

LARGE DEFORMATION BEHAVIOR OF REINFORCED CONCRETE COLUMNS FOR COMBINED BLAST AND AXIAL LOADS

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The behavior of reinforced concrete columns undergoing large deformation under combined blast and axial loads has not been studied sufficiently. When a reinforced concrete column undergoes large deformations, different phenomena may occur, and they need to be addressed in the analysis appropriately. Such phenomena include the possibility to develop a tension membrane behavior, where the steel reinforcement provides extra flexural strength by means of catenary action. Tension membrane behavior has been studied for one way slab, two way slabs and buried reinforced concrete box. However, in the case of reinforced concrete columns, this phenomenon has been ignored since no compressive axial forces may be supported when tension membrane occur. However, if a column fails, the axial load would be taken by other columns, while the failing column may provide additional lateral capacity to the structure.

Furthermore, secondary moments are also of importance when undergoing large deformation, since they will reduce the column strength significantly and affect dynamic response of the structure. An expedient analysis of reinforced concrete columns undergoing large deformation under blast was accomplished using an advanced single degree of freedom system, an Euler beam element that accounts for axial loads, and proper constitutive relationships.

The proposed paper will show how tension membrane behavior may provide significant strength to reinforced concrete columns, and will present analytical results of reinforced concrete columns undergoing large deformation. The advanced single degree of freedom approach, coupled with various known phenomenon present due to blast load, will be discussed. Finally, the paper will conclude with a comprehensive discussion of reinforced concrete columns undergoing large deformation under combinations of blast and axial loads.