STONE
Security Engineering

OBL

Stone OBL
Extreme Load Testing

Protective Knowledge Protection in High Threat Environments

Anatomy of an Explosion

Overview

- Explosion Characteristics
- Charge Weight and Standoff
- Close-in/Contact Explosions
- Near and Far-Field Explosions
- Shielding
- Confined Explosion
- Consequences

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An explosion is…

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Characteristics

- Expands outwards in all directions
- Extremely high loads, short durations
- Decreases exponentially with distance
- Dependent on orientation
- Confinement

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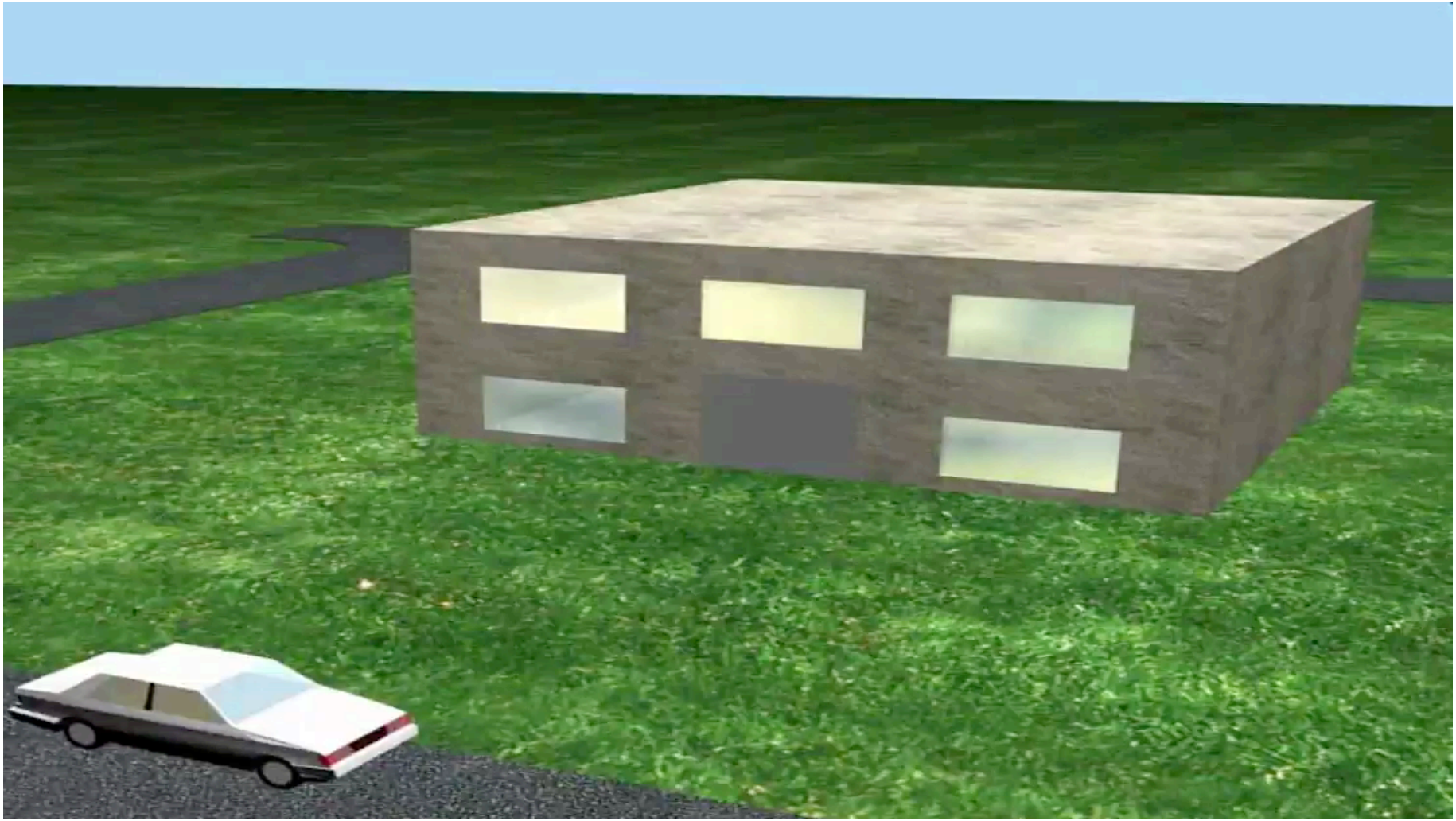
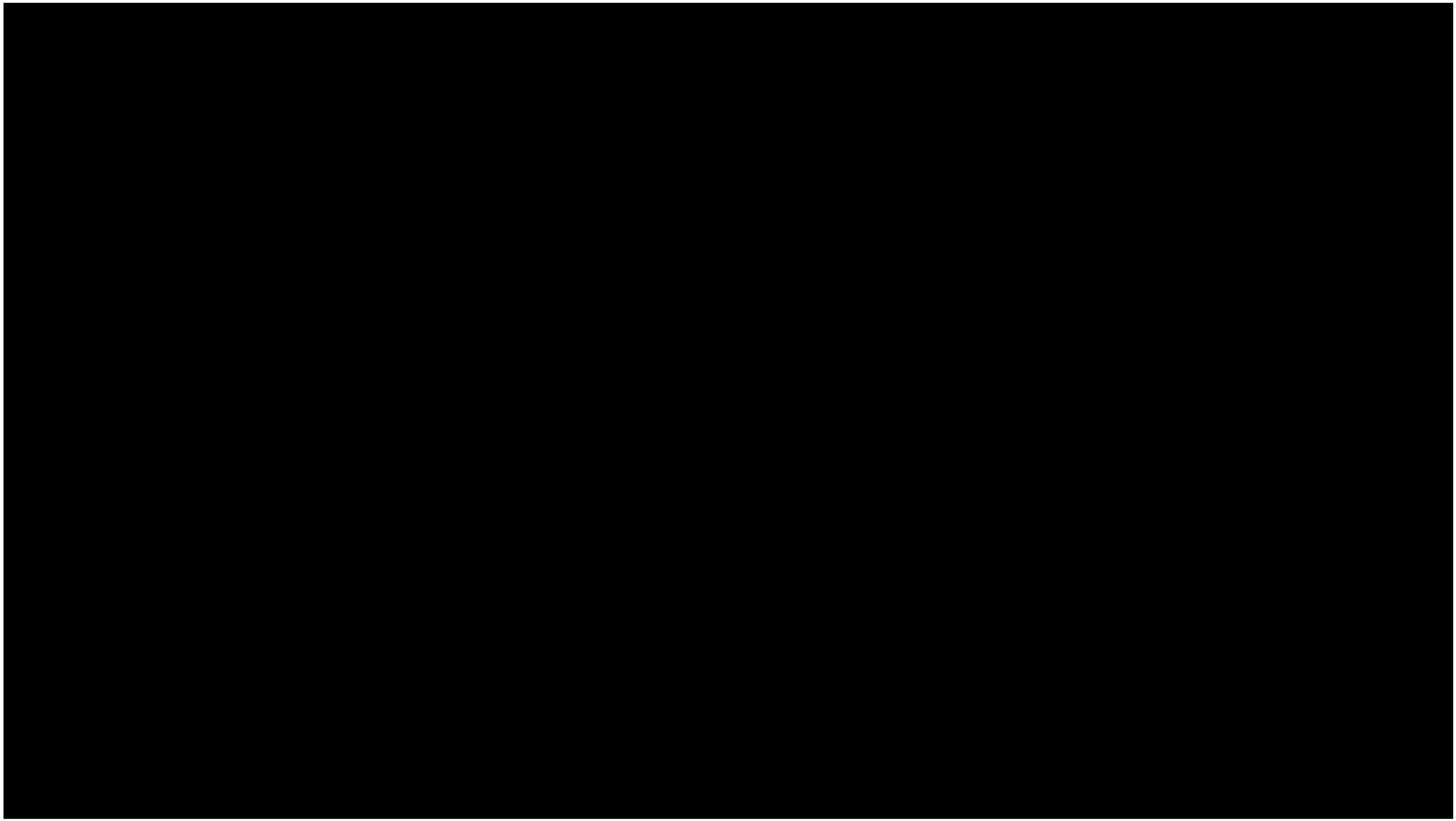
Explosion Animation





What Determines Effects

- Charge Weight and Type
- Standoff Distance
- Shielding (maybe)
- Angle of Incidence and Reflection
- Confinement

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Charge Weight

(Threat Standoff-Card)

BOMB THREAT STAND-OFF CHART

Threat Description Improvised Explosive Device (IED)		Explosives Capacity[1] (TNT Equivalent)	Building Evacuation Distance[2]	Outdoor Evacuation Distance[3]
	Pipe Bomb	5 LBS	70 FT	1200 FT
	Suicide Bomber	20 LBS	110 FT	1700 FT
	Briefcase/Suitcase	50 LBS	150 FT	1850 FT
	Car	500 LBS	320 FT	1500 FT
	SUV/Van	1,000 LBS	400 FT	2400 FT
	Small Moving Van/ Delivery Truck	4,000 LBS	640 FT	3800 FT
	Moving Van/ Water Truck	10,000 LBS	860 FT	5100 FT

http://regulationspolicies.usf.edu/policies-and-procedures/pdfs/policy-6-002-bomb-threat-stand-off-chart-a.pdf

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Explosive Types

- TNT Equivalence
- ANFO
- C4
- Dynamite
- etc

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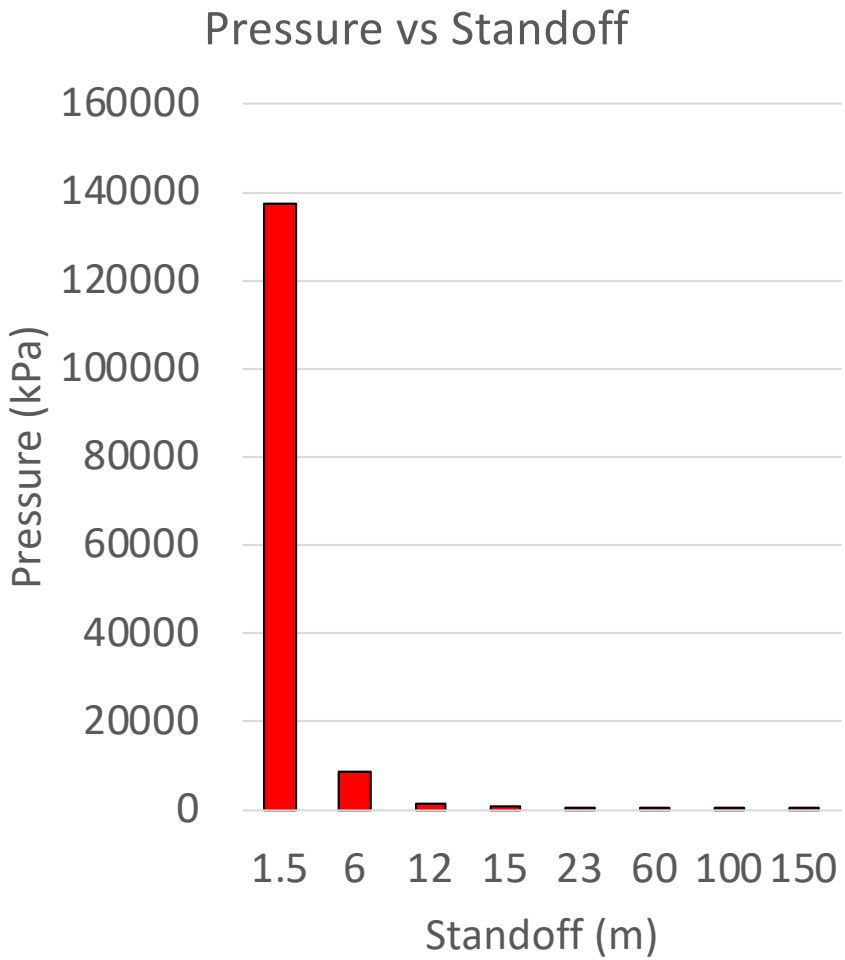
Standoff Distance

Standoff (m)	Pressure (kPa)
1.5	137,000
6	9,000
12	1,400
15	690
23	200
60	34
100	17
150	10



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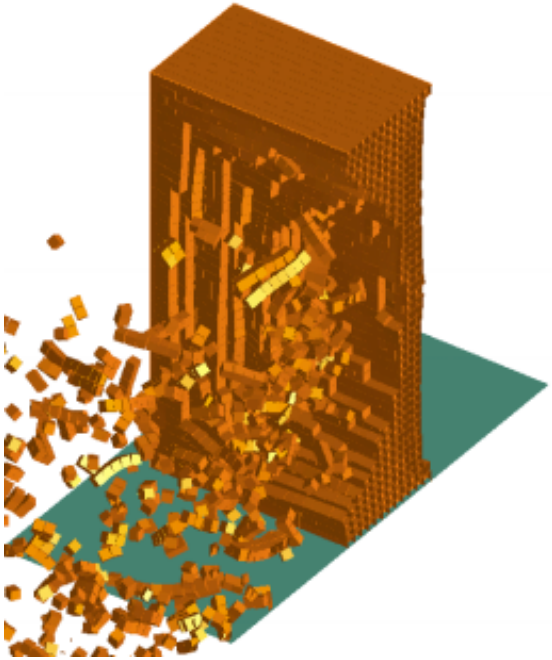
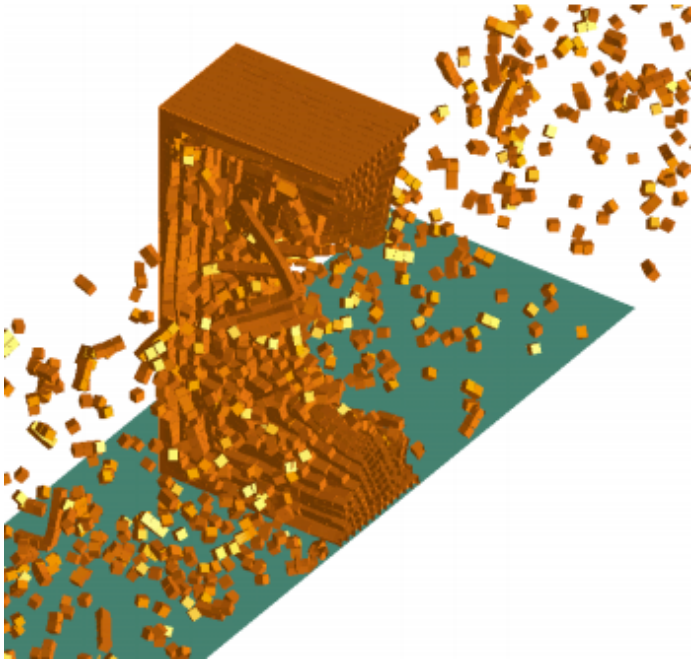
Close-In/Contact

Spall



Breach



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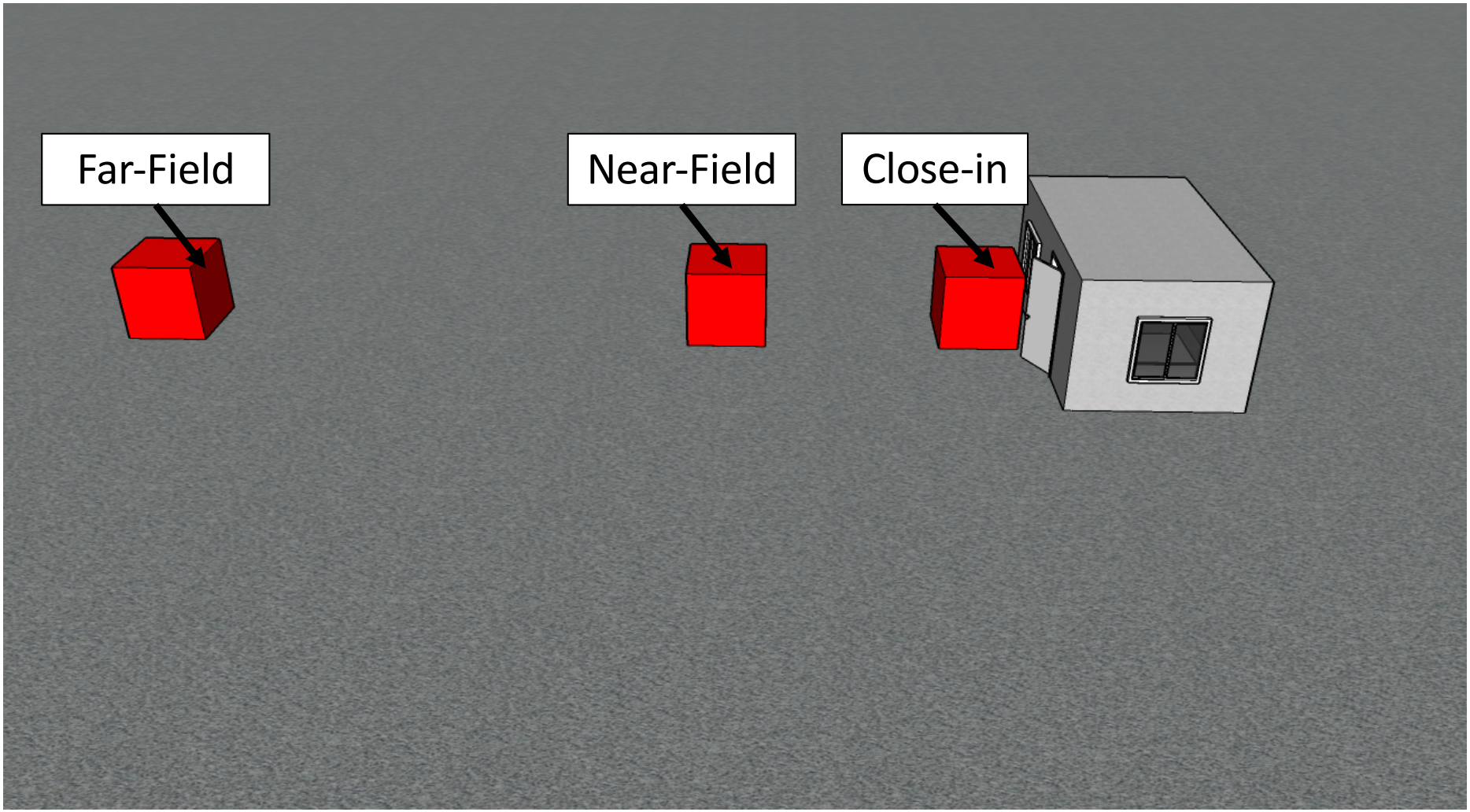
Close-in, Near-Field, Far-Field



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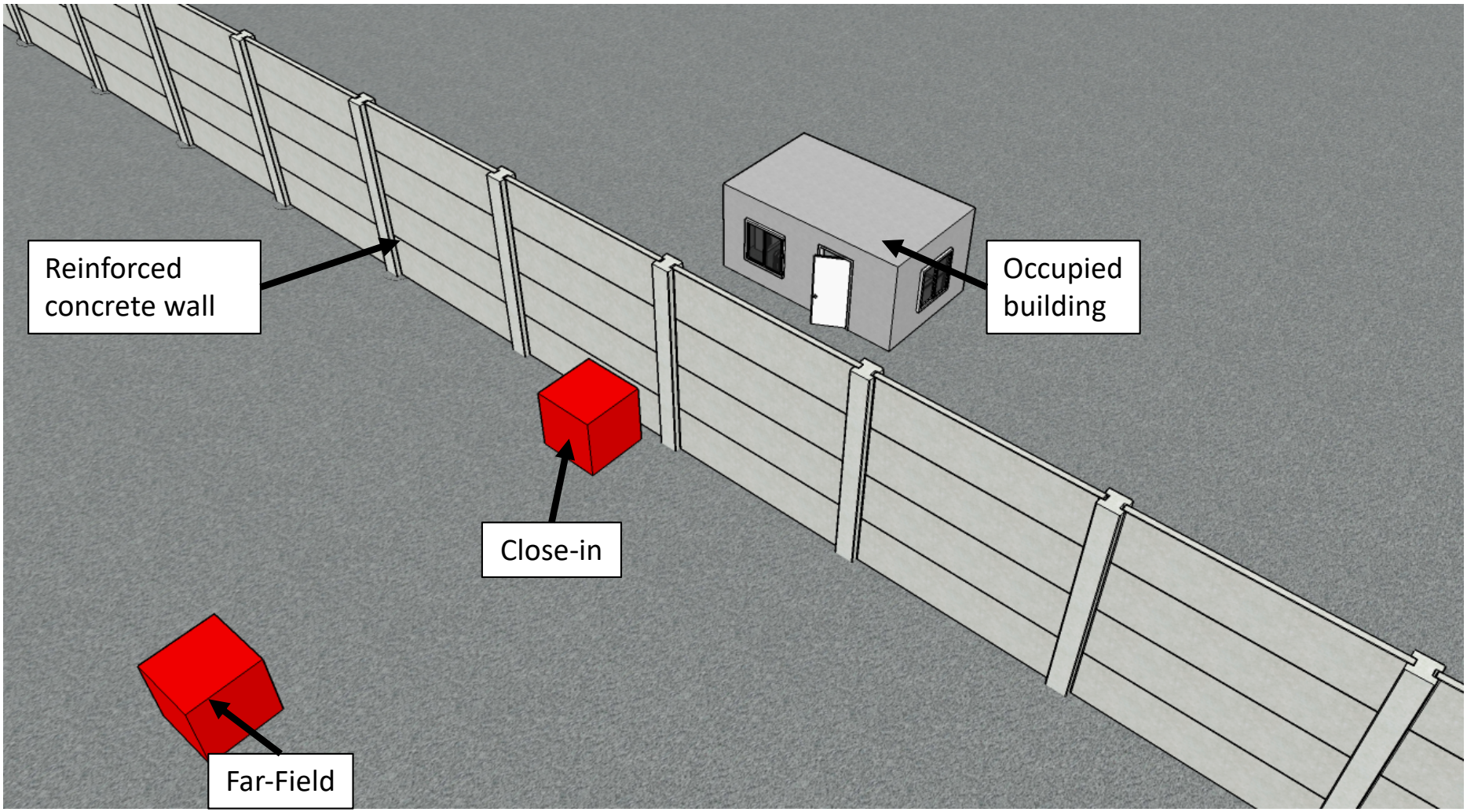
Close-In/Contact

- Threat directly adjacent to wall
- Close-in/Contact charges apply the blast load over a small area of the target.
- Spall/Breach no time to ‘flex’

Shielding



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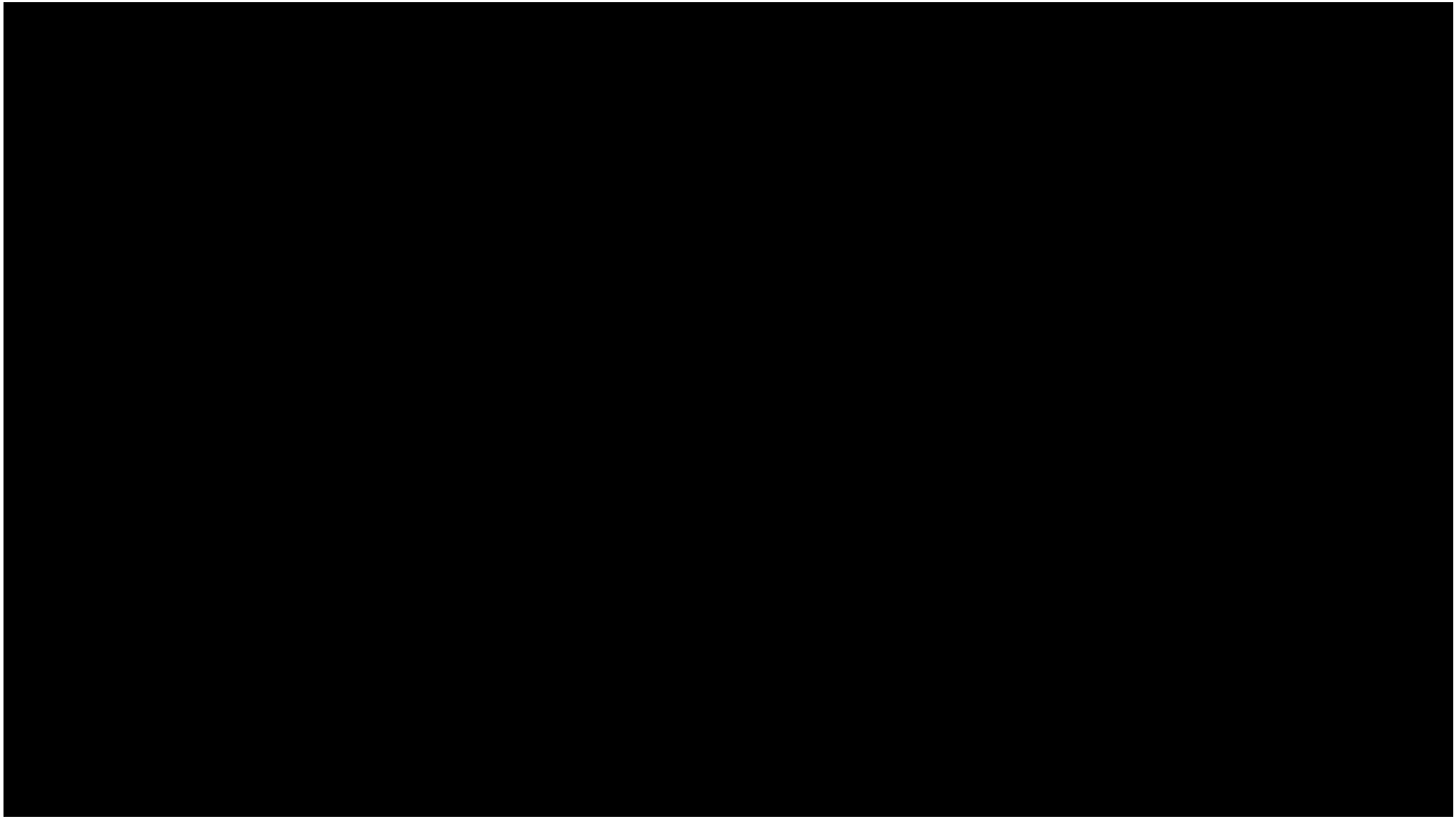

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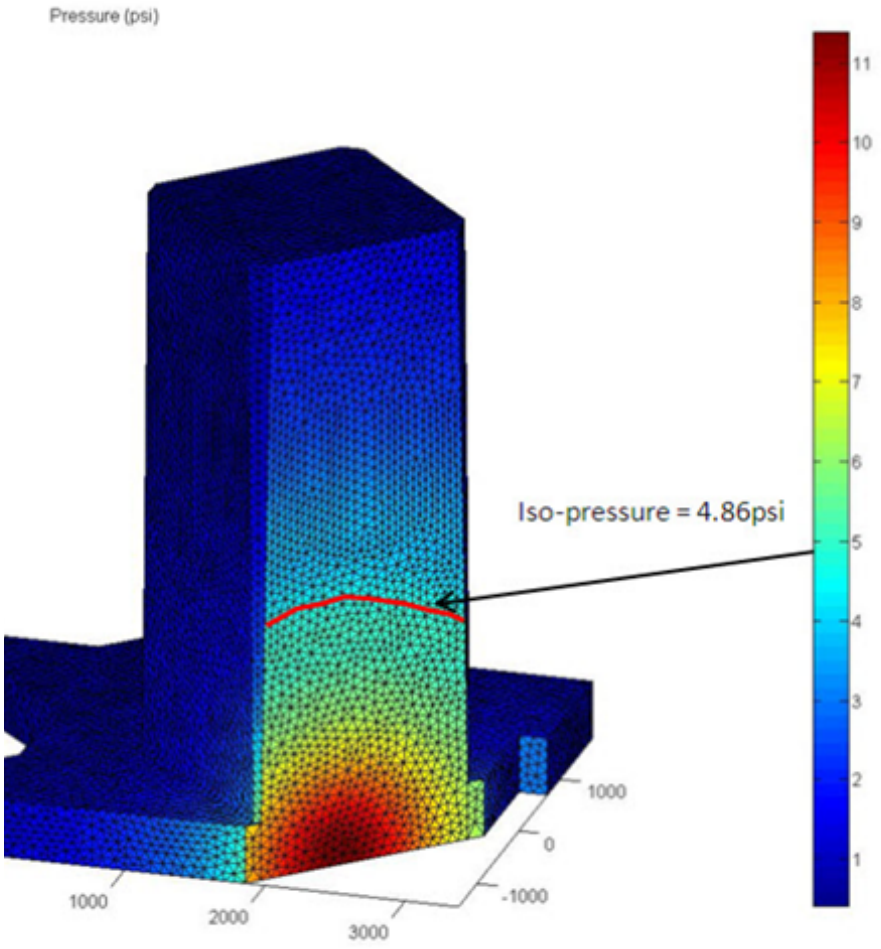
Angle of Incidence



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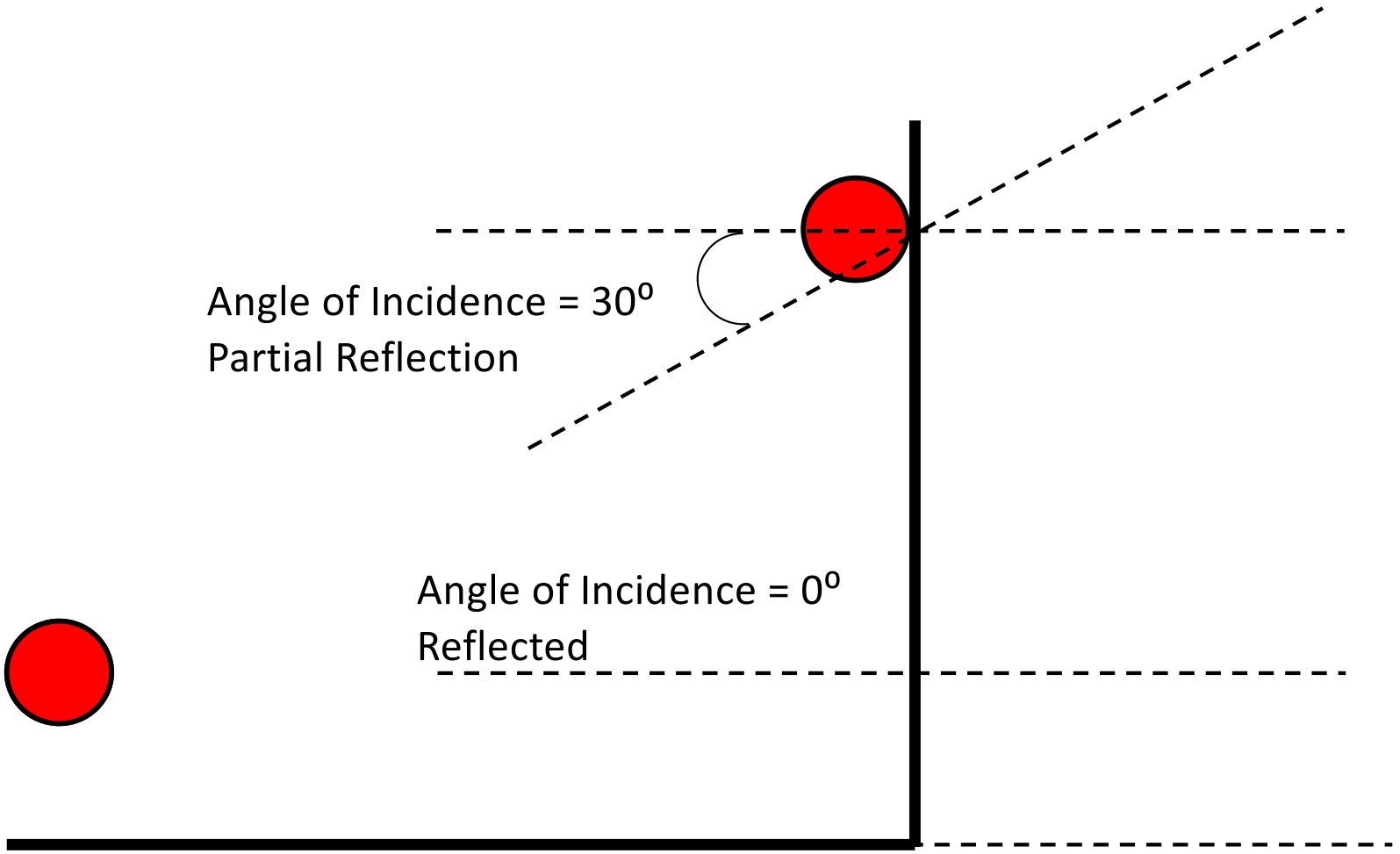
Angle of Incidence



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Confined Explosion

Ref. Bureau of ATF 1993 Explosive Incident Report

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Consequences of Blast Events

- Injuries/Fatalities
- Building Damage/Collapse
- Interruption of infrastructure
- Substantial business losses

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Conclusion

- Explosions create shock waves that can cause a lot of damage to occupied buildings.

- The best defense is a larger standoff distance.

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