

## Implications of climate change on the lifetime of concrete infrastructure in the US

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### Abstract:

This study explores what the equivalent age of concrete in a structure will be due to projected changes in temperature. Additionally, the impact of rain on the erosion of concrete cover is considered. The contiguous United States temperature data is obtained from the NOAA's Gridded Climate Divisional Dataset (CLIMDIV)<sup>1</sup>. Then, the maturity method is applied using projected changes in the climate from the Intergovernmental Panel on Climate Change (IPCC)<sup>2</sup> to estimate the impact of temperature changes on the concrete for each U.S. climate division. The analysis is run considering the temperature-induced changes to nominal and high strength concrete used in structures built today and in the coming decades. The results indicate the equivalent age of concrete structures built in the U.S. between 2050-2070 will be reduced by 0-18% for nominal strength concrete, and 0-29% for a high strength concrete. Experimental erosion data is used to estimate the impact of precipitation changes on steel reinforcement cover loss. Projected rain erosion may result in 0% cover at the end of the 70-year lifetime. It is also found that changes to temperature and precipitation only have minor effects on existing models of carbonation of concrete structures. There is a need for projected precipitation extreme data to better assess the impact of erosion.

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<sup>1</sup> R. S. Vose, S. Applequist, M. Squires, I. Durre, M. J. Menne, C. N. Williams Jr., C. Fenimore, K. Gleason, and D. Arndt (2014). *NOAA's Gridded Climate Divisional Dataset (CLIMDIV) U.S. Climate Divisions*. NOAA National Climatic Data Center accessed April 2020, doi: 10.7289/V5M32STR

<sup>2</sup> IPCC (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]*. IPCC, Geneva, Switzerland, 151 pp.