



DEEP FOUNDATIONS INSTITUTE

Headquarters
326 Lafayette Avenue
Hawthorne, NJ 07506 USA
T: 973 423 4030 F: 973 423 4031
dfihq@dfi.org | www.dfi.org
Theresa Rappaport
Executive Director

DFI SUSTAINABILITY COMMITTEE

GUIDANCE NOTE 1

EMBODIED ENERGY AND CARBON DIOXIDE

When investigating the environmental impact of materials and products used in deep foundations the most common concepts used are Embodied Energy and Embodied Carbon Dioxide.

Embodied Energy is the total primary energy consumed over a defined part of the lifecycle. The lifecycle is often taken to be "cradle to gate", i.e. includes all of the energy used in producing the material or product up to the point it leaves the producer's premises, including the winning of raw materials, the transportation of raw materials, all manufacturing processes, and all other associated uses of energy.

Embodied Carbon Dioxide is the amount of CO₂ produced over a defined part of the lifecycle. The lifecycle is again often taken to be "cradle to gate", i.e. includes all of the CO₂ associated with the consumption of energy used in producing the material or product, and also includes any other CO₂ emissions resulting from the production process up to the point it leaves the producer's premises.

The use of Embodied Energy or Embodied Carbon Dioxide as a concept is to simplify the way that the environmental impact of materials and products used in deep foundations is assessed. Alternatively a full lifecycle analysis can be undertaken, but this requires specific expertise as it will consider all environmental aspects including resource depletion, waste production and ozone depletion.

For a building or structure Embodied Carbon Dioxide is becoming the preferred method because it considers both the environmental impacts associated with the fabric itself plus those associated with its operation in use after construction. For deep foundations there is unlikely to be any ongoing operational energy requirements so either method can be used (exceptions for example would be if there is associated long term dewatering by pumping, or if a ground energy system is being incorporated which may pump groundwater from an aquifer or a heat transfer fluid within the foundations).

A direct comparison of the CO₂ of different materials or products is not encouraged. Instead elements performing the same function should be compared (for example to compare a concrete and a steel bearing pile do not simply compare the CO₂ values for concrete and steel, but compare the CO₂ values for the whole concrete pile with that for the whole steel pile, as the two pile types will have a different geometry).

The environmental impacts of construction materials are increasingly coming under scrutiny in the design and planning process. Many studies have been undertaken throughout the world. Many trade associations and interest groups have published such data, but if not verified by an independent party these should be used with caution. Independent and freely available data is preferred but is unfortunately not widely available.

