

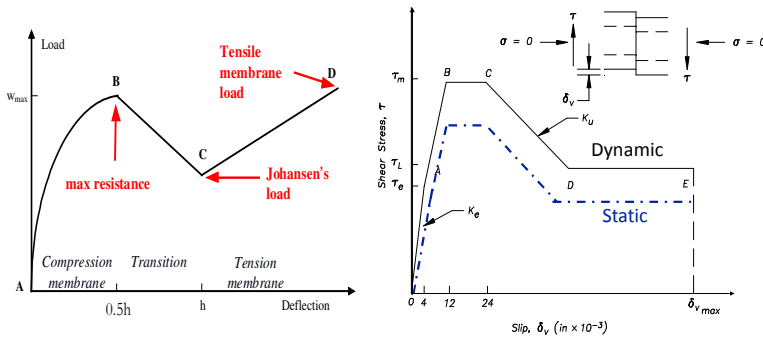
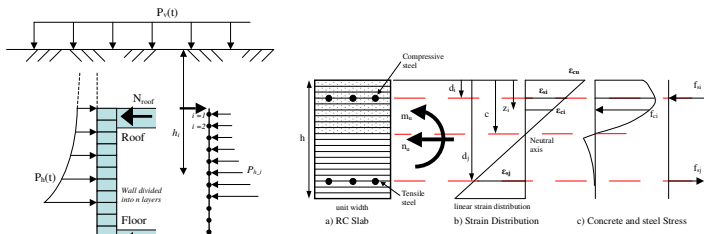
Analysis of Shallow Buried Reinforced Concrete Box Structures Subjected to Air Blast Loads

Introduction

A numerical method for the dynamic analysis of shallow-buried reinforced concrete box-type structures subjected to air blast has been developed. The method is based on the Single-Degree-of-Freedom (SDOF) approach and considered the effects of compression and tension membranes in reinforced concrete slabs, direct shear, soil arching, soil-structural interaction, and P-I behavior assessment. A rational model has been incorporated for varying SDOF equivalent load and mass factors for the dynamic analysis.

Flexural Mode Resistance Function

- Externally applied thrust due to vertical wave propagation in soil
- Horizontal thrust at roof and floor varies with time
- Slab compressive and tensile membrane action using strip method

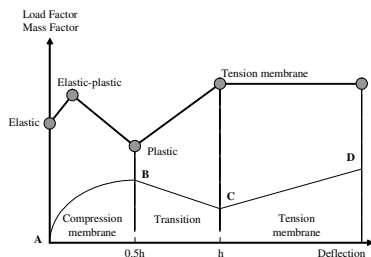
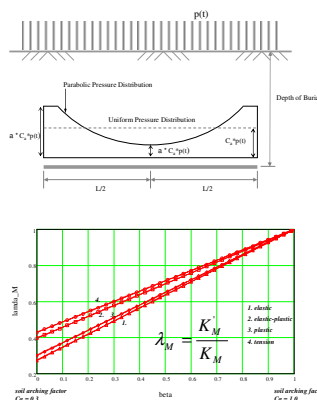


Variation of Load and Mass Factor

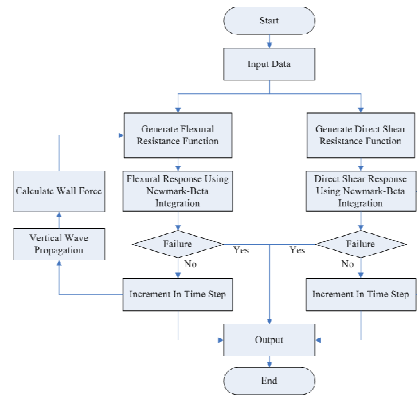
- Non-constant load and mass factor for SDOF analysis
- Dependent on slab flexural behavior region

Soil Arching Effect

- Assumed parabolic distribution for pressure
- Modification of load and mass factors with soil arching effects

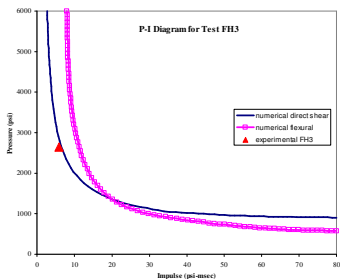
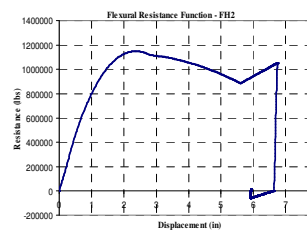
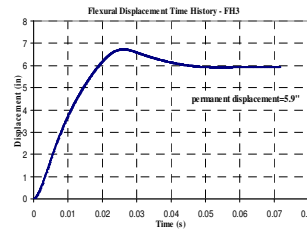
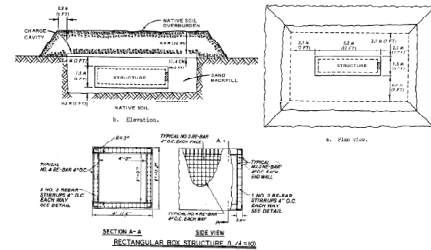


Program Flowchart



Validation with Experimental Data

- Using results from Kiger and Getchell (1980), and Slawson (1984) Foam Hest tests



Summary of Results

Test No.	Experiment Structural Behaviour / Failure Mode	Average Peak Pressure (psi)	Measured Permanent Deflection (in) Δ_1	Numerical Structural Behaviour / Failure Mode	Computed Permanent Deflection (in) Δ_2	$\frac{\Delta_2}{\Delta_1}$	Failure Direct Shear Slip (in)	Time of Failure (msec)
FH1	Flexure	2400	0.44	Flexure	0.50	1.14	--	--
FH2	Direct Shear	5200	Collapsed	Direct Shear	Collapsed	1.00	0.20	1.1
FH3	Flexure	2650	6	Flexure	5.9	0.98	--	--
FH4	Flexure	3000	12.5	Flexure	11.4	0.91	--	--
FH5	Shear	18000	3.1	Flexure / Shear	3.4	1.09	--	--
FH6	Direct Shear	8320	Collapsed	Direct Shear	Collapsed	1.00	0.23	1.2