Practical Application of Physical Security Criteria

Presented By:

Innovative Engineering Inc.

2014 Joint Engineer Training Symposium

Society of American Military Engineers

South Atlantic/South Central/Carolina

The Pinnacle of Structural Engineering

Seminar Overview

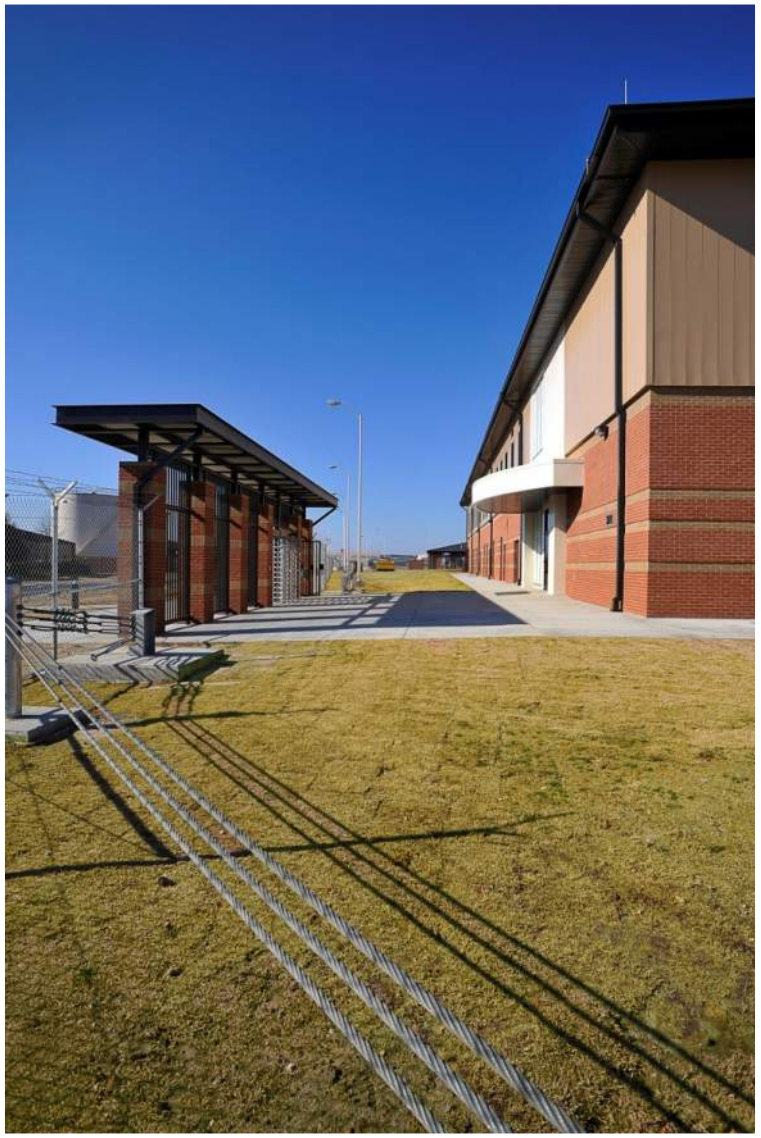
- **Innovative Engineering**
- **Background Information**
  - History of Terrorism
  - Risk Assessment (Asset Value, Threats & Vulnerability)
  - Risk Reduction
- **DoD Minimum Anti-Terrorism Standards for Buildings Unified Facilities Criteria (UFC 4-010-01)**
  - Criteria (Civil, Architectural, Structural and MEP)
  - New Tables & Graphics
  - Practical Application (Example Site Walk Thru)

Innovative Engineering Inc.

- **Structural Engineers**
  - Commercial
  - Government
  - Industrial
- **Specialties**
  - Physical Security
  - Forensics

Physical Security

- **We Bridge the Gap**
- **Advanced Training**
  - Structural Dynamics
  - Specialized Training
- **Services**
  - Site Analysis
  - Blast Load Studies
  - Hardening (Blast Design)
  - Progressive Collapse
  - Peer Reviews



Forensics

- Condition Assessments
- Due Diligence Surveys
- Environmental Sampling
- **Façade Inspection**
- Failure Analysis
- **Post-Disaster Damage Assessments**
- **Sidewalk Vaults**

Today's Presenters

- **Scott L Weiland PE**
  - Education
    - BSCE **University of Michigan**
    - Graduate Studies:
      - San Jose State University
      - Georgia Institute of Technology
    - Anti-Terrorism/Force Protection Security Engineering: Applied Research Associates
    - Design of Blast Resistant Structures: Baker Risk
    - Blast Resistance for Anti-Terrorism: Protective Engineering Consultants
  - Registration: PE in 15 States + PR
  - Experience
    - 34 Years in Design and Construction
    - 20 Years in ATFP Security Engineering

Today's Presenters

- **Stephen L Morgan EI**
  - Education
    - BSCET, **Southern Polytechnic State University**
    - Blast Resistance for Anti-Terrorism: Protective Engineering Consultants
  - Registration: EI
  - Experience: 9 Years Security Engineering
  - Expertise
    - ATFP Peer Reviews
    - Blast Design
    - Progressive Collapse

Physical Security Consultant

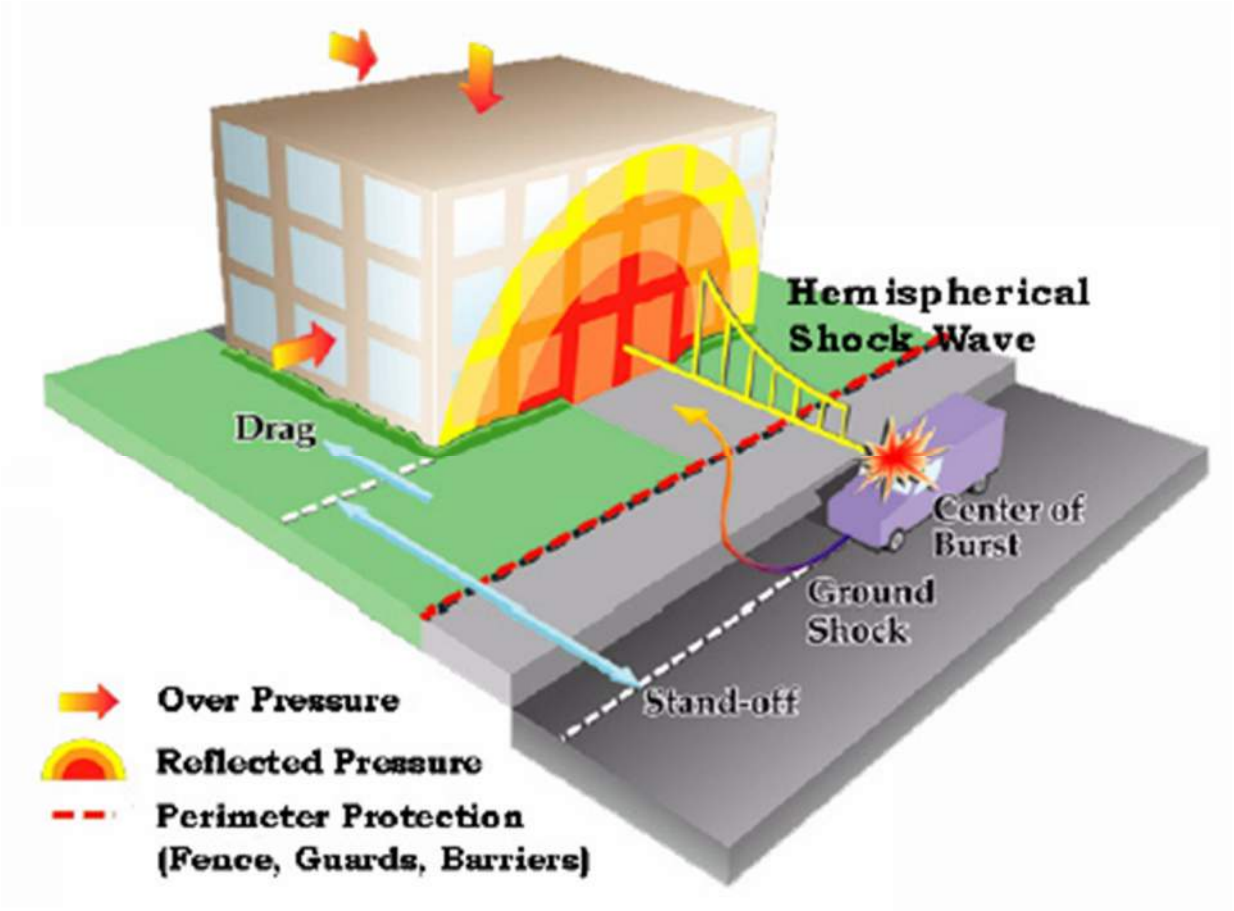
- **Brian L Dance PE SE**
  - Education
    - BSCE **Brigham Young University**
    - MSCE **Brigham Young University**
    - Graduate Studies: Georgia Institute of Technology
    - Design of Blast Resistant Structures: Baker Risk
    - Blast Resistance for Anti-Terrorism: Protective Engineering Consultants
  - Registrations: PE & SE
  - Experience: 8 Years
  - Expertise
    - ATFP Peer Reviews
    - Vehicle Barriers
    - Blast Design
    - Progressive Collapse

Background Information

- **Basic Definitions**
- **History of Terrorism**
- **Risk Assessment** (Asset Value, Threats & Vulnerability)
- **Risk Reduction**

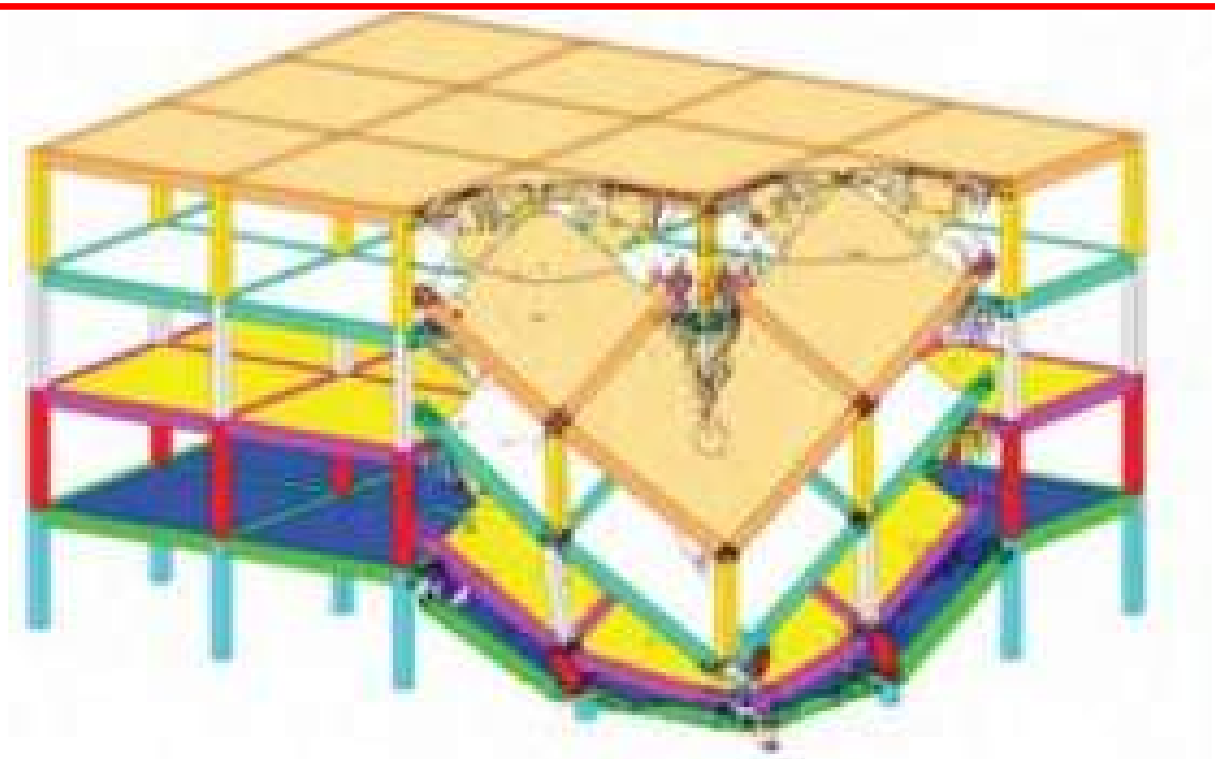
Definitions - Graphical

- Explosive
- Hardening
- Standoff
- Threat



Source: FEMA 426

Progressive Collapse

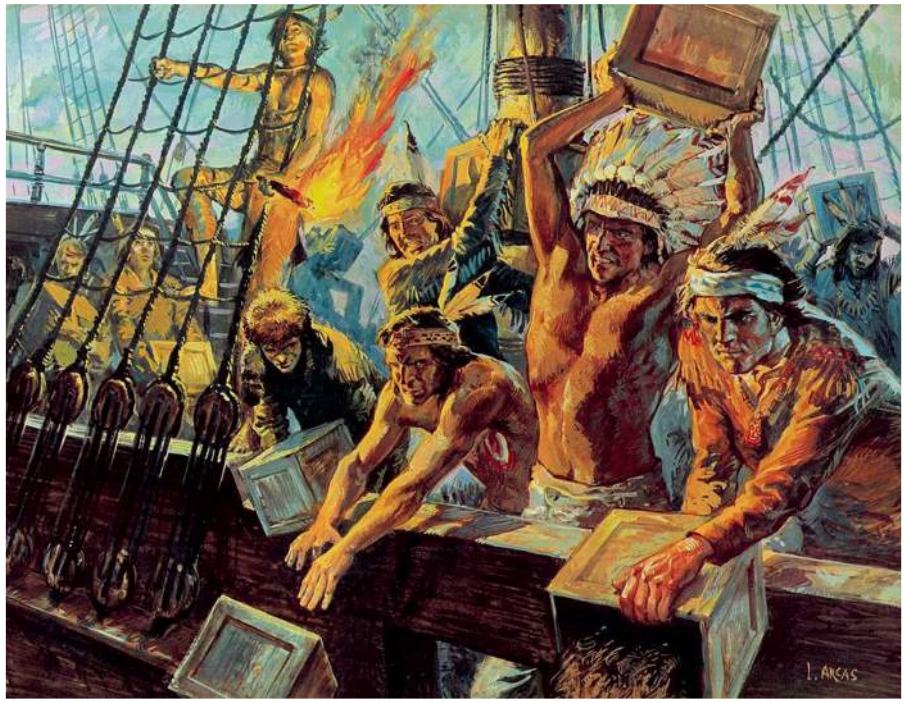


"The spread of an initial local failure from building element to building element, eventually resulting in the collapse of an entire structure or a disproportionately large part of it."

Source: UFC 4-010-01

Historical Perspective – Not New

- Historical references over **2000 years ago**.
- 1773, **Boston Tea Party** Lead to Revolutionary War
- 1914, Started **World War I**.



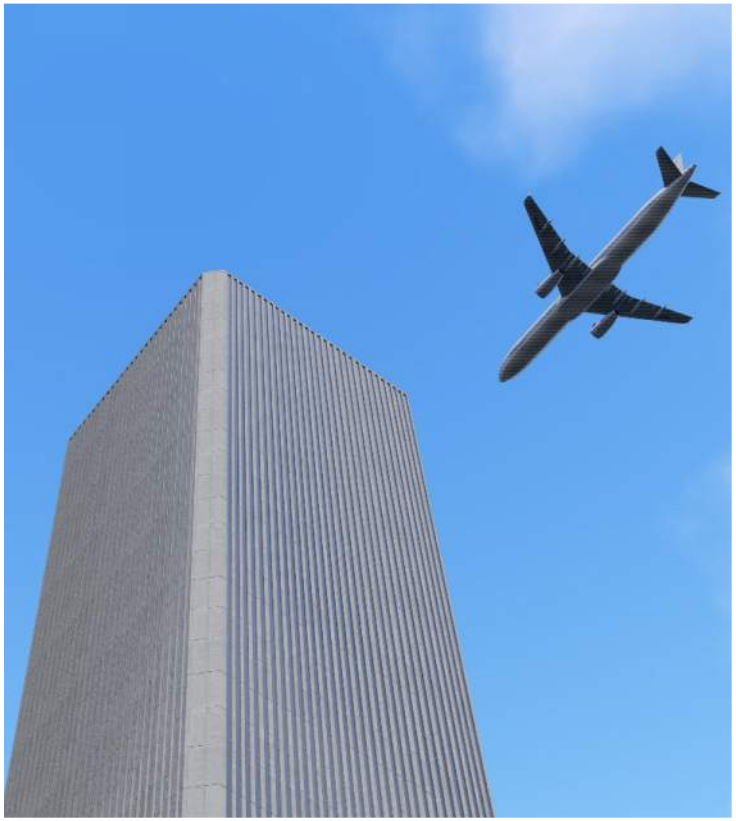
"Boston Tea Party"

Source: Luis Arcas Brauner

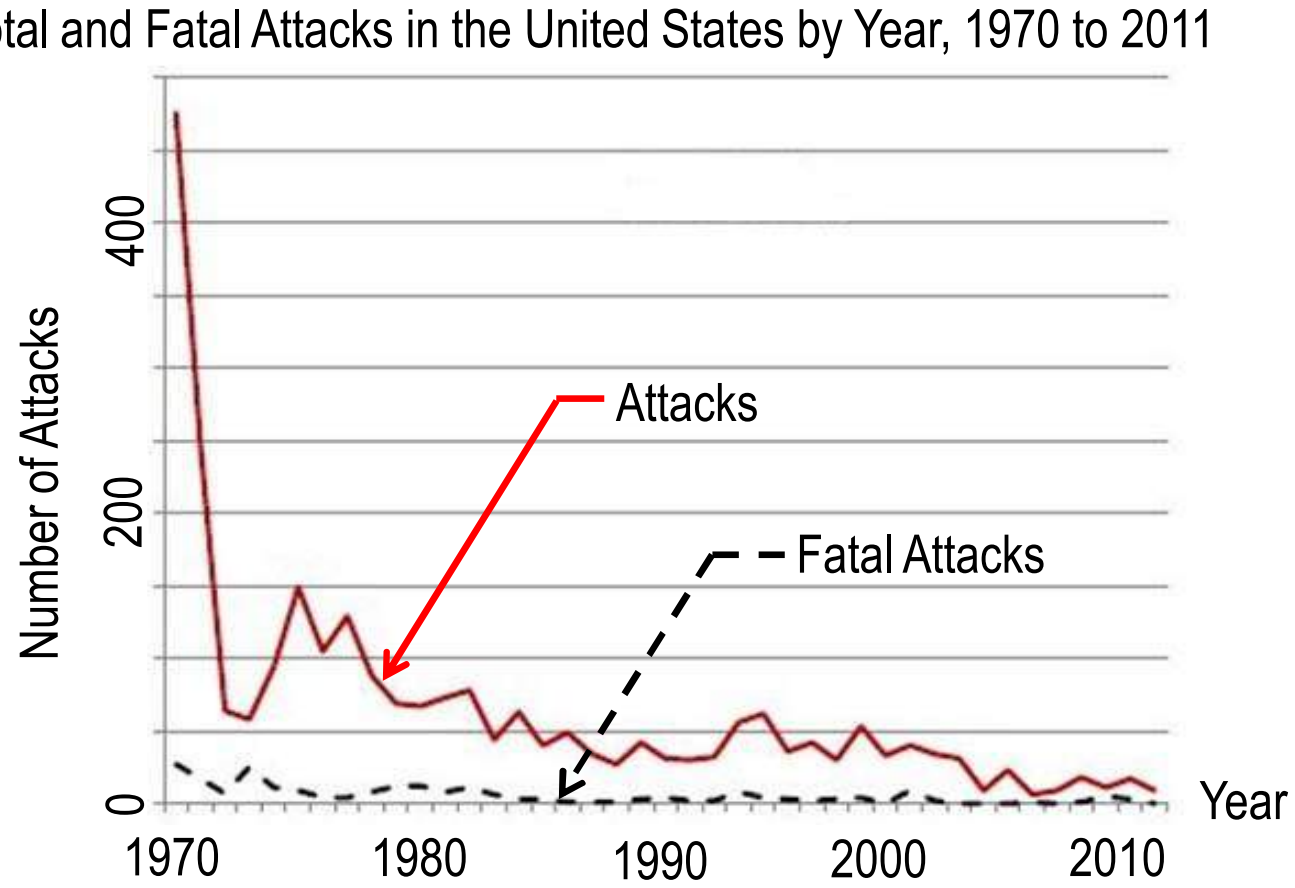
- Middle East in the 1950's
- Escalated after cold war in 80's & early 90's.
- Viewed as a Third World problem.

Historical Perspective - Recent

- 1978-1995 The Unabomber
- **1993-1st WTC Bombing**
- **1995-Oklahoma City Bombing**
- **1996-Centennial Olympic Park Bombing**
- **2001-2nd WTC Bombing**
- 2001-The Shoe Bomber
- **2001-Anthrax Attacks**
- 2002-The Beltway Sniper
- 2006-SUV Attack at UNC, Chapel Hill
- 2009-NYC Subway Plot
- 2009-Fort Hood
- 2009 Little Rock Recruiting Office
- 2009-Underwear Bombing Attempt
- 2010- Times Square Bombing Attempt
- **2013-Boston Marathon Bombing**



Attacks in US

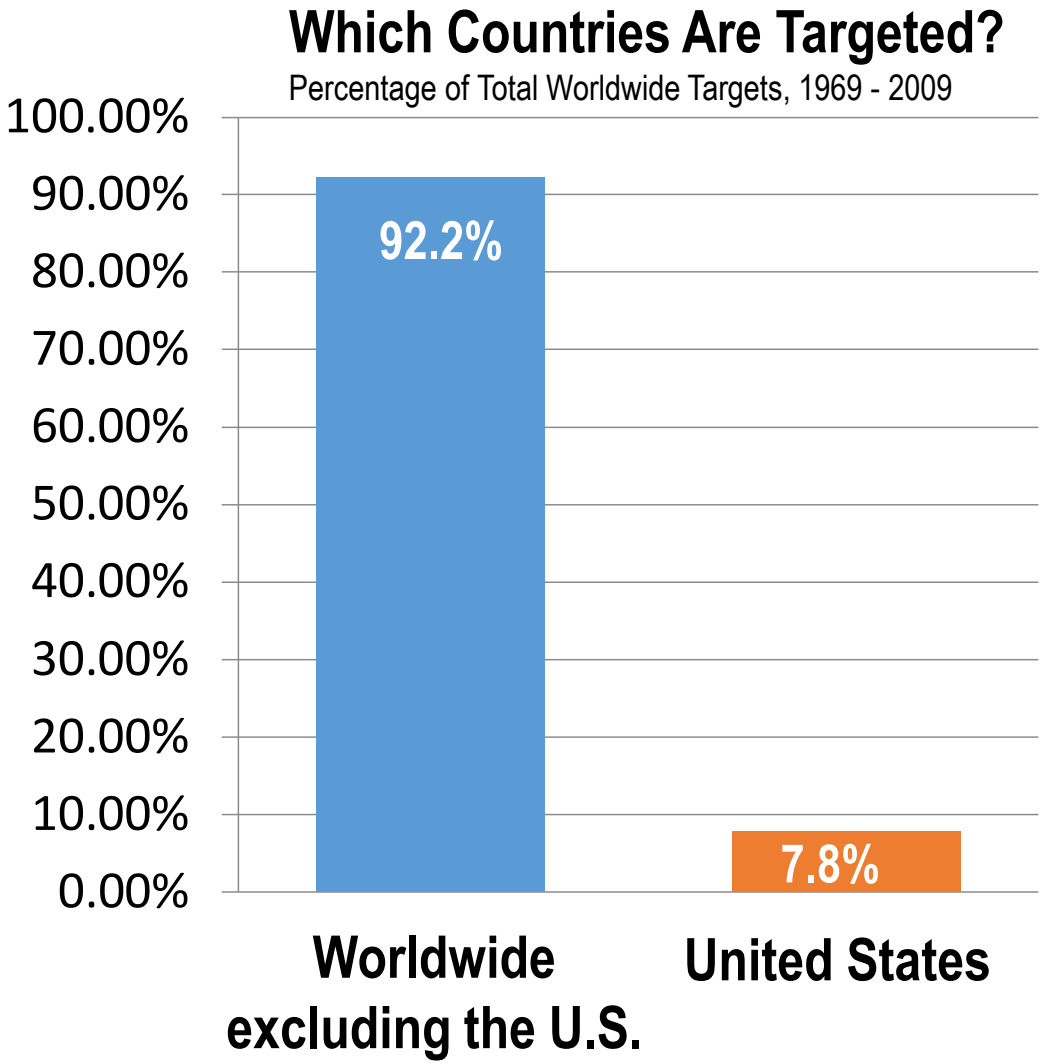


- Attacks in US are declining despite global increase.

Source: IUSSD Terrorism Data, LaFree, Gary, Dugan & Miller

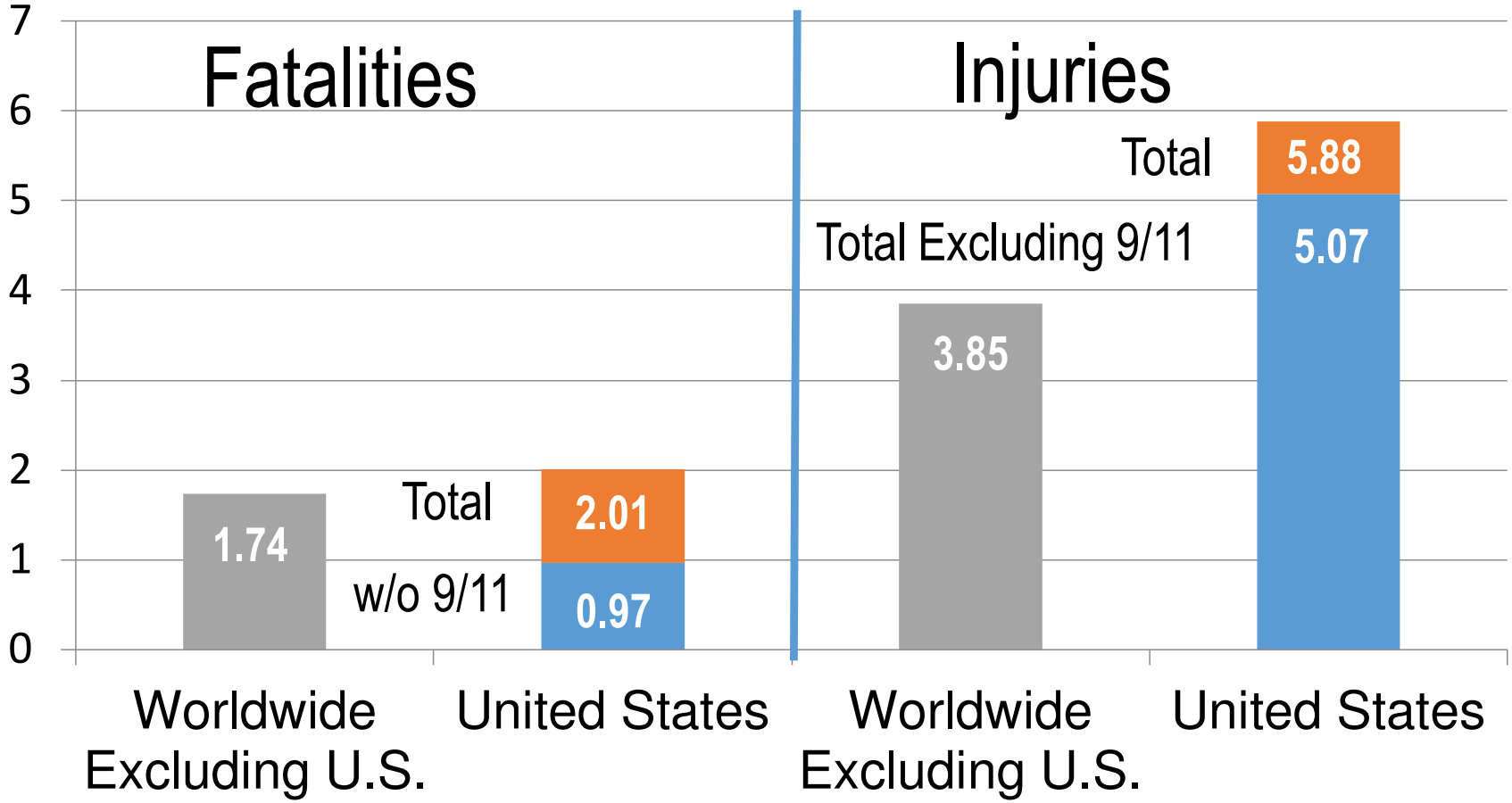
Terrorist Attacks Against US

- US accounts for only **7.8%** of terrorism worldwide.



Source: The Heritage Foundation, Muhlhausen & McNeil

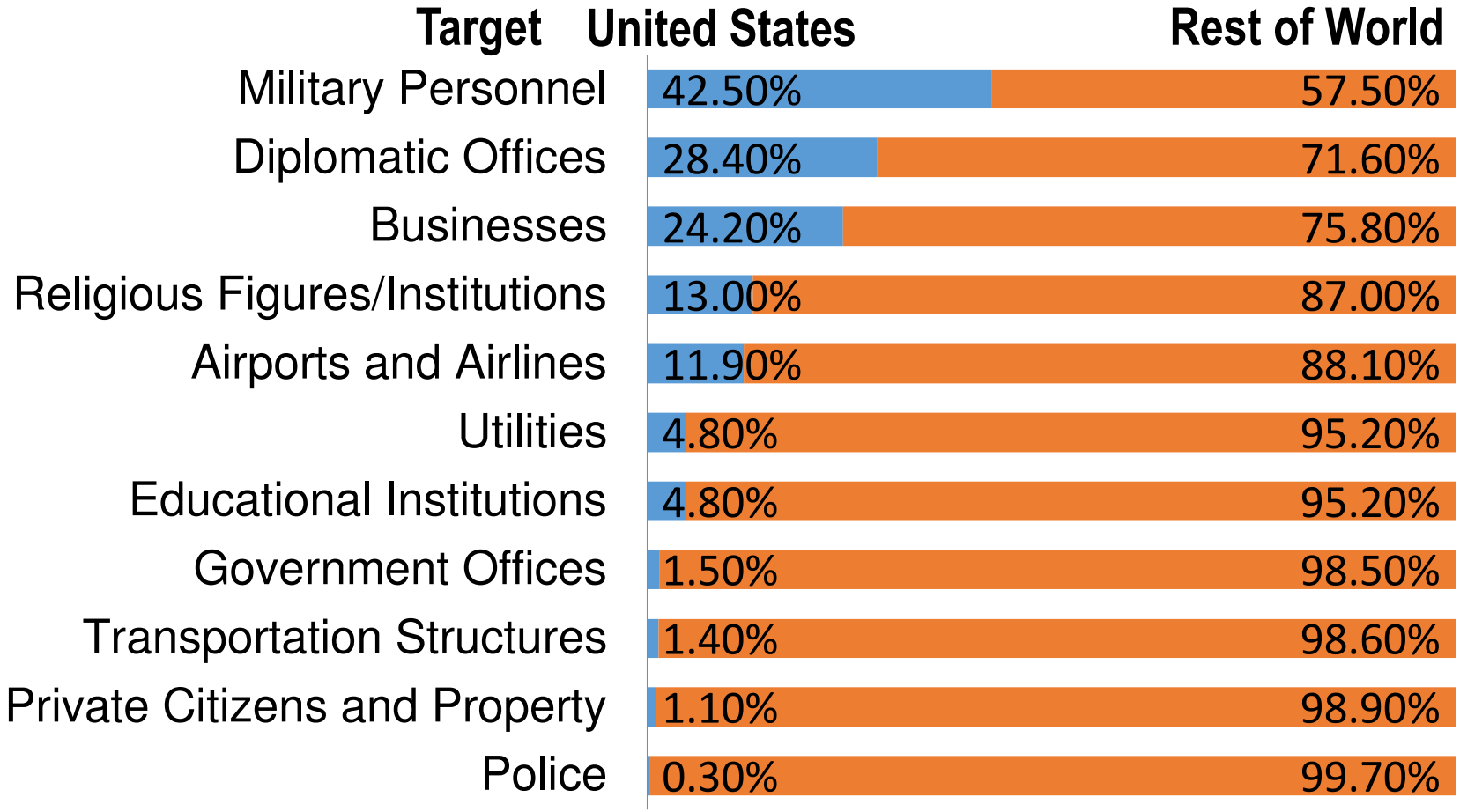
US Casualties/Attack (2009-1969)



Source: The Heritage Foundation, Muhlhausen & McNeil

- However, attacks against the US tend to cause **more casualties/attack**.

Attacks against Military

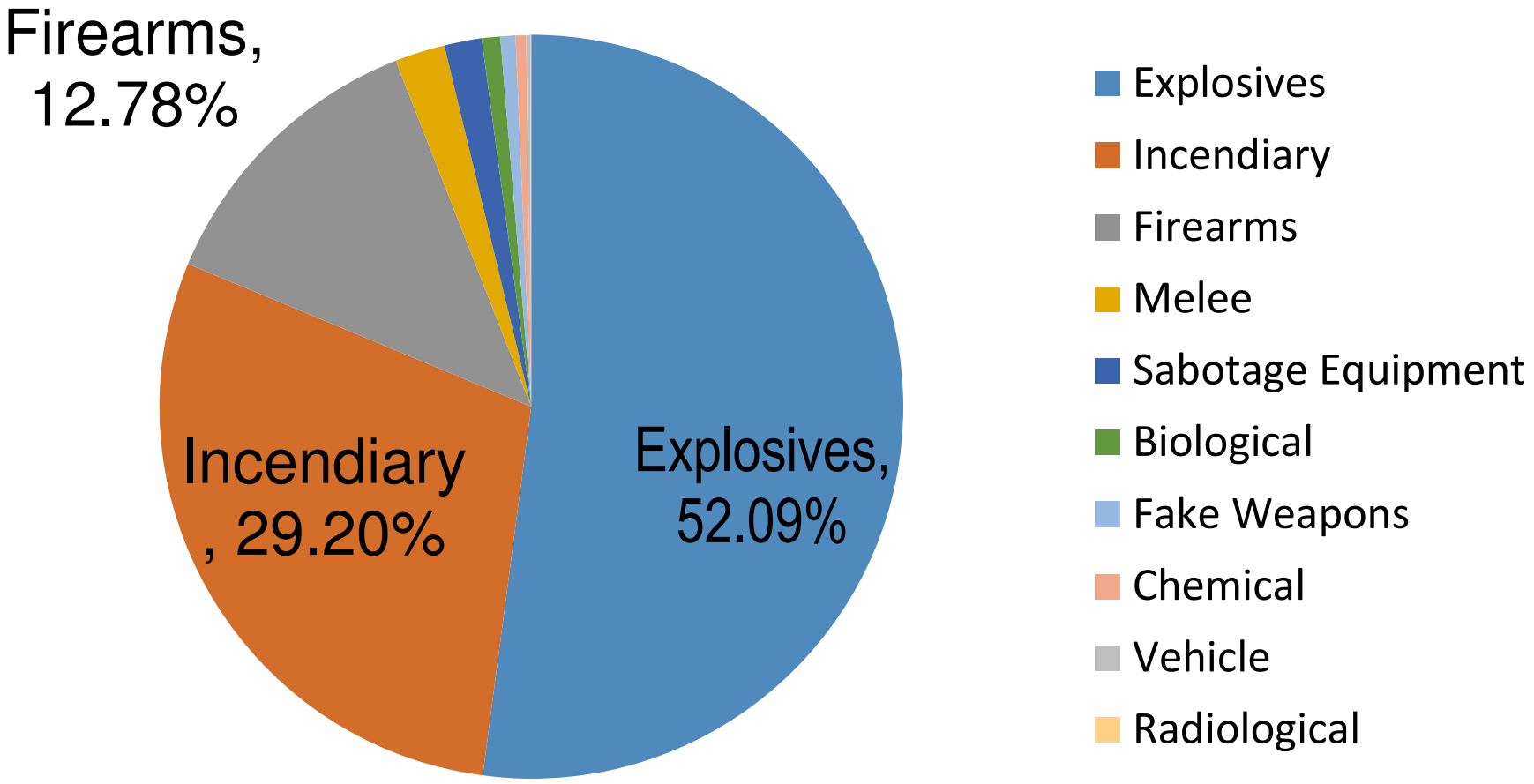


Source: The Heritage Foundation, Muhlhausen & McNeil

- 43% of all attacks against military institutions are leveled against the US.

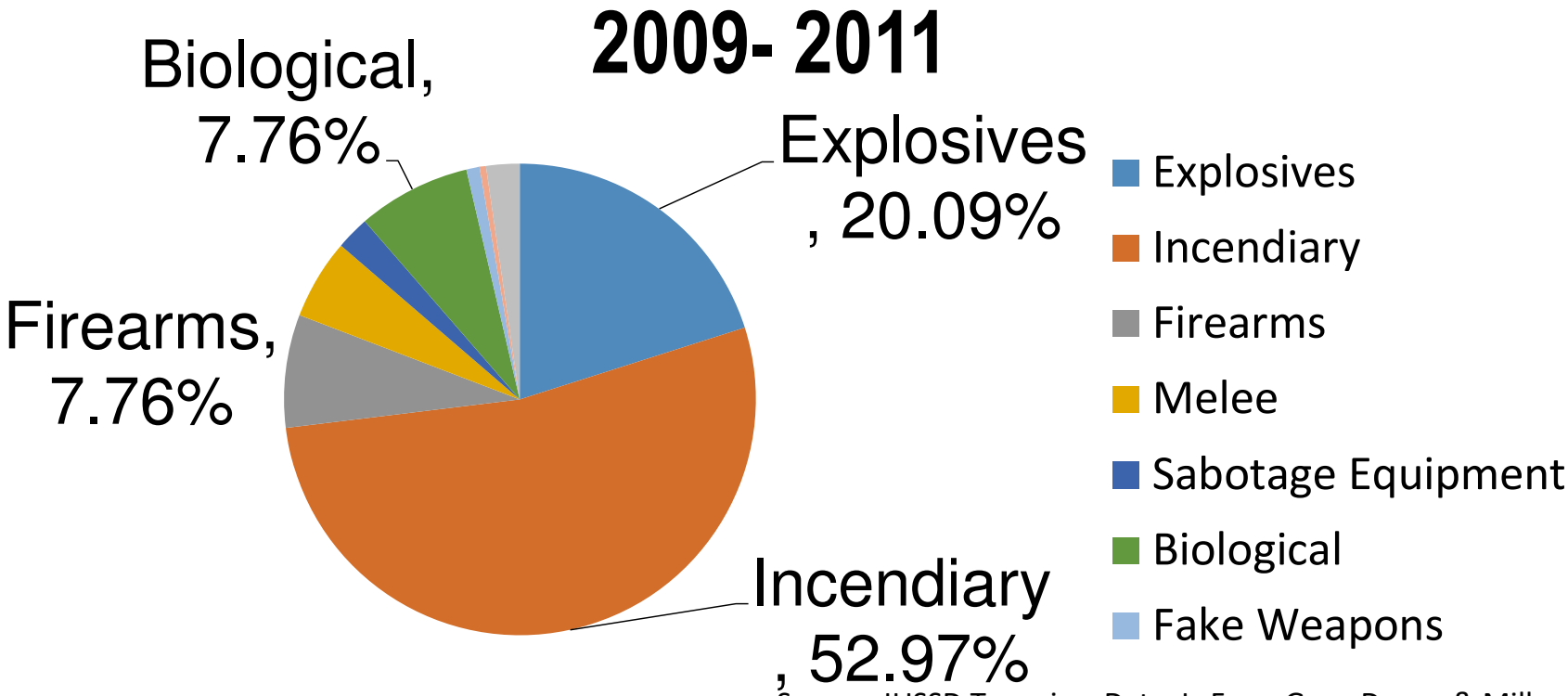
Weapons Used in U.S. Attacks

1970 - 2011



Source: IUSSD Terrorism Data, LaFree, Gary, Dugan & Miller

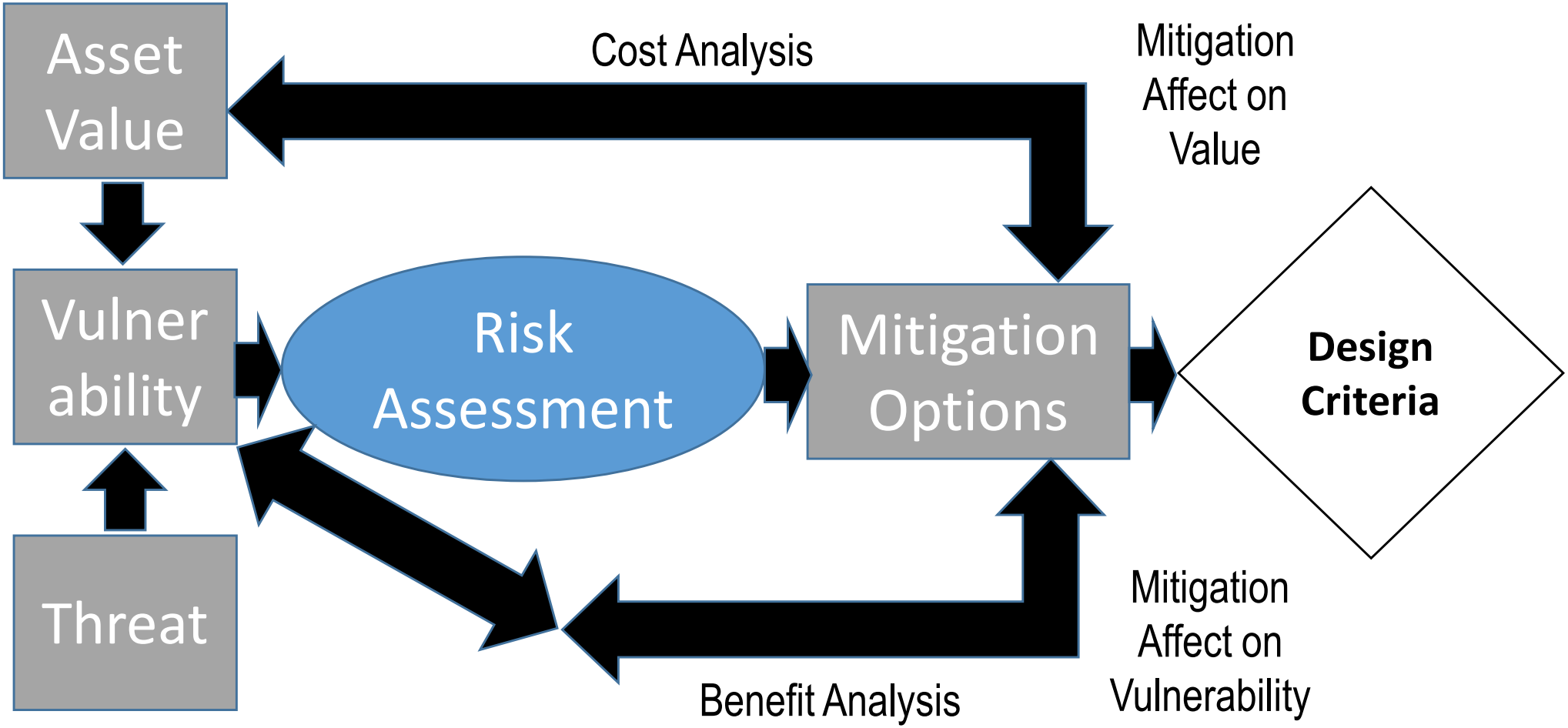
Weapon Trends in U.S. Attacks



Source: IUSSD Terrorism Data, LaFree, Gary, Dugan & Miller

- Less bombing and firearm attacks.
- More Improvised Incendiary Devices and biological attacks.
  - Improvised Incendiary Devices (IID) associated with environmental and animal rights violent extremist groups attacking property.
  - Increase in biological attacks is due to Anthrax Attacks in 2001.

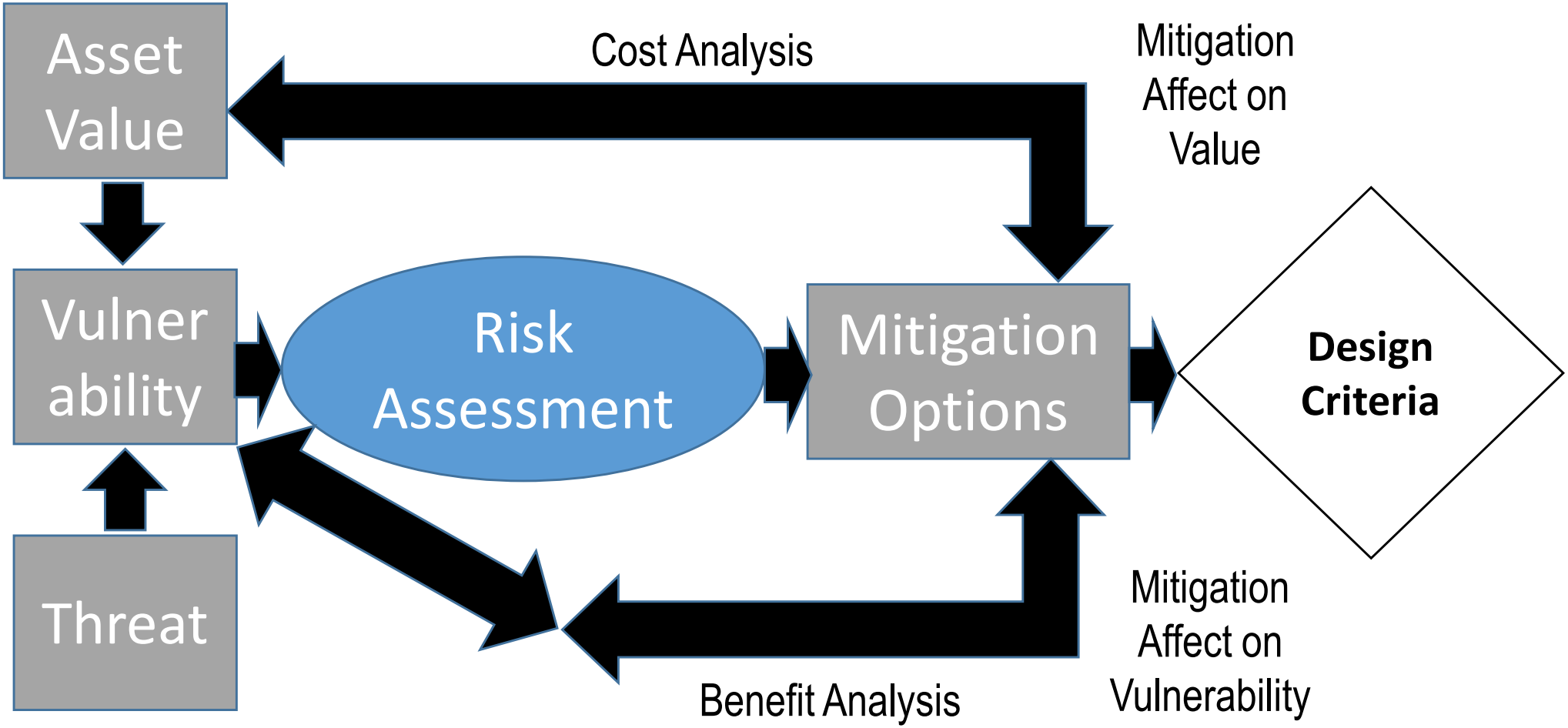
Risk Assessment Process



Risk = Asset Value x Threat Rating x Vulnerability Rating

Source: FEMA 426

Risk Assessment Process



Risk = Asset Value x Threat Rating x Vulnerability Rating

Source: FEMA 426

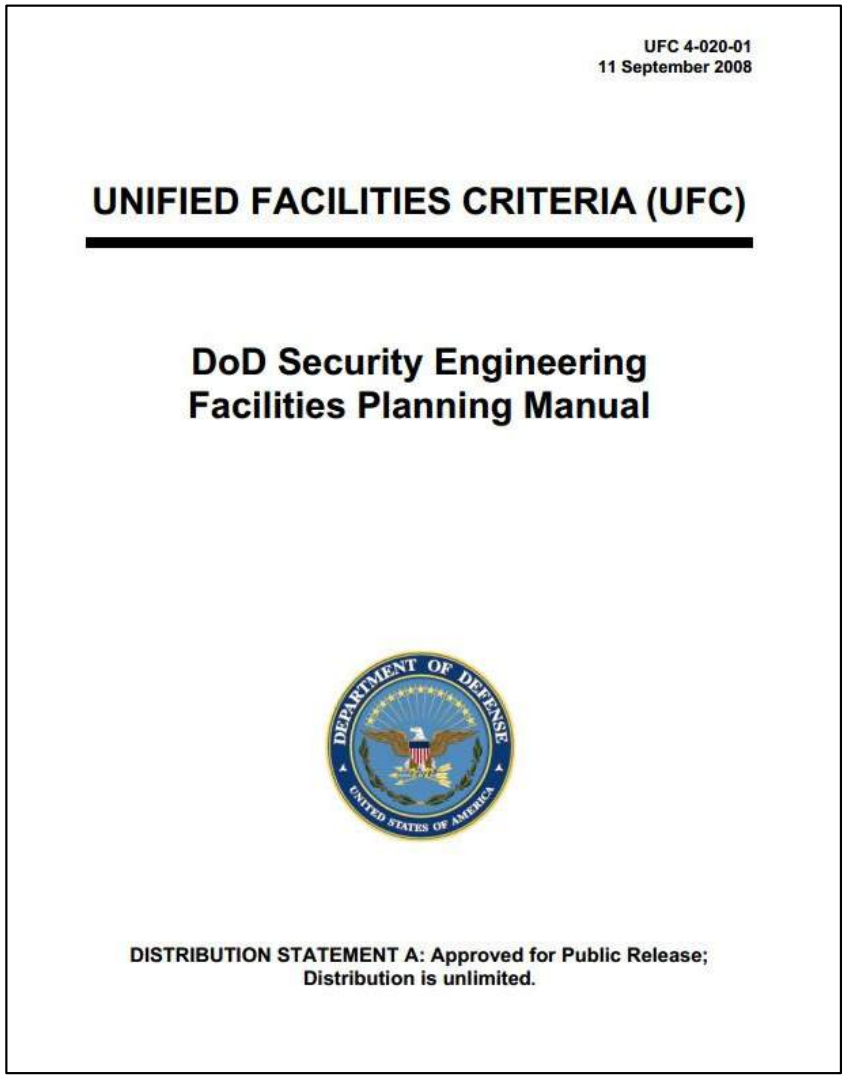
Risk Assessment Standard

- DoD Security Engineering Facilities Planning Manual,

  UFC-4-020-01

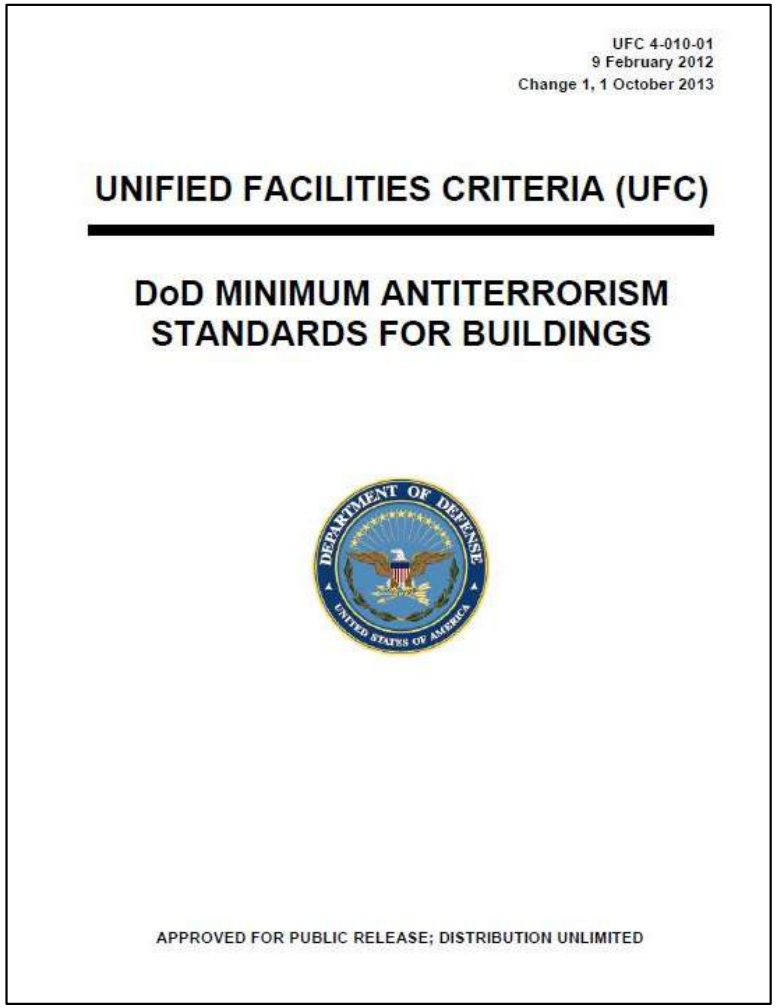
  - Require Risk Analysis
  - Results in Design Criteria
  - May Reference FOUO Support Standards
  - Or DoD Minimum Antiterrorism Standards for Buildings,

    UFC 4-010-01

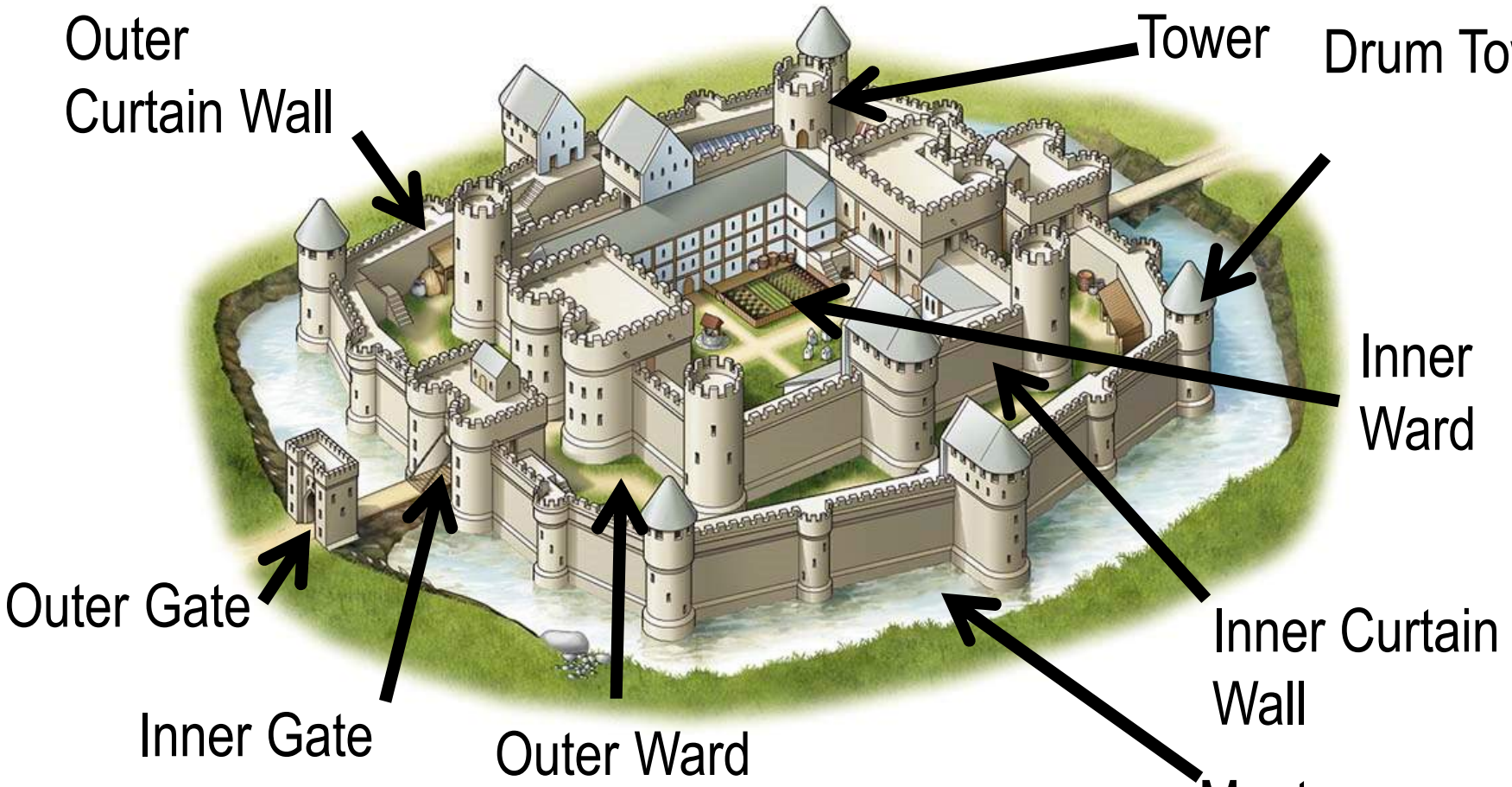


Risk Reduction Criteria

- DoD Minimum Antiterrorism Standards for Buildings, **UFC 4-010-01**
  - Minimum Standards
  - Consider Installation Specific Threats



Risk Reduction Basics



- **Concentric Levels of Protection**
  - Progressively Reduces Threat

Explosive Threats

- Favorite tactic amongst terrorist
- Ingredients easily obtain
- Easy and quick to detonate
- Vehicles carry large quantities to doorstep.
- Dramatic effect
- Mass injuries and casualties

Murrah Federal Building

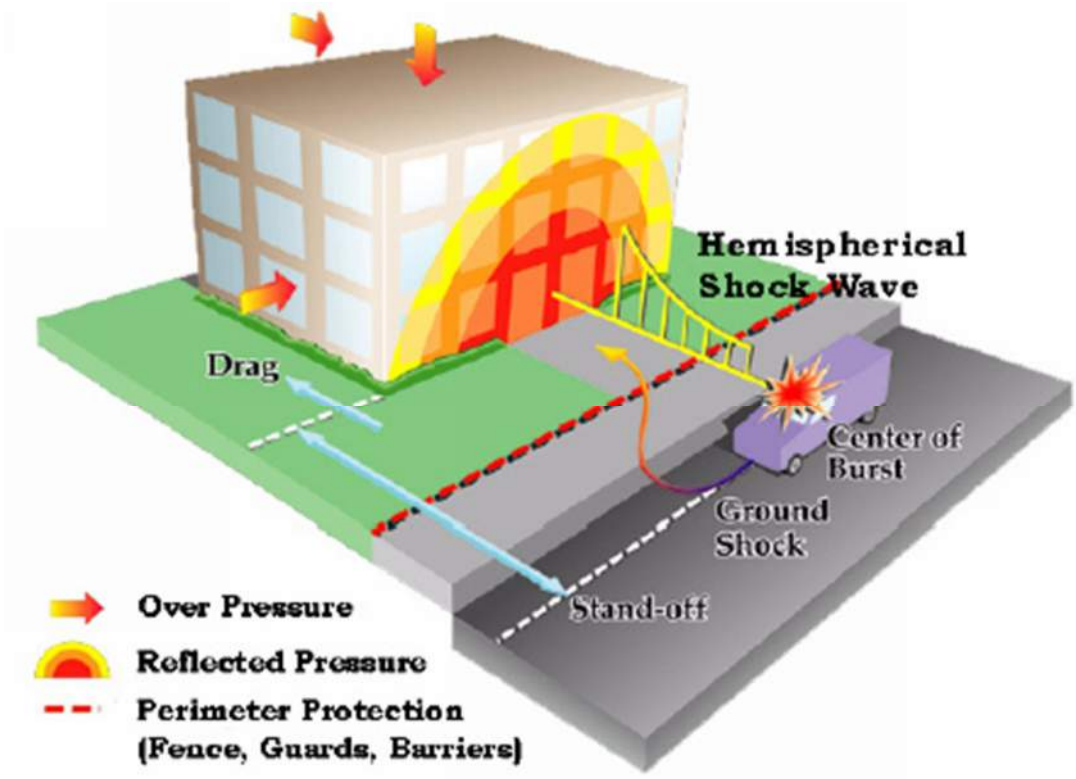
Yield (~TNT Equiv.)	4,000 lbs
Reflected Pressure	9,600 psi
Standoff	15 ft
Killed	166

Source: FEMA

Blast Theory

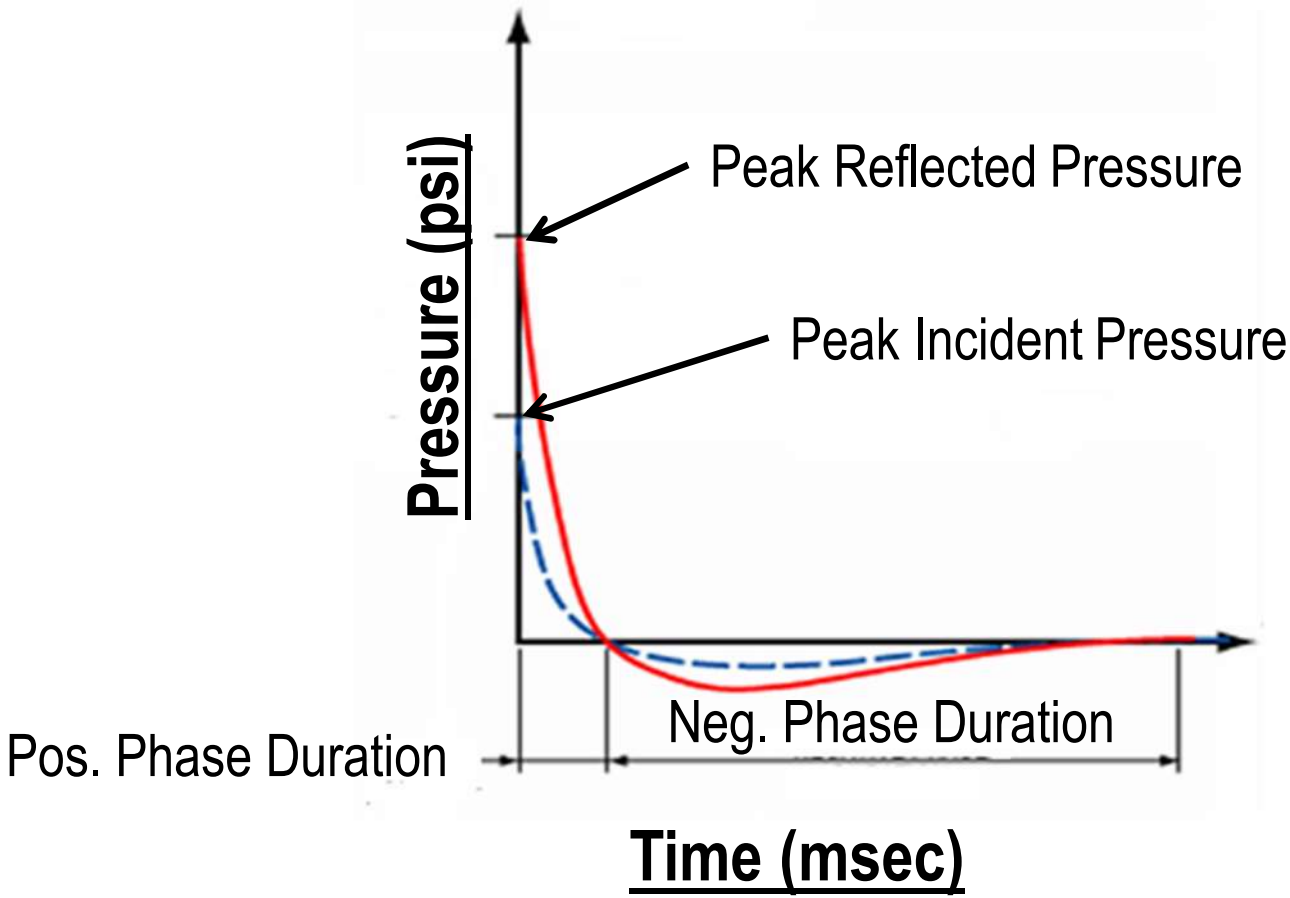
- Supersonic pressure wave caused by detonation
- Similar to water wave including reflections and refractions and reformation

Blast Theory



- Produces tremendous pressures (e.g. > 4 psi, 576 psf) in a short amount of time, milliseconds.
- Produces a small amount of wind ahead of and behind the pressure wave.
- As pressure wave impinges on surface in its path, the pressure buildup, reflected pressure, can be almost 13 times the incident free field pressure wave.

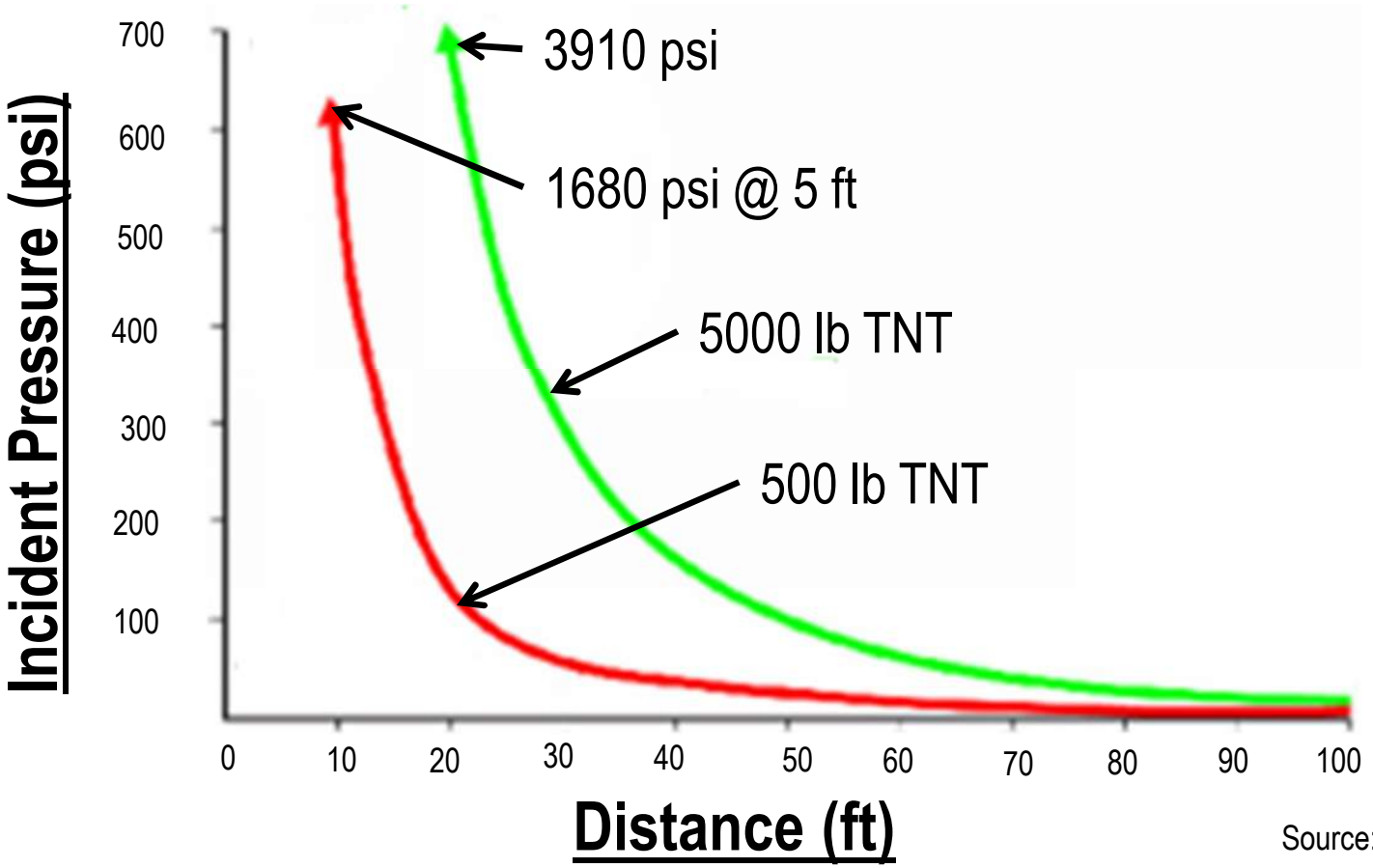
Blast Theory



Source: FEMA 427

- Pressures decay exponentially with time.
- Dynamic, non-linear, time history analysis.

Blast Theory



Source: FEMA 427

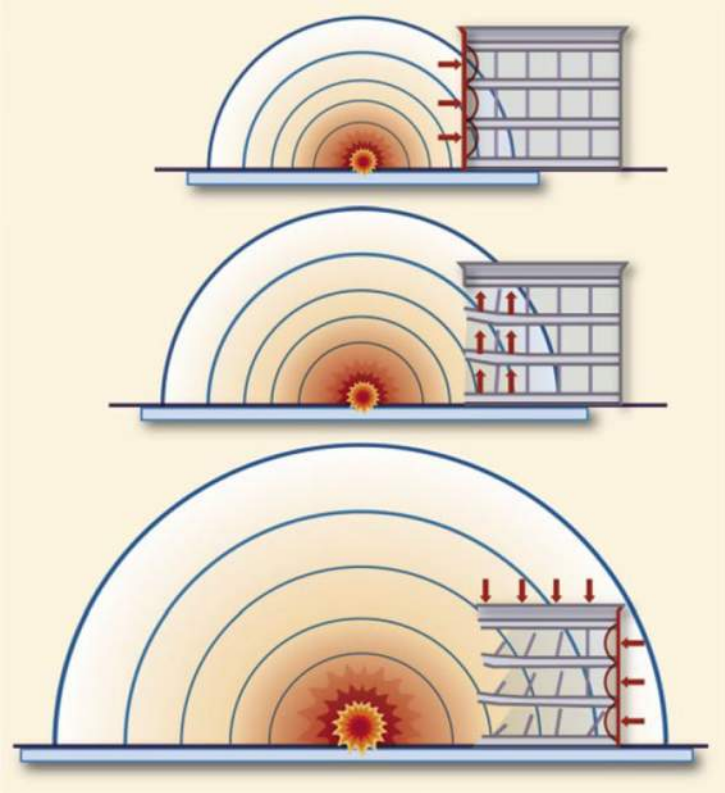
- Pressures decay with the cube of the distance from the explosion.

Blast Theory – Vehicle Bomb

Envelope Failure

Upward Force on Floors

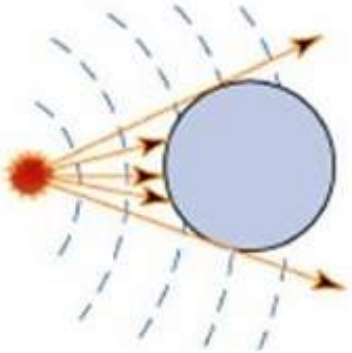
Blast Wave Surrounds Building



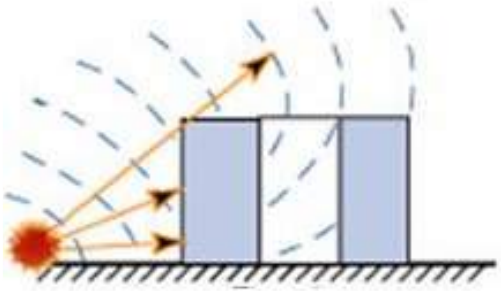
Source: FEMA 427

- Blast breaks windows, lifts floors, fails columns.
- Note positive pressure on all sides of buildings.
- Pressure wave diffracts around object and reforms on the other side.
- Pressures determined by nomograph (Kingery & Bulmash)

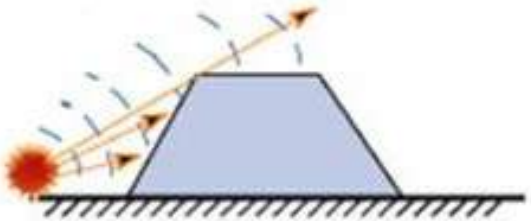
Shapes That Affect Blast



Round Shape

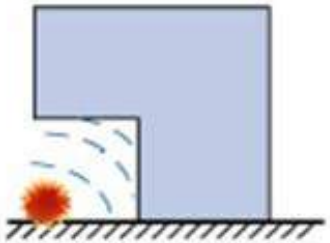


Blast Wall



Berm

Re-entrant corners

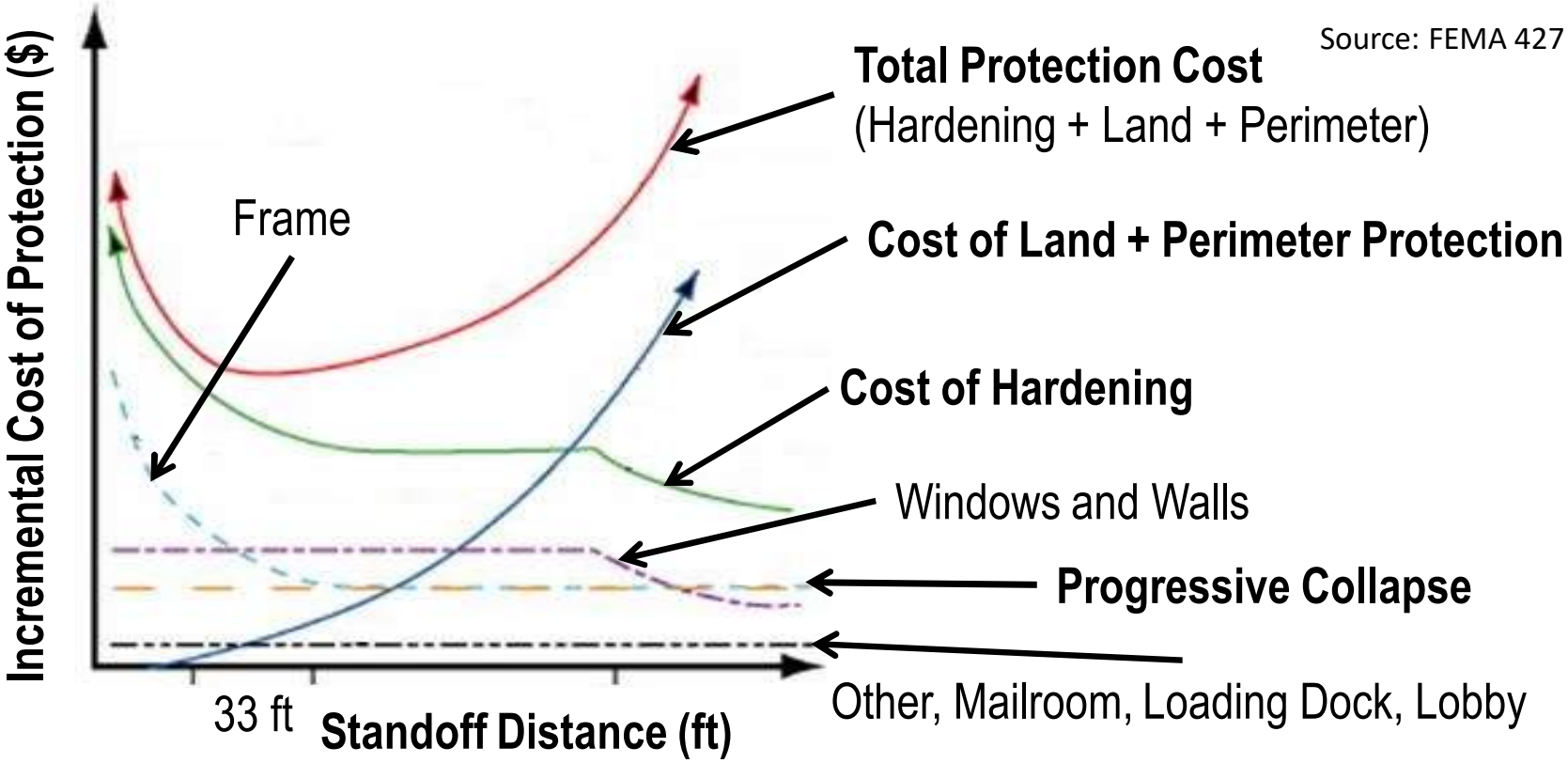


Overhang

- Re-entrant corners can accentuate blast pressures.
- Round shapes can dissipate pressures.
- Berms are ineffective at reducing blast pressures.
- Blast walls can reduce pressures to incident pressures but could accentuate blast pressures.
- Pressure determination may require CFD .

Source: FEMA 427

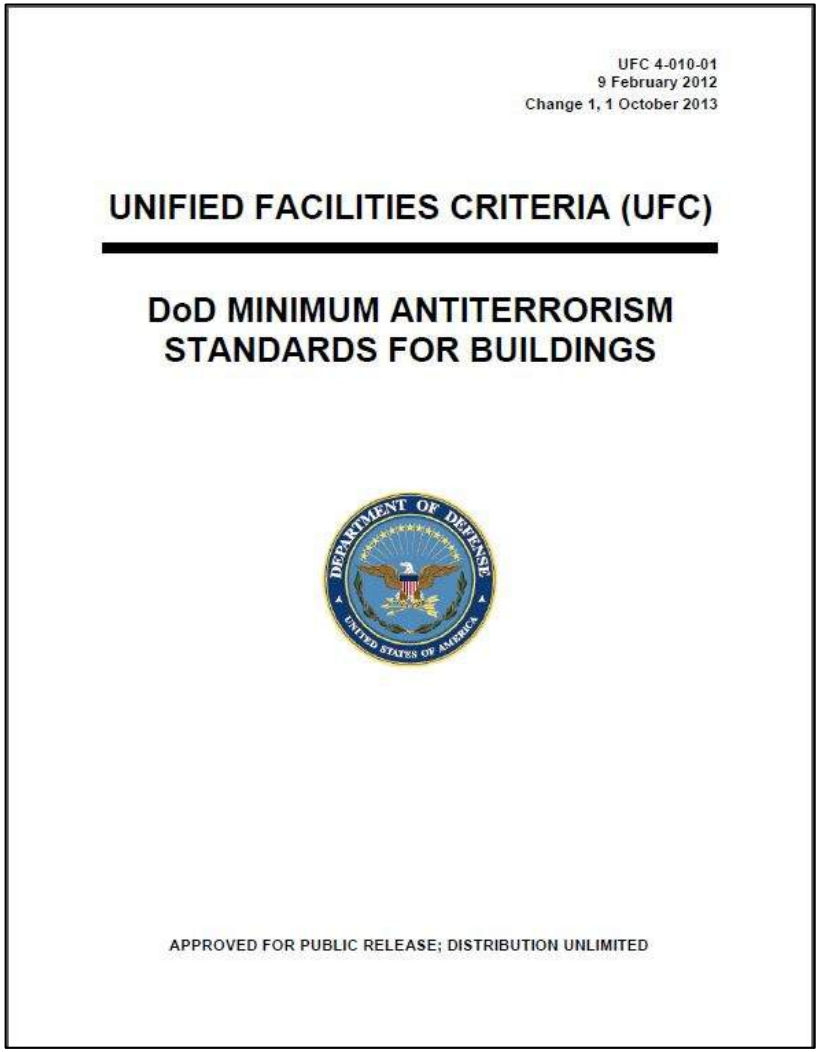
Optimum Standoff

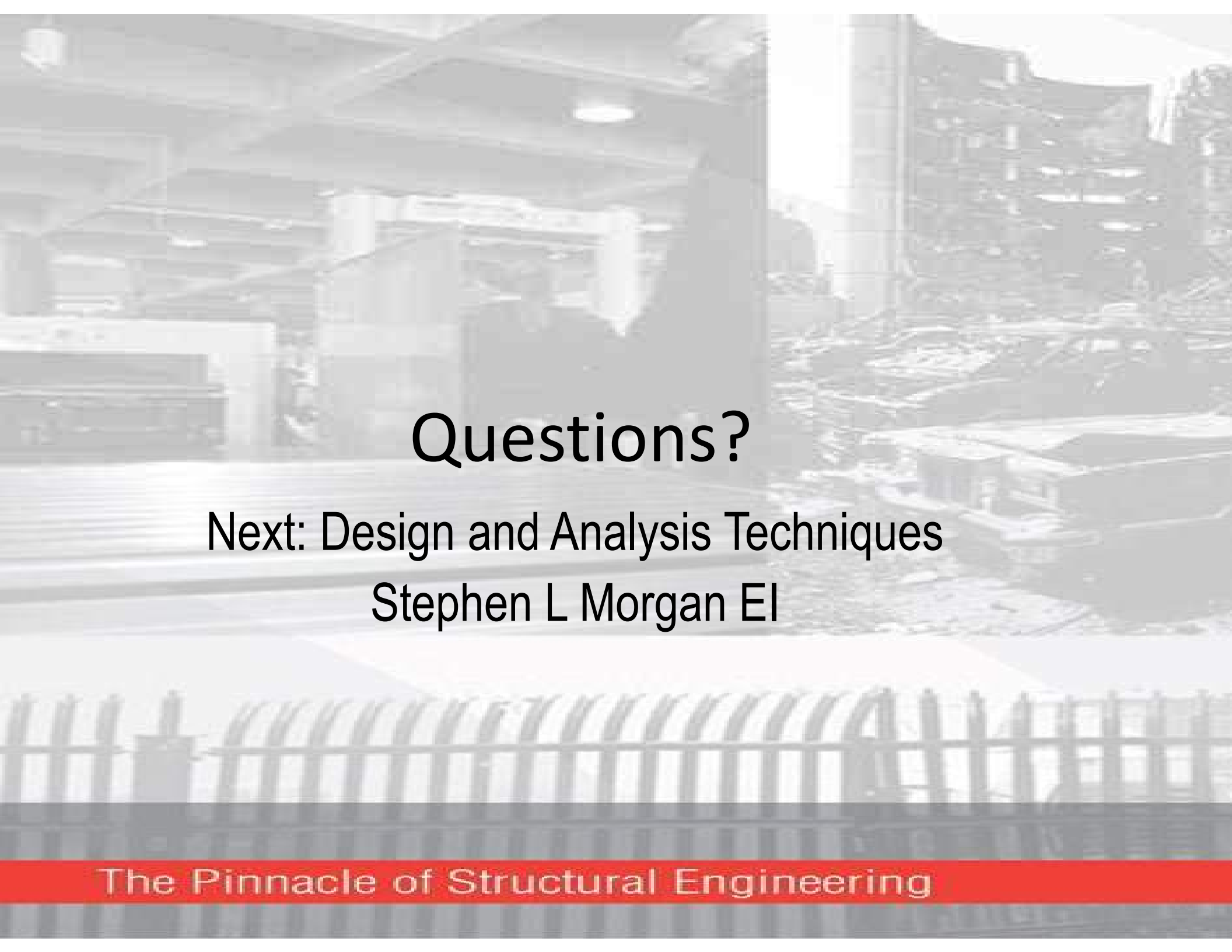


- Optimize total cost of Hardening + Land + Perimeter
  - Less stand-off requires more hardening.
  - More stand-off requires more land and perimeter
  - Note Progressive Collapse is threat independent.

DoD Minimum ATFP Criteria

- DoD Design Criteria
- Combination of performance and prescriptive requirements.
- Simplified graphics and tables.




Questions?
Next: Design and Analysis Techniques
Stephen L Morgan EI
The Pinnacle of Structural Engineering