UF Center for Infrastructure Protection and Physical Security (CIPPS) UNIVERSITY of FLORIDA

DSTA Defence Science & Technology Agency

Characterizing a Reinforced Concrete Beam-Column Connection for Progressive Collapse Assessment

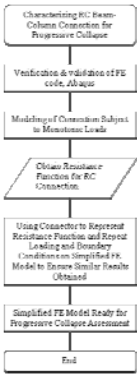
Introduction

Advanced numerical tools are seldom used for progressive collapse analysis of reinforced concrete (RC) structures because it is computationally too expensive and time consuming

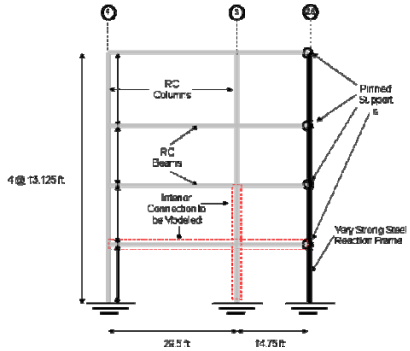
Objective

To develop a simplified structural finite element (FE) model representing a beam-column connection under monotonic loading. This simplified FE model can be used in frame analysis for fast and accurate progressive collapse assessment of RC structures

Research Methodology



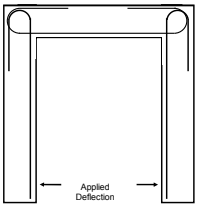
Connection to be Modeled

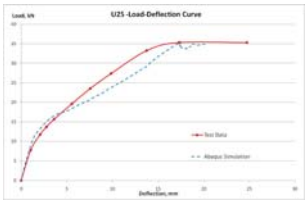


Validation of Abaqus/Standard:

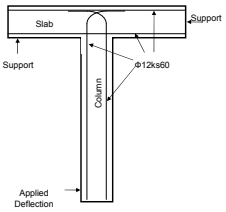
The following three types of RC beam-column connections were considered:

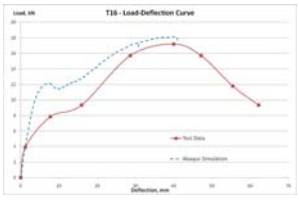
Corner Connection (Nilson 1973, Test U25)



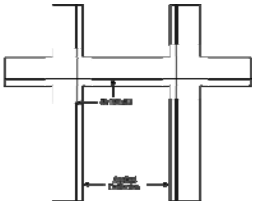


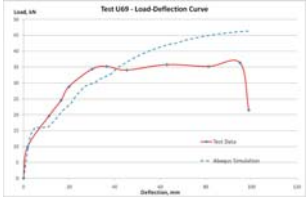
T-Connection (Nilson 1973, Test T16)





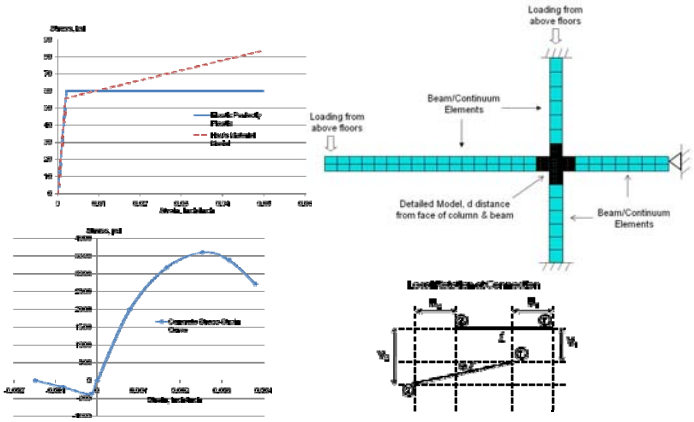
Interior Connection (Nilson 1973, Test U69)



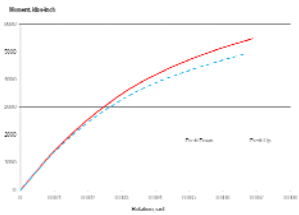


Predominantly Continuum Based FE Model

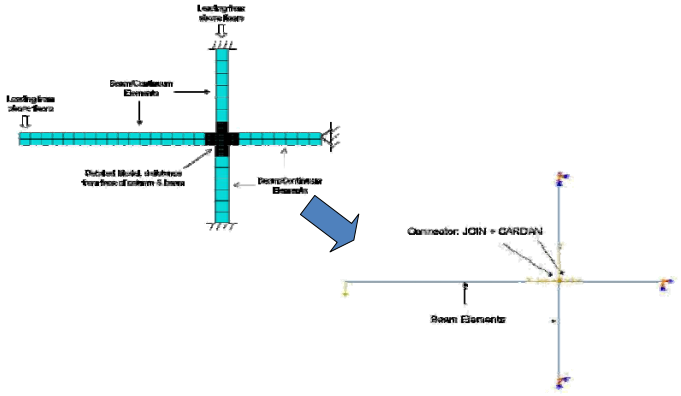
- Concrete Damaged Plasticity Model and C3D8R continuum element to represent concrete
- Classical Metal Plasticity Model and B31 beam elements for reinforcement



M-φ Curve for Interior Connection



Simplified Structural Based FE Model



Comparison of FE models		
	No. of DOFs	Simulation Time
Predominantly Continuum Based FE	256830	150 minutes
Simplified Structural Based FE Model	4802	10 minutes

Conclusions

- Three different RC beam-column connections were validated using Abaqus/Standard
- A simplified structural based FE model was developed to replace the predominantly continuum based FE model. The final model retained the accuracy of the continuum based model at a fraction of the computational cost