Can Urban Design Play a Role in Urban Sustainability?
International developments/local challenges

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Abstract

There is widespread recognition today that we are living in a period of profound technological, social, economic and political change, and that this process of change is accelerating. Yet, there is less certainty about the nature and meaning of these changes—whether they should be regulated or liberalized, supported or resisted— and the kind of world they are leading to.

Despite these uncertainties and the difficulties of evaluating the significance of events and processes as they occur, four fundamental trends can be identified that are dramatically transforming the contemporary world and are shaping a new world. These trends are the continued rapid urbanization of the world's population, particularly in the developing countries, the globalization of economic, social, cultural and political activities, the intensification and globalization of an 'environmental crisis', and the changing relationship of the state to the civil society. Although it is true to say that all cities in the emerging global system are experiencing the effects of these processes, it is perhaps in the cities of the developing countries that the greatest problems and challenges are emerging.

Among many other disciplines and professional activities, efforts have also been made in the field of urban design during the last decade or so to find appropriate ways within the field for dealing with these challenges and to explore the potential contribution urban design can make to change the existing trend and facilitate the achievement of sustainability in urban areas. The degree of success, however, has not been the same in all countries and definitely in all areas. Moreover, the gap between the theory and practice remains critically vast everywhere. Therefore, this paper aims to first review the global achievements in sustainable urban design, both in theory (research) and practice, and then do a critical analysis of the challenges the idea has been facing in the contemporary urban design in Iran. To do so, the study focuses on the major substantive and procedural attributes of urban design at both macro and micro levels, and reveals the purposes they serve towards achieving sustainability in urban areas. At the end, a critical comparison is made between the international achievements in the area of sustainable urban design and the efforts made in Iran in this regard.

Keywords: Urban Design, Sustainability, Sustainable Urban Design, Sustainable Development.

1. Introduction

The concept of sustainable development has received considerable attention in recent years, and has become the prevailing paradigm for balancing society's environmental, social and economic goals. Since its popularization at the Earth Summit (I) in Rio, 1992, the concept has gained even more global attention.

In 1990, the UN introduced the Sustainable Cities Program (SCP) to assist cities which are taking steps towards sustainable development. Supporting developing countries in this area include urban sustainable development indicators, identification of urban environmental problems, development of techniques and approaches for inter-sectoral cooperation and consensus building, establishment of modern and advanced planning and management, making strategies and action plans up-to-date, translating strategies and plans into implementable projects, and monitoring measures.

But why is the sustainable urban environment important? Most of today's environmental problems can be traced, directly or indirectly, to urban areas and urban lifestyle. Sustainable urban development is, therefore, a priority (UNEP, 2001).

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Grainger (1999), in studying the role of spatial scale in sustainable development divided the world into multiple spatial units at different levels on a socio-political spatial scale. One of the levels is the local level which refers to settlements of various sizes including urban areas--cities and towns. Cities and towns have received much attention in sustainable development research (Gibbs, 1994; McLaren, 1996; May et al., 1996), but there is the question of whether it is realistic to consider sustainable development at this scale (see, for example: Duboury and Pearce, 1996).

There is no doubt that a vibrant city can lead to the regeneration of a whole region (Pike, 1998). This is probably why local action to achieve global aims was given prominence in the *Agenda 21* publication produced by the UN Conference on Environment and Development in 1992 (Brand, 1996). This gave rise to the slogan 'thinking globally, acting locally', and to the idea of 'glocalization' in which there is a symbiotic relationship between the two levels (Beauregard, 1995).

It seems that in the area of urban sustainability, current metropolitan growth and development patterns are the biggest sustainability issues worldwide: over urbanization, the conversion of forest and farms to built-up areas at the edges of metropolitan regions, the influx of

people, cars and activities into cities with a magnitude much beyond what their regions can ecologically afford, as well as the utilitarian attitude toward environment (Bahrainy et al., 2006). All these mean more traffic, more fossil fuel consumption, more pollution, more runoff from lawns, parking lots and streets, more erosion, and more air, soil and water pollution which have eventually led to the present unsustainable conditions of the urban environments.

Over thirty years ago, John Seymour (1979) wrote "when I was a boy in the countryside--fifty years ago and more--people gardened for self-sufficiency, for it would not have occurred to them to do otherwise. People were self-reliant because they had to be: it was a way of life. They were doing what generations had done before them; simply carrying on a traditional way of life. Money was a rare commodity: far too valuable to be spent on things you could grow or make yourself. It was spent on tools or fabric for clothes or luxury foods like tea or coffee. They would have laughed at a diet of store-bought foods." This statement is about the situation in almost a century ago. No doubt the situation in the cities is much worse than those days.

As Frey (2000) maintains, the basis of the sustainable city debate is the general agreement that the city we know and inhibit today causes unsustainable environmental stress, is socially stratified and functionally suboptimal, and is expensive to run. On this basis a number of research projects and publications in search of sustainable urban development and living, and as a result of an improved form and structure for the city have been carried out. In fact, the interest in urban environmental questions has risen to an unprecedented degree in recent years.

The Commission of the European Communities (EC) launched its Green book on the Urban Environment (1990), and the Organization for Economic Cooperation and Development (OECD) published its report on Environmental Policies for Cities in the 1990s (1990). Meanwhile, many other institutions (international, national, regional and local) followed this new wave of interest in urban quality of life by organizing meetings of experts, undertaking urban environmental research projects, preparing urban quality of life programs and the like. Moreover, various new concepts such as the 'green city', the 'eco-city', the 'livable city', 'the resourceful city', or the 'environmental city', and the 'urban village concept' have been advocated (see Nijkamp and Perrels, 1994).

In the same vein, the publication of books, journal articles, and research on sustainability has been relentless in recent years. Various groups have looked at it from different angles and based on their own perspectives. In building a new pathway towards sustainability, engineers, for example, believe that they play the main role. Once you get past the rhetoric, sustainability is all about testing and building infrastructure that uses less materials and energy, involves less toxic substances, employs more recycled materials, uses renewable resources, and is more durable. But urban planners and designers are dealing with serious questions about the current course of development. They are also facing new challenges and opportunities for producing products and services that use fewer critical resources, release fewer contaminants, contain less toxic substances, and can be recycled, but offer the same quality at an equal or lower cost.

Sustainability has permeated the discourses of planning and designs too, both in theory and in practice. Yet the precise meaning and implications of sustainable development remain quite elusive for urban designers. While there are everywhere rhetorical genuflections to the idea of sustainable development, there is little clarity of or agreement about what it means in principle, let alone in practice (Blowers, 2000, pp. 371-393).

However, today the designers of the built environment recognize the growing importance of and awareness about sustainable design in the global community and the practices, and recognize that application of professional talent is a necessary component of identifying options for a sustainable future. For example, instead of claiming more open space and increasing urban sprawl, we should be finding ways to reuse the buildings upon the existing infrastructure for our inner cities. Rather than solving transportation gridlock by constructing more highways, we should be rethinking our transportation systems and behavior patterns. Instead of figuring out ways to access more of our limited water or fossil fuel resources, we should find ways to reduce demands or recycle what we have.

Therefore, the question with regard to the issue of sustainability in urban areas is no longer 'should it be done?' or 'can it be done?' as we already know the answer: 'It must '. The only remaining question is 'are we up to the challenge?' And we believe the answer is 'we must be'. And in this case how should it be done?

Sustainability cuts straight to the point of altering the design profession to a true issue rather than chasing short-term objectives. It is important because it addresses the growing concerns of our relationship to the planet that supports us and treats us with equity. In the case of urban design, Moughtin (1996) maintains that the requirements of sustainable development are compatible with, and closely mirror, the post-modern agenda in urban design. The current preoccupation of urban designers, he believes, is with the form of urban space, the vitality and identity of urban areas, qualities of urbanity, respect for tradition and preference for medium rise development of human scale. These and other features in the best of post modern urban design can be absorbed within the schema of sustainable development. The two movements--sustainable development and postmodern urban design--according to Moughtin, are mutually supportive: Indeed, they are both expressions of the current philosophy which has rejected the grand development strategies of the 1950s, 1960s and 1970s together with the modernist architecture which gave those strategies form. The post modern urban design gives form to the ideas of sustainable development while in return it is given functional legitimacy. Without this functional legitimacy and the discipline it imposes on the urban design process, postmodern urban design, like some

of the buildings of post modernism, may develop into the whimsy of another esoteric aesthetic. The foundation of urban design is social necessity. The social imperative of today is an environmental crisis of global proportions and it is coming to terms with the effect of this crisis on cities which give purpose and meaning to urban design (Moughtin, 1996, pp.1-2).

But again problems arise about understanding what we mean by sustainability. What do we do if a client turns to us and says fine, design me a sustainable product--say a neighborhood? There are very few in the profession (if any) who currently have good answers underneath the slogans. Few could deny that the idea of 'sustainability' as epitomized by the *Brundtland* has become one of the most powerful ideas about planning. Yet equally few could deny that turning this powerful idea into an operational practice has proved fraught with difficulty and dissension, to the point where there are both frustration and incipient cynicism among practitioners (see for example: Owens and Cowell, 2003).

Voinov (2007) suggests that while there is no single definition of sustainability most would agree that it implies that a system is to be maintained at a certain level and held within certain limits. Sustainability denies runaway growth, but it also precludes any substantial setback or cuts.

Smith, Whitelegg and Williams suggest the following practical features of sustainable development that can be implemented directly in policies aimed at the built environment:

Environmental limits

The environment imposes thresholds for certain human activities in terms of resources, absorption of waste and maintenance of life support serving such as temperature and protections against radiation. These resources are intrinsically of value to humanity and should not be 'traded' with the benefit of a particular development or a particular activity as a whole.

Demand management

Demand management involves a more subtle and responsive planning to meet basic objectives rather than some derived demands. Hence it is possible, for example, to reduce energy consumption by a variety of conservation and efficiency measures as an alternative to building new power stations.

Environmental efficiency

Environmental efficiency means 'the achievement of the maximum benefit for each unit of resources and waste products'. It could be increasing durability, increasing the technical efficiency of resource conversion, avoiding the consumption of renewable natural resources, water and energy faster than the natural system can replenish them, and closing resource loops by increasing reuse, recycling, simplifying and avoiding the need for resource use (non-renewable).

Welfare efficiency

Welfare efficiency is the direct equivalent of environmental efficiency and describes the objective of gaining the greatest human benefit from each unit of economic activity. It requires a much more diverse social and economic system with many more possibilities for satisfying lifestyle requirements than at present.

Equity

Environmental policies have the potential to make significant improvements in the quality of life, health and job prospects of the marginalized, dispossessed and socially excluded people in the society. Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must be logically extended to equity within each generation (Smith, White Legg and Williams, 1998, pp. 18-20).

Urban design as the physical-spatial setting for all human activities in cities can play a role, of various degrees, to achieve those goals of sustainability. Kunstler (1994) points out that "… we can't have a sustainable economy unless we build a physical setting to house it." He further states that "the physical setting we presently dwell in itself exhausts our capital. It is, in fact, the biggest part of the problem" (Kunstler, 1994, p. 246). Sustainable urban design is, therefore, vital for this century—it is not much to say that our health, welfare and future depend on it.

Following the Rio Conference and particularly after the publication of Local Agenda 21,extensive activities have been carried out in various aspects of urban design, theory and research as well as practice. Thus, although the subject is relatively new, the literature is considerably rich in some areas, if not all. American and European countries have been highly active in this regard. The experience of the developing countries, however, is not the same as the developed world. Thus, first we briefly look at the experiences of these two and then examine the case of Iran, as a developing country, and finally the global status of sustainable urban development is compared with the Iranian status.

2. United States

In a study conducted by Edward J. Jepson Jr. (2004) the condition of local policies in the United States that were consistent with the 'three Es' or the core elements of sustainability was investigated. Specifically, the study intended to provide answers to these three questions: (1) To what extent are sustainable development policies being enacted in US communities, and what is their nature? (2) What are the principal impediments to the enactment of such policies? (3) What is the role of the planning office in their enactment?

The study revealed that there are fairly high activity levels

among communities of all sizes and in all parts of the country with respect to a wide range of policies and techniques that are consistent with and supportive of sustainable development (see Table 1). It also showed that progress is being made in the ecological footprint analysis and solid waste life cycle management, as well as neo-

traditional development and open space zoning. Jepson suggests that the planning profession in the US can move beyond its traditional focus on land use planning and regulation toward becoming a holistic discipline which engages in virtually all aspects of community development (Jepson Jr., 2004, pp. 229-241).

Table 1
Policy areas that were cited most frequently under each of the three action-response categories, arranged from high to low.

Action-response category	percentage
Action taken[a]	
Infill development	83
Bicycle access plan	82.4
Greenways development	79.4
Neo-traditional development	79.4
Pedestrian access plan	68.7
No action taken	
Import substitution	93.8
Heat Island analysis	93.1
Eco-industrial park	85.3
Wind energy development	85
Life cycle public construction	84.4
Action not permitted[b]	
Tax base/tax revenue sharing	11.1
Right-to-farm legislation	10.5
Transfer of development rights	10.1
Rehabilitation building codes tied with agricultural district provisions	8.2

a. The percentage of times the action response category in that column was indicated.

b. State enabling legislation is indicated by respondents as being required for actions to be taken.

(Source: Jepson, 2004, p. 231).

In the US, reference can be made to several success stories. For instance, in Portland (Oregon) limited expansion outward was allowed; in Seattle in 1996, similar measures including a new rail and bus systems were in place, and in 2005 the idea of urban village was used as a new strategy to achieve sustainability in the city; in San Jose, a permanent green line around the city was planned; in Civano (Arizona) a self-sufficient and energy saving residential project was developed; the city of Tucson has sponsored the project and shares some of the risk with the developers.

3. Europe

Many European cities have gone through or are currently going through some form of local Agenda 21 process well. The European Sustainable Cities and Towns Campaign was launched at the end of the first European Conference on sustainable cities and towns which took place in Aalborg (Denmark) in May 1994. So far more

than 1000 local authorities from all over Europe have joined the campaign by signing the Aalborg Charter. They represent more than 100 million European citizens from 36 countries (see www.iclei.org/edrope/aal con.htm).
Sustainability has been endorsed through the legislation and directives of the European Union (EU) as a primary Europe-wide objective too. The topic of sustainable cities has also been given considerable attention within the EU. The Green Paper on the Urban Environment, published in 1990, has been seen as a "milestone" document prompting considerable discussion about the environmental role and context of cities. Moreover, the final report of the Expert Group, European Sustainable Communities, is impressive in scope and coverage and is another significant milestone. It advocates more holistic integrated approaches but goes further in arguing for an ecosystem view of cities (Beatley, 2000).
In some countries like Sweden, 100% of all local governments are at some stage in the local Agenda 21 process. Main issues addressed in the European Local Sustainable Development are compact urban form,

importance of city-centers, pedestrian and public spaces, sustainable mobility, promoting bicycle use, designing-away the automobile, greening the urban environment, balancing urban ecocycles, energy and CO2 reduction, ecological governance, and sustainable building.

Europe has also been a pioneer in the development of low-density housing and in the integration of energy conservation and renewable energy sources into large-scale housing developments.

Yet, it should be pointed out that in spite of all these efforts, European cities on the whole are facing serious problems as there are trends working against sustainability like the dramatic rise in auto ownership and use, and the continuing pattern of de-concentration of people and commerce (Beatley, n.d.)

With regard to the issue of sustainability, two countries in Europe, i.e. UK and France are especially important. Thomas and Fordman (2003) have presented several successful case studies for sustainable urban design in Europe: Coopers Road Estate Regeneration: Southwark, London; Parkmount: Streetscape and solar design; CASPARII; Innovation in housing; Coin Street Housing: Architecture of Engagement; Sustainable design in an urban context: Three case studies (the contact theatre, Manchester (the context in 1993); Coventry University Library (the context in 1996); and Thames Valley University New Learning, Teaching and Central Services Building (the context in late 2000) (Thomas and Fordman, 2003).

In late 2000, a new planning and urban policy law called Solidarite' et Renouvellenmet Urbain or SRU (i.e. the law on solidarity and urban regeneration) was passed by the French Parliament. The law, which came into force in 2001, has the broad aim of promoting social solidarity—a sense of fairness and harmony—and the regeneration of French cities rather than their continued spread into the countryside. It has caused a small revolution in some parts of France as it has brought local 'communes', generally no more than parishes, together in larger administrative groupings and has, in addition, required all communes to house a proportion of their population in the form of social housing or face a fine for failing to do so. The SRU law has introduced significant innovations into the French development plan system and structure, urban form, public spaces, land use and density, infrastructure (transportation, water, waste, energy), and building materials. The procedural attributes consist of urban design process, behavior patterns, indicators, practical guidelines, standards etc., capacity building, and education and public awareness. They were selected based on the criteria of being on the local scale and within the field of urban design. In the presents study, this format is used to review and compare international and Iranian developments in urban sustainability through urban design.

It should be borne in mind that the study is based on reviewing the existing literature available to the author, and therefore it should not be regarded as a careful scientific study based on statistical data and analysis. The scores, from zero to 10, for each attribute indicate the extent of the achievement, which is simply an interpretation of the situation based on the available data and information.

4. Substantive elements

Natural setting

Land form, ecosystem, biodiversity, landscape, and open-space network form the natural environment and sustain planting, together which play a critical role in the quality of urban environment, and should, therefore, be regarded as fundamental elements of the design process. Compared to rigid national or international standards, this will provide a unique and site-specific response to development. The principal items to consider here are solar energy, wind, air quality, temperature, rain, biodiversity and, of course, water. The wind crossing a site is potentially beneficial as it can assist in the natural ventilation of buildings, removal of pollutants and heat and be a potential source of energy.

Urban vegetation draws CO2 from the air, binds airborne particles and other pollutants, absorbs noise, increases humidity, makes the ambient temperature more temperate, and breaks the wind. Meanwhile, it makes urban areas more attractive and enhances the quality of urban life. It also influences human behavior in a positive way.

It is an Emersonian view that nature is the 'beyond', the 'immutable', and picturesque parks are the deliberate product of human hands and were (and are) sustained at tremendous ecological and ecosystem expense. Our world view has changed dramatically in the last 100 years: The earth has limitations and its resources are finite. Science and metaphysics suggest that culture and nature are inextricably linked, and we now value nature because of its ecological worth as well as its aesthetic appeal.

There has been a move toward 'landscape urbanism' and the desegregation of landscape and infrastructure. In this regard, parks can be instrumental in solving larger urban and ecological or infrastructure problems, such as storm drainage, air quality, water supply, and demolition (or construction) of expressway.

Vegetation cover and green open space can be important for ameliorating the build-up of heat in cities. Natural or semi-natural spaces tend to lose heat more rapidly at night while during the day a dense vegetation cover helps to divert more of the heat available at or near the ground surface to the evapotranspiration process, creating a cooling effect on the lower atmosphere. Imaginative and sympathetic urban design which works with nature can also bring great benefits to city dwellers (Haughton and Hunter, 1994, pp. 131-4).

Following the UN Strategy of Disaster Reduction (ISDR), which emphasizes the necessity of moving "from a culture of reaction to a culture of prevention" and of making disaster prevention an integral part of sustainable

development (IGU, 2001, p. 15), damage prevention and risk reduction have become a significant part of sustainable development strategies, particularly in the areas where the cities are most prone to natural disasters such as earthquake.

Thus, natural setting can also be regarded as the original source of natural hazards. Hewitt (1995, p. 155) maintains that if there could be such a thing as sustainable development, disasters would present a major threat to it, or a sign of its failure. Although it is mostly human activities that trigger the problem: where we build, how we build, etc. Based on numerous experiences, we now know that urban design can have a significant role in reducing seismic risks in urban areas (Bahrainy, 1998).

Regional structure

Sustainable urban structure begins with urban region: the town or city and its rural and/or coastal hinterland. The sustainability of regions is interdependent. In other words, the town or city depends on its hinterland for food and water, clean air and open space. The hinterland depends on the town or city as a market for its produce and for employment and services but is also affected by urban waste and pollution (pp. 14-15).

Design frameworks at this level will develop a balanced and functional relationship of the city with its hinterland, will generate a spatial and formal structure for the city's districts in their interaction and interrelatedness, and will set the conditions for design on the next lower level of the city districts (Frey, 2000, p. 20).

As Frey states, the regional structure influences the environmental quality of urban areas and access to open spaces and the countryside and with it the potential for a symbiotic relationship between city and country. Frey evaluated six macro-scale forms against a set of sustainability criteria. A simple and superficial method was used with simple arbitrary values. Overall, the core city scored worst, the linear city and the galaxy of settlements were the second worst, the star city was somewhere in the middle, and the satellite city and regional city scored best.

Advocates of better metropolitan development policies have come up with a clever brand name: Smart Growth. There are three essential elements of smart growth: First, policies to discourage the continued conversion of rural land at the edges of metropolitan region; second, finding ways to make infill development and the restoration of older areas more attractive to investors and consumers; third, knitting the metropolitan region together with the transportation system that reduces dependency on automobile trips (Barnett, 2003, p. 79).

Bioregionalism has emerged as a new framework for studying the complex relationships between human communities, government institutions, and the natural world. Bioregionalists believe that as members of distinct communities, human beings cannot avoid interacting with and being affected by their specific locations, place and

bioregion (McGinnis, M. V. 1999).

One of the principles of bioregionalism outlined by Berg and Dasmann (1977) is living-in-place, which means following the necessities and pleasures of life as they are uniquely presented by a particular site, and evolving ways to ensure long-term occupancy of that site. A society which practices living-in-place keeps a balance with its region of support through links between human lives, other living things, and the processes of the planet-- seasons, weather, water cycle--as revealed by the place itself. One, therefore, has to learn to live-in-place in an area that has been disrupted and injured through becoming aware of the practical ecological relationships that operate within and around it. A bioregion can be initially determined using climatology, physiography, animal and plant geography, natural history and other descriptive natural sciences (see also: Atkinson, 1992; Aberley, 1994).

Urban form

It has been frequently asked that what form of built environment will both be sustainable and facilitate a sustainable lifestyle. Calthorpe (1993) suggests transit oriented developments of high density, mixed land use urban growth along major public transport routes, or the compact city as put forward by the Commission of the European Community (1990).

At the level of town or city, the walkable community or urban village provides a fundamental building-block in creating a sustainable urban form. The concept is of a polycentric urban structure in which a town or city comprises a network of distinct but overlapping communities, each focused on a town, district or local centre, and within which people can access on foot most of the facilities and services needed for day-to-day living.

Street blocks should be arranged in such a way as to enable direct pedestrian movement to and from important facilities and amenities including the centre and public-transport routes and stops.

Barnett (2003) in his recent book points out that urban design has a new and growing constituency that is beginning to understand the physical form of their communities is central to their happiness and that they influence this form. He further identifies and discusses five central principles: community, livability, mobility, equity, and sustainability. Several concepts have been developed recently in the UK and elsewhere, with the general purpose of creating more sustainable environments. These concepts apply to a range of scales but include the compact city (Jenks et al., 1996), the polycentric city (Frey, 1999), the urban quarter (Krier, 1998), the sustainable urban neighborhood (Rudlin and Falk, 1999), the urban village (Aldous, 1997), the eco-village (Barton, 1999), and the millennium village (DETR, 2000).

Public spaces

According to Tibbalds (2001), the overall objective here must be to create a rich, vibrant, mixed-use environment that does not die at night or weekends and is visually stimulating and attractive to residents and visitors alike. He further suggests three areas of concern to be addressed by urban designers:

- Conserving the best of the past
- Looking after present needs, and
- Devising an appropriate future.

What is important, Tibbalds maintains, is to consider all these in a balanced and integrated way. Tibbalds lists nine urban design themes which he believes are capable of contributing to the creation of more people-friendly public spaces in the cities. It is, however, the combination of the themes that could have the actual meaning for creating desired sustainable public spaces in the cities. The themes are: 'places' matter most, lessons from the past, mixed use, human scale, pedestrian freedom, access for all, making it clear (legibility), lasting environments, and finally controlling change.

The lowest level of urban design activities is public space. Public space is the stage upon which the drama of communal life unfolds. The streets, squares, and parks of a city give form to the ebb and flow of human exchange. There are pressing needs that public space can help people to satisfy, significant human rights that it can be shaped to define and protect, and special cultural meanings that it can best convey (Carr et al., 1992). Goals most often cited for public spaces include public welfare, visual enhancement, environmental enhancement, and economic development. Carr et al. (1992) believe that public places should be responsive, democratic, and meaningful(p. 19).

Moughtin (1996) states that there is a need to use already developed areas in the most efficient way while making them more attractive places to live and work. Principles of sustainable urban design, he further suggests, would give priority to the adaption and reuse of existing buildings, infrastructure and roads together with the reuse of recycled materials and components (Moughtin, 1996, p. 11).

Walkable, visitable, user-friendly, nature-friendly areas facilitate social interaction which is educational, collaborative, culture-specific, and value-based.

Land use/density

Land use planning at the turn of this century is energized by the challenges of planning for sustainable development. At the same time it reaches out to incorporate new visions of livable communities exemplified by two movements, of New Urbanism and Smart Growth (Godschalk, 2004, p. 5).

Sustainable development seeks to reconcile the conflicts among **E**conomic development, **E**cological preservation, and intergenerational **E**quity, as reflected in the familiar definition from the report named Our Common Future (Godschalk, 2004, p. 1). The central value of sustainable development, therefore, can be boiled down to a balance among these three '**E**'s: environment, economy, and equity (Berke, 2002, p. 30).

Owensand Cowell (2002, p. 28) state that maintaining such a balance and achieving sustainability is easy to said but difficult to implement. In practice, land-use planning has proved to be one of the most important arenas in which conceptions of sustainable development are contested. Here, more than anywhere else, it has become clear that trying to turn the broad consensual principles into policies, procedures, and decisions tends not to resolve conflicts, but to expose tensions inherent in the idea of sustainable development itself.

Making efficient use of land and supporting local services by developing at appropriate urban and suburban densities is an important thrust of the new urban design approach. Development density should be the outcome of a design approach that responds to a variety of issues creatively rather than a fixed design requirement, or single-purpose (income-generating) criteria as follows:

- The creation of socially mixed and inclusive communities,
- The provision of services and facilities that meet a range of needs,
- The engagement of local communities in the decision-making process,
- The provision of quality public transport services,
- The delivery of excellent local facilities and services,
- The need for efficient long-term management and maintenance.

The relative high density and compact urban structure of European cities are critical features in determining their sustainability on other measures. These features make it possible or at least make it easier to maintain many qualities such as the greater use of public transit, high walkability, vital and vibrant civic spaces, the use of extremely efficient district heating systems, and the protection of large systems of the most accessible green spaces (Beatley, 2000).

In urban areas, there is a 'heat island' effect resulting from the production and accumulation of heat in the urban mass. In fact, cities can be several degrees warmer than their surroundings. The heat-island effect leads to increases in both the temperature and air pollution in cities.

5. Infrastructure

Transport
Reducing the travel need (time and distance), changing mode of travel (from cars to foot or bicycle for short journeys and to public transport for longer ones), mixed uses, viable public transport (in relation to density), and optimum density are factors to be considered in the sustainability of transport. Due to the potential of land use strategies to stabilize or moderately reduce vehicle over time, the US, EPA, is exploring options to promote

patterns of 'sustainable land use' within the regulatory framework of the Clean Air Act. The EPA defines sustainable land use as "a variety of policies and programs that aim to provide attractive and safe places to live and work, minimize the use of natural resources, and allow for alternatives to vehicle travel" (Stone, 2003, pp. 177-190).

One of the dramatic ways in which many of the European cities are more sustainable than their American counterparts is the creative approaches taken by them to transportation and mobility issues. There is a strong recognition of the problems (environmental and others) and limitations of heavy reliance on the automobile, and a strong priority given to finding other environmentally friendly ways of enhancing mobility. A high level of priority is placed on building and maintaining a relatively fast, comfortable, and reliable system of public transport such as some integrated combination of rail, tram, metro, and bus (Beatley, 2000, p. 109). In order to reduce our reliance on the car and to re-establish walking, cycling and public transport as the preferred means of moving around in urban areas, substantial changes must be made in our behavior patterns and lifestyles.

There is also a network—called "Car Free Cities" in Brussels—of about sixty cities working on these issues. The participating cities have signed the Copenhagen Declaration, making a symbolic commitment to find ways to reducing the presence of cars in their cities. Efforts are also being made to design new housing developments in ways that minimize and discourage the use of automobiles.

In many northern and western European cities, bicycles are a significant and legitimate mobility option and an increasingly important part of the transportation mix there. In the Netherlands, for example, there are 17 million bicycles nationally: more bicycles than people (Beatley, 2000, p. 168). As we know there are few mobility options which are more environmentally-friendly than bicycles.

Water

Water is not just a physical-chemical substance but an essential ingredient of human life and complex natural ecosystem, at both local and global scales. Securing water has been, therefore, a central concern in development policies. Scarcity of water is usually due to the issues of limited quality, desired quality, and safety and security (Dalhuisen, 2000). Securing a continuous, healthy and affordable water supply should be regarded as a prerequisite for a sustainable city (for more information on the subject see Built Environment vol. 28, no. 2, 2002, on: Water Management in Urban Areas). Urban water systems are closely related to their surrounding regions. As cities grow and consumption increases, finding reliable sources for water is becoming dangerously critical. This is particularly true in the hot and arid regions of the world. To deal with the problem, demand could be reduced, when possible, and recycling encouraged.

Appropriate vegetation can also help with conserving water. Water should be regarded as a critical factor in determining the size, location, type and shape of development.

Waste

Minimizing waste production, recycling and dealing with it in the city as a closed system are critical issues. Minimizing waste means both reducing the wastage of resources and decreasing waste outputs to the environment from households and industries. The minimization of human resource demands implies reduced resource use, the maximization of reuse and recycling initiative and a greater reliance on repair rather than replacement. Locally appropriate means of reducing the total amount of household waste through, for example, encouraging the voluntary implementation of home composting of the biodegradable component of household waste can be developed. In Ringkobing, Denmark such a scheme was initiated in the mid 1990s, resulting in an active participation of about 60% of family houses (see http://www.sbi.dk).

European cities have been leading the way in the composting and recycling of organic wastes. Through some programs, organic wastes are typically separated at their source and returned to farms or used in gardens. Closed loop or circular metabolism can be implemented at the city neighborhood levels and increasingly there are many good examples of this in European cities (see Beatley, 2000).

Energy

Energy is essential to economic and social development and improved quality of life. However, much of the world's energy is currently produced and used in ways that may not be sustainable in the long term. In order to assess progress towards a sustainable energy in future, energy indicators that can measure and monitor important changes have been developed.

In this regard, by providing empirical evidence from the case studies of five cities, Banister, Watson and Wood (1997) concluded that significant relationships exist between the energy use in transport and the physical characteristics of the cities such as density, size, and amount of open space.

Environmental side-effects of energy consumption and their impacts on human health are as old as urban conglomerations. Over the last several decades, serious concerns about the environmental effects of energy use led to the first round of environmental regulations primarily aimed at local and regional airborne emissions. At present, movement in this area is driven by the efforts of developed countries to reduce their greenhouse gas emissions, roughly four-fifths of which result from the combustion of fossil fuels.

Cities use tremendous amounts of energy. There are, consequently, great opportunities to redesign, reconfigure, and reimagine the way these energy needs are satisfied in order to decrease waste, increase efficiency, and greatly reduce environmental impacts.

Almost all aspects of urban design including the size, form and structure of the city, land use pattern, transportation, and lifestyle deal with the issue of energy. Efficient use of energy, conservation, reducing demand and replacing fossil fuels by renewable sources of energy such as bioenergy, geothermal, hydrogen, hydropower, ocean, solar and wind have been the subject of extensive research in recent decades. These can contribute to the policy formulation of a sustainable urban design.

Building materials

Building materials are used for buildings, roads, services, infrastructure and landscape. To choose and use the materials which are sustainable, one should consider their impact on the global and local environments, embodied energy content, health hazards, and life expectancy, durability and recycling.

These ideas are useful for establishing general principles, but are not helpful as universal guides to future action since they do not necessarily apply to all circumstances and do not command unanimous acceptance (see, for example: Breheny, 1995 and Jenks et al., 1996).

As the Rio Conference in 1992 and the New York Conference in 1997 showed, agreements in principle do not necessarily translate into action on the ground. Thus, the real problem we, as urban designers, are facing is how to achieve sustainability in cities already in existence. It is obvious that in the short term, only limited changes can be made in a physical sense but more significant changes can be made in lifestyles. The built environment can then be changed in form to reflect and facilitate those lifestyles. Over a period of time gradual changes in behavior and action may lead to sustainable changes in the built environment. Sustainable development is itself a process and not an end-point. The best goal in sustainability would be moving toward sustainability. This requires overcoming resistance to change, changing decision-making processes from short-term perspective and sectoral to more holistic criteria. Those who have benefited from this, namely the rich and the powerful, have resisted the necessary changes (e.g. automobile manufacturers).

6. Procedural Elements

Urban design process

Berke (2002) showed that since the 1960s, planning has evaded holistic and overarching visions of place by focusing on procedural ethic. The emphasis on process has led to more attention to individual group and neighborhood interests, openness, and consensus, but not

the creation of urban forms premised on holistic visionary plans. The widely accepted principles of urbanism are narrowly focused on community character and sense of place but give little attention to environmental protection, social equity, and place-based economic development. Moreover, the principles for supporting environmental protection and social equity in designing new urban developments at the regional scale are not carried out at the neighborhood and block scales. An open, explicit, collaborative and participatory process of urban design would definitely have significant positive impacts on the product (see Bahrainy and Aminzadeh, 2007a, b, c). Such a process is a basic requirement of a society.

Behavior patterns

Sustainability requires a fundamental shift in values and behavior. In terms of values, a shift from materialism to a more holistic view of what constitutes quality of life is needed. Intangible, but real, elements of human contentment such as social cohesion, community and full self-development must be priorities.

Achieving and maintaining a sustainable built environment requires significant changes in civil behavior patterns. The profligacy with which materials, energy and space are used have to be reduced so that buildings, settlements, and means of transportation would make fewer demands on resources and produce less waste and pollution. Our buildings and settlements should be of such a form and spatial arrangement that travel is minimized, energy consumption is reduced, recycling is more convenient, and social opportunities are maximized.

Godschalk maintains that the three **E**'s of the sustainable development are not sufficient to guide best practice in contemporary land use planning without considering livable community values. By adding livability to the sustainable development triangle, we can create a three-dimensional figure -the sustainability/livability prism.

Sustainable indicators

Perhaps one of the most significant developments in the area of urban sustainability has been the development of sustainability indicators. Many countries have made some efforts in this regard. There are hundreds of examples of sustainable community projects across the US. Such projects occur in all types of communities—large, medium, and small cities, towns, counties, rural areas. These communities use different definitions of sustainable community. Some also call their efforts by a different name like an ecovillage or a sustainable development project. Sustainability indicators have been developed through a variety of mechanisms including participatory processes such as Sustainable Seattle Project, selected methodologies like PICABUE (Mitchell et al., 1995), and research efforts (Bahrainy and Tabibian, 1998; Wackernagel and Rees, 1995). Thus, new aggregated indicators such as the Ecological Footprint (Gustavon et

al., 1991) as well as others in social and economic dimensions are emerging.

Efforts such as the Human Development Index (UNDP, 2001) and recently the Environmental Sustainability Index (Yale Center for Environmental Law and Policy and Center for International Earth Science Information Network, 2001) have been made to develop an appropriate index.

The city of Seattle was one of the first US cities to explicitly incorporate sustainability concepts as an organizing principle for community planning and management. From 1991 Seattle started working on this area and by 1998 developed some 40 indicators. In order for the indicators to be qualified they should be relevant, attractive to local media, statistically measurable, logically or scientifically defensible, reliable, leading, policy relevant, and should reflect community values. Indicators in Seattle cover five main areas of Environment, Population and resources, Economy, Youth and education, and Health and community, with each including measurable indicators (40). Each indicator may have one of these four statuses: trend improving, declining, neutral, and insufficient data.

Practical guidelines, standards, regulations

Beer and Higgins (2000) present a clear step-by-step guideline on how to develop a site in an environmentally sustainable manner.

Education/public awareness/capacity building

There is no doubt that education and training is the heart of development efforts; without human resource development, most of these efforts would be ineffective. A country's human, scientific, technological, organizational, institutional and resource capabilities enhance the ability to evaluate and address the crucial questions about development options, based on the understanding of environmental potentials and limitations and of needs perceived by the people of the country concerned (UNCED, 1992).

UNDP (1991) defines Capacity Building to encompass the creation of an enabling environment with appropriate policy and legal frameworks, institutional development including community participation, and human resource development and strengthening of managerial systems.

Universities are a necessary component—the crucial node—in a healthy system of science and technology for sustainable development. A weak university system undermines the ability of a country to develop and to retain young scientific talent. The last decade has witnessed some notable developments in this field. For the universities to take the lead in these changes, they must transform themselves in various ways, notably by thoroughly revising their curricula, the organization of research, and their working with different sectors of society (UNDP, 1991).

Table 2

Global development in sustainable urban design

Urban design attributes (subs./proc.)		Theory/Research	Practice
Substantive			
Elements Natural setting			
	Land form	2	0
	Ecosystem/biodiversity	6	3
	Vegetation	4	2
	Landscape	2	1
	Climate (wind, sun, air, water)	6	3
	Natural hazards	3	0
Regional structure (bio-region, footprint)		4	2
Urban form (size, structure, density)		4	1
Public space		**3**	**1**
Land use		**5**	**2**
Infrastructure			
	Transportation	7	4
	Water	6	3
	Energy	6	3
	Waste	8	5
Building materials		**2**	**0**
Overall design		**6**	**3**

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Procedural			
Elements Urban design process		**6**	**4**
	Behavior patterns	7	3
	Indicators	8	3
	Practical mechanisms and guidelines	6	3
	Participation	8	6
	Capacity building	7	4
	Education/public awareness	8	5

Table 3

Urban design elements and the purposes they serve towards sustainability

Urban design elements (subs. /proc.)		**Purposes**
Substantive	**Natural setting**	
Elements	Land form	nature protection, nature conscious design
	Ecosystem	bio-diversity/bio-region/footprint reduction
	Vegetation	air & noise pollution reduction/climate protection
	Landscape	Providing desired micro-climate/ aesthetics
	Climate	Climatic comfort/natural ventilation/sun protection/cooling breeze Clean air
	Natural Hazards	Reducing risks and vulnerability of urban areas
	Regional Structure	Bio-region/reducing footprint efficient natural res.(energy, water, land)
	Urban Form	Efficient natural resource use/limited car dependency/social interaction/less pollution/site specific design
	Public Spaces	Attractive, diverse, friendly space/human scale
	Land Use/Density	mixed use/no sprawl/efficient use of nat.res./reducing heat island impacts
	Infrastructure	
	Transportation	Biking/mass transit/sidewalk/walkability/visitability
	Water	Protecting watershed/conservation/rainwater collection / wastewater reuse/clean water
	Waste	minimizing generation/maximizing reuse/recycling / sorting/biological sewage treatment/composting
	Energy	Minimizing demand/efficient use/renewable energy (solar, wind,…)
	Building Materials	Low radiation, reflection/no toxicity/ recycling/ nature friendly
	Overall design	
Procedural	**Urban Design Process**	Open/participatory/collaborative/cost-benefit-analysis-based
Elements	**Behavior Patterns**	Changing behavior patterns and life styles towards sustainability
	Indicators	Measuring and evaluating sustainability/impact analysis
	Guidelines, Standards,…	Application of knowledge into practice
	Education/Awareness	Preparing the context for sustainability
	Capacity Building	Human resource development, creation of enabling environments, Institutional building

7. The challenges of sustainability in urban areas in Iran

The processes of industrialization and modernization which brought about a major shift in production, development and eventual higher quality of life in the West had a different course in developing countries including Iran. Specifically, the high rate of population growth, over-urbanization, centralization, environmental degradation, etc. led to urban sprawl, over-crowding, primacy, loss of identity, congestion, and low quality of life in cities. All these changes took place in the context of modernization or Modern Movement. The approaches used to deal with the emerging problems were typical comprehensive plans of the early 1900s in which there was little room for urban design. Due to the inadequacy of the approaches, the undesirable conditions in the cities have been intensified for some seventy five years. Today, both the cities and the urban design profession in the country face a real and unprecedented challenge of how to tackle these accumulated phenomena. Can the concept of sustainability be of any help in changing the trend and put a halt on the decreasing quality of life in Iranian cities? Could the urban design profession change its traditional blue-print Euclidean view of urban design towards sustainability?

The National Committee of the Sustainable Development was formed in Iran in 1993 under the Supreme Council of the Environment to coordinate the government policies on sustainability. The Committee is divided into 11 Sub-Committees, among which Management of Urban Sustainable Development is directly related to the sustainability of urban areas and several others including Chemical and Hazardous Wastes, Biodiversity, Cities and CMS, Climate Change, Global Environmental Facility (FEF), Agenda 21 and Green Productivity and Clear Production are indirectly related to the issue of sustainability of urban areas. The Committee's activities mainly involve national policies and not local and practical measures at the city scale (DoE, n.d.). Yet, in some cities like Tehran, a new office called the Office of Environment and Sustainable Development has been set up to deal with the issues of environment and sustainability.

In general, there has not been much effort to find the implication of the concept of sustainability at the city level in Iran. For example, in the Sustainable Development National Report prepared for the Sustainable Summit Conference in Johannesburg, 2002, aggregate national issues such as poverty eradication, deforestation, population, agriculture, desertification and the like were addressed, and therefore no specific mention was made of the critical problems of the cities and the role they play in bringing about sustainability. Yet, below some activities involving the study of sustainability at the

city level in Iran are reviewed.

The problem of urbanization and the role urban planning and design can play to improve the situation towards sustainability were discussed in a paper presented at NETTLAP (Bahrainy, 1996). The study concluded that the paradigm of sustainability in urban planning and design for the 21st century will imply replacing the expansionist worldview of planning with the steady-state or ecological worldview.

As we know, development in Iran has for long been based on classic and cliché ideas of the West imported in the first half of the twentieth century. This kind of development, which is by far different from the concept of sustainable development, must be regarded as the basis of all planning and design activities and responsible for the kinds of decisions made at various levels for about fifty years in the country. In a study (Bahrainy, 1999) I pointed out that our urban planning and design, under the influence of the classic development model which ignores local ecological conditions, has caused unsustainability in not only our cities but the whole region. The study suggested that as the sustainable development concepts are perfectly compatible with the goals and purposes of new planning and design, they may be used as effective tools to achieve sustainability in the urban areas. In a related study (Bahrainy, 1996), a comparison was made between the classical view of development and the emerging concept of sustainable development. The results showed that to save our future we do not have any other choice but to change our direction toward sustainability.

Although traditional settlements in Iran have shown the most practical examples of sustainability in the past (see Bahrainy, 1999; Saiidnia, 2002), the modern cities are far away from being sustainable environments. The population growth, over urbanization, urban sprawl, dominance of car, and tremendous change in behavior patterns have all created critical problems in our cities which have eventually reduced the quality of urban life significantly. In another study (Bahrainy, 1998), I analyzed the impact of urbanization on the environment and also the impact of environmental degradation on cities, particularly large cities in the developing world. Some of the solutions suggested in recent years to tackle the problems were also discussed.

In spite of all these critical problems, environmental issues have not gained priority in planning at the local level. Universities and research centers have paid little attention to the subject and so have practitioners and implementing agencies. In the field of urban design in particular, very few people have shown interest in the subject. The case with consulting firms and implementing agencies, public as well as private, is even worse. All in all, the issue of sustainable urban design has not gone beyond rhetoric and general statements (see Table 4).

According to a study by Bahrainy (1999), traditional cities

regard themselves as a relatively closed bio-region which has to be, to a large extent, self-sufficient with the minimum dependence on outside. Moreover, ecological limits affect all aspects and dimensions of life and, in turn, determine the type and extent of the development. Efforts are made to adjust to the environment and make the undesirable environment livable. Such a development pattern has little adverse impact on the environment. Low levels of technology as well as limited intervention in nature prevent large scale and irreversible degradation of nature. The limited size of settlements and different production and consumption patterns do not require the transfer of great amounts of water, fuel, or waste, to and from outside. The study also showed that there is a rational and sustainable proportion between the built and natural environments.

Since one of the dominant problems of our large cities has been air pollution, Bahrainy (1997) focused on two aspects of urban climatology in the city of Tehran: climate and urban form. Based on an experiment in a low-speed wind tunnel and also the satellite data as the source of information, the study concluded that the concentration or dispersion of urban air pollutants depend on atmospheric conditions and heat island in urban areas, which is affected in turn by the topography and urban form. By some modifications in the urban form, therefore, the atmospheric conditions may be changed (wind direction and speed) in an urban area. Thus, eventually there could be a better air quality in the cities.

For the first time in Iran, in a study by Bahrainy et al. (1999) heat island maps were prepared for the city of Tehran, using the satellite data and the latest land use map of the city. The study showed that the density, distribution and nature of urban activities (land uses) have a significant role in environmental changes, particularly in raising the temperature and concentration of air pollutants in the urban areas. The role urban design can play to reduce air pollution in cities through the study of heat islands were then investigated.

The rapid rate of population growth, over urbanization, and environmental degradation has led to the increasing risk and vulnerability of structures and settlements in Iran. This is a major factor which threatens the sustainability of the cities in the earthquake-prone regions of the country, which in fact cover most of the urban areas. Therefore, Bahrainy (2003) proposed a new structure for natural disaster management in order to improve the condition. A set of guidelines were also developed for earthquake disaster management.

To effectively reduce seismic risks and vulnerability of the environment to future earthquakes in the world's high risk zones, there is an urgent need for a comprehensive and cohesive system of planning and design to integrate, facilitate, complement, and strengthen decisions at various levels and about different aspects, eventually leading to a safer environment. Therefore, the role of urban design and planning in mitigating seismic risks in urban areas was specifically addressed in Bahrainy

(1998).

Very few people have taken up the spatial-physical structure of the city and the role it can play in sustainability. In a case study by Bahrainy and Ahmadi Torshizi (1999) a search was made for ways through which one could bridge the gap between the past and present in the cities and develop guidelines and mechanisms to govern current development trends. The final goal of the study was to achieve a desired quality of life for the present and future generations. To achieve this, the determinant factors in shaping human settlement should be organized, controlled and directed towards sustainability.

Ghafari (2001) did a study on the ecological aspects of urban and architectural forms for sustainable development in warm and arid deserts of Iran. In another study, Golkar (2001), discussing the issue of sustainable urban design within desert-fringe cities suggested that by drawing lessons from the traditional architectural heritage--Iranian compact city--one can guide the physical environment of the cities towards a more harmonious relationship with the natural settings. In addition, Bahadori (1978) studied passive cooling systems including domes, barrel vaults, air vents, and wind towers in the vernacular desert architecture of Iran.

The question of how to design urban spaces for a user-friendly environment is still an unresolved problem in urban design. This issue was taken in a study titled 'urban space analysis and design in relation to users' behavior pattern' by Bahrainy (1996) in which urban spaces were studied in relation to the behavior patterns of users to make required modifications in the urban spaces.

Two important attributes of urban spaces, i.e. territory and privacy, were investigated in a case study in Isfahan (Bahrainy and Tajbakhsh, 2000). By exploring the role of these concepts in urban design, some practical solutions were suggested for their application in the urban design process.

Housing has been always one of the significant components of governments' policies throughout the world. In a study by Bahrainy (2001), the implications of two world views--development vs. sustainable development--on housing were compared and the impact of housing under the development view on the environment was analyzed, and some principles for sustainable housing were introduced.

In another study (Bahrainy, 1995) the impact of mass production and minimum housing on the quality of environment in urban areas was investigated. Reviewing some of the experiences of other countries in public housing policy and then investigating the adverse impacts of this policy on the quality of environment in urban areas, the researcher made recommendations for new policies to enhance the quality of environment.

More recently, to study the role of urban design process in achieving sustainability in cities, the Navab Project--a large-scale urban renewal project in the centre of Tehran--was evaluated in terms of certain sustainability criteria

(Bahrainy and Aminzadeh, 2007). The study concluded that the project does not support sustainability at all, but on the contrary, it intensifies the unsustainability of the Tehran Metropolitan Area.

Bahrainy and Tabibian (1998, 2000) also suggested a model for the evaluation of urban environmental quality. In their study, a general framework was developed through which practical guidelines and implementation mechanisms were introduced to achieve sustainability in urban areas (Bahrainy and Maknoon, 2001).

The results of a study by Bahrainy (1996b) revealed that unsustainability in our cities, particularly in larger urban areas, has turned into such a vicious circle that traditional solutions are no longer capable of making any significant changes in the existing trend. The only way to break this unsustainability cycle and change the trend towards sustainability is through education and public awareness.

In the same vein, Bahrainy and Amini (2001) investigated the role of environmental non-governmental organizations in citizen participation for environmental protection. This research focused on the role of the environmental non-governmental organizations in Iran and evaluated their performance in achieving public participation to protect the environment. The study showed that due to several major constraints so far these organizations have lacked the ability to prepare the context for people involvement in protecting the environment.

The problems and challenges of the country and particularly of the metropolitan areas have intensified in recent years because of the water shortage, increasing demand for fossil fuel consumption, energy shortages, and all kinds of pollutions in the environment. These problems are backed by the population growth, rate of urbanization, inflation, and the high rate of unemployment. In this kind of situation, environmental considerations are the last to be considered in any planning and decision-making process, especially for a long-term period.

In spite of the urgent need for directing the higher education towards environmental issues, particularly in a time when the high rate of urbanization on the one hand and attempts for industrialization and development on the other hand are the dominant features of Iranian national planning, environmental education is still in its early stages of development, and, therefore, not taken as seriously as it should.

I believe urban planning and design can have a significant role to play in the issues of sustainability and formulation of strategies to achieve sustainability in urban areas. This includes education, research, developing indicators, and all substantive areas of urban design such as land use, urban form, transportation system, etc.

Environmental awareness in Iran began in the 1870s following the Environment Conference in Stockholm, when the first Center for Coordination of Environmental Studies--later the Graduate Faculty of Environment--was established at the University of Tehran. Since then many courses and programs have been added to the universities' curriculum, few of which, of course, focus on urban sustainability.

In studying the role of urban design in urban sustainability, one would expect the end result, which is the end product of urban design activities and processes. It is through these plans, guidelines, etc. that sustainability goals may be achieved in urban areas. But it is here that barriers stand against any successful design and then implementation of urban design plans. Three examples are provided here to see if and how sustainability has been included in the plans, and if so, to what extent such a goal has been actually met. The first example is at the city level, i.e. the New Comprehensive Plan for The City of Tehran, the second one is at the community level: the urban village concept, and the last one is at the project level—the Navab Regeneration Project in the centre of Tehran.

Tehran New Comprehensive Plan (2005-2015)

Forty years after the first comprehensive plan for the City of Tehran (1968), the second plan was finally adopted and sent out for implementation. This was at a time when the city was suffering from various severe problems such as overpopulation, sprawl, housing shortages, traffic congestion, environmental problems, physical disorder, lack of identity, etc.

The plan is said to be based on the 20-year (2005-2025) vision plan for the city. The long-term vision plan for Tehran is considered to be a mission for the sustainable development of the city. Based on the vision, the city should be of Iranian character, global, intelligent and knowledge-based, green and beautiful, safe and secure, sustainable and just.

The plan is assumed to be a strategic and structural document, on the basis of which each district will prepare its own detailed plan. The plan includes:
- The vision for the development of the city
- The development strategies for the city
- The city limits
- The spatial organization and zonation
- The development and land use rules and regulations
- Special development plans and projects (substantive and geographical)
- Plan realization and implementation mechanisms

The first questions to be raised here are: How should an urban design solution be found at this scale (if any)? When is the plan prepared? How is it going to be implemented and what are the means and ways to put the decisions into action? (Bahrainy, 1997). It is quite clear that any urban design solution at a smaller scale needs to be based on the concepts of this general plan. Basic parameters, such as space organization, density, land uses, major transportation network, the size and shape of the city are all determined at this scale, which will then have implications for the smaller and detailed plans. Although sustainability has been mentioned as one of the main goals of the plan, one cannot find any implication of this

goal in any part of the plan. In fact, the critical barriers mentioned above would not allow any significant change in the existing situation towards sustainability. What has been actually done at this scale is simply following the ideas, assumptions, and results of the old fashion comprehensive plan just with a new wording.

It is worthy to mention that the real implication of sustainability in urban design is certainly more meaningful at smaller scale plans and projects.

8. The urban village experience

During the last fifty years, Iran has had numerous experiences in various scales and subjects of urban design, ranging from new town design to urban renewal, and reconstruction of the war-and-earthquake damaged areas. Unfortunately, none of the experiences has been really successful, and no lesson has been learned from the failures. The alternative to these approaches, from the autocratic urban design to lack of control policy, was suggested to be the urban village idea. This idea has been predominantly used in not only the peri-urban or growth boundaries of the cities, but also the deteriorated and decaying sections of the central cities which are so badly in need of regeneration. It should be pointed out that in an activity as complex as urban design, particularly in traditional contexts like the old textures of Iranian cities, application of a thorough process may in fact accomplish a main goal by itself in capacity building, empowerment, education, and public awareness--creating a sustainable (environmental, social and economic) community based on the character and assets of the existing setting. Application of the urban village concept in regeneration projects was regarded, therefore, to serve many purposes including:

- Promoting the quality of life and the vitality of community.
- Developing public transportation facilities, promoting cycling and walking
- Creating a local community with a relative self-sufficiency (i.e. local residents live, work, and recreate in the same community).
- Promoting efficient land-uses at small local scales, distributed throughout urban villages based on behavior patterns and life cycles.
- Creating civil institutions and promoting interaction among residents.
- Reducing fuel consumption, waste and pollution
- Protecting ecosystems
- Combining built environments with nature
- Creating human environments, with a sense of belonging, social responsibility and human scale through lively neighborhoods

In this regard, the ideal solution should be not only economically viable, but sustainable from the point of view of employment, public services, facilities, and environmental considerations. Urban villages that are managed by people, liked by people, are efficient and pleasant, and provide a desirable life for the present and future generations seemed to be the right solution for urban renewal, regeneration and neo-traditional developments. Based on all these, two actual cases, within the urban growth boundaries of the city of Isfahan and the city of Ramsar, were analyzed. The purpose was to extract a set of principles and criteria, on the basis of which we can develop some design guidelines, as urban design strategy, which would prepare the context for the realization of sustainable development in *Asheghabaad,* in the urban growth boundaries of Isfahan, and *Javaherdeh*, in the urban growth boundaries of Ramsar.

Two experimental urban design studies were carried out in two settlements in the peri-urban areas of Isfahan *(Asheghabaad)* and Ramsar *(Javaherdeh)* to investigate the possibility of using the urban village idea as a strategy to achieve sustainability. The study revealed that significant deep-rooted institutional barriers in developing countries, particularly in rural settings stand against any progress in this regard. It is, however, suggested that the concept could still be useful, not as an urban design product, but as a process to help with preparing the context for necessary changes. Analysis of the relevant substantive and procedural elements and the stakeholders in the cases of *Asheghabaad* and *Javaherdeh* revealed that all of these elements, individually and collectively, work against any substantial changes in these contexts, including the application of the urban village concept. There is, however, no doubt that the increasing unsustainable trend of the peri-urban areas in developing countries is in urgent need of some effective tools and mechanisms to control and guide the chaotic development in these areas toward sustainability. But this requires a radical change in the institutional structure of the communities involved. If the urban village concept is used as a flexible and 'unfixed' concept, it could help to prepare the context for change through education, public awareness, social learning, capacity building and empowerment. These could be regarded as the key to change and urban village as a mechanism for democracy and local self-sustainable development. In a society where almost all decisions are made on the basis and in the framework of autocratic and up-down mechanisms, urban village cannot be applied according to a democratic, participatory process (Bahrainy and Azizkhani, forthcoming).

9. The *Navab* regeneration project

The project level is the most appropriate scale through which one can better see the tangible results of sustainability. The evaluation and analysis of the *Navab* project once again confirms the idea that a government controlled planning and design which lacks the process of public/private collaboration often leads to problems in the design/ decision-making process and the eventual failure of the product. As the project was heavily dependent on

the conventional theme of government does it all, it failed to respond to the desires, expectations, lifestyles, and tastes of the users, directly, and residents of the whole city, indirectly. A wrong process could lead to a wrong product, or a wrong product is the result of a wrong process. It is quite disappointing that in a time when the dominant theoretical views in urban design, such as sustainability, ecological design, new urbanism, collaborativism, and process-oriented design are emphasizing the key issues mentioned above, the *Navab*

Project is designed and implemented without any slightest attention to these concerns. We may, therefore, conclude that a wrong process has led to a wrong product (Bahrainy and Aminzadeh, 2007 a, b).

Table 4

Local developments in sustainable urban design

Urban design attributes (subs./proc.)		Theory/research	practice
Substantive	**Natural setting**		
Elements	Land form	0	0
	Ecosystem/biodiversity	1	0
	Vegetation	3	1
	Landscape	4	2
	Climate (wind, sun, air, water)	1	0
	Natural hazards	3	0
	Regional structure (bio-region, footprint)	0	0
	Urban form (size, structure, density)	0	0
	Public space	0	0
	Land use	0	0
	Infrastructure		
	Transportation	1	0
	Water	1	0
	Energy	1	0
	Waste	2	1
	Building materials	0	0
	Overall design	**2**	**0**
Procedural	**Urban design process**	3	0
Elements	**Behavior patterns**	2	0
	Indicators	1	0
	Practical mechanisms and guidelines	1	0
	Participation	3	1
	Capacity building	1	0
	Education/public awareness	3	1

By comparing Tables 2 and 4, we can have a general idea of the extensive gap between the knowledge developed worldwide on sustainable urban design and the knowledge at the national level. Successful experiences of the application of sustainable urban design concepts, however, reveal that urban design can, directly and indirectly, through its substantive and procedural elements influence the condition of cities and facilitate the gradual evolution toward sustainability.

Table 5

A comparison of global and local developments in sustainable urban design

Urban design attributes (subs./proc.)		theory/research		practice	
		Int.	Iran	Int.	Iran
Substantive	**Natural setting**				
Elements	Land form	2	0	0	0
	Ecosystem/biodiversity	6	1	3	0
	Vegetation	4	3	2	1
	Landscape	2	4	1	2
	Climate (wind, sun, air, water)	6	1	3	0
	Natural hazards	3	3	0	0
	Regional structure (bio-region, footprint)	4	0	2	0
	Urban form (size, structure, density)	4	0	1	0
	Public space	**3**	**0**	**1**	**0**
	Land use	**5**	**0**	**2**	**0**
	Infrastructure				
	Transportation (walkability, visitability)	7	1	4	0
	Water	6	1	3	0
	Energy	6	1	3	0
	Waste	8	2	5	1
	Building materials	**2**	**0**	**0**	**0**
	Overall design	**6**	**2**	**3**	**0**
Procedural	**Urban design process**	**6**	**3**	**4**	**0**
Elements	**Behavior patterns**	**7**	**2**	**3**	**0**
	Indicators	**8**	**1**	**3**	**0**
	Practical mechanisms and guidelines	**6**	**1**	**3**	**0**
	Participation	**8**	**3**	**6**	**1**
	Capacity building	**7**	**1**	**4**	**0**
	Education/public awareness	**8**	**3**	**5**	**1**

10. Barriers to the urban sustainable development in Iran

The unsustainability of urban design and planning in Iran is the victim of a vicious circle which is institutional in nature. Numerous significant factors are playing their role to preserve this status. The key to any change in this trend seems to be education and raising public awareness through all possible channels (see Bahrain and Azizkhani, forthcoming).

11. Conclusion

In seeking sustainability, we need to engage in a process of major change. This will have profound implications for urban design thinking and action at all levels from how we think of the structure of towns and cities and where we locate new developments to how we layout individual street blocks and design buildings within them.

Today urban planners and designers are well situated to help with reforming self-serving unsustainable behaviors. The concept has been touted as the new large-scale vision to guide the planning agenda for the 21st century. If sustainability is to move beyond vague idealism and rhetoric, the task ahead for urban designers, especially at the local level where most authority to manage and control development is located, is to translate theory into practice. Indeed, the complexity of the task requires holistic and integrative thinking--a task that should not be a distant ideal for urban designers who are well-grounded in substantive and political know-how.

Thus the answer to the question of whether urban design can play a role in making cities sustainable is a definite yes. Today we have considerable scientific evidence that the earth's temperature is rising and will continue to do so as a result of human activities. These activities include the use of fossil fuels – coal, oil and gas—for our buildings and transport, manufacturing and agricultural systems, which results in the increase of CO_2 and in turn global warning. Urban design, through its various substantive and procedural tools, can make significant and meaningful contributions to change the existing deteriorating trend in cities and facilitate their movement toward sustainability.

This will further add to the justification and legitimacy of the still emerging knowledge base of urban design and its professional effectiveness in dealing with real issues in cities. Trevor Roberts (2002) addresses this issue and suggests something which he calls "the changing orthodoxy of planning". His seven lamps of planning provide practical guidelines for urban designers. The study showed that during the last two decades the world has witnessed tremendous amount of progress, both in theory and practice, toward this goal. The case of Iran, as an example of a developing country, however, proves quite different. The three cases discussed above, as evidence, show that in spite of the critical conditions the cities are going through these days in Iran, and the urgent

need for the development and application of the sustainability concepts in urban design practice, no serious effort has been made so far in this regard. The traditional theories and techniques of modernism and the ones before it are still the dominant way of thinking and practicing in urban design education and practice in Iran. Major determinant barriers in this direction should be first dealt with to prepare the context for the application of sustainable concepts in urban design.

References

1) Aberley, D., ed., 1994. Futures by design: The practice of ecological planning, Gabriola Island: New Society Publishers.

2) Aldous, T., 1997. Urban villages: a concept for creating mixed-use urban developments on a sustainable scale (2nd edition), London: Urban Villagers Forum.

3) Angel, F.H. U. et al., 2003. A regional-scale sustainable development index: The case of Baja California Sur, Mexico, International Journal of Sustainable Development and World Ecology, London: Dec. vol. 10, Issue 4.

4) Anon, 1990. Climate and site development, Part 3: Improving microclimate through design, BRE Digest 350, BRE, Garston.

5) Anon, 1999. Guidelines for community noise, World Health Organization.

6) Anon, 2002. Renewable energy in the built environment, Building Center Trust. London.

7) Atkinson, A., 1992. 'The urban bioregion as sustainable development paradigm', Third World Planning Review, 14(4): 327-54.

8) Atkinson, C., Collins, R. and West, J., 1994. 'Use of waste materials in building products', First International Conference on Buildings and the Environment, CIB and BRE, Watford.

9) Bahrainy, H., 1993. Cities and earthquake, Paper presented to the International Symposium: Experiences, prevention, protection, Iraklion, Greece, 6-8 May.

10) Bahrainy, H., 1995. The impact of mass production and minimum housing policy on quality of environment in urban areas, Regional Seminar on the interaction between environment and population issues and their impact on urban and rural sustainable development, 3-5 Dec., University of Tehran, Iran.

11) Bahrainy, H., 1996a. Urban space analysis and design in relation to users' behavior patterns, Tehran: University of Tehran Press (in Persian).

12) Bahrainy, H., 1996b. Development and sustainable development: A theoretical analysis, Proceedings of a Seminar on Urban Sustainable Development, Department of Urban Planning, Faculty of Fine Arts,

University of Tehran, Iran (in Persian).

13) Bahrainy, H., 1996c. Third World urban planning in the21st. century: Urgent need for a new paradigm of sustainability, NETTLAP Regional Conference on Professional Development of Environmental Managers: A vision of the 21st. century, 10-13 Dec., Pattya, Thailand.

14) Bahrainy, H., 1997. Application of meteorology of air pollution in urban design of city of Tehran, MOHIT SHENASI, Journal of Environmental Studies, vol. 22, no. 18, March (in Persian).

15) Bahrainy, H., 1998a. City, urban planning and environment, MOHIT SHENASI, Journal of Environmental Studies, vol. 23, no. 20, March (in Persian).

16) Bahrainy, H., 1998b. Urban design and planning in a seismic-prone region, the case of Rasht in Northern Iran, Journal of Urban Planning and Development, ASCE, Dec., vol. 124, no. 4.

17) Bahrainy, H., 1998c. Urban Planning and sustainable development, Rahyaft, no. 17, Winter, pp. 28-40 (in Persian).

18) Bahrainy, H., 1999a. Exploring sustainability concepts in traditional settlements, Paper presented to The First Congress on Cultural and Natural Heritage, University of Tabriz, Iran (in Persian).

19) Bahrainy, H., 1999b. Indicators for urban unsustainability: The key to a change, Paper presented to a Seminar on Environment and sustainable development, University of Tehran, Oct. (in Persian).

20) Bahrainy, H., 1999c. Modernism, post modernism, and after in urban planning, Tehran: University of Tehran Press (in Persian).

21) Bahrainy, H., 2001. Housing, environment and sustainable development, Proceedings of the Eight Seminar on housing development policies in Iran: Human Settlement, employment and sustainable development, Ministry of Housing and Urban Development, Oct. 13-14, Tehran.

22) Bahrainy, H., 2003. Natural disaster management in Iran during 1990's—the need for a new structure, ASCE, Journal of Urban Planning and Development, vol. 129, No. 3, pp. 140-160, Sept.

23) Bahrainy, H., 2003. Unsustainable urban design: the case of the Navab Project in central Tehran, Iran, Paper presented at the 5th International Conference on Humane Habitat, Jan. 31st-Feb 2nd, Mumbai, India.

24) Bahrainy, H. et al. 2001. Guidelines and mechanisms for urban sustainable development, unpublished research report, Scientific Research Council of Iran (in Persian).

25) Bahrainy, H., 2006. Urban sustainable development agenda, unpublished research report, prepared for the Ministry of Interior (in Persian).

26) Bahrainy, H. and M. Ahmadi Torshizi, 1999. Recognition of the homeostasis mechanisms in the spatial-physical structure of the city, MOHIT SHENASI, Journal of Environmental Studies, University of Tehran, vol. 25, no. 23, Sept. (in Persian).

27) Bahrainy, H. and Amini, F, 2001. The role of environmental non-governmental organizations in citizen participation for environmental protection in Iran, MOHIT SHENASI, Journal of Environmental Studies, vol. 26, no. 26, March (in Persian).

28) Bahrainy, H. and B. Aminzadeh. 2007a. Urban design in Iran: a new approach, HONNAR-HA-YE-ZIBA, Journal of Fine Arts, University of Tehran, No. 26. Summer, pp. 13-27.

29) Bahrainy, H. and B. Aminzadeh., 2007b. Autocratic urban design: The case of Navab Regeneration Project in Central Tehran, IDPR, Vol. 29, No. 2. pp. 241-270.

30) Bahrainy, H. and B. Aminzadeh., 2007c. Evaluation of Navab Regeneration Project in Central Tehran, Iran. Int. J. Environ. Res., 1(2): 114-127, Spring.

31) Bahrainy, H. and M. Azizkhani (forthcoming), Institutional barriers to the application of urban village as a tool for achieving urban sustainability in developing countries—the case of Asheghabaad, Isfahan, Iran, Armanshahr Journal.

32) Bahrainy, H., Barakpour, N. and Khoshpour, H., 1996. An analysis of heat islands in Tehran, the role of land uses and its impact on air pollution in the City, The First Regional Conference on Climate Change, Tehran (in Persian).

33) Bahrainy, H. and Maknoon, R., 2001. Sustainable urban development: From ideas to actions, MOHIT SHENASI, Journal of Environmental Studies, vol. 27, no. 27, Sept., pp. 41-60.

34) Bahrainy, H. and Mobarghai, N., 1997. Evaluation of higher education in environmental fields in Iran, MOHIT SHENASI, Journal of Environmnetal Studies, Universtiy of Tehran, vol. 23, no. 19, Sept.

35) Bahrainy, H., Khoshpour, H. and Barakpour, N., 1999. The role of land use in the formation of heat islands and the resultant air pollution in the city of Tehran, Quarterly Journal of Man and Environment, Iranian Society of Environmentalists, No. 3 and 4, Spring and Summer.

36) Bahrainy, H. and Tabibian, M., 2000. A model for evaluation of quality of life in urban areas, MOHIT SHENASI, Journal of Environmental Studies, Vol. 24, No. 21, pp. 41-56.

37) Bahrainy, H. and Tajbakhsh, G., 2000. Territory concept in urban spaces and the role of urban design in its realization, HONNAR-HA-YE-ZIBA Journal of the Faculty of Fine Arts, University of Tehran, winter, No. 6, pp. 18-32.

38) Banister, D., Watson, S. and Wood, C., 1997. Sustainable cities: Transport, energy, and urban form, Environment and Planning and Design, vol. 24, pp. 125-143.

39) Barnett, J., 2003. Redesigning cities: Principles,

practice, implementation, Chicago: APA Planners Press.

40) Barton, H., ed., 1999. Sustainable communities: The potential of Eco-Village, London: Earthscan.

41) Beatley, T., n.d. Sustainable planning in European cities. Paper presented to 'Creating sustainable place' Conference, Arizona, Arizona State University, Tempe, AZ, Jan. 30-31, University of Virginia.

42) Beatley, T., 2000. Green urbanism, learning from European cities. Washington D.C.: Island Press.

43) Beauregard, R.A. 1995. Theorizing the global-local connection. In: Knox, P.L. and Taylor, P. J. (eds.). World cities in a world system, pp. 232-48. Cambridge: Cambridge University Press.

44) Beer, A. R. and Higgins, C., 2000. Environmental planning for site development: A manual for sustainable local planning and design, 2nd edition, London: E & FN SPON.

45) Berke, P. R., 2002. Does sustainable development offer a new direction for planning? Challenges for the 21st Century, J. of Planning Literature, 17(1), pp. 21-36.

46) Berg, P. and Daasmann, R., 1977. Reinhabiting California, The Ecology, 7(10), pp. 399-401.

47) Birkeland, J., 2002. Design for sustainability: a sourcebook of integrated, eco-logical solutions, London: Sterling VA: Earthscan publications.

48) Blowers, A., ed., 1993. Planning for a sustainable environment, London: Earthscan.

49) Blowers, A., 2000. Ecological and political modernization: The challenge for planning, TPR, 71(4), pp. 371-393.

50) Breheny, M. J., ed., 1992. Sustainable development and urban form, London: Pion.

51) Breheny, M. J. 1995. 'Compact cities and transport energy consumption', Transactions, Institute of British Geographers, vol. 20, pp. 81-101.

52) Brotchie, J., 1992. 'The changing structure of cities', Urban Futures, Special Issue 5, Feb., pp. 12-23.

53) Built Environment, 2002. Water management in urban areas, Vol. 28, no. 2.

54) Buckley, K., Buxton, M. and Mckenzie, F., 1991. 'Towards ecologically sustainable urban development', Urban Futures, vol. 4, pp. 47-54.

55) Burgess, B., Carmona, M. and Kolstee, T., eds. 1997. The challenge of sustainable cities: Neoliberalism and urban strategies in developing countries, London: Zed Books.

56) Cairnes, L., 1993. 'Water resources: Planning for sustainable water use', Urban Futures, vol. 3, no. 1, pp. 25-29.

57) Calthorpe, R., 1993. The next American Metropolis, New York: Princeton Architectural Press.

58) Calthorpe, P. and Fulton, W., 2001. The regional city: Planning for the end of sprawl, Washington D.C.: Island Press.

59) Campbell, S., 1996. Green cities, growing cities, just cities? Urban planning and the contradictions of sustainable development, JAPA, vol. 62, pp. 296-312.

60) Chandler, T. J., 1976. 'Urban climatology and its relevance to urban design', WMO, No. 438, Geneva.

61) Commission of the European Communities, 1990. Green Paper on Urban Environment Commission of the European Communities, Luxembourg.

62) Dalhuisen, J. M., Rodenburg, C. A., de Groot, H.L.F. and Nijkamp, P., 2000. Metropolitan areas and sustainable use of water: The case of Amsterdam, Amsterdam: Free University.

63) DETR, 2000. Millennium village and sustainable communities, London: DETR.

64) Department of Environment, Transport and the regions, 1998. The use of density in Urban Planning, London: DETR .

65) Dimoudi, A. and Nikolopoulou, M., 2000. Vegetation in the urban environment: Microclimatic analysis and benefits, PREC: Assessing the potential for renewable energy in cities, Centre for Renewable Energy Sources, Pikermi, Greece.

66) DoE (Iran), n.d., Iranian Committee on Sustainable Development, Tehran, Iran.

67) Dubourg, R., and Pearce, D. W., 1996. Paradigms for environmental choice: Sustainability vs. optimality. In: Faucheux, S., Pearce, D. and Proops, J., eds., Models of sustainable development, Cheltenham: Edward Eglar, pp. 21-36.

68) Ecological Design Group, 1996. Specifying benign, Environmentally Benign Building Materials Audit: A bioregion Approach for Scotland, Robert Gordon University, Aberdeen.

69) Edwards, B. and Hyett, P., 2001. Rough guid to sustainability, London: RIBA Publications.

70) Elkin, T., McLaren, D. and Hillman, M., 1991. Reviving the city: Towards sustainable urban development, London: Friends of the Earth.

71) Frey, H., 1999. Designing the city: Towards a more sustainable urban form, London: E & FN Spon.

72) Gibbs, D., 1994. Toward sustainable local development: The UK experience, International Journal of Sustainable Development and World Ecology, vol. 1, pp. 121-9.

73) Girardet, H., 1992. Cities: New directions for urban living, London: Gaia Books.

74) Girardet, H., 1999. Creating sustainable cities, Green, Dartingon.

75) Godschalk, D., 2004. Land use planning challenges: Coping with conflicts in visions of sustainable development and livable communities, JAPA, Winter, vol. 70, no.1, p. 5(9).

76) Golubev, A., 1993. 'Sustainable water development: implications for the future', International Journal of Water Resources Development, vol. 9, no. 2, pp. 127-54.

77) Goodchild, B., 2003. Sustainable development and the aims of planning, a'Lafraccuse, TPR, vol. 74, no.

2, pp. 239-245.

78) Gordon, D., ed., 1990. Green cities: Ecologically sound approaches to urban space, Montreal: Black Rose Books.

79) Gordon, P. and Richardson, H. W., 1997. Are compact cities a desirable planning goal? JAPA, vol. 63, pp. 95-106.

80) Grainger, A., 1999. The role of spatial scale in sustainable development, The International Journal of Sustainable Development and World Ecology, vol. 6, no. 4, Dec., pp. 251-264.

81) Gustavson, K., Lorengen, S. and Ruitenbeek, J., 1999. Selection and modeling of sustainable development indicators: a case study of the Fraser River Basin, British Columbia, Ecological Economics, vol. 28, pp. 117-32.

82) Haq, G., 1997. Towards sustainable transport planning: A comparison between Britain and the Netherlands. Avebury, Aldershot.

83) Hewitt, K., 1995. Sustainable disasters, perspectives and powers in the discourse of calamity, in: Crush, J., ed., Power of development, Rutledge, London.

84) High Council for Environmental Protection, National Committee on Sustainable Development, 2000. Bulletin no. 6, Nov.

85) High Council for Environmental Protection, National Committee on Sustainable Development, 2002. Iranian National Report on Sustainable Development presented to the Sustainable Development Summit, Johansburg.

86) Hobbs, G. and Collins, R., 1997. Demonstration of reuse and recycling of materials: BRE energy efficient office of the future, IP3/97, BRE, Garston.

87) Hoagland, W., 1995. Solar energy: Key technologies for the 21st Century, Scientific American, Sept, pp. 136-139.

88) Houghton, G. and Hunter, C., 1994. Sustainable cities. Regional policy and development, series 7, London: Regional Studies Association.

89) Housing Foundation of I.R.I., 1997. Fundamentals and principles of rural sustainable development, Unpublished paper.

90) Intergovernmental panel on climate change, 1996. Climate change 1995: Second Assessment Report, Cambridge University Press.

91) International Atomic Energy Agency, 2002. Indicators for Sustainable Energy Development, IAEA Information Series, Division of Public Information, 02-01570/FS Series 2/02/E.

92) International Energy Agency, 2001. Toward a sustainable energy future, OECD.

93) I.G.U., 2001. "International Geographical Union, Commission on Hazard and Risks", Round brief Geography , vol. 168, pp. 15-16.

94) Jenks, M., Burton, E. and Williams, K., 1996. The concept city: a sustainable urban form?, London: E&FN Spon.

95) Jepson, E. J., 2004. The adoption of sustainable development policies and techniques in U.S. cities: How wide, how deep, and what role for planners, Journal of Planning Education and Research, vol. 23, pp. 229-241.

96) Krier, L., 1998. Architecture: Choice or fate, Windsor, Andreas, Papadakis.

97) Krizek, K., and Power, J., 1996. A planner's guide to sustainable development (PAS Report 467), Chicago: APA.

98) Kunstler, J. H., 1994. The geography of nowhere, New York: Simon and Schuster.

99) Landsberg, H. E., 1981. The urban climate, New York: Academic Press.

100) Leitman, J., 1999. Sustainable cities: Environmental planning and management in urban design, New York: McGraw-Hill.

101) Littlefair, P. J. et al., 2000. Environmental site layout planning: Solar access, Microclimate and passive cooling in urban areas, B.R.E., Garston.

102) Littlewood, J., 2002. Recycling concrete—a hard grind, Building, vol. 267, no. 1, p. 33.

103) Maknoon, R., 1996. National strategy for sustainable development, Paper presented to the 'Sustainable Development and Environment Seminar, University of Tehran. Nov.

104) Mangold, D., 2001. Solar in the city, Renewable Energy World, vol. 4, no. 3, pp. 100-111.

105) May, A. D. et al., 1996. The quantifiable city: The development of a modeling framework for urban sustainability research, presented to Workshop on Information Systems and Processes for Urban Civil Engineering Applications, Nov., Rome, cited in: Grainger, 1999.

106) McLaren, V. W., 1996. Urban sustainability reporting, JAPA, vol. 623, pp. 184-202.

107) McGinnis, M. V., ed., 1999. Bioregionalism, London: Routledge.

108) Meyer, W. B., 1991. 'Urban heat island and the urban health: early American Perspectives', Professional Geographer, vol. 43, no. 1, pp. 38-48.

109) Mitchell, G., Mary, A. and McDonald, A., 1995. PICABUE: A methodological framework for the development of indicators of sustainable development, International Journal of Sustainable Development and World Ecology, vol. 2, pp. 104-23.

110) Moughtin, C., 1996. Urban design: Green dimensions. Oxford, Boston Butterworth Architecture.

111) Nijkamp, P. & Perrels, A., 1994. Sustainable cities in Europe, London: Earthscan.

112) Owens, S. and Cope, D., 1992. Land use planning and climate change, London: HMSO.

113) Owens, S. and Cowell, R., 2002. Land and limits: Interpreting sustainability in the planning process, London: Routledge.

114) Pike, A., 1998. World class cities offer 'key to regional success', Financial Times, 6 April, p. 8.

115)	Rees, W. E. and Roseland, M., 1991. 'Sustainable communities'. Planning for the 21st Century, Plan Canada vol. 31, no. 3, pp. 15-26.

116)	Roberts, T., 2002. The seven lamps of planning, TPR, vol. 73, no. 1, pp. 1-16.

117)	Rudlin, D. and Falk, N., 1999. Building the 21st Century Home: The sustainable urban neighborhood, Oxford: Butterworth-Heinemann.

118)	Seymour, J., 1979. The self-sufficient Gardener, Quoted in: Heinberg, R., 2004, Power down: options and actions for a post-carbon world, New Society Publishers.

119)	Smith, M., Whitelegg, J. and Williams, N., 1998. Greening the built environment, London: Earthscan.

120)	Smith, P. F., 2001. Architecture in a climate of change: a guide to sustainable design, Oxford, Boston: Architectural Press.

121)	Steemers, K., 2001. Urban form and building energy, In: Echenique, M. and Saint, A., eds., Cities for the New Millennium, Spon, London.

122)	St. John, A., ed., 1992. The sourcebook for sustainable design: a guide to environmentally responsible building materials and processes, Boston, MA: Architects for Social Responsibility.

123)	Stone, B., 2003. Air quality by design, harnessing the Clean Air Act Manage Metropolitan growth, Journal of Planning Education and Research, vol. 23, pp. 177-190.

124)	The Urban Task Force, 1999. Towards an urban Renaissance, E &FN Spon, London.

125)	Thomas, R. and Fordham, M., eds., 2003. Sustainable urban design: An environmental approach, New York: Spon Press.

126)	Tourane, C. N. et al., 2003. Assessing sustainability: An assessment framework to evaluate Agenda 21 actions at the local level, International Journal of Sustainable Development and World Ecology, London, vol. 10, no. 3.

127)	U.N.C.H.S. (Habitat), 1993. Promoting sustainable construction industry activities, Paper presented at the First Consultation on the Construction Industry, Tunis, Tunisia, 3-7 May.

128)	U.N.D.P., 1991. A strategy for water sector capacity building, UNDP. Delft.

129)	U.N.D.P., 2001. Human Development Report 2001, New York: Oxford University Press.

130)	U.N.E.P., 2001. Annual Report.

131)	Unwin, N. and Searle, G., 1991. 'Ecologically sustainable development and urban development', Urban Futures, Special Issue 4, November, 1-12.

132)	U.S. E.P.A., 1992. 'Cooling our communities, a guide book on tree planting and light-colored surfacing', Washington, E.P.A.

133)	Van der Ryn, S. and Cowan, S., 1996. Ecological design. Washington D.C.: Island Press.

134)	Van Diepen, A. and Voogd, H., 2001. Sustainability and planning: does urban form matter? International Journal of Sustainable Development, vol. 4, No. 1, pp. 59-74.

135)	Alexey, V., 2007. Understanding and communicating sustainability: global vs. regional perspectives, Journal of Environment, Development and Sustainability, pp. 487-501. Feb.

136)	Wackernagel, M. and Rees, W., 1996. Our ecological footprints: reducing human impact on Earth, New Society Publishers, British Columbia.

137)	Whitelegg, J., 1993. Transport for a sustainable Future: The case for Europe, Belhaven, London.

138)	Yale Center for Environmental Law and Policy and Center for International Earth Science Information Network, 2000. Environmental Sustainability Index.

Websites

1.	www.iclei.org/edrope/aalcon.htm
2.	www.socsci.umn.edu
3.	http://www.stopwaste.org/
4.	http://www.sustainable-city.org/
5.	http://www.eeve.energy.gov/
6.	http://www.sustainable.doe.gov/
7.	http://www.lib.berkeley.edu/ENVI/solardesign.html
8.	http://www.lib.berkeley.edu/ENVI/climate.html
9.	http://www.ciesin.columbia.edu/indicators/ESI