

## CO<sub>2</sub> Emission and Cost Optimization of Reinforced Concrete Frame Designed by Performance Based Design Approach

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**Abstract :** As greenhouse effect has been recognized as serious environmental problem of the world, interests in carbon dioxide (CO<sub>2</sub>) emission which comprises major part of greenhouse gas (GHG) emissions have been increased recently. Since construction industry takes a relatively large portion of total CO<sub>2</sub> emissions of the world, extensive studies about reducing CO<sub>2</sub> emissions in construction and operation of building have been carried out after the 2000s. Also, performance based design (PBD) methodology based on nonlinear analysis has been robustly developed after Northridge Earthquake in 1994 to assure and assess seismic performance of building more exactly because structural engineers recognized that prescriptive code based design approach cannot address inelastic earthquake responses directly and assure performance of building exactly. Although CO<sub>2</sub> emissions and PBD approach are recent rising issues on construction industry and structural engineering, there were few or no researches considering these two issues simultaneously. Thus, the objective of this study is to minimize the CO<sub>2</sub> emissions and cost of building designed by PBD approach in structural design stage considering structural materials. 4 story and 4 span reinforced concrete building optimally designed to minimize CO<sub>2</sub> emissions and cost of building and to satisfy specific seismic performance (collapse prevention in maximum considered earthquake) of building satisfying prescriptive code regulations using non-dominated sorting genetic algorithm-II (NSGA-II). Optimized design result showed that minimized CO<sub>2</sub> emissions and cost of building were acquired satisfying specific seismic performance. Therefore, the methodology proposed in this paper can be used to reduce both CO<sub>2</sub> emissions and cost of building designed by PBD approach.

**Keywords :** CO<sub>2</sub> emissions, performance based design, optimization, sustainable design

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