Time-variant flexural reliability of RC beams with externally bonded CFRP under combined fatigue-corrosion actions

Titre	Time-variant flexural reliability of RC beams with externally bonded CFRP under combined fatigue-corrosion actions
Type de publication	Article de revue
Auteur	Ali, Osama [1], Bigaud, David [2]
Editeur	Elsevier
Type	Article scientifique dans une revue à comité de lecture
Année	2014
Langue	Anglais
Date	novembre 2014
Pagination	257-270
Volume	131
Titre de la revue	Reliability Engineering and System Safety
ISSN	0951-8320
Résumé en anglais	Time-variant reliability analysis of RC highway bridges strengthened with carbon fibre reinforced polymer CFRP laminates under four possible competing damage modes (concrete crushing, steel rupture after yielding, CFRP rupture and FRP plate debonding) and three degradation factors is analyzed in terms of reliability index β using FORM. The first degradation factor is chloride-attack corrosion which induces reduction in steel area and concrete cover cracking at characteristic key times (corrosion initiation, severe surface cover cracking). The second degradation factor considered is fatigue which leads to damage in concrete and steel rebar. Interaction between corrosion and fatigue crack growth in steel reinforcing bars is implemented. The third degradation phenomenon is the CFRP properties deterioration due to aging. Considering these three degradation factors, the time-dependent flexural reliability profile of a typical simple 15 m-span intermediate girder of a RC highway bridge is constructed under various traffic volumes and under different corrosion environments. The bridge design options follow AASHTO-LRFD specifications. Results of the study have shown that the reliability is very sensitive to factors governing the corrosion. Concrete damage due to fatigue slightly affects reliability profile of non-strengthened section, while service life after strengthening is strongly related to fatigue damage in concrete.
URL de la notice	http://okina.univ-angers.fr/publications/ua5492 [3]
DOI	10.1016/j.ress.2014.04.016 [4]

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