


## Research Abstract

<b>Name:</b>	Bishnu Prasad Gautam	
<b>Specialization/ Qualification:</b>	Master's in Civil Engineering (to be awarded on Sept 28, 2007)	
<b>Current Affiliation</b>	The University of Tokyo	
<b>Contact Address:</b>	341-0003, Saitama, Misato City, Hikonari 4-4-13-414	
<b>E-mail:</b>	bishhnu@yahoo.com	
<b>URL:</b>	<a href="http://bgautam.googlepages.com">http://bgautam.googlepages.com</a>	
<b>Affiliation in Nepal (if applicable):</b>		
<b>Contact Address in Nepal:</b>	+977-1-4312820, Naikap Bnanjyang -9, Kathmandu	
<b>Research Interests:</b>	Applied mechanics and structural aspect of concrete, SCC and FRP composites	
<p><b>Current Research Abstract (As in MS Thesis)</b></p> <p>Carbon fiber reinforced polymer (CFRP) composite emerges as a promising construction material with light weight, high strength and favorable durability. Orthotropic nature of CFRP, though involves complexity in design, offers a unique opportunity of tailoring its properties in desirable directions to achieve an efficient design.</p> <p>This study investigates a beam structure composed of CFRP box filled with concrete in an attempt to utilize it in a structural application. Finite element analysis is employed for the study. An experimental study performed by joint researchers comprised testing of beams under transverse and axial loads. Twenty-five beams were tested from a combination of different types of CFRP, infill condition and moment-axial force ratio. Deformation, damage and failure mechanisms of the beams needed further investigation and verification. Empty beams possessed very low stiffness compared to that estimated by beam theory. Not only that, the stiffness showed hardly any improvement even after concrete infill. Similarly, damage progress could not be captured adequately. Beam failure was almost always observed near a loading plate on the upper part, without any visible damage beforehand. It occurred on the side opposite to mid span. Also, the load capacity of the beams was not correlated with CFRP longitudinal strength. This study elucidates these mechanisms to a considerable extent.</p> <p>The mechanisms associated with the deformation, damage and failure of a CFRP box beam are discussed with the help of the results obtained from the analysis. Shear deformation contributes as high as 60% of total deflection of an empty beam. Concrete-filled beams suffer from an interface slip. Euler Bernoulli theory remains inapplicable for both empty and filled beams. Beam stiffness can be significantly improved with a perfect bond that limits shear deformation of CFRP. P-delta effect is seen to produce a secondary moment as high as 23% of a primary moment in case of a highly axially loaded beam. Concrete confinement is observed in axially loaded beams. Failure location is found similar to that in the experiment. Longitudinal compression and in-plane shear remain critical to CFRP failure leading to the failure of a beam. Moreover, for modeling a laminate in finite element analysis, 3D approach appears better than a lamina based approach.</p> <p>The findings explained in this study are expected to contribute directly to the analysis and design of CFRP box beams with and without concrete infill. They will be helpful in the study of FRP beam and column structures, in general. Despite the findings, the mechanisms related to load capacity could not be clarified fully. The load capacity is often underestimated by the analysis. Scarcity of reliable CFRP properties remains vital for this phenomenon. The consequences of CFRP properties on the beam mechanisms are explained with some theoretical and parametric studies. Further studies with reliable material properties are recommended for detailed understanding on the subject.</p>		