Comparative Durability Analysis of CFRP Strengthened RC Highway Bridges

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Mots-clés	CFRP strengthening [4], Chloride-induced corrosion [5], Live load [6], RC bridges [7], Structural reliability [8]
Résumé en anglais	The paper presents parametric analysis of durability factors of RC highway bridges strengthened with CFRP laminates during their service life. Durability factors considered are concrete cover and CFRP laminate thickness. Three deterioration factors were considered. First, growth of live load with time. Second, resistance reduction due to chloride-attack corrosion which causes reduction in steel properties. Corrosion losses are evaluated through a time–temperature dependent corrosion current. Two types of corrosion are considered; uniform and pitting corrosion. Third, deterioration due to aging of CFRP. The reliability analysis is controlled by three failure modes; concrete crushing, CFRP mid span debonding and CFRP rupture. Monte-Carlo simulation is used to develop time dependent statistical models for rebar steel area and live load extreme effect. Reliability is estimated in term of reliability index using FORM algorithm. For illustrative purpose, a RC bridge is assumed as an example. The reliability of interior beam of the bridge is evaluated under various traffic volumes and different corrosion environments. The bridge design options follow AASHTO-LRFD specifications. The present work also extends to calibrate CFRP resistance safety factor corresponds to three target reliability levels, β = 3.5, 3.85, and 4.2. The results of the analysis have shown that corrosion has the most significant effect on bridge life time followed by live load growth. Pitting corrosion type is more hazardous than uniform. Also, initial safety index is proved to be traffic dependent. AASHTO design equation (that corresponds βtarget = 3.5) seems to be overestimated for strengthening purpose. Strengthening with (βtarget = 4.2) provide better reliability than βtarget proposed by AASHTO provision with no significant differences in CFRP amounts required.
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