Chapter 8
Technologies in Urban Design Practice:
Integrating Environmental Design Considerations

Yan Zhu
University of Nottingham, UK

Tim Heath
University of Nottingham, UK

ABSTRACT

This chapter argues that urban sustainability needs to consider the user's engagement, and in particular, the influence of physical urban environmental conditions. Environmental performance such as outdoor thermal comfort is a crucial factor that influences people's use of the urban environment, and it should, therefore, be fully integrated into the urban design process. As such, available and affordable computational tools, such as EcoTect and CFD simulation, can enable designers to deliver more successful physical urban environments. Through live project case studies, this chapter will demonstrate that using such computational tools can help mainstream urban designers, architects, and landscape designers to improve and adjust physical urban environmental conditions and therefore encourage outdoor activities that can deliver more sustainable urban places.

INTRODUCTION

In recent decades, issues such as global warming and the rapid depletion of fossil fuels have made sustainability a significant and critical issue for architecture and urban design. As such, researchers and practitioners have focused upon the investigation and analysis of environmental design in architectural design practice (for example: Littlefair 1991 & 2001; Kolokotroni et. al. 2007). Urban sustainability has been widely studied and discussed from both a social perspective (Williams 2007; Farr 2008; Ritchie & Thomas

DOI: 10.4018/978-1-61350-453-6.ch008

2009) and a technical perspective (Nikolopoulou et. al. 2001; Nikolopoulou & Steemers 2003; Steemers 2003; Ratti et. al. 2005). In addition, the interrelationship between environmental performance and urban forms, and its significance in achieving urban sustainability has also been explored and discussed in contemporary urban design research (Ratti 2003; Chatzidimitriou & Yannas 2004; Cheng et. al. 2006; Ali-Toudert & Mayer 2006; Ali-Toudert & Mayer 2007). The possibility of designing urban form to improve the local microclimatic environment has also been discussed for over a decade (Yannas 2001). It is important for urban design practitioners to consider the interrelationship between microclimatic environments and design interventions and this can have a significant effect upon mainstream urban design practice. Therefore, the purpose of this chapter is to discuss the potential for urban design practitioners to integrate environmental design, solar performance and air-flow performance, from the beginning of the design process. The utilisation of market-available digital design tools in this process can significantly help urban design practice to pursue the goal of urban sustainability. To demonstrate this approach, this chapter will use three recently completed live-project case studies to illustrate its application in practice.

In 1900, just 10 per cent of the world's population lived in cities, today, by 2010 this figure had risen to over 50 per cent and it is estimated to reach 75 per cent by 2050 (Burdett & Sudjic 2007). The fact of the matter is that we now live in an 'urban age'. Rapid urbanisation has only exacerbated this problem, with cities held responsible for a large number of these changes and therefore a driving force behind this environmental catastrophe.

Urban sustainability has been debated often in the last decade. However, there is a consensual definition:

"A sustainable city is organised so as to enable all its citizens to meet their own needs and to enhance their well-being without damaging the natural world or endangering the living conditions of other people, now or in the future." (Girardet 1999: p13)

The concept of sustainability in an urban context differs from the general term of sustainability in other sectors. Sustainability in an urban context can be divided into four major interrelated components - social, climatic, economic and cultural (Elkin et. al. 1991; Philips 2003; Carmona et. al. 2010; Boyko et. al. 2005; Heath et. al. 2010). Sustainability as an integrated approach proposes the creation of physically-enhanced and socio-economically viable urban environments. A comprehensive design approach could therefore assist in determining urban form in many ways, for example, lessening the need for vehicle-based travel to promote more walking and cycling; creating a denser urban fabric to create more open spaces; and providing more opportunities to enhance the socio-economic base of a city.

Yannas (2001) argued that in order to pursue sustainable urban design, many environmental design considerations should be involved and the physical dimensions of urban form should be exploited to influence the microclimatic environmental parameters. Indeed, it was suggested that urban form could play a significant role in meliorating local microclimate conditions. There are many scholars that have dedicated their research on the comfort of outdoor spaces (Nikolopoulou et. al. 2001; Nikolopoulou & Steemers 2003). It has been concluded that although the environmental conditions of outdoor spaces are not the only decisive factor that determines outdoor activities, they have a considerable influence upon users' decisions in terms of outdoor activities. Indeed, physical environmental conditions in an urban context, such as open spaces and public places, have been well discussed (Spagnolo & de Dear 2003). It is now commonly accepted that the physical environmental conditions of the built environment should respond to the local microclimate, and outdoor open spaces should be well