SEARCH & LOCATING TECHNIQUES
&
RESCUE STRATEGIES AND TECHNIQUES

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06 NDRF

AIM

TO ACQUAINT WITH SEARCH & LOCATION TECHNIQUE
AND
RESCUE STRATEGIES AND TECHNIQUES

WILL BE COVERED IN TWO PARTS

PART -1 SEARCH AND LOCATION TECHNIQUE

PART- 2 RESCUE STRATEGIES AND TECHNIQUE


NDRF

OBJECTIVES

- IMPORTANCE OF SEARCH AND LOCATION TECHNIQUE
- COMPOSITION OF SAR TEAM AND APPLICATION OF BASIC EQUIPMENTS
- STEPS FOR SEARCH AND LOCATING
- IDENTIFICATION OF VOID SPACE IN COLLAPSED STRUCTURE
- MODE, TYPES AND PATTERN OF SEARCH

SEARCHING AND LOCATING

IT IS A SET OF TECHNIQUES AND PROCEDURES, THE PURPOSE OF WHICH IS TO OBTAIN A RESPONSE OR INDICATION OF THE PRESENCE OF LIVE VICTIMS INSIDE A COLLAPSED STRUCTURE.

METHODS OF CONSTRUCTION

- **UNFRAMED STRUCTURE-** UNFRAMED STRUCTURES ARE THOSE IN WHICH THE WEIGHT OF THE FLOOR AND ROOF ARE SUPPORTED BY THE BEARING WALLS.
- **FRAMED STRUCTURE-** ERECTED BY CONSTRUCTING STRUCTURAL STEEL OR REINFORCED CONCRETE SKELETON MADE OF HORIZONTAL AND VERTICAL COLUMN.

STRUCTURE TYPE

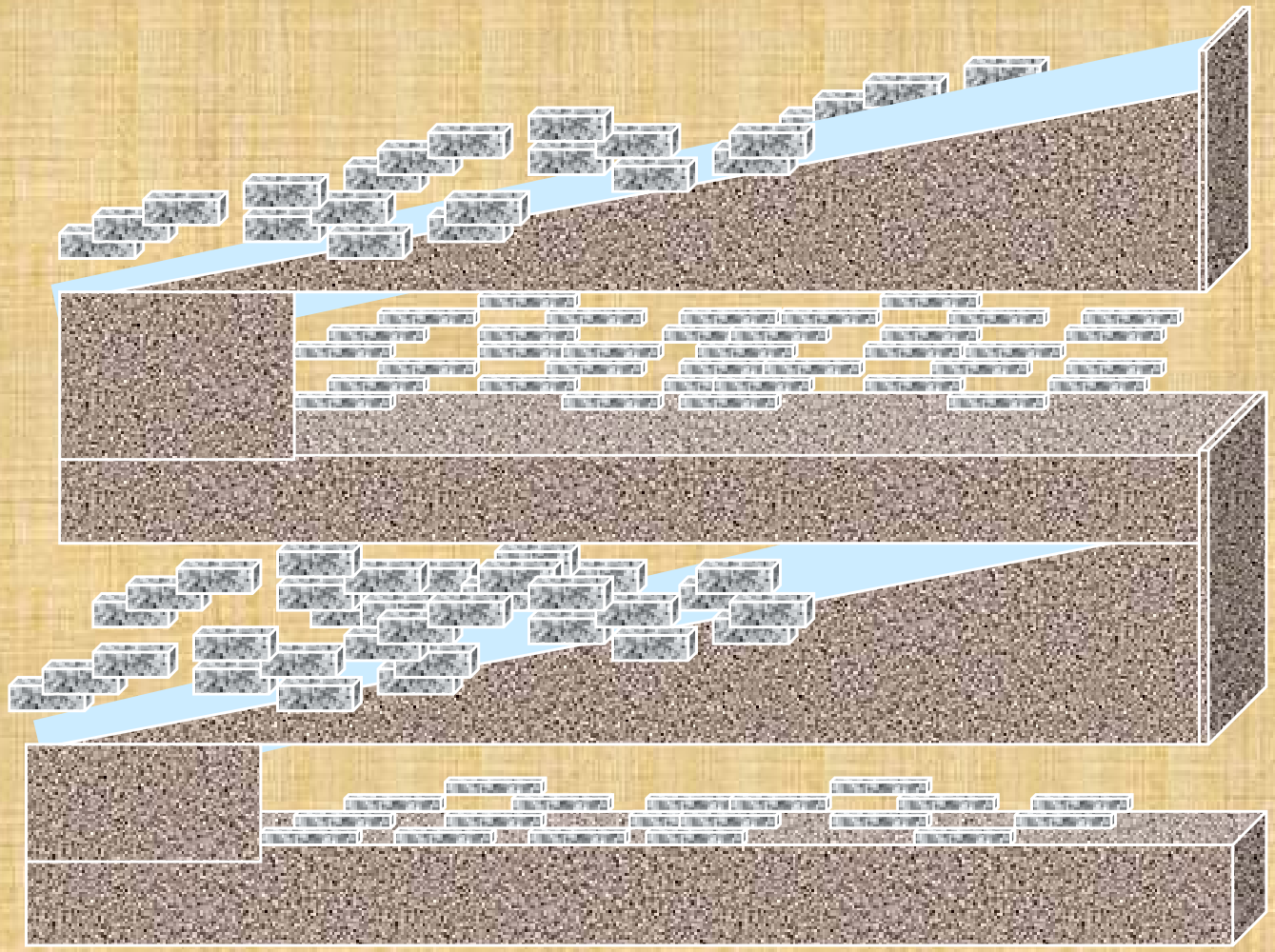
- LIGHT FRAME
- HEAVY WALL UNREINFORCED MASONRY
- HEAVY FLOOR REINFORCED
- PRE-CAST CONCRETE

HEAVY WALL
UNREINFORCED MASONRY (URM)

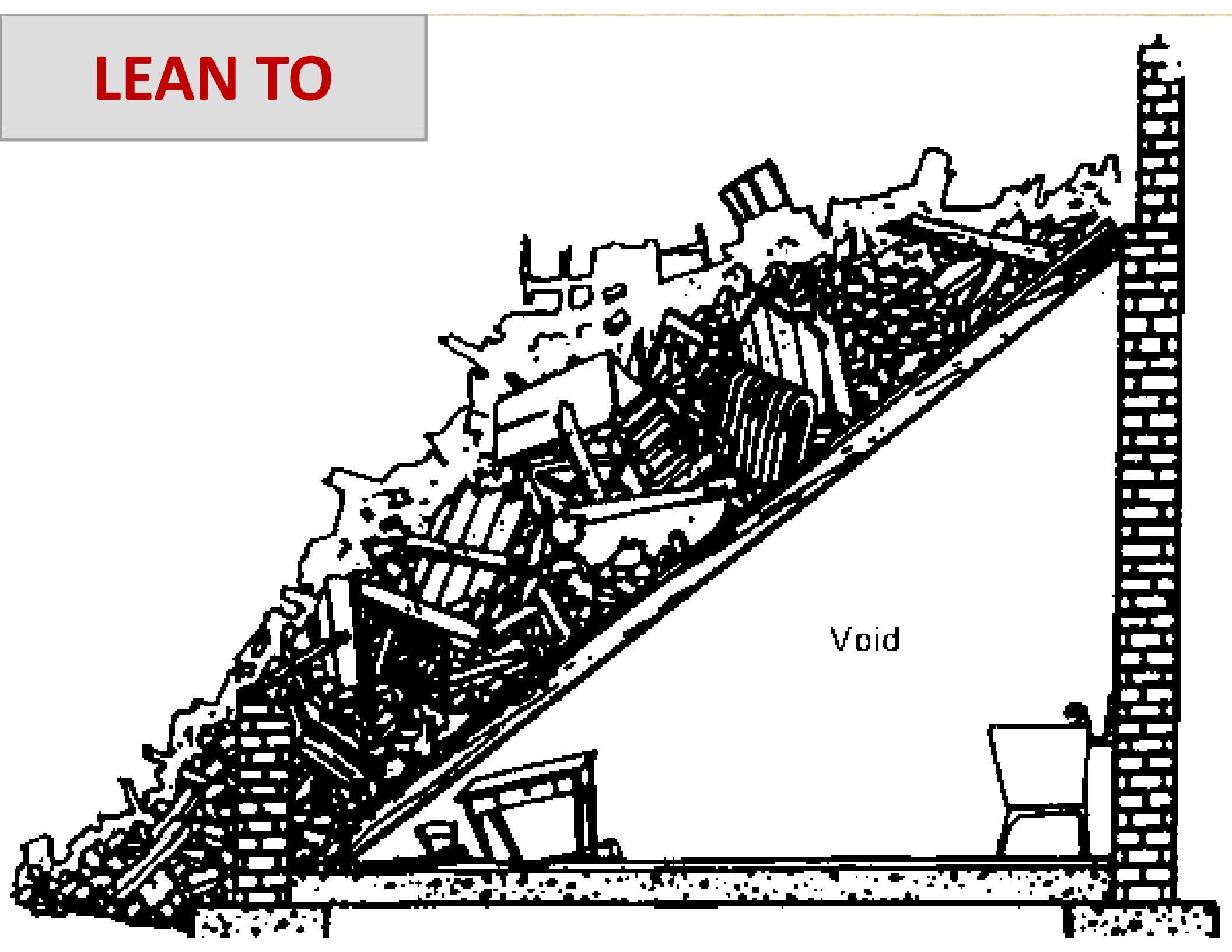
HEAVY WALL TILT-UP/REINFORCED MASONRY


COLLAPSE PATTERN
HAZMAT

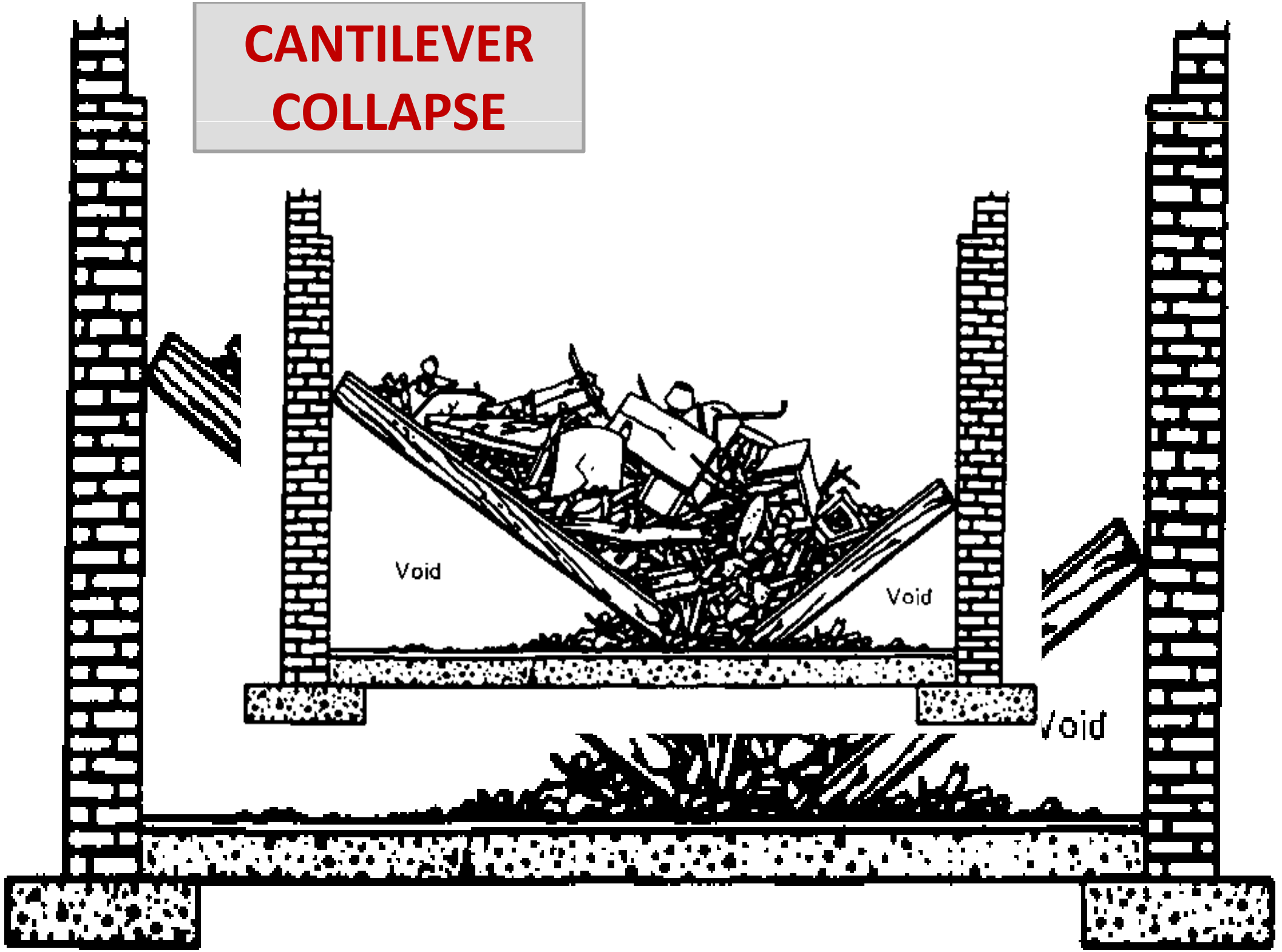
PANCAKE COLLAPSE



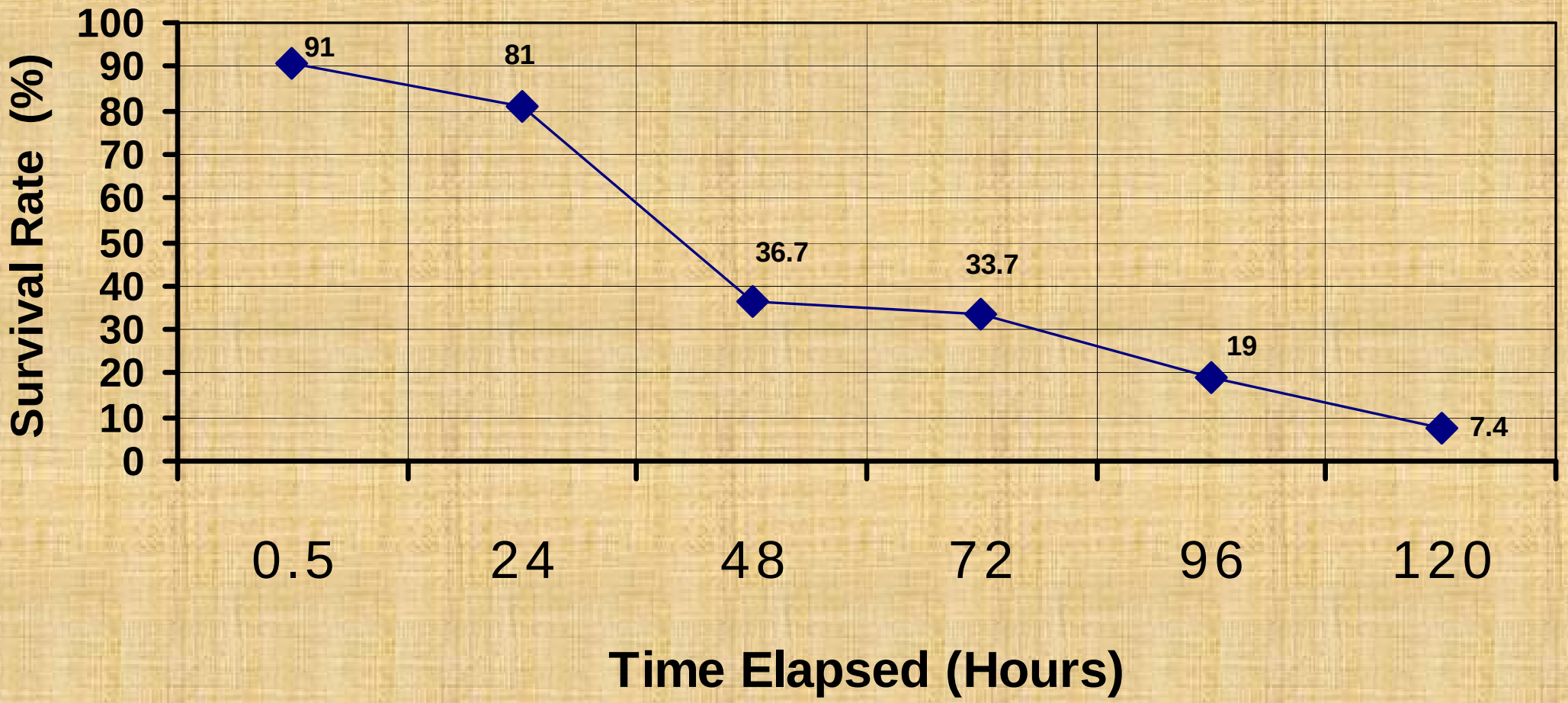
LEAN TO



CANTILEVER COLLAPSE

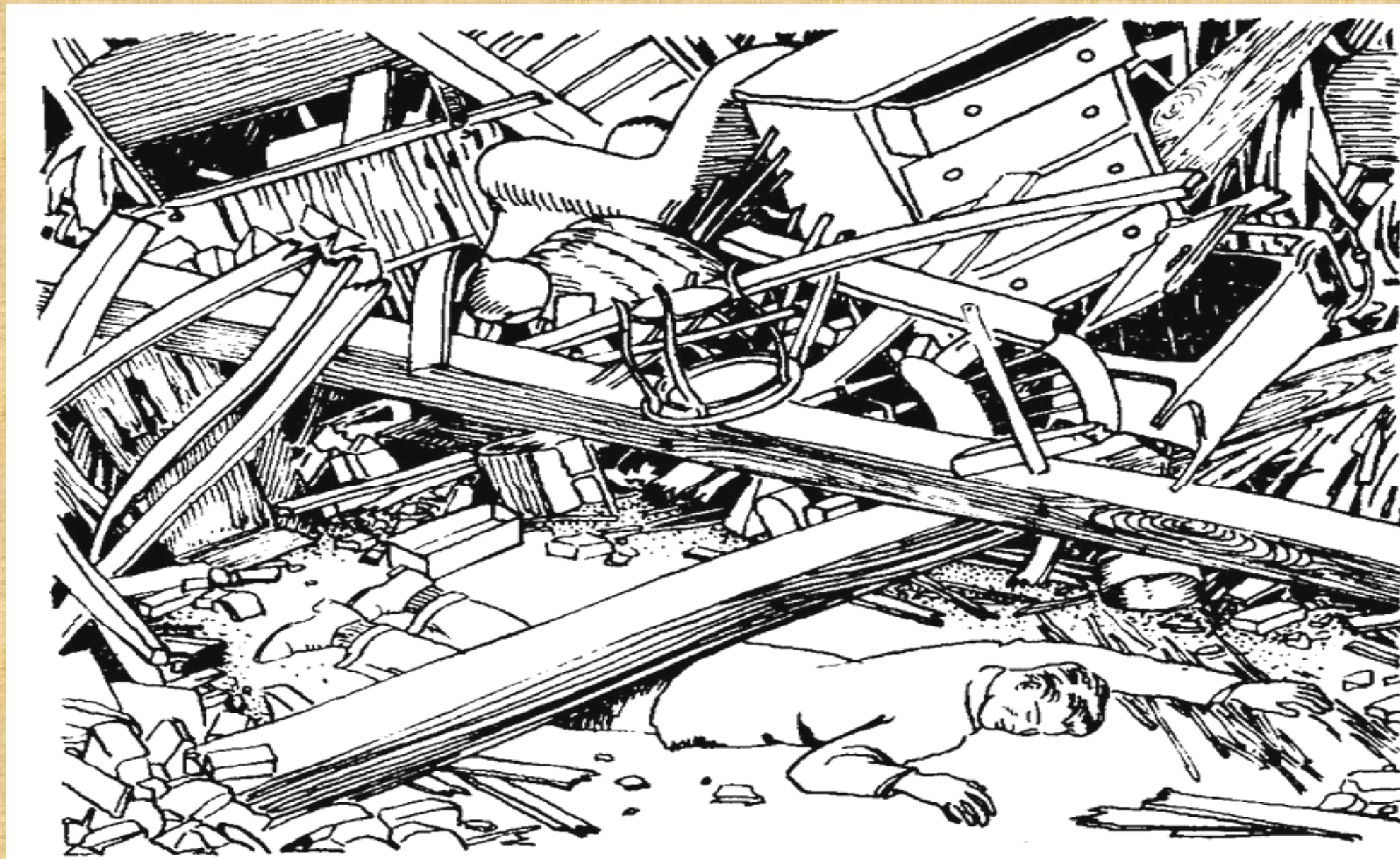


SURVIVAL RATE

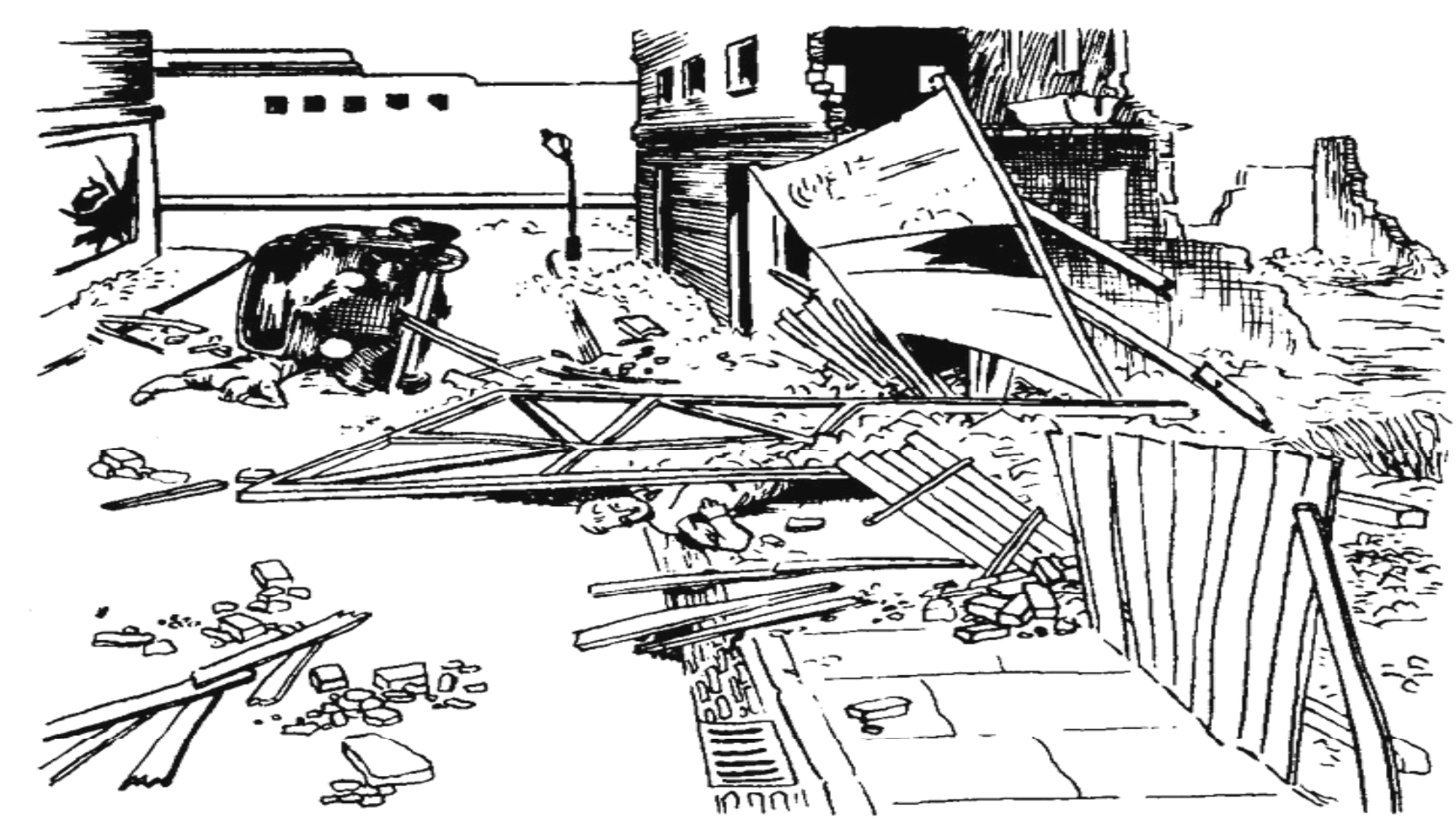


15% VICTIMS TRAPPED IN VOID SPACES

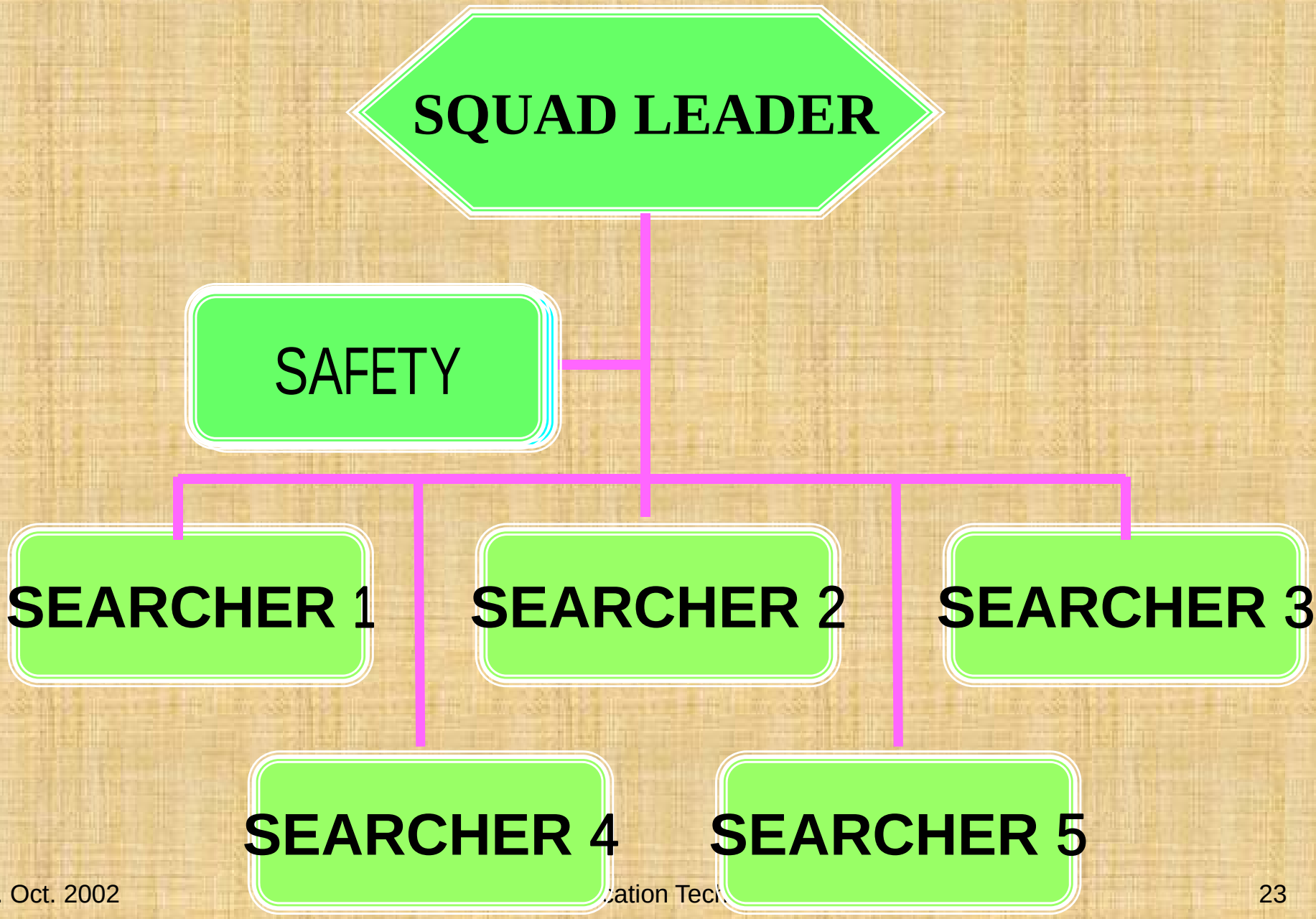
35% victims lightly trapped



50% victims on surface



COMPOSITION OF SEARCH SQUAD



STRUCTURE OF NDRF SEARCH AND RESCUE TEAM

TEAM COMMANDER
(INSPECTOR)

2-I/C OPERATIONAL OFFICER
(SUB INSPECTOR)

SUB TEAM A
SI : 01
CT : 05
TOTAL : 06

SUB TEAM B
HC : 01
CT : 05
TOTAL : 06

SUB TEAM C
SI : 01
CT : 05
TOTAL : 06

SUB TEAM D
HC : 01
CT : 05
TOTAL : 06

TECH SUPPORT SUB TEAM
SI + HC COMN – 02 (EACH)
SI + STRUC ENG – 02
HC ELEC -01
HC /TEC – 01
TOTAL - 06

ADM SUPPORT SUB TEAM
SECURITY : HC - 01, CT -03
ADM HC – 01, CT - 01
HC DVR – 01, CT DVR – 02
CT COOK – 01
TOTAL - 10

MEDICAL SUPPORT TEAM
HC (PARAMEDIC) - 02
TOTAL – 02

DOG SQUAD
CT – 03
TOTAL - 03

INPS GD	SI GD	SI ENG	SI COMN	HC GD	HC COMN	HC ELEC	HC TECH	CT GD	HC PM	CT COOK
01	03	02	01	04	01	01	01	27	02	01

HC DVR 01 , CT DVR 02 , TOTAL 47

SEARCH MODALITIES

- HASTY SEARCH
- EXTENSIVE SEARCH

HASTY SEARCH

- RAPID DETECTION OF VICTIMS
- SCENE ASSESSMENT
- SETS PRIORITIES

EXTENSIVE SEARCH

- THOROUGH SYSTEMATIC SEARCH
- REDUNDANT(UNNECESSARY)CHECK
- ALLOWS FOR USE OF ALTERNATE SEARCH RESOURCES

SEARCH METHODS

1. PHYSICAL SEARCH
2. CANINE SEARCH
3. TECHNICAL SEARCH

PHYSICAL SEARCH

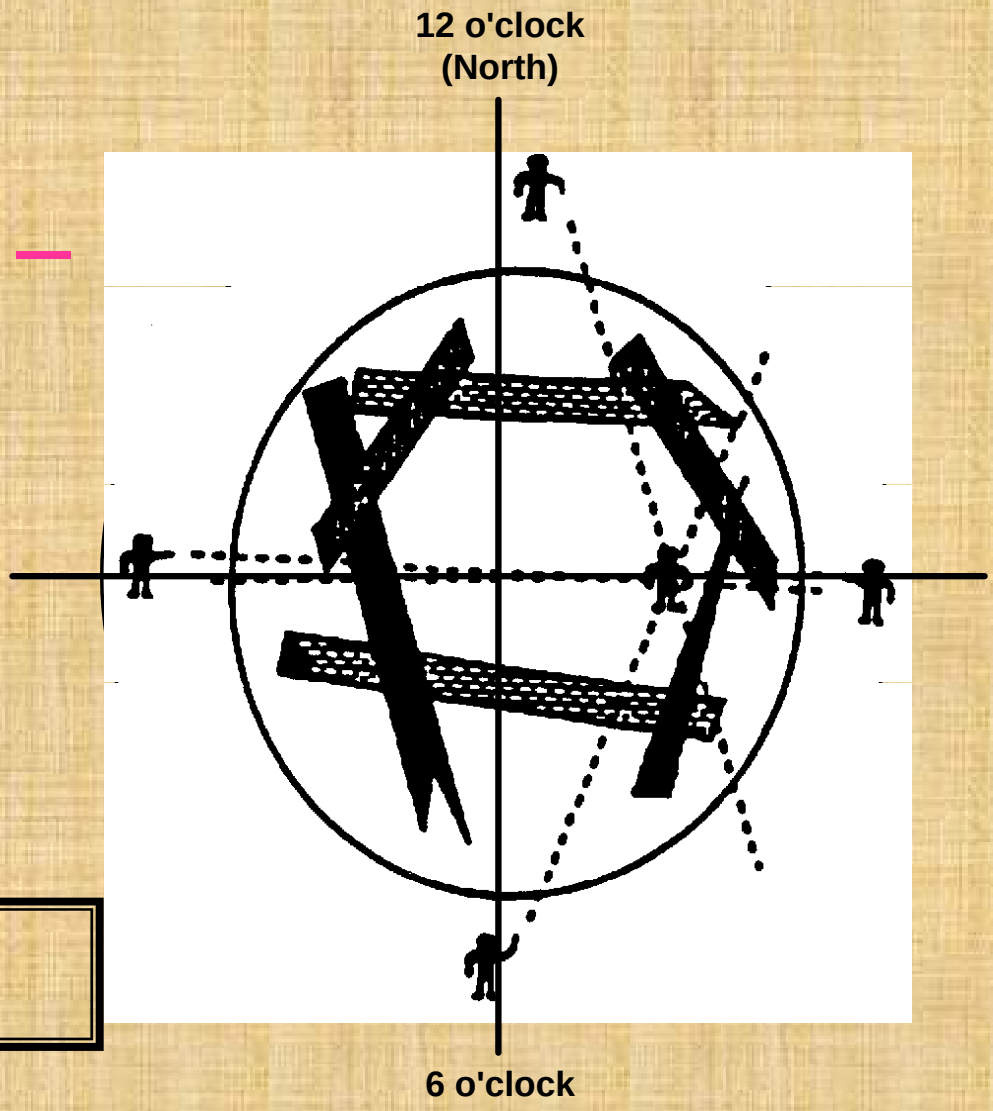
1(a) HAILING METHOD -

VOCAL ANNOUNCEMENT AIRED FROM ALL DIRECTION AND OBSERVE THE REACTION OF VICTIMS.

Contnue

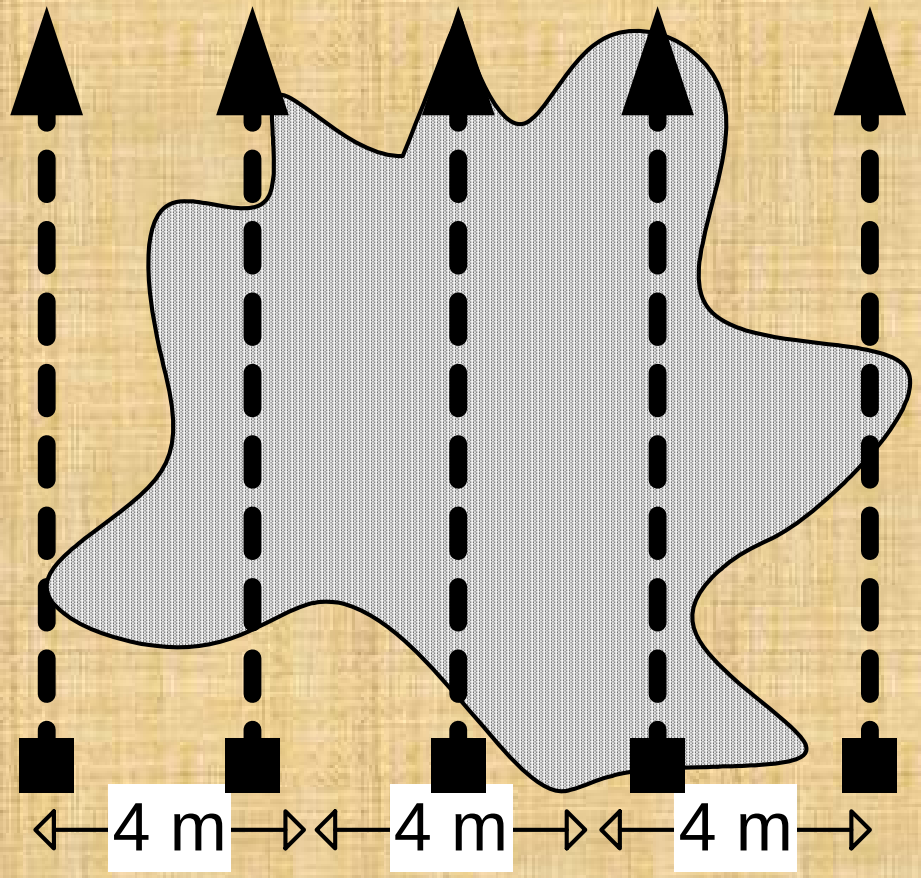
HAILING METHOD

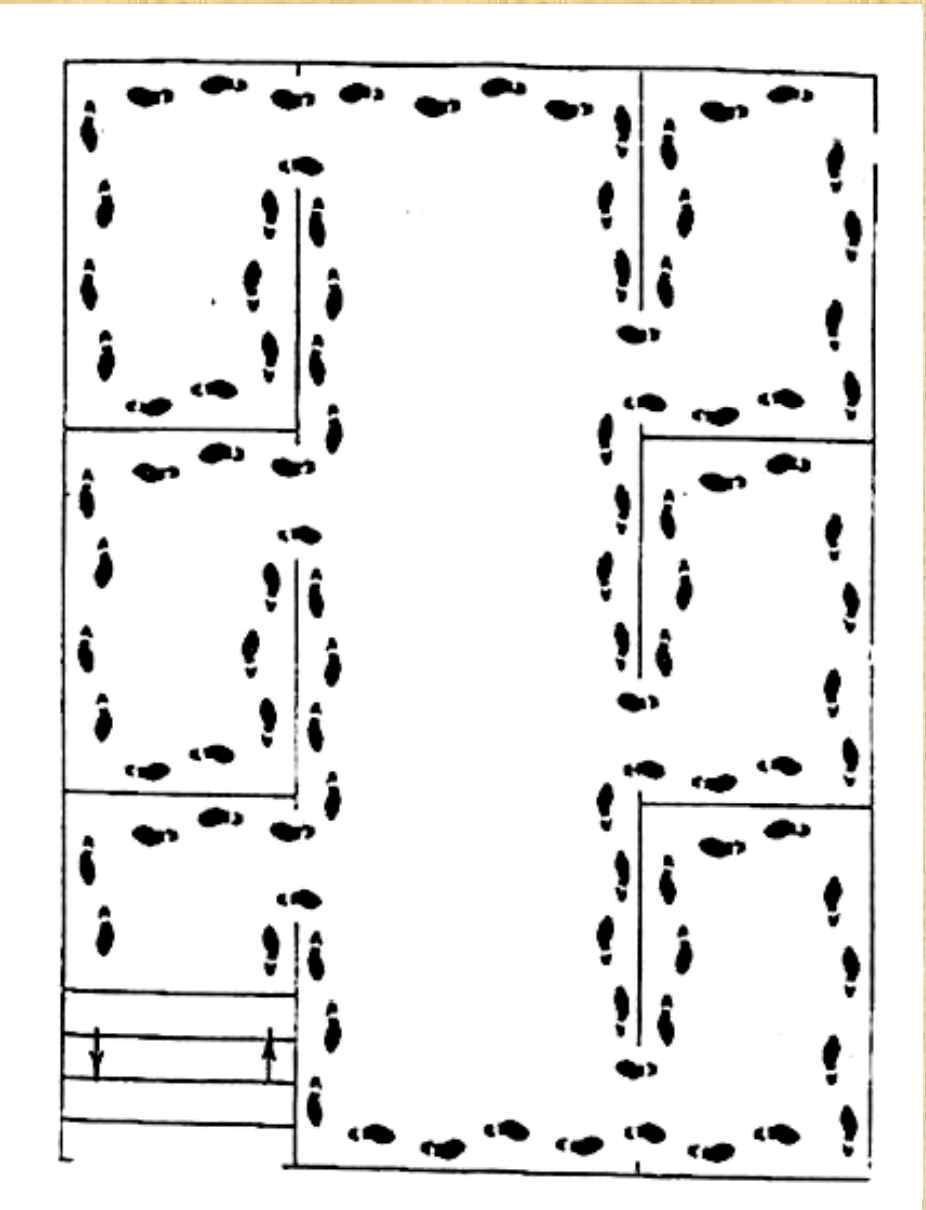
"We are rescuers – make some noise so we can hear you!!"



Silence is essential

1(b) LINE SEARCH





1(C) Multiple Rooms Search

“Go right, stay right.”

VOID SPACES

1(d) VOID SEARCH

RESCUERS PHYSICALLY CHECK THOROUGHLY ALL THE VOID SPACES , WHERE PROBABILITY OF TRAPPED VICTIMS.


CANINE SEARCH

2 CANINE SEARCH

- PLAY A CRITICAL ROLE DURING STRUCTURAL COLLAPSED INCIDENTS
- LOCATE SURVIVORS USING THEIR INCREDIBLE SENSE OF SMELL
- CAN DETECT HUMANS BURIED DEEP INSIDE RUBBLES
- ODOUR RELEASED BY DECOMPOSITION DUE TO BACTERIAL ACTION ON HUMAN SKIN OR TISSUE , SKIN RAFT AND EVAPORATED RESPIRATION
- **EX – GERMAN SHEPHERED, TOLLERS, GOLDEN ,LABRADORS ETC**

3 TECHNICAL SEARCH

- TECHNICAL SEARCH INCLUDES THE USE OF MECHANICAL SEARCH EQUIPMENT.

- EX- VISUAL(VLC), THERMAL (THERMAL IMAGINE CAMERA), SEISMIC AND ACOUSTIC DEVICE(LD-1), SPREADER CUTTER, ROTARY/CIRCULAR/DIAMOND TIPPED CHAIN SAW, BREACHING SYSTEM , HYDRAULIC JACK, PNEUMATIC BAGS ETC


BOSCH


Husqvarna

LIFE DETECTOR (LD-2)

LIFE DETECTOR(LD-1)

BASIC EQUIPMENTS FOR PHYSICAL SEARCH

- PERSONAL PROTECTIVE EQUIPMENT
- PERSONAL SUPPLIES (UNASSISTED FOR 12 HOURS)
- MARKING SUPPLIES
- COMMUNICATION DEVICES
- WARNING AND ALERT DEVICES
- RECONNAISSANCE AND VISION

STEPS TO SEARCH AND LOCATE

1. COMPILE AND ANALYSE INFORMATION.
2. SECURE THE SCENE.
3. INSPECT AND EVALUATE THE STRUCTURE.
4. RESCUE SURFACE VICTIMS.

more …

. . . *cont'd.*

STEPS TO SEARCH AND LOCATE

5. MAKE MARKINGS ON THE STRUCTURE.
6. CREATE A DIAGRAM.
7. SELECT SEARCH AREA.
8. SELECT SEARCH METHOD.

more…

…*cont'd.*

STEPS TO SEARCH AND LOCATE

9. CONDUCT SEARCH AND PLACE INSARAG MARKINGS ON STRUCTURE AND DIAGRAM.
10. CONFIRM POTENTIAL VICTIM LOCATION
11. ANALYSE RESULTS AND RE-EVALUATE.
12. PRE-HOSPITAL TREATMENT.

POSSIBLE LOCATION OF VOID SPACES

- BASEMENTS
- ELEVATOR SHAFTS
- BATHROOMS
- INSIDE HALLWAYS
- CONCRETE WALLS

VICTIM MANAGEMENT

- PRECAUTIONS DURING A SEARCH
- STEPS FOR INITIAL CONTACT WITH A LOCATED VICTIM

PART- 2

RESCUE STRATEGY & TECHNIQUES

Overview

- STRATEGIC PLAN
- GUIDELINES FOR SP
- FOUR LEVEL OPS CAPABILITY
- FOUR LEVEL COLLAPSE RESCUE
- HAZARD CATEGORIES
- SAFETY ISSUES

RESCUER`S PHILOSOPHY

- **WE WILL RISK OUR LIFE TO SAVE A LIFE;**

- **WE WILL USE CONSIDERABLE CAUTION TO PROTECT SAVABLE PROPERTY;**

- ***WE WILL NOT RISK OUR LIFE TO SAVE WHAT IS ALREADY LOST***

STRATEGY

- LOOSELY DEFINED AS "WHAT HAS TO BE DONE TO SOLVE THE PROBLEM"

- OVERALL PLAN TO CONTROL THE OPERATION

BENEFITS OF A STRATEGIC PLAN

A. DEVELOPS AND MAINTAINS A **CONSENSUS** BETWEEN ALL STAKEHOLDERS
B. ENSURE DIRECTIONS AND AGREEMENT OF WORK AT **NATIONAL, DISTRICT AND LOCAL LEVELS**
C. ENSURES IMPLEMENTATION **THROUGHOUT THE RESPONSE** IN A PHASED MANNER

DEVELOPING A STRATEGY

DEVELOPING A STRATEGIC PLAN FOR RESPONSE FALLS ON 11 ACTIVITIES AS A PLANNING TEMPLATE

GUIDELINES IDENTIFY 11 ACTIVITIES

1. **STRATEGIC PLANNING OBJECTIVES** - *WHAT IS THE HUMANITARIAN PRIORITY*
2. **ASSESSMENT, MONITORING AND EVALUATION** - *WHAT ARE THE NEEDS*
3. **COORDINATION** - *WORKING WITH OTHER STAKEHOLDERS*
4. **CRITICAL PATH ANALYSIS** - *WHAT ARE THE BARRIERS*
5. **TRANSITIONAL SETTLEMENT AND RECONSTRUCTION** - *WHAT ARE THE SHELTERING AND REBUILDING OPTIONS*

6. **RESOURCES** - *WHAT DO WE HAVE TO WORK WITH*

7. **SCHEDULE FOR IMPLEMENTATION** - *WHAT IS THE SCHEDULE OF WORK*

8. **PARTICIPATION** - *HOW TO INVOLVE A COMMUNITY*.

9. **SCENARIOS** - *HOW COULD THE SITUATION CHANGE*

10. **LEGAL FRAMEWORK** - *WHAT ARE THE LEGAL ISSUES*

11. **HANDOVER** - *WHAT HAPPENS WHEN WE LEAVE*

Interdependent activities

Diagram: ***Transitional settlement and reconstruction after natural disasters*** **(United Nations, 2008)**

1.Strategic planning objectives

3. Coordination

4.Critical path analysis

5.Transitional settlement and reconstruction

6.Resources

7.Schedule for implementation

8.Participation

2.Assessment, monitoring and evaluation

9.Scenarios

10.Legal framework

11.Handover

FOUR LEVELS OF OPERATIONAL CAPABILITIES

1. **BASIC OPERATION LEVEL**
2. **LIGHT OPERATION LEVEL**
3. **MEDIUM OPERATION LEVEL**
4. **HEAVY OPERATIONAL LEVEL**

1. BASIC OPERATION LEVEL

- SIZE UP EXISTING AND POTENTIAL CONDITIONS TO CONDUCT SAFE SAR PROCEDURES FOR ESTABLISHING ICS
- UTILIZE THE STANDARD SAR MARKINGS FOR BUILDING AND VICTIM
- PERFORM VISUAL AND AUDIBLE SEARCH FOR VICTIMS
- PROVIDING BASIC MEDICAL CARE

2.LIGHT OPERATION LEVEL

- BASIC KNOWLEDGE OF TACTICS AND THEORY TO HELP LOCATE LIKELY SURVIVAL SPOTS
- KNOWLEDGE OF ABILITY TO PERFORM BREACHING IN LIGHT WEIGHT CONSTRUCTION
- ABILITY TO TRANSPORT PATIENTS FOR ELEVATED OR BELOW GRADE AREAS OF ONE TO FOUR STORIES

3.MEDIUM OPERATION LEVEL

- MINIMUM CAPABILITY TO CONDUCT SAFE SAR IN COLLAPSED BUILDINGS
- UNDERSTANDING AND ABILITY TO BREACH, BREAK AND LIFT HEAVY CONCRETE
- USE OF TOOLS LISTED IN MEDIUM OPS. TOOL LIST
- KNOWLEDGE OF HEAVY EQPTS.AND RIGGING OPS. AND HOW TO ACQUIRE SUCH EQUIPMENT.

4.Heavy Operation Level

KNOWLEDGE OF THE USE AND OPERATION OF EQUIPMENT FOR CUTTING, BREACHING, LIFTING, AND MOVING COMPONENTS OF STEEL AND REINFORCED CONCRETE STRUCTURES

Building Construction Types and Characteristics

LIGHT FRAME BUILDING COLLAPSE

- RESIDENTIAL HOMES AND APARTMENTS
- HIGHLY SUSCEPTIBLE TO FIRES
- COMPLETE COLLAPSES OCCUR FREQUENTLY

- RESCUERS LOOK FOR BADLY CRACKED WALLS, LEANING WALLS, OFFSET OF STRUCTURE FROM FOUNDATION, OR LEANING FIRST STORY

HEAVY WALL
UNREINFORCED MASONRY (URM)

HEAVY WALL
UNREINFORCED MASONRY (URM)

- ONE TO SIX STORIES HIGH, RESIDENTIAL, COMMERCIAL, INDUSTRIAL, OR INSTITUTIONAL
- PRINCIPLE WEAKNESS IN LATERAL STRENGTH
- PARTIAL COLLAPSE IS MOST COMMON
- RESCUERS CHECK FOR LOOSE/BROKEN WALLS, CONNECTIONS BETWEEN WALLS AND FLOOR, UNSUPPORTED AND PARTIALLY COLLAPSED FLOORS

HEAVY WALL
TILT-UP/REINFORCED MASONRY

HEAVY WALL
TILT-UP/REINFORCED MASONRY

- ONE TO FIVE STORIES
- USUALLY INDUSTRIAL/COMMERCIAL
- WEAKNESS IS BETWEEN WALLS AND FLOORS OR ROOFS. WALLS FALL AWAY FROM FLOOR/ROOF
- RESCUERS CHECK CONNECTION OF WALLS AND ROOFS/FLOORS, AND CONNECTION BETWEEN BEAMS AND COLUMNS

HEAVY FLOOR BUILDING

OVERHEAD HAZARDS

- LOOSENED DEBRIS AND UNSTABLE BUILDING STRUCTURES OVERHEAD
- LOW HANGING POWER LINES
- BUILDING CONTENTS THAT ARE UNSTABLE AND DISPLACED
- FAILING SLINGS OR CABLES WHILE LIFTING MATERIAL

SHARP DEBRIS

- BROKEN GLASS
- JAGGED METAL
- NAILS
- WOOD SPLINTERS
- ROUGH MASONRY

SLIPPERY SURFACES

- FLUIDS
- WATER, ICE, SNOW
- SEWAGE
- UNSURE FOOTING
- IMPROPER FOOTWEAR

UTILITIES HAZARDS

- ELECTRIC
- FUEL/GAS
- WATER
- STEAM
- SEWAGE

FOUR PHASES OF STRUCTURAL COLLAPSE RESCUE

PHASE I
SIZE UP AND RECON

- DEPENDING ON EVENT CAN LAST FEW MINUTES TO SEVERAL HOURS
- FIND OUT HOW BIG THE PROBLEM IS
- ORGANIZED SURVEY OF THE DAMAGED AREA
- WHAT RESOURCES ARE AVAILABLE
- WHAT CAN WE DO ABOUT THE PROBLEM

contd

PRIORITIZE THE PROBLEMS

PRIORITIZATION ALLOWS YOU TO DETERMINE WHICH PROBLEMS TO SOLVE FIRST

Contd

ESTABLISH COMMAND AND CONTROL

- DESIGNATE A COMMAND POST
- REMAIN AVAILABLE BY STAYING IN THE COMMAND POST

RESCUE AND REMOVE SURFACE VICTIMS

- 50% OF ALL SURVIVORS ARE SURFACE VICTIMS- INJURED BUT NOT TRAPPED, DEAL WITH THEM FIRST
- REMOVE THEM AWAY FROM THE HAZARDS
- KEEP PEOPLE AWAY FROM ENTERING STRUCTURES, MAKE THE STRUCTURES STABLE BY SHORING TECHNIQUES

Phase II

- BEGINS WHEN RESCUE TEAMS ARRIVE AND ICS HAS BEEN ESTABLISHED
- USE INFO. GATHERED TO SEARCH THE LIKELY SURVIVAL PLACES
- USE LOCATION METHODS, SEARCHING OUTSIDE BY VOICE, LISTENING DEVICES AND DOGS

PHASE II (CONT.)

- ENTER THOSE VOIDS THAT HAVE HIGHEST LIKELIHOOD OF SURVIVORS, SHORE AS YOU GO
- MONITOR FOR HAZARDS
- 30% OF ALL SURVIVORS IN STRUCTURAL COLLAPSE ARE INVOLVED IN NON STRUCTURAL ENTRAPMENT

PHASE III

- STARTS AFTER ALL SURFACE VICTIMS ARE REMOVED AND CARED FOR AND THOSE IN VOIDS CAN BE REMOVED WITHOUT MAJOR DEBRIS REMOVAL
- SELECTIVE DEBRIS REMOVAL USING HEAVY EQUIPMENTS
- REMOVAL OF ENTOMBED VICTIMS

PHASE IV

- USUALLY 5-6 DAYS AFTER EVENT
- PROBABILITY OF FURTHER SURVIVORS IS MINIMAL AND CLEAN UP OF AREA IS DONE

Hazardous Materials

- COMMERCIAL ESTABLISHMENT
- HAZARDOUS HOUSEHOLD CHEMICALS
- AMMONIA, BLEACH, CLEANERS, SOLVENTS, ETC.
- GARAGE

BELOW-GRADE HAZARDS

ATMOSPHERIC CHANGES DUE TO RUPTURED FUEL, GAS LINES OR PRESENCE OF HAZARDOUS CHEMICALS

FLOODS

- MAY HAVE CAUSED THE COLLAPSE
- FROM RUPTURES WATER/SEWAGE LINES
- FROM GROUND WATER

ELEVATION DIFFERENCES CAN CAUSE DIFFICULT ACCESS AND EGRESS

SAFETY OFFICERS

- ONE FOR EACH UNIT SHOULDN'T BE ENGAGED IN RESCUE EFFORTS
- CONCENTRATION ON TEAM AND HAZARDS
- UTILIZE SAFETY CHECKLIST
- ROTATION OF CREWS

COMMUNICATIONS

- MAINTAIN VOICE CONTACT WITH RESCUERS
- ALL RESCUERS SHOULD HAVE A PORTABLE RADIO
- HAVE PREDETERMINED SIGNALS

CONTD.....

- COMMUNICATE TEAM LEADER REGARDING PROGRESS OF WORK
- ESPECIALLY DURING NIGHT OPS
- COORDINATE RESCUE EFFORT WITH OTHER TEAMS SO THAT ONE TEAM DOESN'T PLACE OTHER TEAM IN DANGER.

EVACUATION/ESCAPE PROCEDURES

- SIGNALING SYSTEMS
  - SAR TASK FORCE EVACUATION SIGNALS
- DEVICES
  - AIR HORNS
  - VEHICLE HORNS

SIGNALS

CEASE OPERATION/ALL QUIET: ONE LONG BLOW (3 SECONDS)

EVACUATE AREA: THREE SHORT BLOW (ONE SECOND EACH)

RESUME OPERATIONS: ONE LONG AND ONE SHORT BLOW

ESCAPE PROCEDURES

- ALTERNATE EXIT
- COMMUNICATE IF YOU ARE TRAPPED
- RADIO
- VOICE
- BANGING ON STRUCTURE
- PREARRANGING SIGNALS
- ADVISE LEADERS TO ESCAPE FROM BUILDING

SAFETY CONSIDERATIONS

- WEAR PROPER GEAR, USE THE BUDDY SYSTEM
- CONTROL UTILITIES EARLY

  GAS, ELECTRIC, WATER
- MONITOR ATMOSPHERE

  RADIOACTIVITY, O2, FLAMMABLE
- ELIMINATE FIRE DANGER
- HAVE HOSES/EXTINGUISHERS AVAILABLE
- WET AREAS PRIOR TO USING SPARK PRODUCING TOOLS

CONCLUSION

IT'S A TEAM WORK

Thanks

Team Work