



CONCRETE'S CONTRIBUTION TO SUSTAINABLE CONSTRUCTION



CEMENT INDUSTRY OPEN WEEK

Concrete is a versatile construction material, providing sustainable advantages throughout the entire life cycle of a building or a civil structure. This is important when bearing in mind that a house, an office block, a warehouse, an airport, a railway, a bridge, a road or any other structure, will have a service life of many decades.

The creation of the structure and the making of the construction materials it requires will, of course, generate emissions, in particular CO₂ emissions. That is the case when steel and/or concrete are being used. But it is an established fact that these CO₂ emissions do represent a much lower contribution to climate change than the emissions related to energy used and the energy saved by the structure over its service life.

For example, according to the [Energy Performance of Buildings Directive \(2002/91/EC\)](#) the “residential and tertiary sector, the major part of which is buildings, accounts for more than 40% of final energy consumption in the Community and is expanding, a trend which is bound to increase its energy consumption and hence also its carbon dioxide emissions”. As a building material, concrete contributes positively towards the energy efficiency of building. The thermal mass of concrete enables significant energy savings related to heating and cooling.



Examples of the benefits of concrete include a **reduction in heating energy consumption by 2 – 15%**, its ability to reduce peak temperatures which can make air-conditioning unnecessary, and the fact that it optimises the benefits of solar gain, thereby reducing the need for heating fuel. Heavyweight concrete buildings can also provide outstanding air tightness, which is another positive feature in respect of heating energy.

In addition, intelligent combinations of heating, ventilation, solar shading and building structure can **reduce energy use for cooling and related CO₂ emissions by up to 50%**. For example, investments in concrete together with insulation reduce the need for heating in winter, as well as protecting against heat and limiting the need for air-conditioning during warmer summer months.

Infrastructure projects range from small road construction over standard rail or road overpass bridges to large megaprojects with an expected service life of many decades.

Concrete road pavements reduce the need for maintenance and the CO₂ emissions related thereto. Concrete has a higher material stiffness which means less deflections under the wheel loads and, therefore, less resistance against rolling, resulting in fuel savings. A series of four studies by the National Research Council of Canada highlighted that the fuel saving on concrete roads compared to asphalt roads, both for an empty and full tractor-trailer unit, ranged from 0.8 to 3.9% and this was found with statistically significant results with a confidence level of 95%. Over the lifetime of a busy motorway, an average fuel saving of 2.35% represents an immense difference in emissions of CO₂ and polluting gasses.

Different pavement colours can also lead to a difference in the need for artificial electrical lighting. Concrete has better reflectivity, as such the need for artificial lighting during dark hours is reduced. In addition, the lighter appearance of pavements also results in improved traffic safety as obstacles are more visible.

Sinard tunnel

The Sinard Tunnel is located just south of Grenoble in the east of France on the A51 motorway between Grenoble and Marseille. Concrete pavement was the material of choice due to its lighter colour and better durability. The higher reflectivity of the concrete pavement results in better traffic safety and lower energy consumption for tunnel lighting.

Royal Danish Playhouse

The project design of this 12.000m² building focused on reduced energy consumption for heating and cooling. The project quantified visions of reduced CO₂ emissions of up to 75% compared with traditional building design. Concrete structures are used as a heat sink and, in connection with a highly intelligent building energy management system, this contributes towards reductions in energy consumption and CO₂ emissions.

Atrio shopping centre

The Atrio shopping centre opened in Villach (Austria) in 2007 and has a floor area of 28.000m². The pile foundation (which is the part of a structure used to carry and transfer the load of the structure to the bearing ground located at some depth below ground surface) has been designed to serve as a heat exchanger with the underground. Annual savings of 500 tonnes of CO₂ have been estimated.



Marmaray Project

The Marmaray Project is a major transportation infrastructure project across the Istanbul strait (Turkey). As well as taking pressure off road and maritime traffic, the Marmaray Rail Tube Tunnel and Commuter Rail Mass Transit System is expected to lead to an annual average reduction in greenhouse gases of approximately 115,000 tonnes/year over the first 25 years of operation. More information: www.marmaray.com

Normandy bridge

In France the Normandy bridge across the Seine estuary, a gateway between Northern and Southern France as well as to the West coast, a project completed in 1987, allows a reduction of travel time of 20 minutes for cars, 25 minutes for lorries, leading to an average gain of time of 300 000 hrs and a saving of about 3500 tonnes of oil equivalent each year, with the corresponding reduction of CO₂ emissions.



Twin layer concrete pavement

In Austria, the technique of twin layer concrete, which allows the use of recycled concrete from the demolished pavement in the lower course, is widely applied. Growing environmental awareness and an innovative desire encouraged the Flemish Authorities to follow the Austrian example and it was decided to proceed with the construction of a 3 km pilot section in continuously reinforced concrete on the E34 express road at Zwijndrecht near Antwerp.



The design strives both for durability and sustainability, with Continuously Reinforced Concrete Pavement being noted for its long lifetime combined with concern for the environment and the finite nature of natural resources. This project may therefore be most certainly regarded as an optimised sustainable road design.

Cement is a basic material for all types of construction: housing, commercial buildings, schools, hospitals, roads and bridges. The most important use of cement is in the production of concrete, typically making up 12% of the total concrete mix. Concrete is an essential, virtually irreplaceable product used in the built environment.



About CEMBUREAU:

CEMBUREAU is the European Cement Association, representing the cement industry in Europe. Acting as the spokesperson for this industry towards the European Institutions and other public authorities, CEMBUREAU communicates the industry's views on all topics and policy developments with regard to technical, environmental and promotional issues.



About EUPAVE

EUPAVE is a non-for-profit association, with the objective to promote all aspects of cement and concrete products to the transport infrastructure and related areas in particular the specific contributions of cement and concrete to road safety, fuel consumption, congestion reduction and sustainable construction, amongst others.