Lifetime seismic vulnerability assessment of highway bridges considering climate change

In recent decades, particularly after the industrial revolution, the emissions of greenhouse gas (CO_2) has substantially increased. The continued increase in the CO_2 concentration can lead to an increase in global temperature (see Fig. 1). It is important to note that, the increase in temperature has an effect on the rate of corrosion and consequently, the seismic performance of the bridges may be affected by this variation. In fact, numerous studies have attempted to explain the effects of climate change and global warming on corrosion and maintenance cost of highway bridges. There has been little discussion about the seismic vulnerability due to climate change.

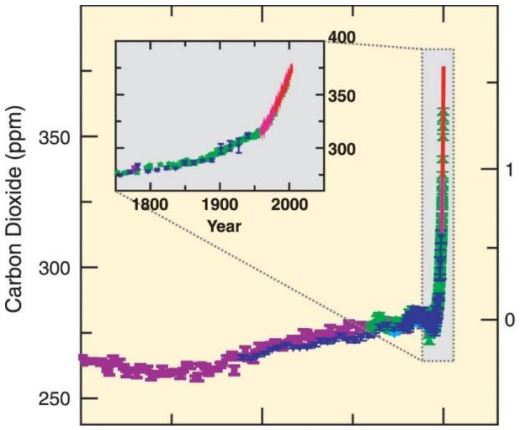

Fig. 1: The change of atmospheric CO_2 concentration (IPCC, 2007)

In this regard, this study seeks to address the influence of climate change on the seismic vulnerability of aging bridges when located in regions characterised by moderate to high seismicity.

This research focuses on a framework to evaluate the seismic performance of the bridge components under a multi-hazard threat scenario, i.e., earthquake hazard, aging and deterioration, and global warming due to climate change. Firstly, based on a future climate change scenario, the influence of aging and climate change is estimated on the seismic performance of a case study multi-span continuous steel girder bridge (MSC steel girder bridge) located in the Central and Southeastern United States. It is observed a decrease in median fragility when climate change is considered within the framework of seismic vulnerability assessment of highway bridges (see Fig. 2). Second, a comprehensive study of the bridge bearings deterioration due to aging and climate change is provided.

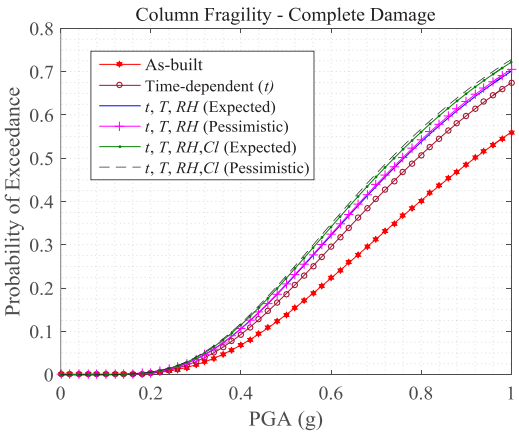

Fig. 2: Seismic fragility curves of the bridge columns for complete damage considering corrosion deterioration of columns only

Our ongoing work includes evaluation the effect of climate change due to both of corroded columns and bearings on the seismic fragility.

Prof. Jayadipta Ghosh, Department of Civil Engineering, jghosh@iitb.ac.in