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Steel Concrete Composite Bridge: Modelling Approach and Analysis

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Abstract : India being vast in area and population with great scope of international business, roadways and railways network connection within the country is expected to have a big growth. There are numerous rail-cum-road bridges constructed across many major rivers in India and few are getting very old. So there is more possibility of repairing or coming up with such new bridges in India. Analysis and design of such bridges are practiced through conventional procedure and end up with heavy and uneconomical sections. Such heavy class steel bridges when subjected to high seismic shaking has more chance to fail by stability because the members are too much rigid and stocky rather than being flexible to dissipate the energy. This work is the collective study of the researches done in the truss bridge and steel concrete composite truss bridges presenting the method of analysis, tools for numerical and analytical modeling which evaluates its seismic behaviour and collapse mechanisms. To ascertain the inelastic and nonlinear behaviour of the structure, generally at research level static pushover analysis is adopted. Though the static pushover analysis is now extensively used for the framed steel and concrete buildings to study its lateral action behaviour, those findings by pushover analysis done for the buildings cannot directly be used for the bridges as such, because the bridges have completely a different performance requirement, behaviour and typology as compared to that of the buildings. Long span steel bridges are mostly the truss bridges. Truss bridges being formed by many members and connections, the failure of the system does not happen suddenly with single event or failure of one member. Failure usually initiates from one member and progresses gradually to the next member and so on when subjected to further loading. This kind of progressive collapse of the truss bridge structure is dependent on many factors, in which the live load distribution and span to length ratio are most significant. The ultimate collapse is anyhow by the buckling of the compression members only. For regular bridges, single step pushover analysis gives results closer to that of the non-linear dynamic analysis. But for a complicated bridge like heavy class steel bridge or the skewed bridges or complicated dynamic behaviour bridges, nonlinear analysis capturing the progressive yielding and collapse pattern is mandatory. With the knowledge of the postelastic behaviour of the bridge and advancements in the computational facility, the current level of analysis and design of bridges has moved to state of ascertaining the performance levels of the bridges based on the damage caused by seismic shaking. This is because the buildings performance levels deals much with the life safety and collapse prevention levels, whereas the bridges mostly deal with the extent damages and how quick it can be repaired with or without disturbing the traffic after a strong earthquake event. The paper would compile the wide spectrum of modeling to analysis of the steel concrete composite truss bridges in general.

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