

Large Deformation Analysis of RC Columns Subjected to Blast Loads

Objective

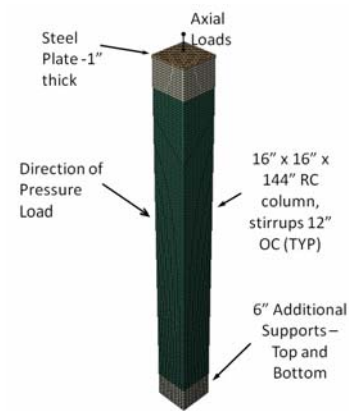
Develop an accurate and fast running algorithm for analysis of reinforced concrete columns under combined effects of axial and transverse loads due to blast. Incorporate this algorithm to DSAS.

Nonlinearities to be considered:

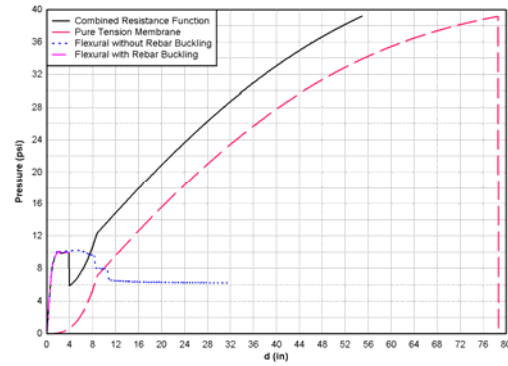
- Material nonlinearities,
- Secondary effects and large deformations,
- Tension membrane behavior,
- Buckling.
- Influence of diagonal shear



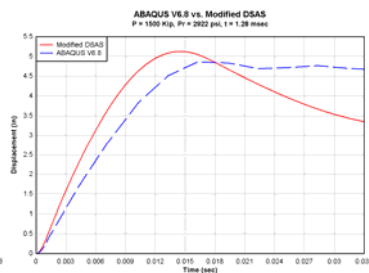
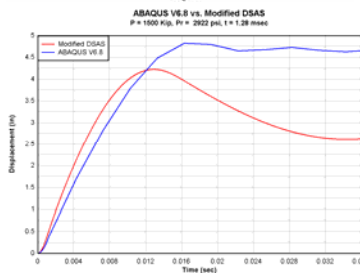
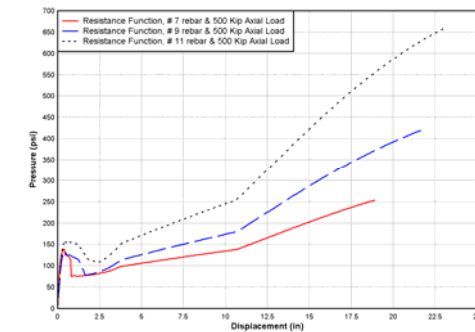
Validation



Resistance Function



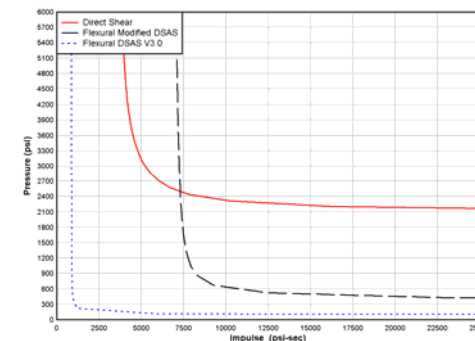
Effect of rebar on resistance function



Difference = 9.71 %

Difference = 5.39 %

Load-Impulse Diagram



Conclusions

○ Tension membrane may provide significant lateral strength to vertical/horizontal elements under prescribed circumstances,

○ The FEA direct shear capacity of the reinforced column is an important factor to take into consideration when designing RC columns to undergo catenary action and lateral forces

Reinforced Concrete Column Under 800 Kip Axial Load and Explosion Load Modeled as Equivalent Triangular Load						
Triangular Load Parameters		800 Kip Axial Load		FEA Results		
Reflected Pressure	Incident Reflected Impulse	Time Duration	DSAS V3.0	Modified DSAS V 3.0	ABAQUS V6.8	% Difference
Pr (psi)	Ir (psi-msec)	Time (msec)	Max Disp (in)	Max Disp (in)	Average Mid-Span Disp (in)	
4208	2844	1.352	1.32	7.59	8.98	15.45
4757	3305	1.390	1.32	9.45	11.36	16.75
6262	3755	1.427	1.32	11.31	13.58	16.70
Tension Membrane	Direct Shear Failure		Direct Shear Failure & Tension Membrane		Flexural Failure.	

Reinforced Concrete Column Under 1500 Kip Axial Load and Explosion Load Modeled as Equivalent Triangular Load						
Triangular Load Parameters		1500 Kip Axial Load		FEA Results		
Reflected Pressure	Incident Reflected Impulse	Time Duration	DSAS V3.0	Modified DSAS V 3.0	ABAQUS V6.8	% Difference
Pr (psi)	Ir (psi-msec)	Time (msec)	Max Disp (in)	Max Disp (in)	Average Mid-Span Disp (in)	
4208	2844	1.352	0.77	8.60	9.10	5.51
4757	3305	1.390	0.78	10.48	10.33	1.47
6262	3755	1.427	0.76	12.26	13.48	9.03
Tension Membrane	Direct Shear Failure		Direct Shear Failure & Tension Membrane		Flexural Failure.	

