

Editorial: Can we have 'one-sided' concrete impact only?

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The first time I came across the phenomenon of 'impact' was during my student years, in the subject of structural dynamics. I learned about the common system of the impacting and the impacted objects. My well-respected professor underlined: you shall remember that, due to the action of the impacting object, one shall have a response from the impacted object, notwithstanding how much they are different.

The theme of the third *fib* Congress in Washington in 2010 was 'Think globally – Build locally'. We had at the Congress a large number of presentations – partly during the sustainability sessions – dealing with the impact of concrete on the environment and on society. In my understanding, both the environment and society will have some, but often indirect, response impacts on concrete. I would not like to deal with the response impact of society, this is not the special duty of an engineer, but I think this problem should have been considered by others too. What I would like to try in this short editorial is to discuss the existence of response impact(s) of the environment on concrete.

It is well known that all the industrial activities – including cement and steel production, concrete casting, erection of structures and so on – are sources of greenhouse gas (GHG) emission. These gases are considered to be probably the main cause of global warming and consequently causes of climate change. It is supposed that the earth could balance the GHG emission increase up to a certain limit; exceeding this limit the changes would be irreversible.

While making concrete more environmentally friendly is a great step to reduce the footprint of concrete on the environment, there will still be a footprint. Unfortunately there are some emission sources which add significantly to the footprint and will not decrease, or at least not sufficiently, in the future, but everybody should act to reduce the footprint as best they can.

Nowadays there are lots of signs of climate change(s). The high summer heat and the more frequent meteorological extremes will be of no little interest for concrete technology and for concrete structures. Our concrete industry should not be short-handed and should deal with the possible response impact of the changing environment. In this way, we could treat the impact of concrete on the environment together with the response impact of the probable climate change (due to the changing environment) on concrete structures.

The next question is what would be included in the possible response impact of the environment on concrete structures? There are, first of all, higher temperatures, then more frequent and higher extreme values of wind speed, more precipitation in winter and spring, and less precipitation in summer. Last but not least, the greater frequency of higher-speed winds and increased precipitation would result in more frequent and more intense driving rain.

These are impacts of climate change on concrete structures, but they are special kinds of impacts because the values of these impacts are unknown; these are uncertain future values.

Let us see first what could be the main consequence of these impacts on concrete. The higher summer temperature together with less precipitation would be hard for in-situ concrete technology (casting and curing). The extreme wind and the high precipitation in winter (the snow load) would cause higher design loads, the driving

rain would cause deterioration of the concrete outer surfaces.

Second, let us see why these are uncertain values. Usually everything which will be in the future is uncertain. Up to now, for future events – for example, new buildings – the structural design approach used the traditional statistical methods of the evaluation of past events. Now, however, we know that the future will be different from the past.

What can we do? The first natural step would be to ask the meteorologists; but their first answer would be: we can only give you general values for a large time interval – for example, 30 years – based on global models. However, for a more or less correct estimation one needs to know the probability of repetition of the extreme values of, for example, wind, snow and hurricanes. This is much more complicated; validated local models are needed as well as complex statistical assessment of the possible extreme values and their frequencies. Some research work in this direction is going on, and it is hoped it will provide acceptable results in the near future.

The impact of the industrialised world on the environment is continuously changing and, at the same time, there is an answer: a continuously changing impact from the environment on the whole globe, including on concrete structures. So here is the answer to the question raised in the title: no one-sided impact exists. There should be a response impact too (like in mechanics, with the substantial difference; the response impact is originated not only from one given object – in our case not only from the emission of one concrete object, but from many other emission sources globally).

Summing up, all human activities (industry, transport, agriculture, construction, household, astronautics and so on) are sources of GHG emissions; these gases are reflecting the heat radiation of the earth; this leads to higher

earth temperature; the higher temperature changes climate. Climate change could change all the living/operation conditions on

Earth. In future, concrete structures would be subjected to the actions mentioned above.

The duty of engineers is to take these effects

into account and not rely on robustness alone without any additional assessment. This will require real global thinking for local building.