

INTERREG-IPA CROSS-BORDER COOPERATION
PROGRAMME
ROMANIA-SERBIA

5.1. SEARCH & RESCUE IN EARTHQUAKES

7 Septembrie 2023

Facts

- Over the last two decades, the number of recorded disasters has doubled, increasing from around 200 to over 400 per year.
- Within the past 18 years, there have been approximately 11,000 extreme events worldwide, resulting in the loss of 600,000 lives and causing damages amounting to 1.7 trillion dollars (US).
- Earthquakes stand as one of the most lethal natural hazards, responsible for more than 60 percent of deaths caused by natural disasters between 2000 and 2009.
- The National Earthquake Information Centre of the US Geological Survey now locates about 50 earthquakes each day.
- Earthquakes and other natural disasters often lead to a significant surge in mortality and injuries within the initial 72 hours, and chances of survival decline significantly after this period.



Facts

- Building collapse is the primary cause of fatalities, accounting for 75% of all deaths.
- In cases of entrapment, survival rarely extends beyond 48 hours. Approximately 85-95% of individuals rescued alive from collapsed buildings are saved within the first 24-48 hours after the earthquake occurs.
- Trapped victims have the potential to survive for 3-4 days, and under ideal conditions (with access to food and water), survival may extend up to two weeks.
- The successful rescue of those trapped heavily relies on the effectiveness of search and rescue (SAR) operations, which, in turn, depends on various factors:
 - o The proportion of buildings that have collapsed.
 - o The availability of organized SAR teams to complement local community capabilities.
 - o The distance traveled by rescue teams to reach the affected areas.



Disaster Timeline

Experience shows that the following timeline is typical of a structural collapse incident:



What are First Responders?

- ❑ The local organised rescue capability:
 - Emergency services and civil defence
 - Military organisations
 - Community responders
 - Volunteer organisations
 - Non-Government organisations
 - Civilian Response Teams

Role of First Responder

- ✓ Rescue in the initial stages of a collapse incident
- ✓ Providing information about the event
- ✓ Assessing the nature and scale of the incident
- ✓ Requesting the appropriate resources required to successfully complete the rescue phase
- ✓ Providing leadership and direction to the local community



Training Needs of First Responder

- ✓ Awareness of the generic hazards and risks within a structural collapse
- ✓ Assessment of the scene and information gathering
- ✓ Search and rescue techniques that are not dependent upon the possession of specific equipment
- ✓ Knowledge of the regional or national search & rescue support available if required



Examples of disasters affecting the urban environment

Natural	Accidental	Deliberate
Earthquake	Train crash	Explosion
Flood	Collapsed building	Terrorism
Tsunami	Plane crash	
Fire - forest	Fire - urban	
Landslide	Chemical release	
Volcano		
Typhoon or Hurricane		

Impact of disasters on the urban environment

- Casualties – dead and injured
- Damage and destruction to the infrastructure
- Disruption of the public utilities
- Environmental damage
- Economic damage
- Sociological damage
- Disruption to normal life

What is the urban environment?

- Buildings
- Bridges, tunnels and viaducts
- Roads, railways and airports
- Dams, canals, water treatment facilities
- Powerlines, pipelines and over-ground utilities
- Underground railways and utilities
- Ports, piers and dock facilities

What is the urban environment?

Building Construction

- ✧ Un-reinforced masonry, mud brick
- ✧ Light timber or bamboo frame
- ✧ Reinforced masonry
- ✧ Concrete framed
- ✧ Monolithic concrete – precast sections

Each type of construction often collapses in predicted ways, leaving recognised patterns of hazards and opportunities for survival

Collapse Patterns

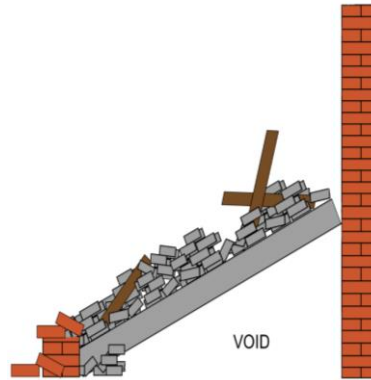
- Lean-to
- Cantilever
- Pancake
- V-type
- A-frame





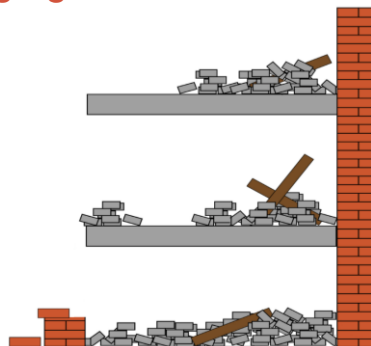
Lean-to or supported

- Floor/wall connection at one end fails
- Debris supported by the remaining wall
- Large but unstable voids
- Victims in voids



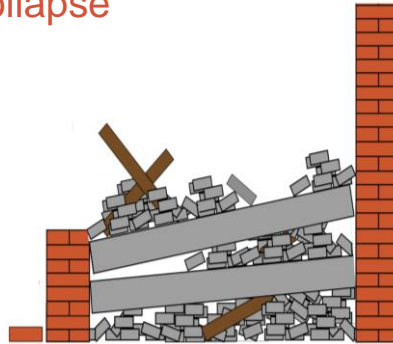
Cantilever or hanging

- Floor is supported at one end only
- Strongest part next to the remaining wall
- Debris are very unstable
- Victims may be uninjured but not able to get down



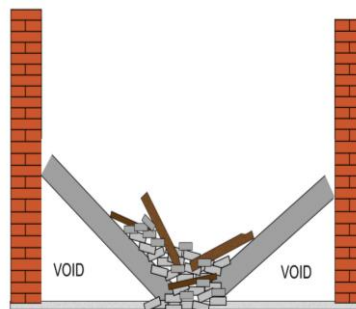
Pancake or total collapse

- Floor/wall connections fail at both ends
- Debris impact onto floors below causing further collapse
- Fairly stable
- No or few voids
- Not very survivable



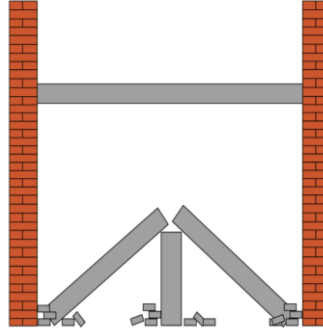
V-type collapse

- Floor fails in the centre – mid-span
- Fairly stable
- Victims found in small voids below the floor
- Victims found in the debris on top of the floor



A-frame or tent collapse

- Floor/wall connections fail at both ends
- Interior load bearing wall or girder remains intact
- Fairly stable
- Victims found in small voids below the floor



Structural collapse realities

- It is common for more than one type of collapse pattern to be present
- Often, walls and floors fail catastrophically
- Often, there is both lateral and vertical displacement

Overview of Rescue Operations Aims

- Safe life
- Reduce suffering and distress
- Contain and minimise damage and destruction to property
- Help stabilise the situation
- Prepare for community recovery

Sequence of rescue operations

1. Reconnaissance	2. Search	3. Rescue
Aim: To assess the area involved, gather information about both victims and the damaged infrastructure	Aim: To quickly find victims, to remove those able to move from immediate danger	Aim: To treat remaining victims, to rescue them, to get them to medical care
Actions: Move quickly through the area, take notes, photographs, draw maps, mark areas where victims and hazards are	Actions: Assist the moving victims, search easily accessible areas, get control of the area	Actions: Provide first aid, move victims, move debris to access victims

Sequence of rescue operations

- Follow the sequence – reconnaissance – search - rescue
- Speed is vital – most important
- Make a plan – share the plan – keep to the plan
- Control access and mark hazards – stop things getting worse
- Once the sequence is completed – repeat it but slower and in more detail

Reconnaissance and Survey Aims

- Gather information about victims, damage and hazards
- Divide the affected area into manageable sectors
- Record and collate information
- Use information to formulate a plan of action
- Share information with the authorities

Reconnaissance – information requirements

1. Victims	2. Damage	3. Hazards
<p>Information: How many, where are they, are they trapped/injured, how easy to access them</p>	<p>Information: What is damaged, how bad, stable or unstable, are roads and bridges usable, are utilities damaged</p>	<p>Information: Where are the hazards, what areas are safe, how stable are debris, leaks or spills, fires or smoke</p>
<p>Methods: Observation, record notes, interview survivors, mark debris or buildings</p>	<p>Actions: Observation, listen, record notes, draw or mark maps, take video and photographs</p>	<p>Actions: Observation, record notes, photographs, draw or mark maps, measure safe zones</p>

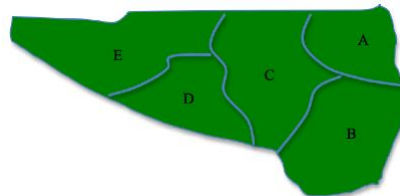
Recording and collating information

- Information improves success of rescue operations
- During reconnaissance make notes, take pictures and video and draw maps and plans
- As soon as possible, collect all this information at a central point and collate it
- Use the information gathered to determine the worst affected areas
- Share the information with all First Responders and use it to make a Plan of Action



- If the area affected is large, consider dividing it into smaller, more manageable sectors, particularly if resources are insufficient
- Use the information gathered to divide the area into sectors
- Divisions should be made along geographical boundaries such as road or rivers
- Mark the sectors and the boundaries on a map
- Give each sector a letter – A, B, C etc.

Examples of sectors



Managing operations using sectors

- Plan to use the First Responder resources in each Sector in turn
- For example:
 1. Search and then rescue in Sector B
 2. Search and then rescue in Sector C
 3. Search in Sectors A and D
 4. Rescue in Sector A
 5. Rescue in Sector D
- Prioritise sectors worst affected – determined by reconnaissance = Plan of Action

Reasons for Sector Creation

- When a disaster necessitates an international USAR response, it often involves a large-scale event. The destruction can range from affecting a single city to encompassing numerous cities and even multiple countries.
- To ensure effective coordination of search and rescue (SAR) efforts and to improve the span of control, the affected areas may be divided into geographical sectors.
- This sectorisation enhances operational planning, facilitates better assignment of USAR Teams, and improves overall incident management.
- The size and number of sectors depend on various factors, including the available resources, the needs of the affected area, the extent of damage, geographical features, and the scale of the response.
- When required, sectors can be further divided into subsectors, each managed by respective sector coordinators.



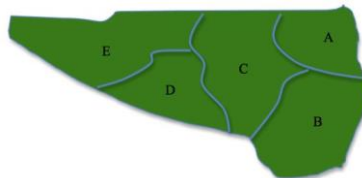
Timing and Method of Sectorisation

- Sectorisation should be initiated at the earliest stage of a disaster response to maximize its effectiveness. Ideally, the Local Emergency Management Agency (LEMA) should already have a sectorisation plan in place, which the international USAR Teams can follow. The LEMA may have local sectors designated, such as neighborhoods or parishes, which provide organized information.
- However, if no sector plan exists, it should be developed at the earliest stage of the response in close collaboration with the LEMA. The planning process may involve the UNDAC team or personnel from the On-Site Operations Coordination Centre (OSOCC) or the Unified Coordination Centre (UCC) within the USAR Teams. In cases where the LEMA lacks a sector plan, a Wide Area Assessment (ASR1) may be necessary to gather relevant information for designing the sector plan.



Sector Identification

- The default INSARAG sector identification system employs a simple lettering system to code each sector (e.g., A, B, C, D, and so on), with the exclusion of the letters I and O to prevent confusion with the numbers 1 and 0. To ensure clarity, a local name or description can be added to the sector designation, such as "Sector A, North Padang." If the LEMA has an existing coded sector identification system, such as Sector 1, 2, 3, or using colors like Red, Blue, Green, etc., it should be adopted, and any documentation or markings should account for it.
- The diagrams below illustrate how geographical se
the affected areas into smaller, more manageable se



Definition of Worksite

- For effective coordination, it is crucial to uniquely identify each location where significant Urban Search and Rescue (USAR) operations are being carried out. These locations are referred to as worksites. A worksite can have various meanings, but in its simplest form, it refers to "any site where significant USAR operations are being conducted." Such operations typically occur when there is a potential for live rescues. However, to avoid deploying teams to sites with confirmed fatalities only, sites with victims to be confirmed as deceased may also be given an identification (ID) for documentation purposes. Worksites can vary in size; they may encompass a single building where one USAR Team or squad is working due to a potential live rescue, or they could be much larger, such as a hospital complex, or smaller, like the site of a single rescue in a small area.

Worksite Identification

- When it is determined that a site requires USAR operations, primarily rescue work, it should be allocated a unique Worksite Identification (Worksite ID) in addition to its existing street name and building number. This allocation can be done during ASR2, but the LEMA may also assign sites. Regardless, each site should be given its Worksite ID using the following protocol:
- The first part of the Worksite ID is the sector letter allocated to the area where the site is located, for example, A.
- As a worksite is identified, a sequential number is allocated, such as 1, 2, 3, and so on. Combining the sector letter and the allocated number generates the unique Worksite ID, such as A-1, A-2, A-3, and so forth.



Thank you!