a base case, by 2030, and by 8 percent to 11 percent by 2050. If only 25 percent of housing units were developed more compactly, and residents drove 12 percent less (lower-bound scenario), then personal travel, fuel use, and CO2 emissions would be reduced by approximately 1 percent by 2030, and by 1.3 percent to 1.7 percent by 2050. If in this lower-bound scenario residents drove only 5 percent less, then personal travel, fuel use, and CO2 emissions would be reduced by less than 1 percent by 2050 (U.S. National Research Council, 2009).

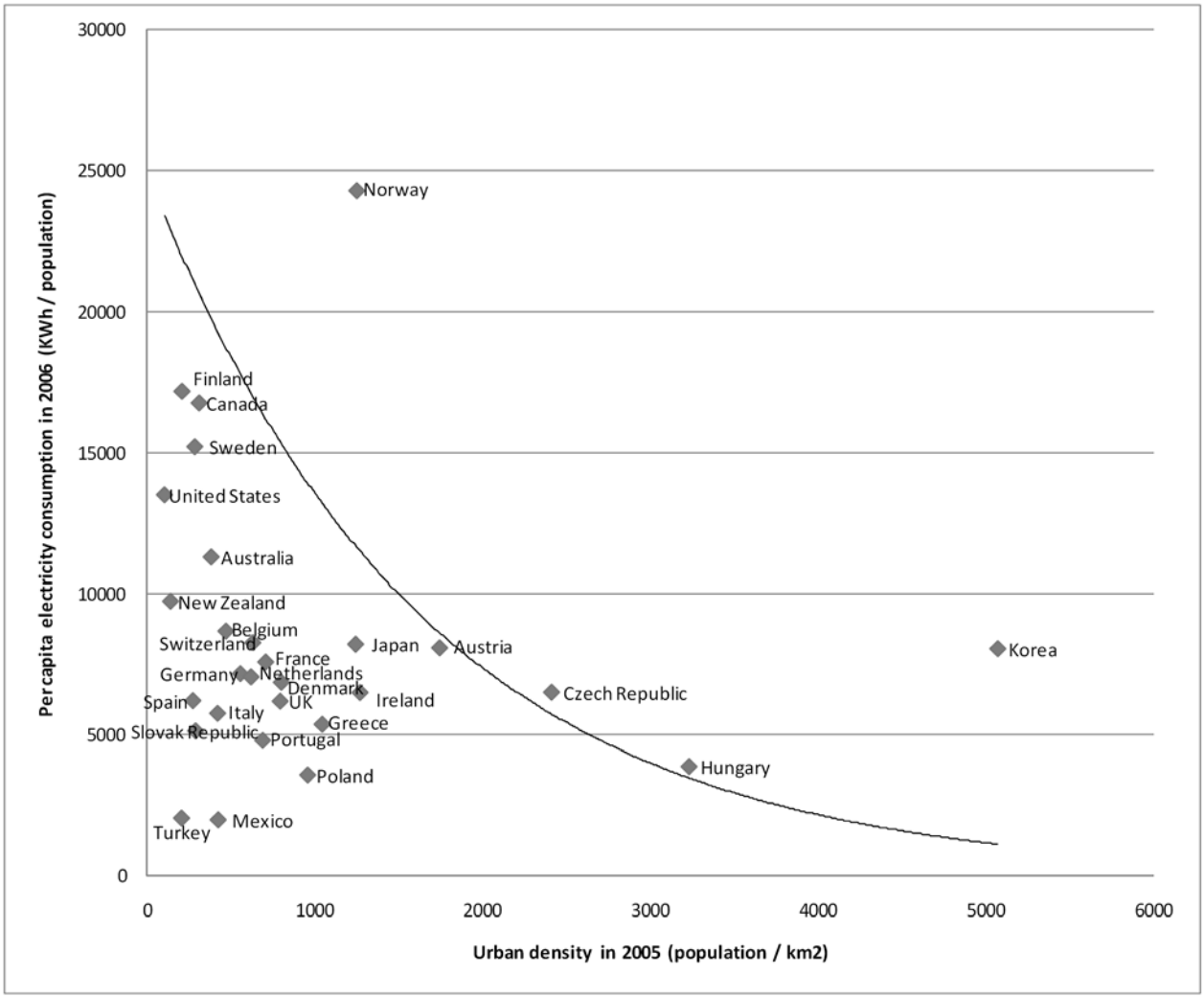
30. Ewing estimated that compact development may impact GHG emission reduction by 10% (Ewing *et al.*, 2008). A case study in Finland indicates planning solutions may impact GHG emissions by 10% at regional level and by 20% at local community level (Wahlgren 2007).

31. On the other hand, some argue that such advantage of higher density may be offset or even be surpassed by negative impacts due to congestion. For example, it is discussed that high densities combined with a large urban population typically result in longer commuting trips (Gaigne et al., 2009). Similarly, others argue that energy savings from urban compaction will be minimal and it is more effective to decentralise jobs and homes from city centres for reducing trip length (Breheny, 1995; Gordon and Richardson, 1997). An important observation here is that a densification policy without coping with congestion problems may not effectively contribute to reducing trip length. In any case, careful consideration is needed on how density is defined when discussing the impact of densification (see Annex 1).

Electricity demand and GHG emissions

32. Densification also impacts on electricity demand. A cross-country analysis on urban density and electricity consumption illustrates that, as density increases in urban areas, per capita electricity demand decreases (Kamal-Chaoui and Robert (eds.), 2009) (Figure 5). This implies that denser cities can use electricity more efficiently with less GHG emissions although a closer study at the city level is necessary.

Figure 5. Urban Density and Electricity Consumption



1. Urban density is calculated on the basis of PU areas.
2. Iceland and Luxemburg were not included in the sample as the OECD Regional Database identifies no predominantly urban (PU) regions in those countries.

Source : Kamal-Chaoui and Robert (eds.) (2009)

33. Densification also makes it possible to introduce other low-carbon policies. For example, land-use policy tools that promote multi-family or compact housing zones can also facilitate the use of district heating and cooling systems by allowing service to a greater number of customers in a given area than would be possible in a single-family residential zone (Kamal-Chaoui and Robert (eds.), 2009). District-wide renewable energy utilisation and smart grids can be operated more efficiently with higher density.

Mixed land uses, mass transit linkages and GHG emissions

34. Mixed land use can also reduce travel distance, contributing to reducing energy consumption and eventually GHG emissions.

35. Promoting transit oriented developments and mass transit connections to key employment and residential areas can contribute to reducing personal vehicle use and can function even in the absence of high-density policies (Kamal-Chaoui and Robert (eds.), 2009). In addition, strategic location of large facilities (e.g., commercial developments, public facilities) is important to reduce private car use. However, actually reducing personal vehicle use requires service expansion and improvements that present viable alternatives to personal vehicle travel. Routes must be carefully planned to target concentrations of employment, retail and social activities and residential neighbourhoods, without increasing demand for undeveloped land (Kamal-Chaoui and Robert (eds.), 2009).

Impacts on urban economy

Higher density and productivity / innovation

36. It is well-accepted that increasing city size leads to the productivity and growth effects (the advantages of city size). In contrast, recent studies on urban economy are beginning to reveal the fact that urban density has a positive relationship with productivity of cities, as higher density enables more frequent exchange of ideas, thus increased knowledge. For example, using data on gross state output in the US, Ciccone and Hall (1996) found that a doubling of county employment density increases average labour productivity at the state level by around 6%. Lucas and Rossi-Hansberg (2002) also argue for the importance of density in speeding productivity. These studies suggest that we can make urban economies more efficient by seeking for more compact form of cities. On the other hand, sprawl could indeed reduce agglomeration economies and therefore negatively impact on aggregate productivity.

37. Difference in industries also raises an interesting point. Tabuchi (1986) showed that doubling the population density of cities would result in 4 to 8% increase in the labour productivity of the manufacturing industry while Morikawa (2008) showed that 10 to 20% productivity increase in selected consumer service industries. That is, the intensity of the effect of density to productivity is stronger in the service sector than in the manufacturing sector.

38. In fact, in many cities in the developed countries, the sources of economic value are shifting from manufacturing to the service sector and the knowledge-based industry. This shift in urban economy gives more relevance to the "Compact City" policies today by the following two reasons. One reason is that it intensifies the productivity-raising effect of density as we just mentioned, and the other reason is that the shift can facilitate taking mixed-use policies. It is quite difficult to take a mixed-use policy in an industrial city because its negative externalities tend to be large while it is not necessarily the case in a city supported by the service sector and the knowledge based industry.

Higher density and urban finance

39. Densification could improve urban service delivery (water, sewage, gas, electricity, street maintenance, etc.) efficiency by cutting down on unnecessary costs for providing inefficient public

services in sprawled areas. A study conducted by the Policy Research Institute of Ministry of Land, Infrastructure, Transport and Tourism of Japan, PRIMLITJ (2009), shows that implementing a compact city policy in a de-populating region would result in substantial cut on maintenance costs for infrastructure. In this study, it is showed that local authorities of a former coal mining region in northern part of Japan could cut their maintenance costs of infrastructure, such as schools, roads, water facilities, by 17% to 32% if they limit their residential areas by 58%. Such benefit from densification may be very attractive for local policymakers who face severe budget constraint. On the other hand, it is also argued that it takes long time for such effect to occur and that the implementation process would be extremely complex.

40. Higher density also allows mass transit systems to be more economically viable.

Urban amenity and quality of life

41. The compact city, by virtue of its density, is seen as offering a lifestyle which is both varied and culturally enriched (Fulford, 1996). More cultural diversity means higher quality of life, and thus attracts high-skilled people.

42. On the other hand, high-density development may impact negatively on residents' quality of life, access to open space, housing prices, and responsiveness to market demand. For example, high residential densities can lead to increased traffic congestion and pollution, which can be exacerbated by a lack of trees or vegetation. The value of land may also rise significantly as a result of high-density developments, which can discourage the preservation of open space (Churchman, 1999). Therefore, policies to improve urban amenities are important in order to lessen the potential impacts of high-density developments on quality of life. A study of neighbourhood satisfaction in central Dublin found that density itself was less important to perceived quality of life than management of the physical environment (e.g. litter, pollution, greenery), noise and traffic congestion, and access to open space, children's facilities, quality food stores and secure parking (Howley *et al.*, 2009).

Mass transit linkages and travel costs

43. Improving mass transit linkages would reduce travel costs within cities and therefore support cities' productivity in a number of ways. For example, lower urban transport costs improve the function of the labour market. As the pool of interacting firms and households is limited by commuting costs, a positive productivity effect is brought about by the fact that an increase in the number of firms and households trying to find a superior working relation enhances the expected quality of a match (Helsley and Strange, 1990) and the likelihood of finding such a match (Mortensen and Pissarides, 1999; Berliant *et al.*, 2000).

44. Also, a dynamic productivity effect is expected from cities providing opportunities to enhance production-relevant knowledge. Hypotheses on the positive effects of low transport costs on the creation and dissemination of technical and organisational knowledge are based on the perception that learning is not only an individual activity but involves interaction with others, much of which is of a face-to-face nature (OECD, 2007). Knowledge diffusion is mainly considered to occur via a knowledge transfer from skilled workers to lower skilled and young workers, and low-skilled workers can increase their skill level by successful face-to-face interaction with skilled workers (Jovanovic and Rob, 1989). The lower the intra-urban urban transport costs, the higher would be the potential number and quality of the interactions between the skilled and unskilled labour forces.

2.2 "Compact City" policy challenges

45. Although the concept of "Compact City" is attracting more attention, there are a number of obstacles stand in the way when designing and implementing the policies, which make many policymakers hesitate to introduce the policies. In this section, we tried to identify key challenges for each stage of public policy process: agenda setting, policy formation, implementation and evaluation. Table 3 summarise the discussion.

Table 3. Challenges of Compact City policies

Stages	Challenges	Key actions
Agenda setting	Defining clearly desired outcomes	• Vision
Policy formulation	Coping with the lack of short-term results	• Combining with policies to create synergy and complementarity • A long-term strategy
	Place-based policy design	• Better understanding each local urban context
	Minimising negative impacts	• A holistic approach
Imple-mentation	Consensus building	• Local leadership, bottom-up approach • Collaboration among different levels of government
	Fiscal capacity	• Market-based strategies • Promoting private investments • Collaboration with the private sector
Evaluation	Regular monitoring and evaluation	• Indicators to monitor and to evaluate the policy impacts

Agenda setting stage

46. It is essential to define and share among stakeholders what they are going to achieve over short- and long-term. Governments could play a key role by setting such a vision with clear policy goals and illustrating strategies to achieve the goals. This vision is useful to demonstrate cities' long-term commitment. This point is crucial because it takes a long time for "Compact City" policies to take their desirable effects. Local leadership and citizen involvement are important factors to make such vision effective, as urban policies are directly linked with activities of private firms and households. Bottom-up approach is a key.

47. It is also important to consider "Compact City" policies as *strategies* to achieve these goals. Making cities compact *per se* should not be a purpose. It is important to have clear policy goals, share them with stakeholders and then to discuss strategies.

Policy formation stage

Difficulty to achieve outputs in a short term

48. "Compact City" policies are concerned with urban land use and infrastructure, but physical improvement of existing cities is not at all an easy task. One of the most difficult issues to deal with is that "Compact City" policies require a long period of time to achieve the effects. For example, the proportion of new build in England is less than one percent of the total existing stock each year. That is, two-thirds of

homes currently existing are still likely to exist in 2050 (Department for Communities and Local Government, 2006). Although cities are expected to take effective measures to meet the nationally set GHG emission reduction target, compact city policies are less effective to achieve the short-term result. However, the policies still need to be carried out, since the impact of "Compact City" policies on GHG emission reduction in the long-term is not minimal and usually irreversible. Similarly, investment on mass transit infrastructure tends to be postponed due to current severe fiscal constraints, although such investment may well be a base for the long-term economic growth.

49. To avoid overlooking "Compact City" policies' long-term impacts, two issues are particularly important to be considered in the process of policy formation.

50. First, synergy and complementarity with other environmental and economic policies should be pursued. For example, compact city policies can be more effective when combined with building policies that enhances building energy efficiency. Also, they work well when combined with renewable energy policies that require district heating for new housing development, congestion charge and fees, along with mass-transit expansion can be supplemented with each other – while infrastructure projects can take long time to realise their effects, transportation policies to encourage the use of public transportation (and discourage private car use) are likely to impact on GHG emission reduction even in the short term. Similarly, combining "Compact City" policy with other urban economic policy, such as innovation policy (e.g., cluster building) and labour policy (e.g., a job creation tax credit), would produce desirable short- and medium-term results, while continuing the long-term effort for "Compact City".

51. Second, a long-term strategy should be put in place. By doing this, governments can show their long-term commitment to local constituents and private investors.

Place-based policy design

52. The fact that urban forms, climate and their economic structure greatly vary clearly indicates 'one size does not fit all'. "Compact City" policies should be designed in accordance with the local context (e.g., climate, industry, population size, history, etc.). In other words, "Compact City" policies should be place-based. It is a real challenge of policymakers how to select relevant policy instruments (Table 4) and customise them in the local context.

Minimising negative impacts – a holistic approach

53. Most concerns and resistance against "Compact City" policies come from their possible negative impacts rather than expected positive impacts. Congestion, loss of green and open space, and housing affordability crisis are among typical negative images of compact cities.

54. Careful policy design is needed to minimise such negative impacts. A useful idea is a holistic approach that our "Compact City" concept takes. For example, while just densification may cause problems rather than benefits, pursuing densification, with mixed land use and mass transit linkages as a package, can create synergy. Ensuring high-quality urban services and amenities in compact cities are another important policy to ameliorate the negative effects. Careful design of space is needed to enhance this function.

Table 4. Policy Instruments for compact cities

Strategies		Instruments	Main Actors	Mode of governance
Increasing densities	Managing suburban sprawl	- Green belts - Urban growth boundaries - Development control only to allow new development on land immediately adjacent to already developed land	National / Local	Regulatory
		- Public acquisition of recreation areas, forests, environmentally sensitive areas etc.	Local	As provider
		- Development impact fees - Real estate transfer tax - Split-rate property tax	Local	Fiscal
	Promoting inner-city development	- Designating target density for new development - Deregulation in intensive growth areas - Deregulation of density limits in inner-cities	Local	Regulatory
		- Subsidies, floor area bonus for brown-field (and inner-city revitalisation) developers - Historic rehabilitation tax credits	Local	Fiscal
		- Priority funding for infrastructure in city centre - Tax reform in favour of inner-city property owners	National / Local	Fiscal
	Ensuring high-quality urban services and amenities	- Development of network of open space in cities	Local	As provider
Promoting mixed land uses	Promoting mixed-use development	- Zoning measures to ensure mixed-use development	Local	Regulatory
		- Infrastructure provision to support relocation of firms from a mono-centric core to other urban cores	Local	As provider
Improving mass transit linkages	Promoting traffic oriented development	- Development control measures to link development with public transport	Local	Regulatory
	Improving mass transit service level	- Public investment for better transportation network	Local	As provider

Source: Kamal-Chaoui and Robert (eds.) (2009), OECD (forthcoming).

Implementation stage

Consensus building

55. Even well-designed "Compact City" policies can meet resistance from existing homeowners. Their concerns about congestion, local taxes, or home values may be at odds with long-term policy agenda, such as economic growth and climate change (U.S. National Research Council, 2009). For example, landowners just outside urban growth boundary tend to oppose to such regulatory measures as they severely depreciate their property values. Moreover, metropolitan regions usually consist of many local governments, all of which are not sharing the same interests. Reaching consensus among local constituents and retaining it for a long term is a real challenge.

56. To overcome such challenges, strong local leadership to implement necessary measures are very important. Bottom-up approach is crucial in order to reach consensus at the local level. In addition,

collaboration among different levels of government is important. National government can have a key role to play by introducing legal frameworks and national policies to support and promote local action.

Fiscal capacity

57. Public infrastructure investments, such as public transit could be a way to steer communities toward compact, mixed-use development, but it would require significant new investments.

58. Market-based strategies (e.g., congestion pricing, higher parking fees) to favour dense, mixed-use development linked with public transportation can promote compact cities as well as ensuring the budget for public investment. Besides, innovative tools to facilitate private investment for compact development are needed, to achieve maximum results with less public expenditure. Collaboration with the private sector is also a key.

Evaluation stage

59. Monitoring and evaluating the policy effects are also important. Modelling the impact of policy options on future GHG emissions and on the regional economy is a key step in understanding policy opportunities and tradeoffs. It is useful to develop indicators to measure "compactness" of urban spatial structure.

2.3 Preliminary conclusions: combining two goals

60. From the observations above, although preliminary, we can conclude that "Compact City" policies are strategies that can contribute to the global climate challenges and regional economic growth. Combining the two goals is particularly effective because, while it has not been rational for city and regional governments to give high priority only to climate policies (since many still think global warming is a worldwide issue and not local), compact city policies can help overcome such perception difficulties. Urban attractiveness would play a key role for the success of "Compact City" policies. "Compact City" policies can also be regarded as an important element of the "Green Growth" strategies.

3. FUTURE STUDIES

3.1 Analysis of the policy impacts

61. As seen in the previous chapter, compact city policies are likely to contribute to both economic and environmental performance of cities. However, people may still want to know "which characteristics" matters "by what degree" because such information is crucial in designing effective policies. Therefore, the following analyses are indicated.

i) "Compact City" policies and GHG emissions

A macro analysis can be done to see to what extent "Compact City" policies influence GHG emissions. Alternatively, we can take a case study approach. A simulation model will be used to predict GHG emissions under different spatial development scenarios including "sprawl" and "compact" development patterns. As compact city policies can be more effective when combined with other climate policies, the effects of other climate policies (e.g., building, energy) can also be analysed.

ii) "Compact City" policies and cities' competitiveness

We have observed that "Compact City" policies will become more and more important and attractive policy choice, because they enable local economy to be more competitive and healthier by enhancing innovation and raising the productivity of the city. This study tries to better understand such contribution to regional growth, possibly on a quantitative basis, by using an economic model.

iii) "Compact City" policies and public urban finance

As discussed in the previous chapter, fiscal capacity is a key challenge for the implementation of "Compact City" policies. We will further investigate policy effects of "Compact City" on local finance from two different viewpoints; (1) finance schemes including type of investment for compact city, expenditure structure, source of financing (development charges, fees, taxes and transfers), burden sharing among stakeholders, and governance and (2) public service delivery.

iv) Indicators for "Compact City" policies

We will further examine what data are effectively and feasibly used to monitor and evaluate "Compact City" policies, and collect necessary data from the OECD metropolitan regions.

3.2 Policy case studies

62. We would like to continue to collect policy examples from the OECD member countries, in order to see more complete picture of current policy practices. Such information by country is useful to compare policies. In addition, major "Compact City" policy tools are analysed. The major policy tools to be reviewed include the following:

- Measures to limit sprawl and manage suburban growth
- Measures to promote inner-city revitalisation
- Measures to promote mixed land uses and mass transit linkages

63. It is also important to select case cities with different sizes and geographical locations, because, as discussed, "policy design according to characteristics of cities" is a key to success. Interviews and field surveys will be conducted. We will focus on the following points:

- Are the implemented policy tools appropriate in the local context? How effective have they been? Combination with other policies?
- How are they dealing with people's negative perception of compact cities as well as the adverse effects of compact cities (e.g., how to deal with strong opposition of landowners in suburban areas, and how to deal with congestion problems?).
- What kind of cooperation is being done among different levels of governments (multi-level governance)? Public-private partnership?
- What are tools for monitoring and evaluating compact city policies?

64. As the result of case studies, key tips for successful policy implementation will be summarised. They will work as a policy guide for compact cities for both national and local governments.

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ANNEX 1. CONCEPT OF "COMPACT CITY"

History

65. It is not easy to tell when the concept of "Compact City" was emerged, because the concept itself has been evolving over time. Its origin can go back to fortress cities in the sixteenth century, aiming at protecting from an attack by a foreign enemy (Breheny, 2000).

66. Perhaps, the first compact city policy in the modern society might be the Green Belt policy in the UK, as the first official proposal was made by the Greater London Regional Planning Committee in 1935 (Department of Environment, 1995). It was one of the first policy attempts to limit urban sprawl. Another moment was when Regional Planning Committee for Greater Copenhagen introduced the Finger Plan of 1947, the first spatial plan for Copenhagen. The urban form it proposed was in the form of a hand: an urban core at the centre, with four nodes as the fingers along which further urbanisation was to take place. The space in between the fingers was supposed to remain green areas (OECD, 2009c).

67. While these policies can be perceived as a part of "Compact City" policies, they are not just the same as what we think now they are. The fundamental aim of Green Belt policy was, and still is, to prevent urban sprawl by keeping land permanently open; most important attribute of Green Belts is their openness (Department of Environment, 1995). The Finger Plan aimed to address the main trend of suburbanisation and far-sightedly linked the land use and public transportation (OECD, 2009c). However, they were not incorporated with policy measures to actively concentrate development and promote "compactness".

68. Jacobs might be among the first to advocate the concept of "Compact City", although she did not use the term "compact". She argued that the city with its vitality, mix of uses and tradition, in contrast to low-density suburbs, represents the most desirable form of development (Jacobs, 1962).

69. The term "Compact City" is first found in a book published in 1973 (Dantzig and Saaty, 1973). Faced by serious problems of urbanisation and growth, the authors argued that an efficient use of space should recognise the vertical dimension and proposed an imaginative circular city composed of eight levels or platforms. Despite of their theoretical approach without considering feasibility, they clearly illustrated high density and a mass-transit system as the concept of "Compact City".

70. In the 1990's, along with the concept of sustainability, the concept of "Compact city" gained widespread political support in many Western countries (Fulford, 1996). The European Communities' Green paper on the urban Environment (CEC, 1990) heralded a rediscovery of the value of urban living, which it believed 'reflects the failure of the periphery: the absence of public life, the paucity of culture, the visual monotony, the time wasted in commuting'. The compact city, on the other hand, by virtue of its density, is seen as offering a lifestyle which is both varied and culturally enriched (Fulford, 1996).

Principal characteristics

71. Today, the concept of "Compact City" has a number of definitions (Table 5). In general, compact city strategy aims to intensify urban land use through a combination of higher residential density and centralisation, mixed land uses, and development limits outside of a designated area (Churchman, 1999).

Compact cities also typically involve concentrations of urban services and transportation options and high degrees of land-use planning controls (Neuman, 2005).

72. We extracted the principal characteristics of compact cities, minimally, as **higher densities**, **mixed land uses**, and **mass transit linkages**. We also see that high-quality urban services and amenities, including access to open space, are keys to the long-term attractiveness and effectiveness of compact city policies.

Table 5. Different concepts of compact cities

Authors	Concepts
Jacobs (1962)	The city with its vitality, mix of uses and tradition, in contrast to low-density suburbs, represents the most desirable form of development.
Dantzig and Saaty (1973)	A circular city with a diameter of 8840 feet and a terraced perimeter is proposed. It is composed of eight levels, or platforms, which are thirty feet apart. This city can house 250,000 people and can be expanded to a population of two million by doubling its diameter and height. The central core contains commercial, industrial, entertainment, and service centres. The top level is a large recreational park. The core is surrounded by residential areas including both apartments and houses. A circular ring called the "mid-plaza" runs in the middle of the residential area and provides such local facilities as schools, clinics, neighbourhood shops, and play areas. At the maximum size the city has 256 elevator systems and a mass-transit system running lines along the radials and the mid-plaza. The transportation system also consists of publicly owned electric cars. They describe the characteristics of compact city as follows. Urban form: 1) High dense settlements 2) Less dependence on automobile (← high density) 3) Clear boundary from surrounding areas Spatial characteristics: 4) Mixed land use 5) Diversity of life (←mixed-land use) 6) Clear identity Social functions: 7) Social fairness (← high dense settlements) 8) Self-sufficiency of daily life 9) Independence of government (← clear boundary)
Scoffham and Vale (1996)	They argue that prescriptions of residential density are irrelevant, as the same density can conceal a variety of built forms which both psychologically and physically may be either compact or loose, urban or suburban, intense or diffuse. According to them, what matters more for sustainability is the manner in which residential functions are arranged, so as to provide long term flexibility and adaptability.
Thomas and Cousins (1996)	They argue that the 'compact city' as proposed by Friends of the Earth (Elkin et atl, 1991), the Council for the Protection of rural England (CPRE, 1993) and by the Commission for the European Communities (CEC, 1990) is an inappropriate urban form for the future. They identify the basic aspirations of the 'compact city' in these proposals as: compactness in scale, accessibility for all on foot, by bicycle and by public transport, and greater respect for wildlife. They argue that more "decentralised concentration" of development may provide a settlement pattern which is not only more environmentally sustainable, and more in tune with popular aspirations, but could also meet the demand of economic forces, and hence win political favour.
Bertaud and Malpezzi (1998)	They constructed compactness indices for world cities. The ingenious measure they used is the average distance per person (by census tract or equivalent small area) to the central business district (CBD) as a ratio of the average distance to the centre of a circle. This measure, called a "dispersion ratio", assumes that the city is represented by a cylinder with a height corresponding to uniform density. The higher the ratio, the more dispersed the city (Richardson et. al., 2000).

Table 5. Different concepts of compact cities (*cont.*)

Marcotullio (2001)	He argues that the general notion of urban compactness had it origins as the concentrated center city model (Haughton and Hunter, 1994). In this model, the concentrated city is typified by high-density urban living associated with high-rise residential buildings. The modern originator of this type of urban form was Le Corbusier, as he is considered as one of the most influential advocates of higher density living.
Burton (2002)	Three aspects of the compact city are identified: a high-density city, a mixed-use city, and an intensified city. The first two aspects are related to the form of the compact city, while the third focuses on the process of making the city more compact.
Ewing, Pendall and Chen (2005)	They created an index of sprawl by combining four different factors: - residential density - neighbourhood mix of homes, jobs and services - strength of activity centres and downtowns - accessibility of the street network Although this is a measure of sprawl, they provide an implication about what compact cities are.
Newman (2005)	Compact city characteristics include the following: 1. High residential and employment densities 2. Mixture of land uses 3. Fine grain of land uses (proximity of varied uses and small relative size of land parcels) 4. Increased social and economic interaction 5. Contiguous development (some parcels or structures may be vacant or abandoned or include surface parking) 6. Contained urban development with clearly demarcated limits 7. Urban infrastructure, especially sewerage and water mains 8. Multimodal transportation 9. High degree of accessibility: local/regional 10. High degree of street connectivity (internal/external),including sidewalks and bicycle lanes 11. High degree of impervious surface coverage 12. Low open-space ratio 13. Unitary control of planning of land development, or closely coordinated control 14. Sufficient government fiscal capacity to finance urban facilities and infrastructure

Some discussions around the concept

73. It is not our purpose to find a unique definition of "Compact City". In this study, our goal is to see how compact cities can influence environment and regional economy. However, it is worth illustrating discussions around the concept of "Compact City" in order to understand how the concept is perceived differently among people.

Compact is not just small

74. The word "compact" literally means "small" and "miniature". Some may think that, in compact cities, they have to live in small houses or apartments giving up their own gardens and private cars. While such lifestyle can surely be a part of compact city life, it is not the only solution. Careful urban design may allow detached house developments with a certain degree of density. Similarly, cities are not compact just because they are small in population or in geographical size. Rather, compact cities presume a certain degree of agglomeration. Moreover, although the word "compact" implies to squeeze things, compact cities do not necessarily mean building skyscrapers. While high-density developments are often associated with high-rise towers, low-rise buildings can also achieve relatively high densities. For example, a study of Toronto, Canada, identified net densities of 120-230 dwelling units per hectare in areas of buildings up to five stories (Churchman, 1999). In fact, building design and availability of neighbourhood amenities affect residents' perceptions of high density developments' advantages and disadvantages. In determining urban

quality of life, residents' perceptions of density, or perceived density, may be as important as real measures of residential density (Churchman, 1999).

75. Overall, the concept of "Compact City" can provide diverse urban forms and a various ways of living for urban residents.

Mono-centric structure is not always a solution

76. Compact cities have been often discussed as a mono-centric spatial structure (for example, Bertaud and Malpezzi, 1998). In some metropolitan regions, however, compact development may apply to polycentric development, where two or more cities in a region share complementary functions (Nordregio, 2005). Particularly in large cities, compact cities may well be in the form of a multi-core structure. Some argue that decentralised concentration is the most efficient urban form in reducing car travel (Jenks et al., 1996). Again, we emphasise that desirable urban forms (physical design of city space) are not unique everywhere.

Indicators of "Compactness"

77. As discussed in this paper, it is useful to develop indicators to measure "compactness" of urban spatial structure. Such indicators may be necessary to understand the current urban spatial structure, and assess the future policy impacts on environment and economy. In this study, several indicators are discussed in terms of relevance and availability, according to our concept of compact cities.

Density

78. **Population density** is an indicator of residential density. Residential density is perceived in a number of ways, including the number of dwelling units and/or floor areas per land area, but population density is a primary indicator. Population densities in OECD metro-regions shows Birmingham, Deagu, Naples, Tokyo and Mexico City are among highest population density (over 2,000 persons per square km) (Figure6). However, it must be noted that total land areas within administrative borders are used here to calculate land area. For more precise definition, built-up areas should be used (open space should be excluded). Besides, employment density or other job-related statistics should be used to see the impacts of densification of jobs.

Mixed use

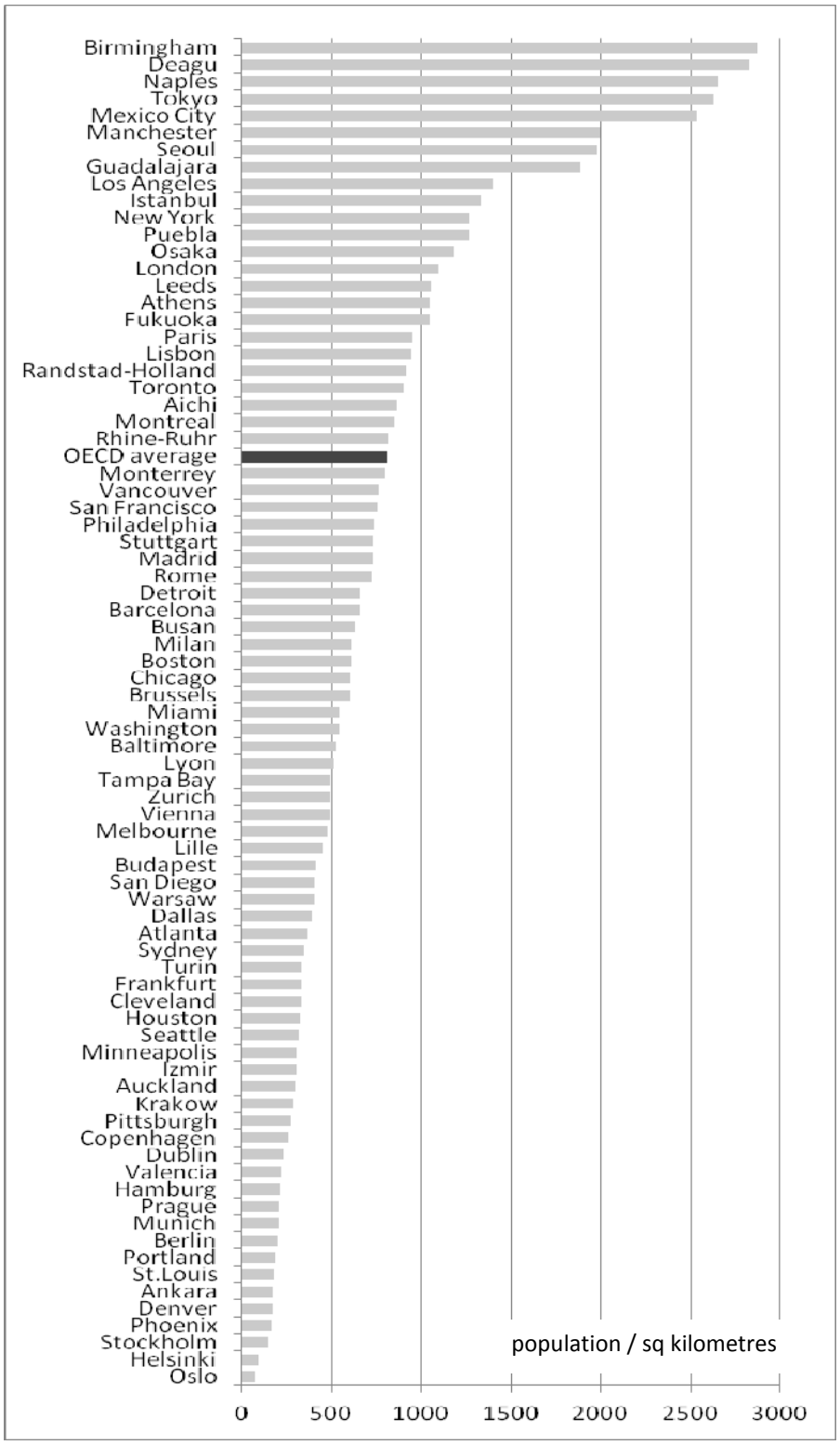
79. Mixed use is difficult to measure. Satellite photo data are useful to distinguish urban and rural land uses, but they are not always sufficient to distinguish land uses in detail. **Average commuting distance** is an alternative indicator to see proximities between homes and working places, and thus the degree of mixed use. Shorter commuting distance may imply more proximity. However, careful observation is needed because commuting distance tends to depend on the size of cities and regions. In addition, data are not readily available for most metropolitan regions.

Public transport linkage

80. **The share of mass-transit use** is used as an indicator of public transport linkage. It is based on the idea that in compact cities, more people do not have to use their own cars but travel by public transportation (compact movement). In this study, we experimentally used data from the American Community Survey (ACS) for the US metropolitan areas and data from Urban Audit for European cities to calculate the percentage of commuters who take public transit (bus, trolley bus, streetcar, trolley car, subway, elevated, railroad, ferryboat), bicycle or walk. The result shows that European cities generally have higher public transportation ridership (Figure 7).

Figure 6. Population densities in OECD metro-regions

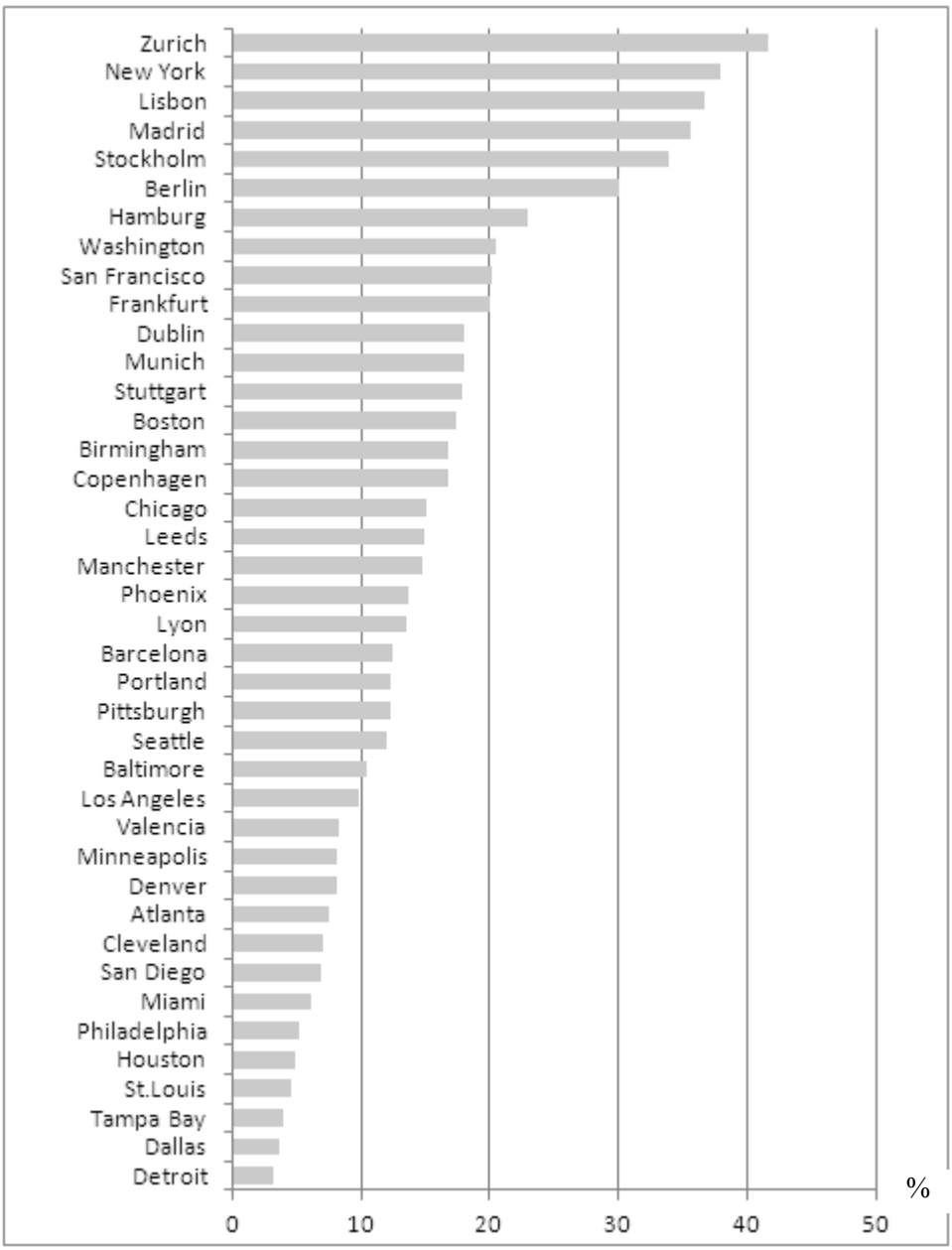
Sample of 78 OECD metro-regions (2005)



Source : Own calculations based on data from the OECD metropolitan database.

Figure 7. Percentage of commuting trips by public transport

Sample of 40 major metropolitan regions in US and Europe



1. Data for US regions are based on the American Community Survey (2006). Data for European regions are based on urban audit (2003-2006 survey), except for Zurich, Lisbon, Manchester, Leeds and Birmingham (1999-2002 survey) and Lyon (1994-1998 survey).

2. For US regions, the definition of OECD metropolitan regions is used (however, some counties with no data availability are excluded). For European regions, the definition of larger urban zones of Urban Audit is used.

Source : Own calculations based on data from the American Community Survey (2006) and Urban Audit.

ANNEX 2. COMPACT CITY POLICY PRACTICES IN OECD COUNTRIES

81. We have started collecting policy practice in OECD countries at different levels of government. For the moment, we recognise all policies that can contribute to the three principal characteristics of "Compact City": higher densities, mixed land uses, and mass transit linkages. Although we need further research, here are some facts from what we have collected so far.

Policy practices at the national level

82. First, at the national level, several countries have introduced the concept of "Compact City" as spatial development strategies (Table 6).

Table 6. Compact City policies at the national level

from selected OECD countries

Countries	Outline of policies
Japan	• The City planning act of 1968 introduced Urbanisation Control Areas, which were applied major cities to restrict suburban sprawl. • The Japanese government is studying the concept of "Eco-Compact City" as one of its top-priority urban policies (Ministry of Land, Infrastructure, Transport and Tourism, 2009). • "Kyoto Protocol Target Achievement Plan" also promotes compact cities as a means of creating low-carbon cities and regions.
Korea	• Based on the 1971 City Planning Law, Greenbelts (Restricted Development Zones) were designated around Seoul and 13 other cities between 1971 and 1973 (Kim, 2010).
The Netherlands	• the Dutch government has made urban compactness a central element of its sustainable development policy (National Physical Planning Agency, 1991)
Switzerland	• The Swiss Land Use Plan is mandated by the Federal Law on Spatial Planning and developed by each canton. The Cantons design a structure plan (Richtplan) that covers their entire area and vision future spatial development. The structure plan must be approved by the Federal Council. Land Use Plans, designed by municipalities and are subject to the above-level structure plan, regulate detailed land use and set the boundary between building zones and non-building zones. The boundary is evaluated and adjusted to new needs every 10-15 years.
United Kingdom	• 1947 Town and Country Planning Act allowed local authorities to incorporate Green Belt proposals in first development plans. Circular 42/55 in 1955 invited local planning authorities outside London to designate Green Belts. "Planning Policy Guidance Note 2: Green Belts" (1995) provides current Government planning guidance on Green Belts (Thorpe, 2010). • In 1993, the UK Government has adopted the compact city, making it a central element of its national planning policies and promoting stronger urban containment (Department of the Environment, 1994) • The UK Urban Task Force, recommended that 65% of all public expenditure for transport should be spent on projects that benefit pedestrians, cyclists and public transport users (Urban Task Force, 1999). Where urban form is concerned, it recommended that: "Towns and cities should be well designed to be more compact and connected, support a range of diverse uses within a sustainable urban environment which is well integrated with public transport and adaptable to change."

Source : OECD (forthcoming) etc.

Policy practices at the city/regional level

83. At the regional and city levels, many OECD cities and regions have introduced compact city policies. For example, Ile de France metropolitan region, Toyama, Portland and Melbourne clearly state that Compact Cities as their urban policy goal (Box 2).

Measures to increase density

84. Land-use regulation to restrict suburban sprawl and instruments to promote inner-city development are among the most widely used tools.

85. Measures to restrict suburban sprawl include urban growth boundaries in Switzerland and US, urbanisation control areas in Japan, green belt policies in United Kingdom and Korea, and development control in Germany (only to allow new development on land immediately adjacent to already developed land) (Buehler *et al.*, 2009). Some of these policies are seen as effective. For example, the effect of urban growth boundaries (UGBs) in four Swiss municipalities is demonstrated in a study (Gennaio *et al.*, 2009). The study, by measuring three variables ((1) developed land extent, (2) number of buildings, and (3) building density) inside and outside UGBs or building zones, shows that the UGBs restricted most development to building zones and promoted increased building density.

86. Measures to promote inner-city development include subsidy and deregulation. Main targets of inner-city development are brown-fields. The US Environmental Protection Agency, using a restrictive definition and focusing on commercial sites, estimates that there are about 450 000 brown-field sites in the US while British authorities estimate that there are 660 square kilometres of brown-field sites in England alone. Only a small part of the brown-field sites is redeveloped (OECD, 2007). City governments or private developers have to choose whether to redevelop brown-field sites or initiate new developments on green-field sites when they start projects. They often face a trade-off between redeveloping a brown-field site, which may allow them a better use of existing infrastructure but only with high demolition and clean-up costs, and a green-field site that requires investing new public infrastructure. From a commercial point of view, development in a green-field site may look advantageous because the costs for the required infrastructure are not, or not fully, charged to the local users, while developers often have to bear the full redevelopment costs in a brown-field site (OECD, 2007). In this kind of situation, fiscal incentives for brown-field developers can be effective tools. In some cases, brown-field developers are given incentives by relaxing original zoning regulations. On the other hand, there is a strategy that internalises environmental and public services costs incurred by new development (Kamal-Chaoui and Robert (eds.), 2009).

87. Another strategy for inner-city development is to reform land-use policies that restrict opportunities for high-density. Zoning and other land-use controls impose an "implied zoning tax" that discourages new housing construction (Glaeser and Gyourko, 2003). Floor-area-ratio restrictions, restrictions on units per acre, and height restrictions all can restrict compactness policies (Kamal-Chaoui and Robert (eds.), 2009). In some cities, zoning control is loosened in intensive growth areas designated within inner cities.

Box 2. Compact Policy Practices in some OECD cities and regions

- Île-de-France, France

The new SDRIF (Master Plan for the Île-de-France Region) continues past practices of targeting polycentric development in the region, but also emphasizes the importance of a compact region and places new attention on the historically dense urban core of the agglomeration. With the goals of limiting traffic and curbing urban sprawl, the SDRIF encourages higher density in existing urban spaces and prioritises development in areas served by public transportation. As a prescriptive land-use document in particular, it reworks the map of constructible land, seeks minimum densities for new urbanisation, and places conditions on the urbanisation of certain areas. The counterpart of this "ville compacte" is the plan's strong effort to preserve and mobilize the region's open spaces, whose various economic, environmental, and public uses are now better acknowledged. Finally, the new SDRIF continues longstanding efforts to develop the metropolitan area around a network of strong, structured urban centres. The plan's transportation programme plays a key role in this effort as it will help structure the region's urban core and give a boost to the new dense neighbourhoods called for in the SDRIF. In addition to reinforcing the region's historically "radial" transportation system, which spans outward from Paris, the new SDRIF calls for a number of new high-capacity lines running around the Parisian centre.

- Toyama, Japan

Toyama City has developed a strategy called "Compact City Formation", that is, to concentrate city functions such as business, residential, commercial and cultural amenities in the city centre and along the railway lines by improving public transportation. The first step toward a "Compact City" is to enhance the quality of public transportation and to make the city center a more attractive place. The city administration invested a private railway line, which was scheduled to be phased out in February 2006, and restarted it as "Toyama Light Rail Transit". It is a public private partnership project, with facilities installed by the public sector and operated by the private sector. With more frequent and user-friendly train service, the city succeeded in recovering passenger numbers. The city can now see a gradual migration of citizens from the suburbs into the areas where convenient public transportation is available. Toyama City has started a long-term (about 20 years) city plan, aiming to increase the amount of people living in the best quality transportation areas (targeted areas) by 14 % of the total population, from the current 28% to 42%.

- Portland, Oregon

In 1973, Oregon adopted "urban-growth boundaries" (UGBs) to preserve the farmlands that were then the mainstay of Oregon's economy. Over time the rationale for UGBs changed to "don't Californicate Oregon"—ie, don't become Los Angeles, a freeway sprawl with no centre. The result has been unusually compact living, which is in turn easily served by public transport (The Economist print edition, Apr 15th 2010, http://www.economist.com/world/united-states/displaystory.cfm?story_id=15911324).

- Melbourne, Australia

In Melbourne 2030, City of Melbourne promotes compact city by designating priority growth areas. The main thrust is to continue to protect the liveability of the established areas and to increasingly concentrate major change in strategic redevelopment sites such as activity centres and underdeveloped land. While a good supply of land for development will be maintained in growth areas, over time there will be a shift away from growth on the fringe of the city.

Source : OECD (2003), OECD (2009b), Tsutsumi et. al. (2006)

Measures to promote mixed land use

88. Traditional zoning regulations tend to prevent mixed land use, as they are often designed to separate different uses of land. Residential zones restricted to single-family dwellings, common for instance in the United States, can greatly restrict the availability of multi-family and row housing, both of which typically are more energy efficient per capita than detached single family dwellings (Kamal-Chaoui and Robert (eds.), 2009). Deregulation of such regulations, for example by introducing form-based zoning, can promote mixed-use development. The establishment of mixed-use zones, which allow for the development of a combination of business and residential uses, is one way of providing alternatives to

segregated zoning. However, where mixed use zones are not the norm, they are typically only applied in specially designated districts where their impact is limited (Hirt, 2007).

89. Promoting multi-core development can be part of mixed-use development policy. It includes infrastructure provision to support relocation of firms from a mono-centric core to other urban cores. Office development in city fringes can also be a part of this strategy, but only if it is accompanied with good public transport linkages (otherwise it can promote suburban sprawl).

Measures to promote transit-oriented development

90. Land-use zones that allow for transit-oriented development can facilitate increased use of public transportation, as it can decrease the distances between mass transit stations and residences, places of work and retail (Kamal-Chaoui and Robert (eds.), 2009). The City of Toronto has created policies to encourage or require mass-transit oriented development, in addition to policies to facilitate density in the urban core and mixed-use (residential and commercial) development. The City of Toyoma, Japan, is pursuing transportation-oriented growth by concentrating city functions such as residential, commercial, business, and cultural facilities along a newly established light rail line, built over an underused long distance rail line (Mori in OECD, 2009b). Arlington County, Virginia, promotes transit-oriented development around the light rail system by providing density credits, increasing parking requirements and improving infrastructure around transit stations. As with mixed-use zones, transit-oriented development zones are often exceptions to traditional land-use zones and therefore can be limited in their reach. Comprehensive reform may require an overhaul of residential zoning codes to systematically allow non-residential uses rather than the piecemeal designation of mixed-use zones (Hirt, 2007).

91. Curitiba, Brazil is one of the most renowned examples of transit-oriented development. In its linear "transit-oriented development" model, urban growth is channeled along selected structural axes based on mass transit routes and on modal interchange nodes. This is achieved through a combination of densification, intensification and mixed land use measures that are closely integrated with transport planning and environmental policies (Burgess, 2000).

Improving mass transit service level

92. As providers of public transit, local and regional governments can increase the use of public transit systems by focusing on improving quality, increasing linkages with multiple modes and expanding service. For instance, many local transportation agencies, including those in Stuttgart and Paris, have implemented real-time signage systems to communicate expected arrival times to mass transit customers. To improve linkages between multiple modes of travel, multiple local agencies often need to coordinate service delivery, which requires effective regional coordination on transportation planning (Kamal-Chaoui and Robert (eds.), 2009).

Sustainable neighbourhoods

93. At the neighbourhood scale, some cities and regions (rather than pursue a city-wide policy for sustainable or compact development) have used land-use planning to create "sustainable neighbourhoods" or "eco-neighbourhoods" that combine transportation, natural resource preservation, building, waste and water policies to respond to climate change and reduce the urban environmental footprint. Common principles include increasing energy efficiency, using sustainable building materials, and reducing personal vehicle use. The most notable "eco-neighbourhoods", either completed or currently under development, are located in western and northern Europe (Kamal-Chaoui and Robert (eds.), 2009) (Box 3).

Box 3. Example of sustainable neighbourhoods

- Bo01 and Augustenborg (Malmö, Sweden)
- Hammarby Sjöstad (Stockholm, Sweden)
- Viiki (Helsinki, Finland)
- Vauban and Rieselfeld (Freiburg, Germany)
- Kronsberg (Hanover, Germany)
- Vesterbro (Copenhagen, Denmark)
- Leidsche Rijn (Utrecht, the Netherlands)
- BedZED (Beddington, United Kingdom)

Source : Kamal-Chaoui and Robert (eds.) (2009)