



SEPTEMBER 11, 2001



# THE PENTAGON

PRESENTED BY :

**Leo J. Titus, Jr., PE**

ECS Group of Companies

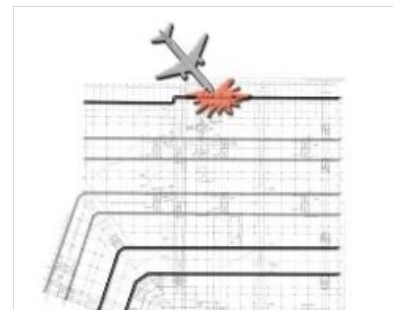
---



THE PENTAGON

## Objectives

- Overview of FEMA US&R Response System
- Review attack and general description of damage



THE PENTAGON

# Project Overview

## Discuss US&R mission objectives

Reconnaissance, Shoring, Recovery,  
Monitoring + Demolition



## Review daily Task Force activities



## Review of Project Phoenix



---

# FEMA Urban Search + Rescue (US&R) Response System



28 Teams specializing in Urban Search + Rescue in the U.S.



Specialists serve on a team in four major functional elements:

- Search
- Rescue
- Technical
- Medical

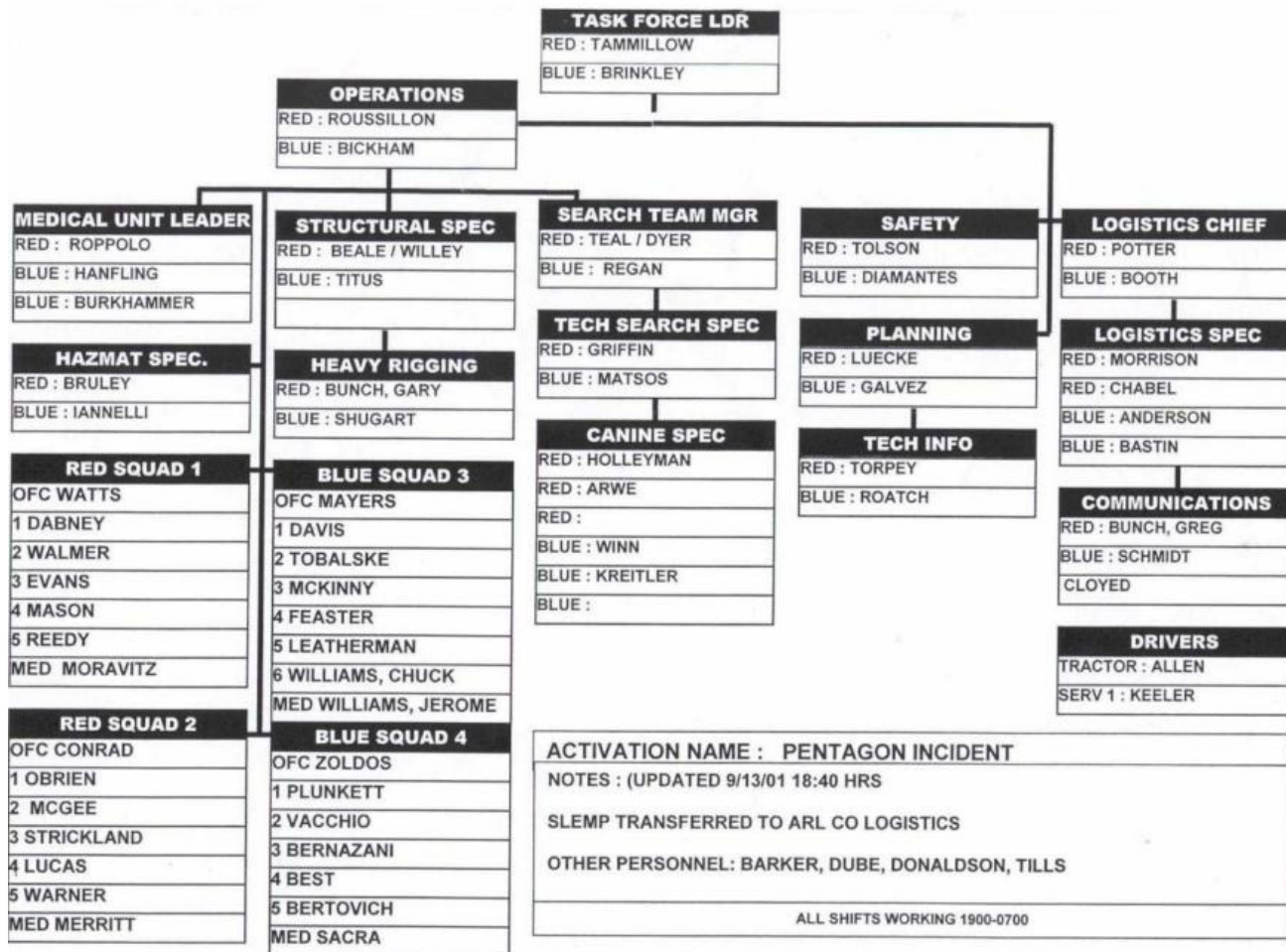






## Virginia Task Force One (VA-TF1)

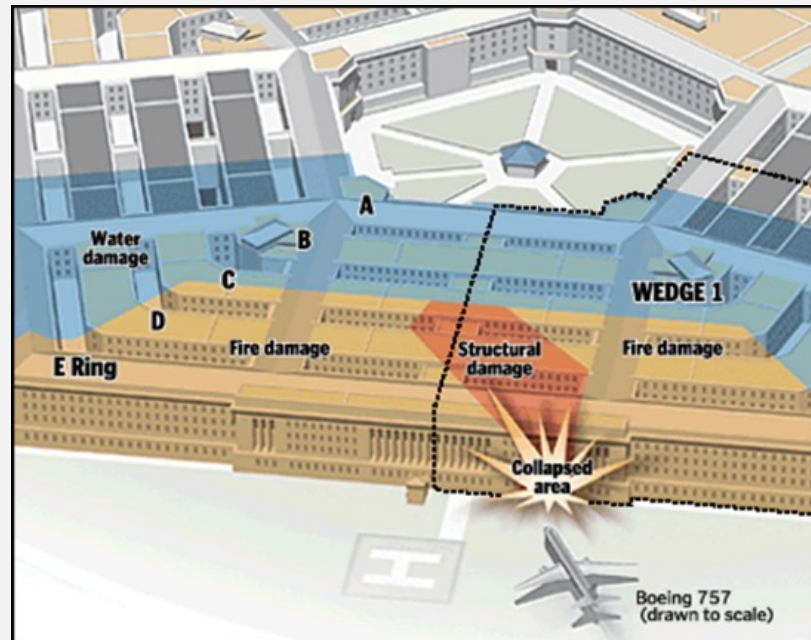
- Comprised of civilian and career members
- 70,000+ pounds of tools, equipment and supplies
- Ready for world-wide deployment within 6 hours
- Self-sufficient for 72 hours domestic and 10 days international



9-11...

## The Attack

- Boeing 757
- 30,000 pounds of fuel
- Recently renovated
- Plane strikes first floor
- Building collapses 19 minutes after impact
- 189 people killed













THE PENTAGON – SEPTEMBER 11, 2001

## FEMA Search + Rescue Operations

### 4 FEMA Teams on site:

- VA-TF1 (Fairfax Co., VA) – 1:00 p.m.
- MD-TF1 (Montgomery Co., MD) – 3:00 p.m.
- VA-TF2 (VA Beach) – 8:00 p.m.
- TN-TF1 – Wednesday morning
- Military District of Washington – Army Search & Rescue



MISSION #1

## RECON

### RECON OBJECTIVES:

- Search for potential live victims
- Evaluate rescue hazards
- Evaluate Structural Damage



- 
- Significant internal damage on all floors.
  - Fire, smoke, heat, debris, water: all obstacles for recon team.
  - Floors too hot for canine teams.





























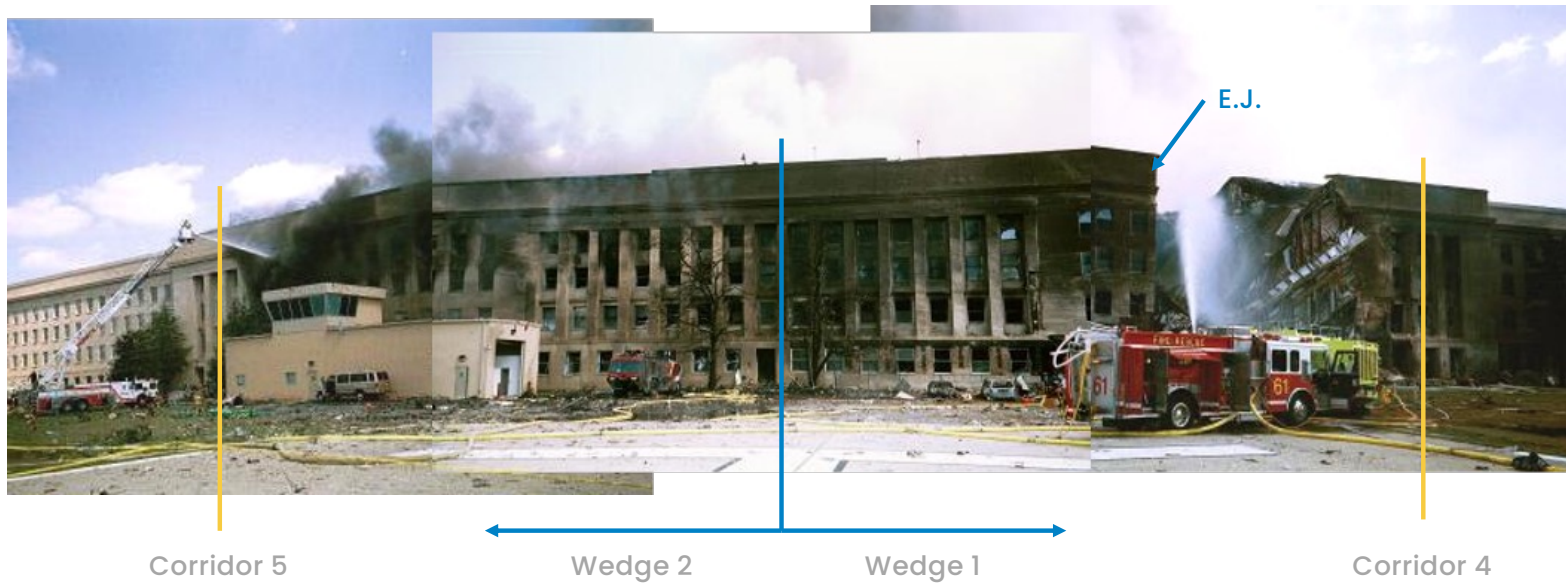


---

## Overview of Structural Damage

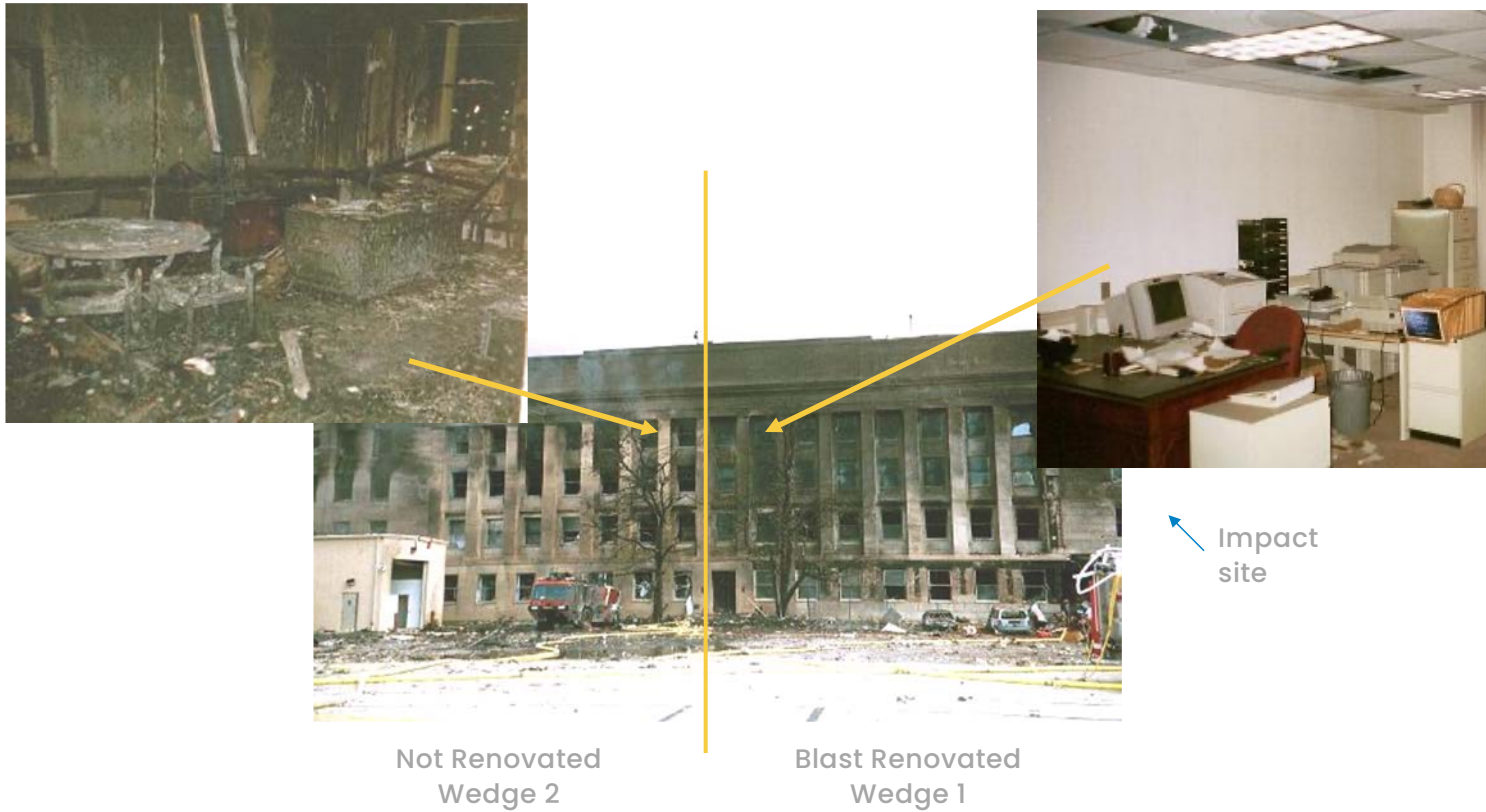


## Front view at 1pm | 9/11

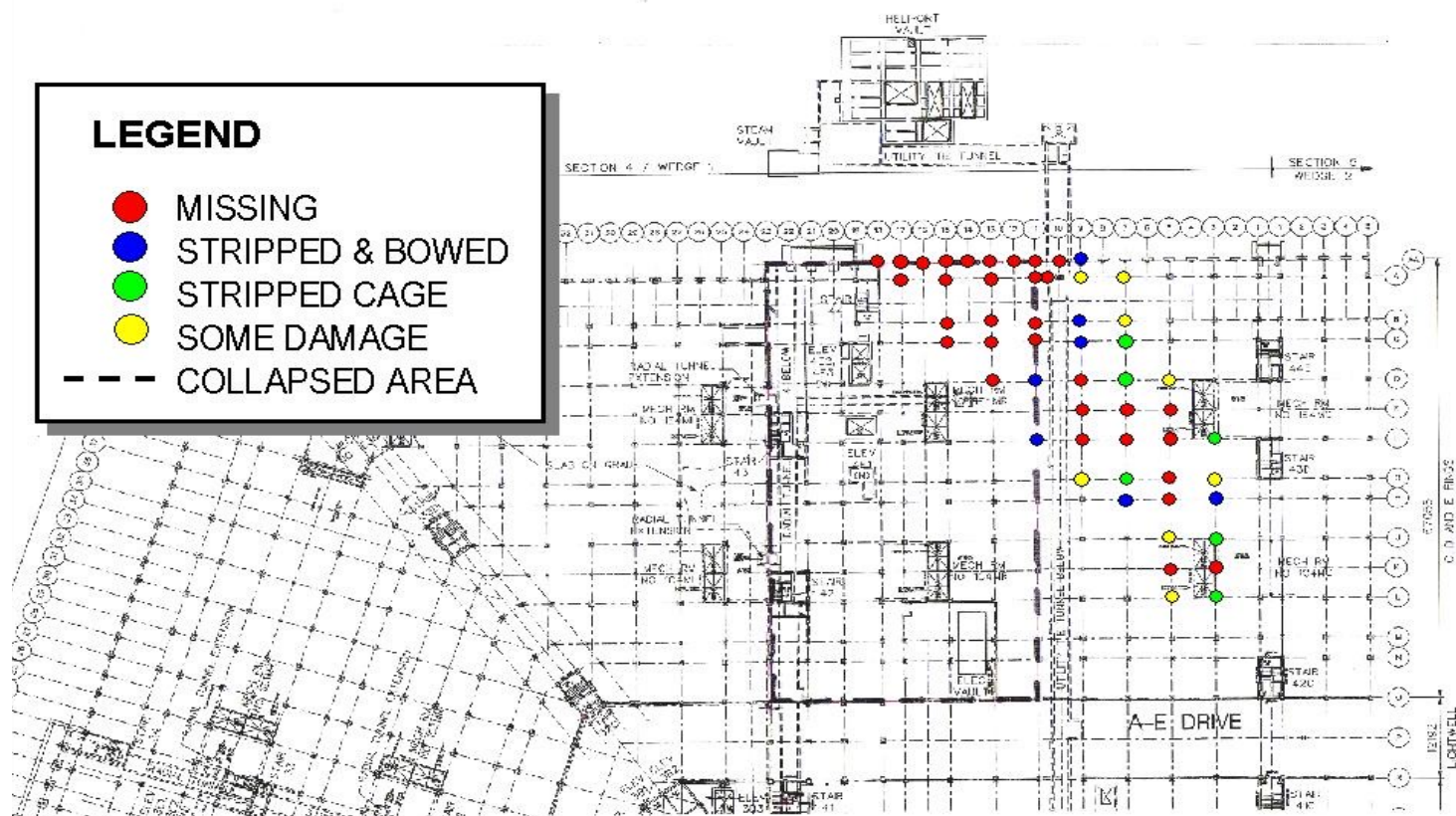




## Blast Design Benefits



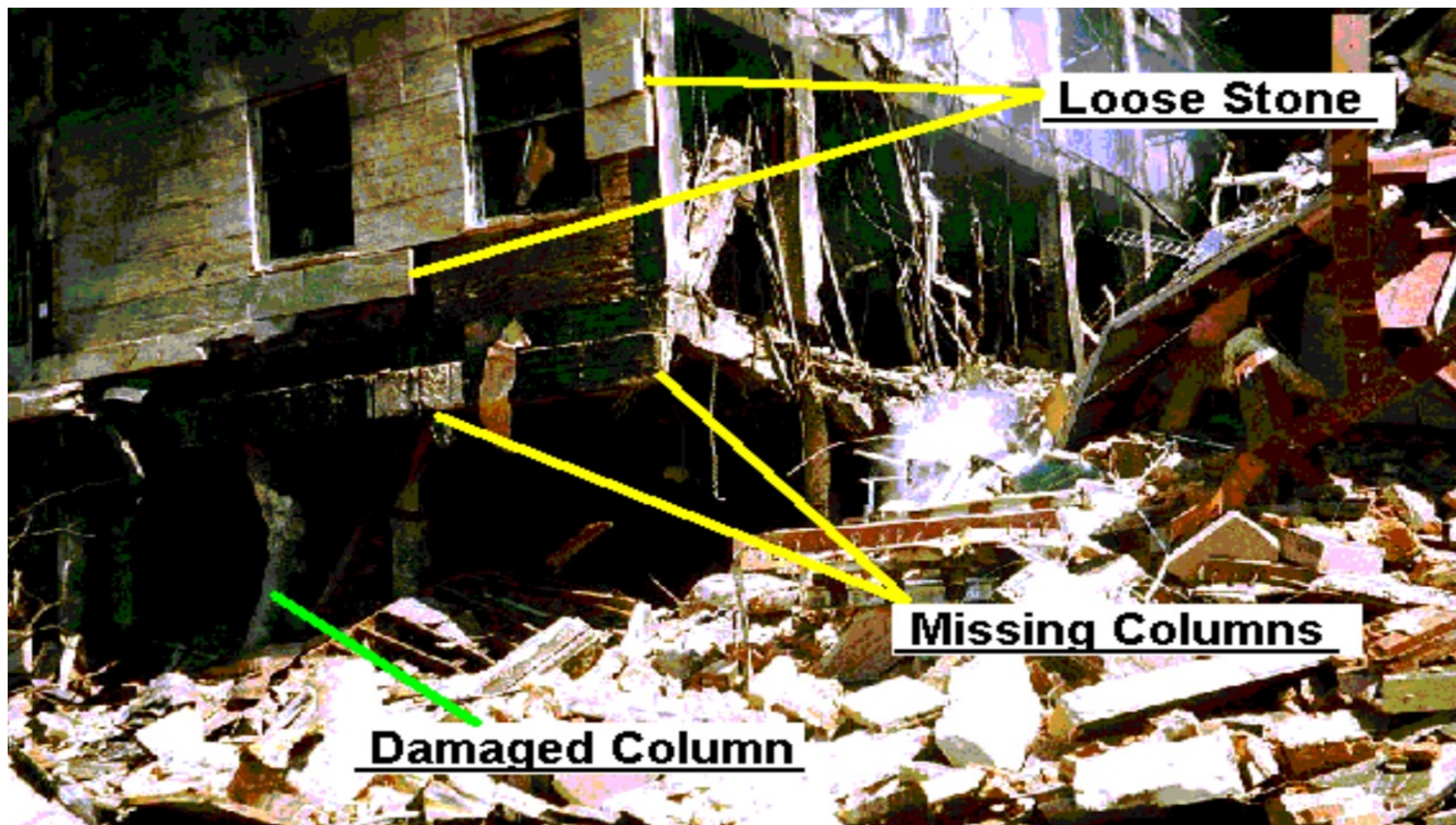
# Structural Integrity











**Loose Stone**

**Missing Columns**

**Damaged Column**



MISSION #2

## Shoring



---

## Logistical Issues Before Shoring Could Begin

- Debris + Hazards
- Lumber
- Victims + Evidence
- Lighting

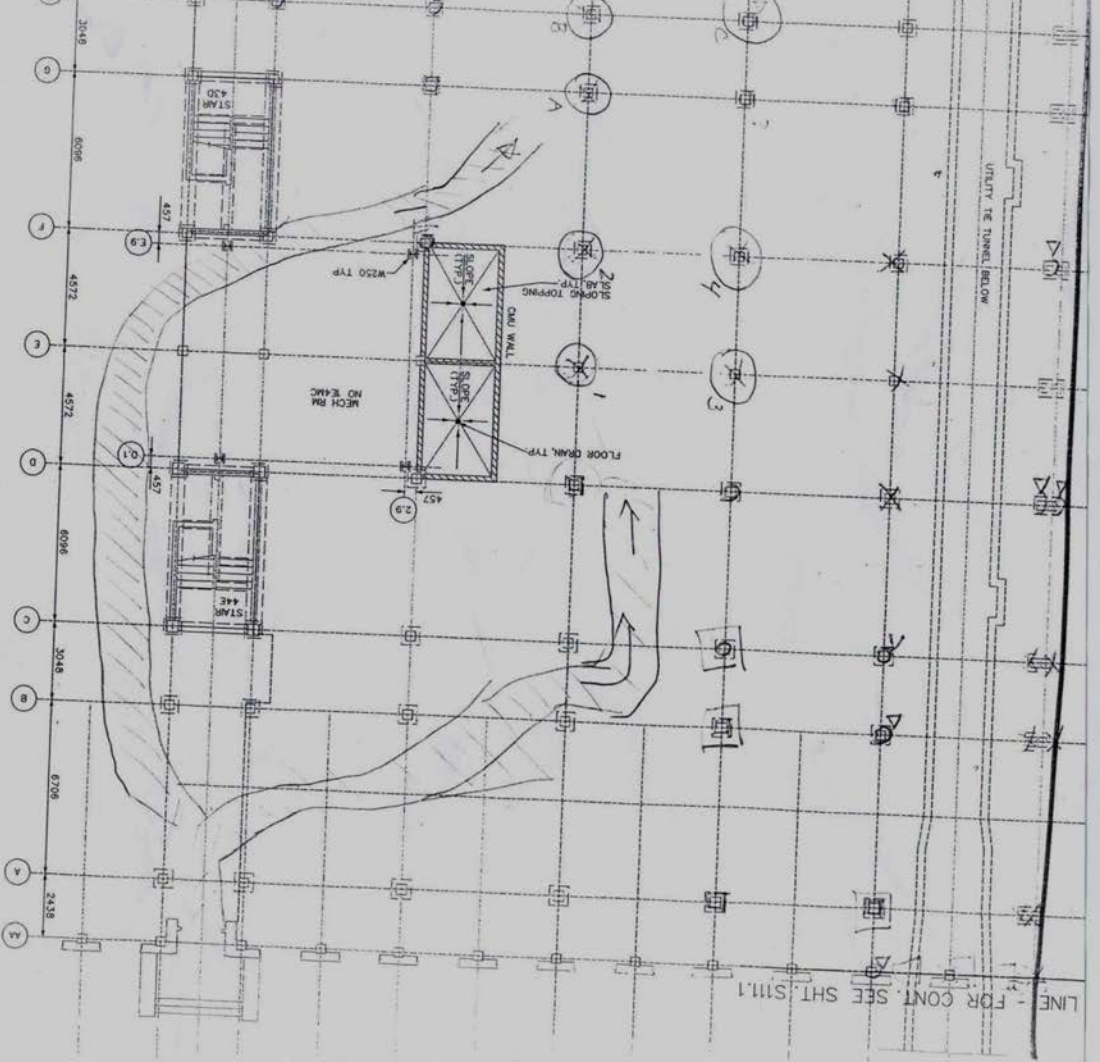




1. PREPARATION OF SHOP DRAWINGS, IF IT  
 DIMENSIONS DO NOT AGREE WITH THOSE  
 CONTRACT DRAWINGS, THE CONTRACTOR  
 NECESSARY ADJUSTMENTS TO DIMENSIONS  
 CONTRACT DRAWINGS TO ENSURE THAT THE  
 CONSTRUCTION PROPERLY FITS ON THE EX  
 STRUCTURE.  
 2. SLAB ON GRADE E.L. = 1179.0 (S.O.S.) AND 15 1/2"  
 3. 1/2" EXIST. CONC. SLAB ON GRADE E.L. = 11  
 5. NEW SLAB ON GRADE AT ALL AREAS OF DE  
 THICK, NORMAL WEIGHT CONCRETE SLAB PL  
 WATER BARRIER OVER 152 THICK LA  
 NEW SLAB SHALL MATCH TOP OF SURROUND  
 6. SLAB, WALL, ETC. INDICATES WALL PLATES  
 STEEL FRAMING TO EXISTING CONCRETE PA  
 GIRDERS, COLUMN, WALLS.  
 7. FOR OTHER INFO, SEE DEMOLITION PLANS  
 THRU S0111.

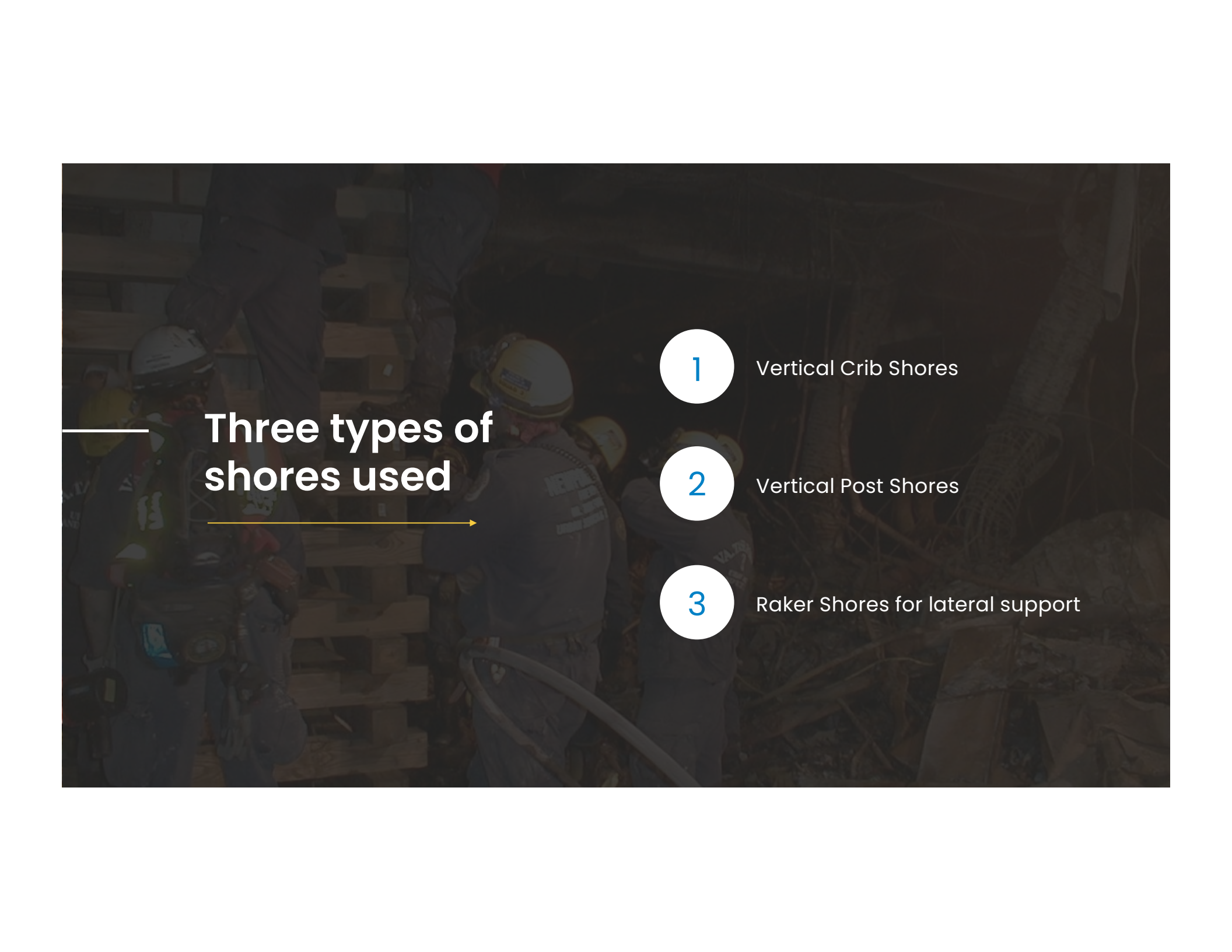
X Missing  
 O = stripped  
 Δ = stripped  
 □ = same draw

X-9-point  
 6-4-8



Over **42**  
columns  
required  
shoring on  
the first floor.





## Three types of shores used

---

1

Vertical Crib Shores

2

Vertical Post Shores

3

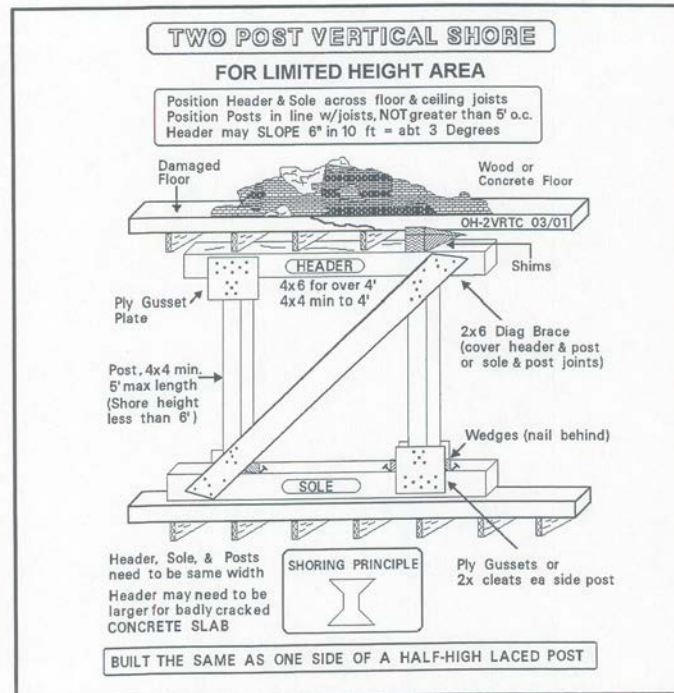
Raker Shores for lateral support



## SECTION 2.3 US&R SHORING CONSTRUCTION

### TWO POST VERTICAL SHORES

- The Limited Height Area, Two Post Vertical Shore is constructed the same as a Half High, Single Side of a Laced Post Shore
- The Full height Two Post Vertical Shore is constructed the same as the Single Side of a Laced Post Shore







- 3 vertical crib shores used on front corner
- 6"x6" lumber used for cribbing











- Raker Shore constructed for lateral support
- Knocked off "Widowmakers"





MISSION #3

## Recovery



---

## 2<sup>nd</sup> Night: “A&E Drive”

- Plane punched out into alley.
- Escorted FBI for body and evidence recovery.









---

## Canine Teams Search for Victims



MISSION #4

## Monitoring





## Monitoring Building Movement

- 2 points monitored all week with transits
- Cantilevered corner
- Hanging concrete parapet

### Equipment Used:

- 3 Transits
- Binoculars
- Air Horn
- Monitoring Log



Field logs were kept to keep records of any building movement.

4000 Copyright: Rescue Engineering Council, Inc.

### Building Stability Monitoring Log

Site ID: PENTAGON Page: 01

Search Grid: \_\_\_\_\_ Team: BLUE Event: \_\_\_\_\_

Monitoring Station: LEFT SIDE OF COLLAPSE Date: 9/11/01 Start time: 22:50

TIME	✓	Notes	TIME	✓	Notes	TIME	✓	Notes
23:00	<input checked="" type="checkbox"/>	No Mov	04:00	<input checked="" type="checkbox"/>	N/C	:00	<input type="checkbox"/>	
23:15	<input checked="" type="checkbox"/>	No Mov	04:15	<input checked="" type="checkbox"/>	N/C	:15	<input type="checkbox"/>	
23:30	<input checked="" type="checkbox"/>	N/C	04:30	<input checked="" type="checkbox"/>	N/C	:30	<input type="checkbox"/>	
23:45	<input checked="" type="checkbox"/>	N/C	04:45	<input checked="" type="checkbox"/>	N/C	:45	<input type="checkbox"/>	
00:00	<input checked="" type="checkbox"/>	N/C	05:00	<input checked="" type="checkbox"/>	N/C	:00	<input type="checkbox"/>	
00:15	<input checked="" type="checkbox"/>	N/C	05:15	<input checked="" type="checkbox"/>	N/C	:15	<input type="checkbox"/>	
00:30	<input checked="" type="checkbox"/>	N/C	05:30	<input checked="" type="checkbox"/>	N/C	:30	<input type="checkbox"/>	
00:45	<input checked="" type="checkbox"/>	N/C	05:45	<input checked="" type="checkbox"/>	N/C	:45	<input type="checkbox"/>	
01:00	<input checked="" type="checkbox"/>	N/C	06:00	<input type="checkbox"/>		:00	<input type="checkbox"/>	
01:15	<input checked="" type="checkbox"/>	N/C	06:15	<input type="checkbox"/>		:15	<input type="checkbox"/>	
01:30	<input checked="" type="checkbox"/>	N/C	06:30	<input type="checkbox"/>		:30	<input type="checkbox"/>	
01:45	<input checked="" type="checkbox"/>	N/C	06:45	<input type="checkbox"/>		:45	<input type="checkbox"/>	
02:00	<input checked="" type="checkbox"/>	N/C	07:00	<input type="checkbox"/>		:00	<input type="checkbox"/>	
02:15	<input checked="" type="checkbox"/>	N/C	07:15	<input type="checkbox"/>		:15	<input type="checkbox"/>	
02:30	<input checked="" type="checkbox"/>	N/C	07:30	<input type="checkbox"/>		:30	<input type="checkbox"/>	
02:45	<input checked="" type="checkbox"/>	N/C	07:45	<input type="checkbox"/>		:45	<input type="checkbox"/>	
03:00	<input checked="" type="checkbox"/>	N/C	08:00	<input type="checkbox"/>		:00	<input type="checkbox"/>	
03:15	<input checked="" type="checkbox"/>	N/C	08:15	<input type="checkbox"/>		:15	<input type="checkbox"/>	
03:30	<input checked="" type="checkbox"/>	N/C	08:30	<input type="checkbox"/>		:30	<input type="checkbox"/>	
03:45	<input checked="" type="checkbox"/>	N/C	08:45	<input type="checkbox"/>		:45	<input type="checkbox"/>	

CHECK BOX IF NO CHANGE

StructuresFieldDataForm.xls, Monitoring Log

---

## Man Basket Operations

- Watching for victims
- Monitoring building movement
- 2-hour shifts



Arlington, VA, September 17, 2001 -- FEMA Urban Search and Rescue workers inspect the Pentagon crash site from a crane.

Photo by Jocelyn Augustino/ **FEMA News Photo**



THIRD NIGHT

**Fire!**



MISSION #5

## Demolition





---

## 4<sup>th</sup> Day Demolition Begins

- “Pulverizer” used to break up concrete safely.







---

# Operations



- 
- VATF-1 & VATF-2: Night Shift 6:00 PM to 6:00 AM
  - MDTF-1 & TNTF-1: Day Shift





## FEMA – IST (Incident Support Team)

- Daily transitional meetings  
6:30 AM + 6:30 PM



## Other Agencies On Site Involved with Search + Rescue

- Arlington County Fire Department
- Fairfax County Fire Dept
- US Army
- FBI
- NTSB
- ATF





# Personal Protective Equipment (PPE)

- Flash Gear
- Helmet
- Respirator
- Tyvex
- Boots/Gloves
- Eye Protection



## “Decon”





BASE OF  
OPERATIONS

# VATF-1 BOO







---

**Arriving at  
Anacosita base  
for rehab...**





---

# Fantastic Support!!



## American Red Cross

- American Red Cross
- Salvation Army
- Local Contractors & Businesses

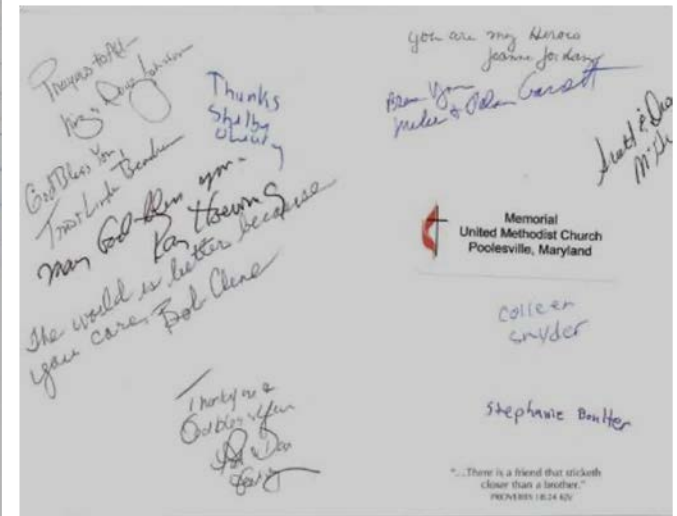
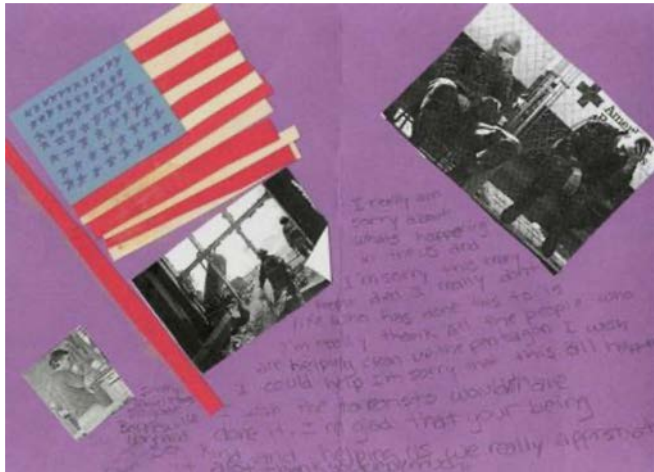


- Food
- Clothing
- Services
- Letters/Cards/Flowers









## Special Visitors

- President Bush
- VP Cheney
- Governor Gilmore
- Sec. Defense Rumsfeld
- Congressmen





## VA-TF1 Goodbye – Sept. 18<sup>th</sup>, 2001



---

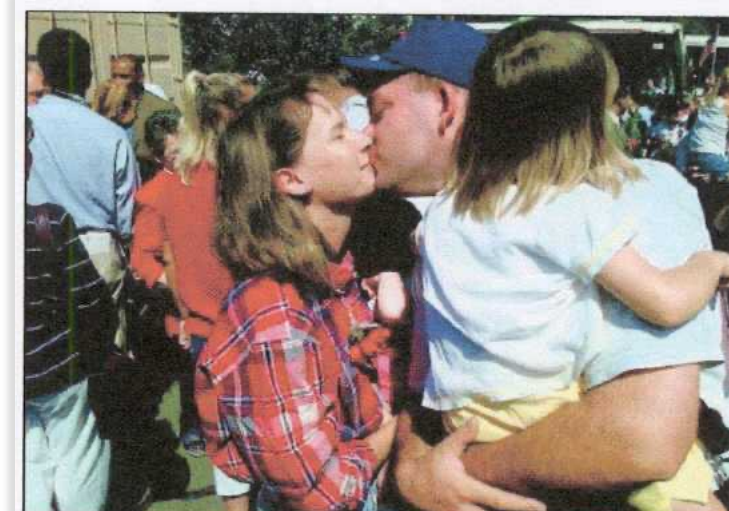
# HOME COMING



- Team + families addressed by several dignitaries.
- Pictures, lunch + HOME!





[illegible]

Leo Titus is reunited with his wife, Jennifer, and his daughters, Allison and Laura, after spending a week at the Pentagon searching for survivors of the Sept. 11 terrorist attack.



**THE PHOENIX PROJECT**

***"LET'S ROLL"***



# Stabilize Analyze Demolish Rebuild



Sampling Concrete

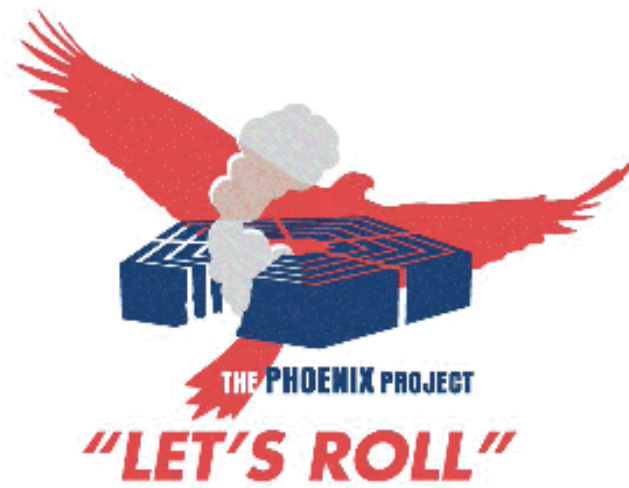


Pile Load Testing in Collapse Area

Helical Anchor Piles

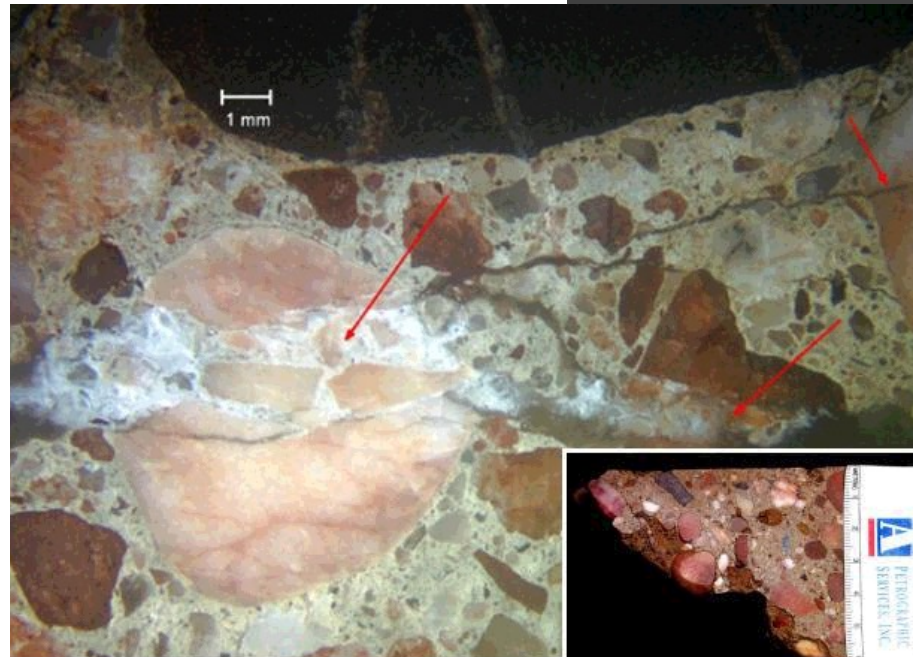




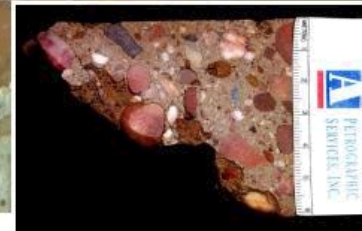




# Stabilize Analyze Demolish Rebuild



Saw-cut cross section of concrete from the support columns showed numerous micro-fractures.



---

# September 11<sup>th</sup>, 2001







---

# Stabilize Analyze Demolish Rebuild



Demolition completed November 19, 2001. Four weeks ahead of most aggressive schedule.









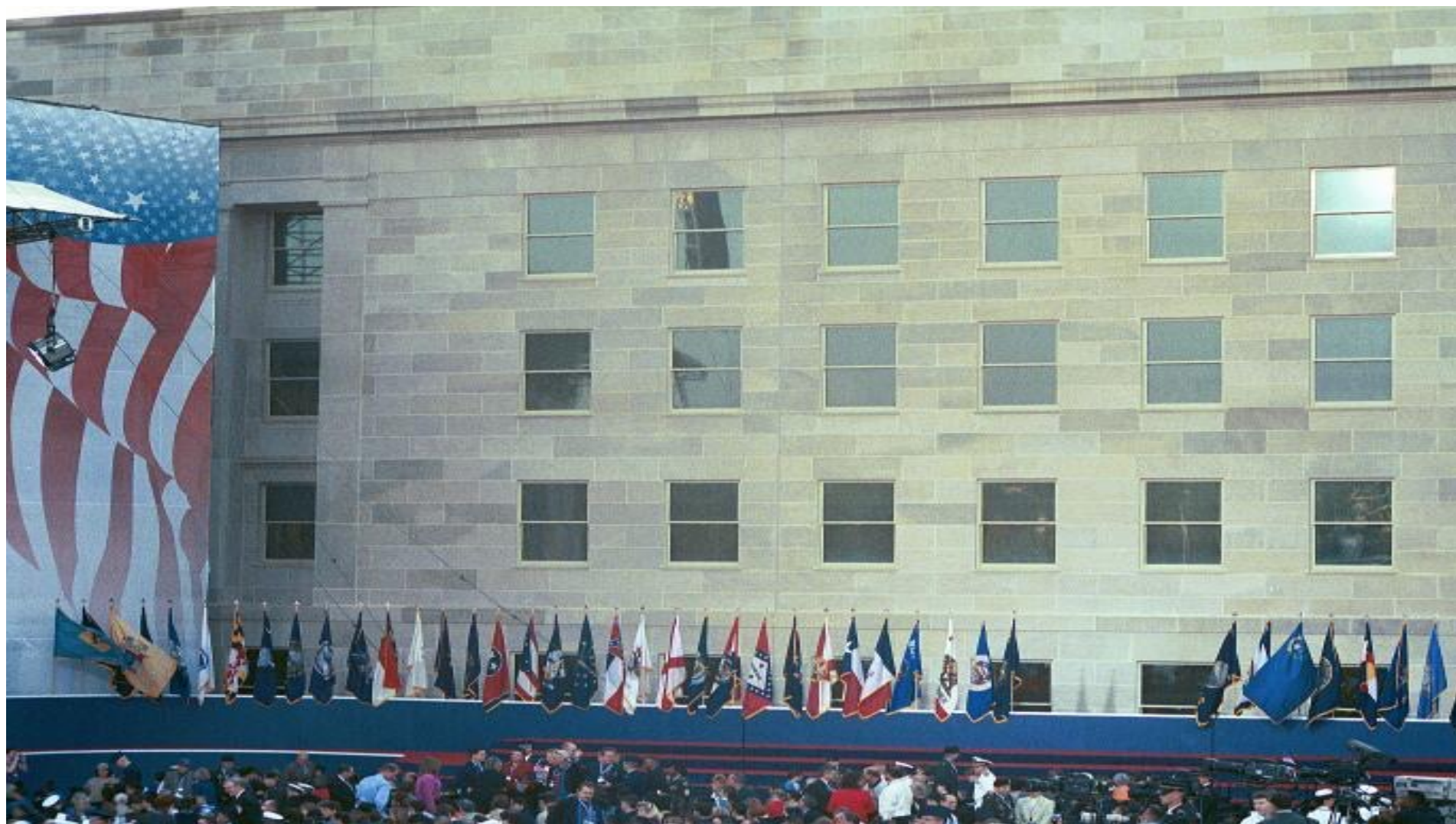
## Topped Out April 5<sup>th</sup>, 2002!



---

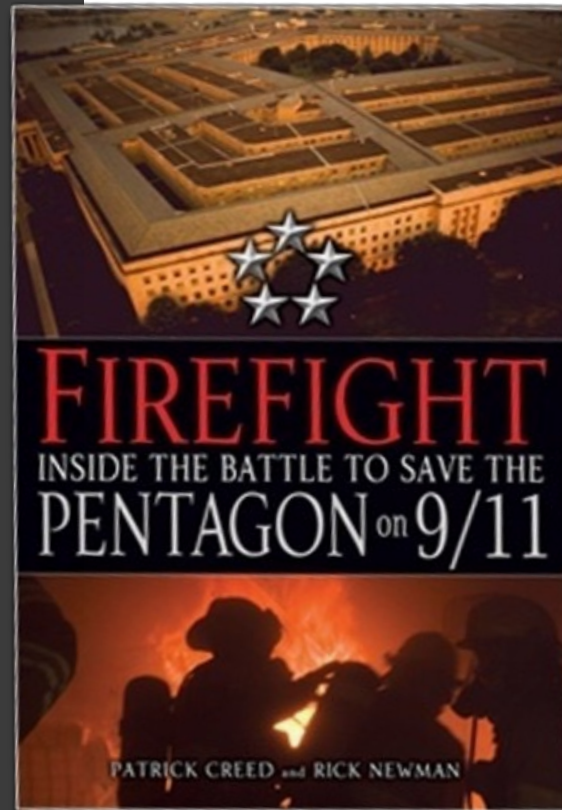
## September 11<sup>th</sup>, 2002







[www.firefightthebook.com](http://www.firefightthebook.com)





THANK YOU

FOR LISTENING!