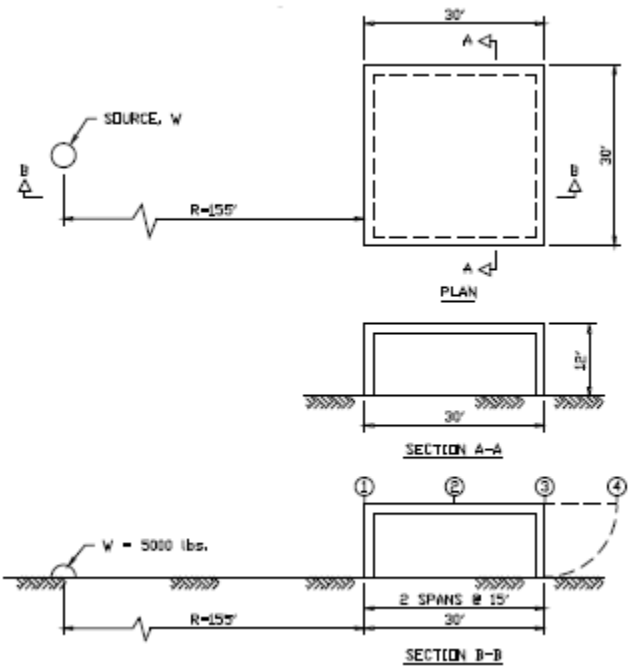
PARAMETER UNITS & DESCRIPTION

Charge Weight (lbs): quantity of explosive material
Distance (ft): distance of explosive material from structure
Structure Width (ft): width of structure
Structure Length (ft): length of structure
Structure Height (ft): height of structure

EXAMPLE OF EXTERNAL BLAST LOADING ON STRUCTURES

Example of blast loading graphs based on the UFC manual. All Figure and equation references in all steps of the calculation procedure are taken from the UFC manual.



Initial parameters:

Charge weight: 5000 lbs
Distance: 155 ft
Structure Width: 30 ft
Structure Length: 30 ft
Structure Height: 12 ft

The following steps are performed to formulate the plast loading graphs for front, side, roof & rear structure wall.

Step 1.

The charge weight is transformed to a TNT charge weight equivalent to use in all the following steps by increasing it 20%.

W = 1.2 * 5000 = 6000 lbs

Step 2.
The scaled distance Z_G as well as extra blasting parameters using Figure 2-15 are computed for three points of distance at the front, middle and back of the structure. These values will be used in the calculation of each graph parameters.

Point	R_G (ft)	Z_G (ft/lb$^{1/3}$)	P_{so} (psi)	t_A (ms)	L_W (ft)	t_0 (ms)	i_s (psi-ms)
1	155	8.53	12.8	2.10	38.2	42.7	163.5
2	170	9.35	10.8	2.24	40.7	45.1	
3	185	10.18	9.0	2.35	42.7	47.6	

Step 3. (Front Wall Loading)
For the front wall loading the parameters of point 1 are used in the calculations. Firstly, C_{ra} from Figure 2-193 as well as P_{ra} & i_{ra} from Figure 2-194 are calculated.
C_{ra} = 2.70
$P_{ra} = C_{ra} \times P_{so}$ = 34.6 psi
i_{ra} = 308.9 psi-ms

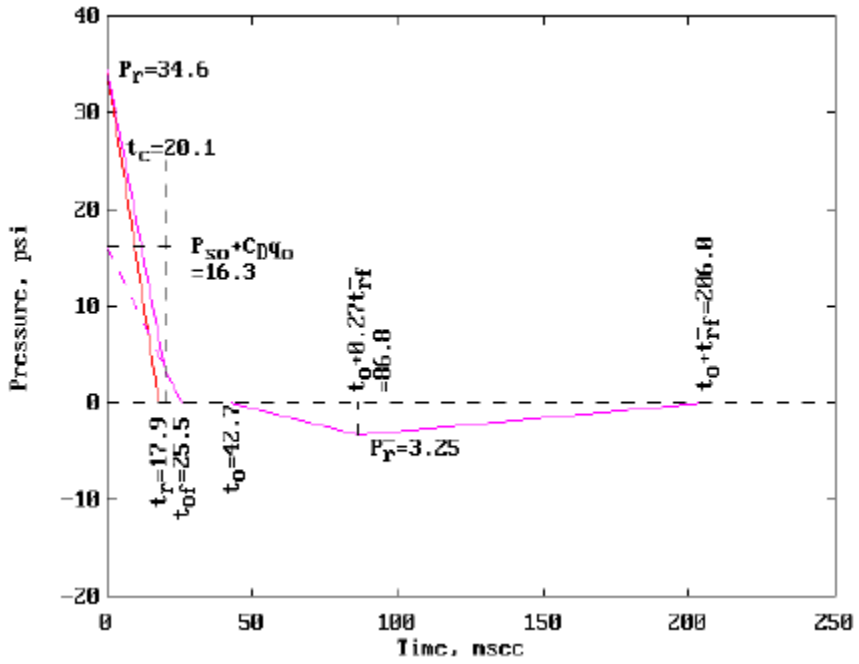
Step 4.
Sound velocity & clearing time is calculated next.
C_r = 1.325 ft/ms
$t_c = 4S/(1+R)C_r$ = 20.1 ms
Where:
S = 12.0 ft
G = 30/2
R = S/G = 0.80

Step 5.
t_{of} from Equation 2-11 & q_0 from Figure 2-3 is computed
t_{of} = 25.5 ms
q_0 = 3.5 psi

Step 6.
$P_{so} + C_D q_0$ equation & t_r from equation 2-11 are calculated
$P_{so} + C_D q_0$ = 16.3 psi
t_r = 17.9 ms

Step 7.
Z from P_{ra} & $i_{ra}/W^{1/3}$ from Figure 2-15 is first calculated and then P_{ra} & $i_{ra}/W^{1/3}$ are recalculated using Z from Figure 2-16.
P_{ra} = 34.6: $Z(P_{ra})$ = 8.5: P_{ra} = 3.25 psi
$i_{ra}/W^{1/3}$ = 17.0: $Z(i_{ra}/W^{1/3})$ = 10.4: i_{ra} = 265.3 psi-ms

Step 8.
Fictitious duration & negative phase time points are lastly calculated and the final front wall blast loading graph can be created.
t_{rf} = 163.3 ms
$t_0 + 0.27t_{rf}$ = 86.8 ms
$t_0 + t_{rf}$ = 206.0 ms



Step 9. (Side Wall Loading)
For the side wall loading the parameters of point 2 are used in the calculations.Firstly, L_{wf}/L is calculated.
L_{wf}/L = 2.71

Step 10.
Then C_E from Figure 2-196, t_d from Figure 2-197 and t_{of} from Figure 2-198.
C_E =0.76
t_r = 12.0 ms
t_{of} = 44.9 ms

Step 11.
Then P_{of} for computing q_0 from Figure 2-3.
$P_{of} = C_E * P_{so}$ = 8.2 psi
q0 = 1.55 psi

Step 12.
The C_D from Section 2-15.3.2 & the peak positive & negative pressure from the following equations:
Peak positive pressure = $C_e * Ps + C_D * q0$

Peak negative pressure = C_e(negative) * Ps

Where:

C_D = -0.4

C_e(negative) from Figure 2-196

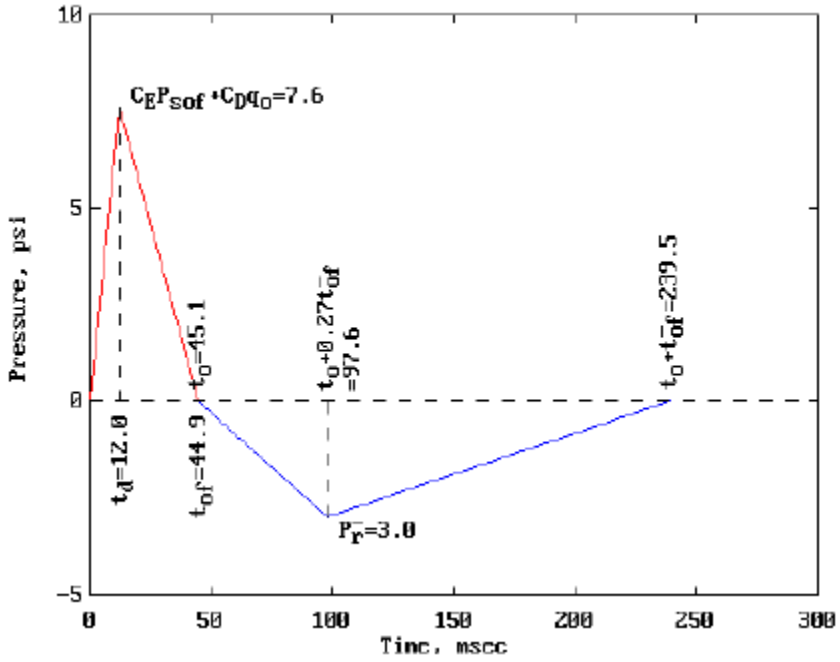
Step 13.

Then t_{of} from Figure 2-198 as well as the rest of the negative phase time points are calculated and the side wall blast loading graph is created.

t_{of} = 194.4 ms

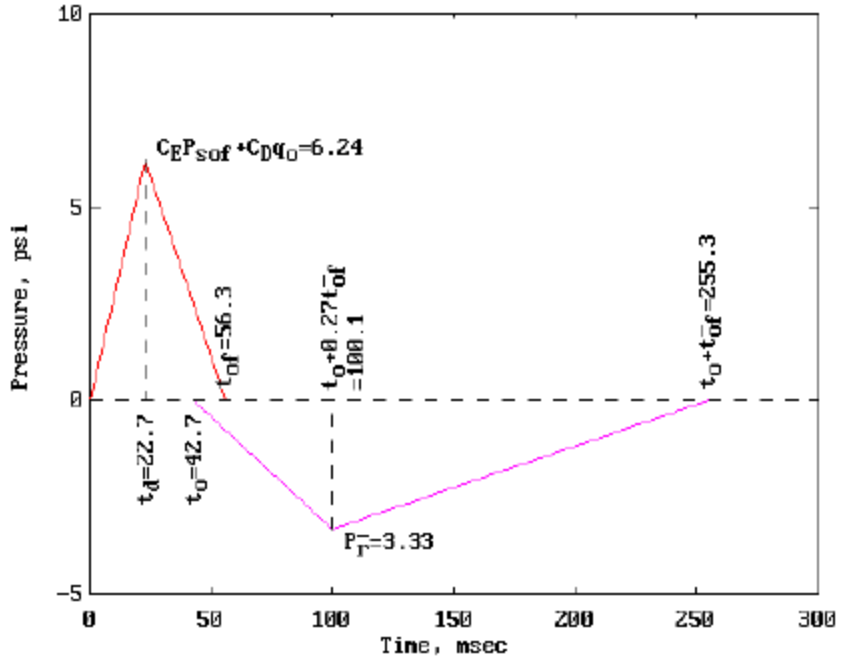
$t_0 + 0.27t_{of}$ = 97.6 ms

$t_0 + t_{of}$ = 239.5 ms



Step 14. (Roof Loading)

The procedure for creating the roof loading graph is the same as for the side wall loading graph using point 1 is the calculations. The final roof blast loading graph can be seen below.



Step 15. (Rear Wall Loading)

The procedure for creating the rear wall loading graph is the same as for the side wall loading graph using point 3 in the calculations. The final rear wall blast loading graph can be seen below.