SOME BASELINE DATA FOR A EFFECTIVE RESPONSE OF EMERGENCY SERVICES IN A SEISMIC DISASTER IN SOUTHERN CAUCASUS

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Summary: *On the base of statistical materials of 1988 Spitak earthquake suggesting some important date for an effective response of emergency services in a disaster are suggested: dynamics of casualties (irreversible human losses) in the ruins during the first days of earthquakes; the dynamics of rescue force expansion during the first two weeks for earthquake zone with 500000 population; an estimate of minimum necessary medication and medical accessories per 5000 patients; forecasting the degree of damage to different types of residential buildings depending on the intensity of the earthquake and the number of possible victims.*

Key words: *services, earthquake, response, losses.*

Based on the post-earthquake situation and the impact assessments, it is necessary to estimate the approximate volumes of assistance to be provided to the disaster zone, including time for rescue operations, quantity of rescue forces and equipment, medical assistance, medicines and medical supplies, various services: specialists, technicians and materials, food, water, clothing, financial minds, fuel, overnight accommodation, evacuation of population from the disaster zone, temporary housing, vehicles and fuel, etc. For the calculation of all these needs, in addition to international standards, estimation methods have been developed in the Republic of Armenia in account of local conditions [5,6].

The first 2-3 days are the most important in terms of effective respons to earthquakes, in particular saving lives, reducing or preventing negative effects (when the rescue, pre-medical, engineering and other assistance is primarily provided by the local population and services), and the organization of works locally, at different levels of government [3]. By effectively crisis management, losses of strong earthquake can be substantially reduced [4,5]. There are both methods and approaches developed in Armenia for the preliminary assessment of earthquake effects and important data for an effective response of emergency service a disaster [1,5,6].

Time for effective rescue operations.

As a shown in figure 1, the first 5 days after earthquake are very important for saving the lives of population in ruins. Usually the first two days, before the arrival of professionals, the main rescue operations lie with the local unprepared population.

Required rescue forces.

In seismic catastrophes it is important to quickly determine the necessary rescue forces – specialists (rescuers, firefighters, civil engineers, seismologists, life support engineers, etc.) and rescue equipment (cranes, loaders, bulldozers, trucks, excavators, etc.) [2,6]. The number of rescue forces depends on the scale of the destruction of buildings, the construction (structural) type of destroyed buildings, the condition of the implementation of rescue operations, etc. To calculate the rescue forces, we can take as a guide the data on the dynamics of rescue force during the 1988 Spitak earthquake (table # 1). Which

shows that for an earthquake zone with a population of 500,000, the number of rescuers needed is 38,000, and for heavy equipment – 3,100.

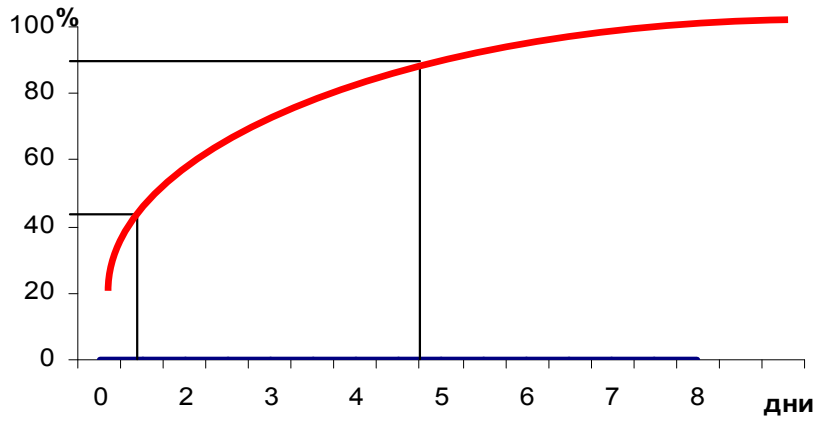

Fig. 1. Dynamics of Casualties (irreversible human losses) in the ruins during the first 10 days of earthquakes [3].

Table 1. The dynamics of rescue force expansion and survivors number during the first two weeks after the 1988 Spitak earthquake [5].

Date	Number of Rescue forces		Number of extracted people		Comments
	Specialists	Heavy Rescue Equipment	Alive	Dead	
07.12. 1988	11 000	1200	20 000	3 900	1. Unprepared residents carried out main rescue operations by themselves; 2. Lack of adequate organization and rescue forces.
08.12. 1988	33 000	2100	5 000	6 000	1. Lack of adequate organization, lack of rescuers and vehicles/equipment, their uneven distribution in the destruction zone.; 2. Heavy traffic; 3. Arrival of civil defense forces.
09.12. 1988	35 000	3000	4 800	3 400	1. Start of Traffic regulation; 2. Start of rescue operations;. 3. Assistance of professional rescuers.
10.12. 1988	37 000	3100	5 700	750	1. Control of the situation, management of rescue operations. 2. Sufficient human, material, and technical resources.
11.12. 1988	38 000	3150	1 800	2 600	1. Operative rescue actions, organization of works:
12 -21. 12. 1988	-	-	1 000	8 350	1. Sharp decline of survival ability of those remaining in the ruins.
Total	**-**	**-**	**38 300**	**25 000**	

Minimum necessary medication and medical accessories.

Table 2 provides a list of the most needed first aid medicines and medical accessories per 5000 patients affected by the earthquake.

Table 2. An estimate of minimum necessary medication and medical accessories per 5000 hospitalized patients based on the 1988 Spitak earthquake experience [3,5].

Name of the drug or accessory	**Quantity**
Blood	5000 litr
Medicine droppers	3750 pcs
Syringes	10000 pcs
Needles	20000 pcs
Pain Relief and other Medications	
Analgin;	1000 bundles with 10 ampoules
Promedol;	1250 package
Physiological solution	2500 bottles
Ringer solution;	1200 bottles
Piliglyukin	2500 bottles
Reopoliglyuks	750 bottles
Glucose solution	1250 bottles
Manitol;	250 bottles
Vitamin C;	250 bottles
B1, B6 vitamins;	125 package
Lasix	250 ampoules
Bandage	15000 pcs
Gauze	2500 metr
Gypsum	250 kg
Splint	250 pcs
Iodine solution	25 litr
Hydrogen peroxide	50 litr
Stretchers	250pcs

Assessment of damage to different types of residential buildings and number of possible human losses.

Damage to various types of residential buildings common in the Southern Caucasus and the number of victims with an earthquake intensity of 8-10 units was predicted based on statistics from the 1988 Spitak earthquake [5,7]. For the assessment of damage degree five point scale was used [5]. The number of victim in day-time and night-time was calculated (table 3).

Table 3. The degree of damage of different types of residential buildings depending on the intensity of the earthquake and the number of possible victims on the base of 1988 Spitak earthquake statistical data.

N	Types of residential buildings, story and number of apartments	The degree of damage(**D**) of different types of residential buildings depending on the intensity (EMS-98) and number of victim's* $\mathbf{V_d}$-in day, V_n-in night) in a collapses building								
		8 unit			**9 unit**			**10 unit**		
		D	V_d	V_n	***D***	V_d	V_n	***D***	V_d	V_n
	Multistory buildings									
1	Large-panel 9-storey buildings, 36 apartments	1		0	2	0	0	-	-	-
2	Large-panel 6-storey buildings, 24 apartments	1		0	2	0	0	-	-	-
3	Frame-panel 5-storey buildings, 20 apartments (build up to 1991)	1		0	5	54	108	-	-	-
4	Frame-panel 5-storey buildings, 20 apartments (build up to 1991)	1-2		0	4	30	60	-	-	-
5	Frame-panel, 14-storey buildings, 48 apartments (build up to 1991)	2		0	4-5	72	144	-	-	-
6	Stone 5 storey buildings of series A-450, 60 apartments (build up to 1991)	2		0	3-4	63	126	5	90	180
7	Stone 5 storey buildings of series A-451, 90 apartments (build up to 1991)	2		0	3-4	95	189	5	135	270
8	Buildings, constructed by the "floor lifting" method, 16-storey, 128 apartments (build up to 1991)	-		-	3-4	134	269	-	-	-
9	Buildings, constructed by the "floor lifting" method, 10-storey, 80 apartments (build up to 1991)	-		-	5	120	240	-	-	-
	Apartments									
10	Stone 1-2 storey buildings with sand-clay and lime mortar without metal (1000 apartments)	-3		0	3-4	30	60	5	100	200
11	1-2 storey stone buildings with concrete mortar and metal (1000 apartments).	-2		0	2-3	15	30	3-4	50	100

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