PART 2—
CONSIDERATIONS FOR BEST USE OF CONCRETE FOR SUSTAINABLE STRUCTURES

Chapter 1—Carbon footprint

As discussed in the Introduction, the environmental impact portion of sustainability reaches far beyond CO_2 alone, but CO_2 is given special consideration in this book due to the direct relationship between cement production and CO_2 emissions. A carbon footprint is "the total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event or product" (Carbon Trust 2007). A carbon footprint essentially measures the potential contribution humans have on climate change as expressed in weight of CO_2 equivalent.

A carbon footprint, therefore, includes both CO_2 emissions directly associated with the manufacture of an item or product (including the extraction of resources, burning of fossil fuels for energy to manufacture, and for transporting materials and the final product) and indirectly through its continued use, operation, and maintenance. For example, the creation of an article of clothing generates CO_2 during the manufacturing and the shipping of the raw and finished materials. Additionally, energy used in laundering the clothing article contributes additional CO_2 emissions.

For concrete, the life cycle emissions can be segregated into that generated during the building construction (direct) and the operational energy used by the building (indirect). In the case of buildings, CO_2 emissions generated during the lifetime operational phase are considerably more than those generated during construction.

Cement production

As discussed in Part I, cement production directly produces CO_2. Approximately one-half of the CO_2 emissions from cement production come from combustion (burning of coal or other fossil fuels) with the other half from calcination (the conversion of limestone to lime, liberating CO_2). The Environmental Protection Agency (EPA) published an online version of a working draft in May 2008 on Quantifying Greenhouse Gas Emissions from Key Industrial Sectors in the United States. This working draft provides objective comparisons of the 14 industrial sectors that contribute the majority (over 84%) of greenhouse gas emissions in the U.S. based on 2002 statistics. This report defines a consistent description of boundaries for a sector and consistent