

CEDIM Forensic Earthquake Analysis Group

Shelter report for the Oct. 23 2011 Eastern Turkey Earthquake

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(built with support of earthquake-report.com)

Summary

Tens of thousands of people spent a third night under canvas, in cars or huddled round small fires in towns rattled by aftershocks from a massive earthquake in eastern Turkey that killed hundreds (Reuters, 25 October). Although there are currently no reliable estimates of the number of people left homeless from the October 23 earthquake at this point, the Turkish Red Crescent is preparing to **provide temporary shelter for around 50,000 people (26.10 07:00CET)**. As of October 26th, **17,836 tents have been transported to the earthquake area**. The Red Crescent has also mobilized 76,560 blankets, 1120 food packages, 10,064 food parcels, 36 mobile kitchens, 3051 kitchen sets, 5139 catalytic stoves (Earthquake Report). The relief agency was criticized for failing to ensure that some of the most needy, particularly in villages, received tents as temperatures plummeted overnight.

The current death toll is at 461, with 1352 injured as of 09:00 Turkish Time yesterday. 100s remain missing. 200 technical staff are undertaking preliminary assessment of buildings.

In total in the region, there are also 3,755 search and rescue staff, 860 medical personnel, 16 search dogs, 595 construction equipment and vehicles, including 140 ambulances, 7 rescue choppers, 33 generators and 95 portable toilets, and 60 prefabricated houses with provision for 3000 more.

Not all displaced population will seek public shelter, and some may find alternative shelter accommodations, stay with family and friends, or leave the affected area. The decision for seeking shelter is also a matter of the coping capacities of the affected communities and the responding authorities. Nevertheless the true sheltering needs and strategies will unfold in the coming days. In the worst case the harsh weather conditions and continuing aftershocks will prolong recovery efforts and people will still live in emergency shelters (e.g., winterized tents, makeshift dwellings, etc.) before intermediate shelter and permanent construction starts. Past earthquakes of similar magnitude and in comparable climatic conditions in eastern Turkey point to several immediate lessons for the emergency shelter strategy in Van-Ercis.

1. Many victims will not return to moderately or slightly damaged houses for fear of aftershocks increasing the demand for shelter as well as the risk of more damage to the moderately and slightly affected houses since they were left unrepaired and exposed to severe weather conditions.
2. As Turkey has not had a major earthquake like Izmit 1999 in the last decade a considerable stock of prefab housing may exist, however past events show that accelerating the reconstruction

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process to provide prefabricated housing may backfire if these ignore climatic, material and cultural conditions.

3. Past events have also shown that displaced persons did not want to relocate and wanted to remain close to their original homes. These events show that temporary shelters built by local means were put up as close as possible to the original houses of victims or any land belonging to the families.
4. With over 50% of the affected population being under 20 years, many social issues where historically young populations have been exposed to major earthquakes have occurred. Schooling and university education continuation, safety, underage care and nutrition/health issues have been some of the previous concerns.

Current Situation in Van-Ercis

In this initial quick assessment, the current situation in Van-Ercis with respect to several factors which typically set the trajectory for sheltering strategies are discussed. This is followed by key lessons learned for emergency sheltering in a comparative analysis of several similar Eastern Turkey earthquakes.

Destroyed and severely damaged housing units: The latest reports indicate that 2,262 houses / buildings have collapsed (Earthquake-Report.com). Initial fatality estimates (ELER method, Prof. Mustafa Erdik, Kandilli Observatory, Istanbul) were from 700 to 1,000 persons. Based on these early estimates KOERI had placed the number of homeless from building damage in the range of 5,000 to 10,000.



Figure 1 Spending the night outside with some blankets and a campfire mainly because of the fear for aftershocks

Exposure to cold weather: Cold weather will cause additional stress to homeless persons, and those who are afraid to return to their homes. Given the very young population in Van (40% are between 0-14 years old and 13% or 138,000 between the ages of 0-4 according to the 2010 ABPRS Database, State Institute of Statistics, Turkey) the cold temperatures will make it more difficult to care for the needs of children and families in shelters. Interestingly only 3% of the population in Van is aged 65 or older. Around this time of the year night time temperatures reach an average of 5° Celsius (Figure 2). The current forecasts indicate temperatures at 14°C high and 5°C low for Wednesday, 26th of October. Anticipating the shelter situation in the next days rain is predicted for much of the area on Thursday and snow in the mountains with day temperatures falling to between 6 and 8°C (Figure 3). Temperatures are unchanged on Friday with frosty nights but slight improvement over the weekend. A full report on the weather conditions in Eastern Turkey is compiled by Bernhard Muehr at KIT (http://www.wettergefahren-fruehwarnung.de/Ereignis/20111025_e.html). It can be seen that average temperatures in November for the affected area hover around 0°C and precipitation rates vary between 60-120mm with snow in the mountains (Figure 3).

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Monat	Tmean °C	Tabsmax °C	Tmeanmax °C	Tabsmin °C	Tmeanmin °C	rel. Feuchte %	Niederschlag mm	Niederschlagstage	Sonne pro Tag h
Jan	-4.5	12.6	1.6	-28.7	-7.9	70	35	6	4.3
Feb	-3.5	14.3	2.2	-28.2	-7.8	70	33	6	5.2
Mar	0.9	20.4	5.5	-20.2	-4.2	70	43	8	5.5
Apr	7.4	24.0	12.7	-17.5	1.5	64	54	9	7.1
Mai	12.7	26.6	18.9	-3.5	6.4	57	49	9	9.3
Jun	17.6	33.5	24.3	2.6	9.8	51	21	4	11.8
Jul	21.9	37.5	28.7	3.6	13.8	44	4	1	12.1
Aug	21.3	36.7	29.1	5.0	13.7	41	5	1	11.1
Sep	16.8	32.6	25.0	2.2	9.9	44	11	1	9.1
Okt	10.1	28.8	17.4	-14.0	5.0	59	46	7	6.5
Nov	4.0	19.6	10.6	-20.5	0.4	67	47	7	5.3
Dez	-1.1	13.5	4.0	-21.3	-5.4	69	33	6	4.3
Jahr	8.6	37.5	15.0	-28.7	2.9	59	381	65	7.6

Figure 2 Average values (1966-1990) and Extreme values for Van Station, Turkey (Source, Bernhard Muehr) – rel Feuchte = relative humidity, Niederschlag – rainfall (mm), Niederschlagstage – rain days, Sonne pro Tag – sunshine per day in hours.

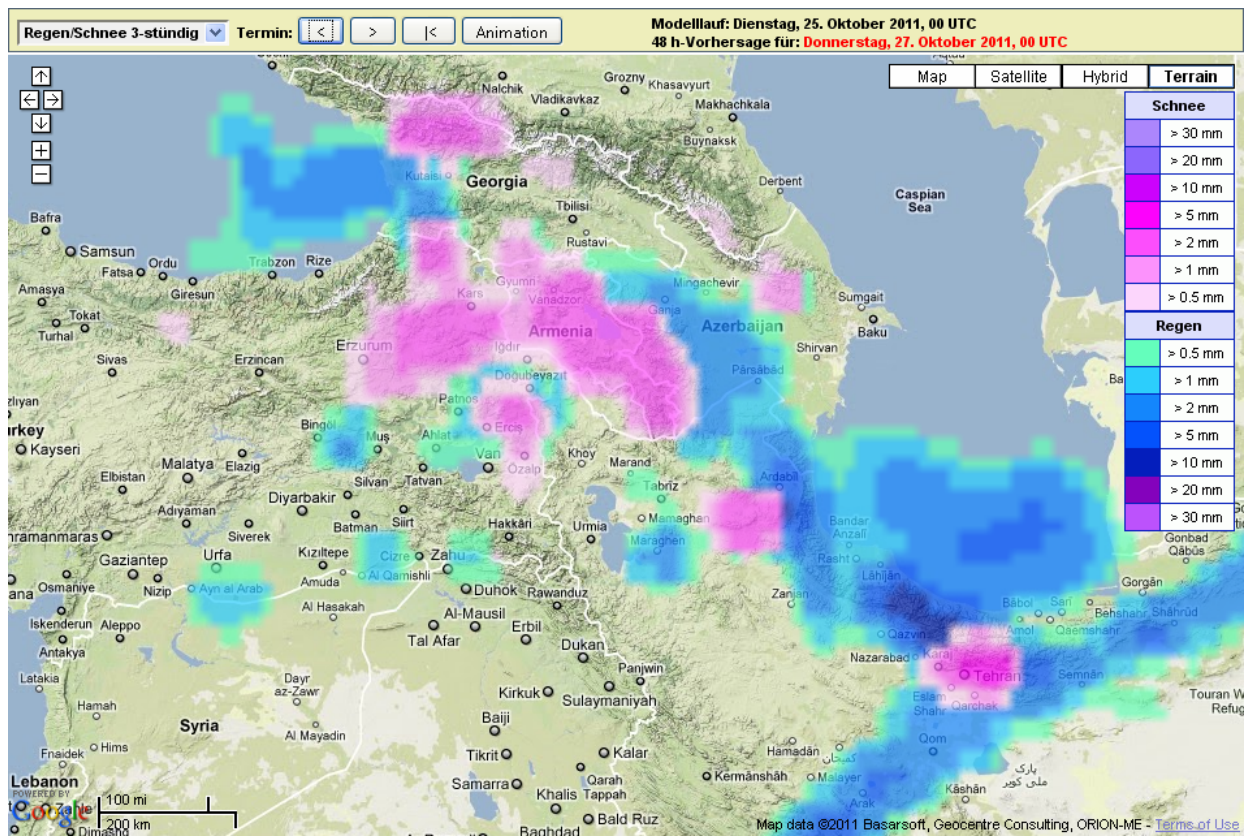


Figure 3 Modeled snow and rainfall for the 48 hours to Thursday, October 27th 2011. Source Bernhard Muehr, KIT. http://www.wettergefahren-fruehwarnung.de/Ereignis/20111025_e.html

Fear of aftershocks: The affected area is still hit with continuous aftershocks. There have been over 600 aftershocks greater than magnitude 3 within 72 hours after the earthquake. Over 7 of these have been greater than magnitude 5, including a M5.6 and M5.9 soon after the quake, a M6.0, 10 hours after the earthquake, and a M5.7 which caused much additional damage including collapsed houses, late

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afternoon yesterday (25.10 15:00UTC), 50 hours after the original quake. This sequence of events has kept people on the streets with reports of many more people leaving their homes after the latest aftershock. As can be seen below, felt aftershocks have been distributed over a large area, meaning that most of the Van Province population has been significantly affected. In addition, aftershocks have led to suspended search and rescue activities.

In many historical earthquakes, aftershocks are the main reason for people staying out of their homes, combined with the fear of buildings collapsing until proper assessment is done. In this earthquake, like the 2011 Japanese earthquake, the aftershock sequence has produced a larger than normal number of people to leave their homes who do not have severely damaged or destroyed housing. People are staying outside of their homes warming up in the heat of a campfire and covered with sheets.

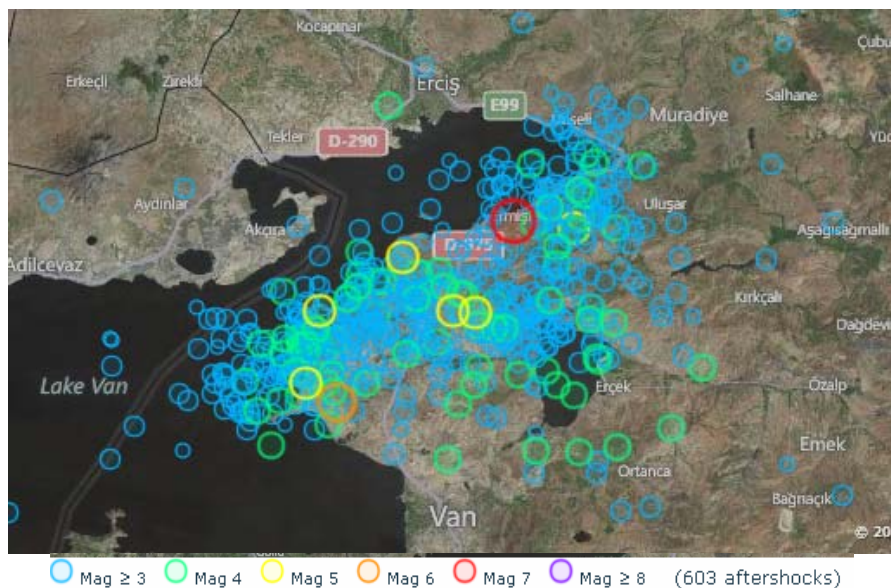


Figure 4 Aftershock distribution from EMSC representing over 600 aftershocks over $M>3$ (Courtesy: EMSC, <http://www.emsc-csem.org/Earthquake/202/Earthquake-M7-2-Eastern-Turkey>)

Age: According to the ABPRS Database (State Institute of Statistics, Turkey), 52% of the population of Van province are under 20 years old, only 3% are older than 65 years old. 40% are children under 15, one third of them (13% of the total Van Province population) are from 0-4 years old. From these numbers, it can be expected that a substantial proportion of those in the public shelters are children having specific needs (baby food, a warm place to stay, suitable space for families in the shelter to allow families to create a feeling of safety). Given the high number of children required to go to school and the fact that school buildings collapsed, it is important to allocate the children to other schools in the region or other regions when the schools are opened again.

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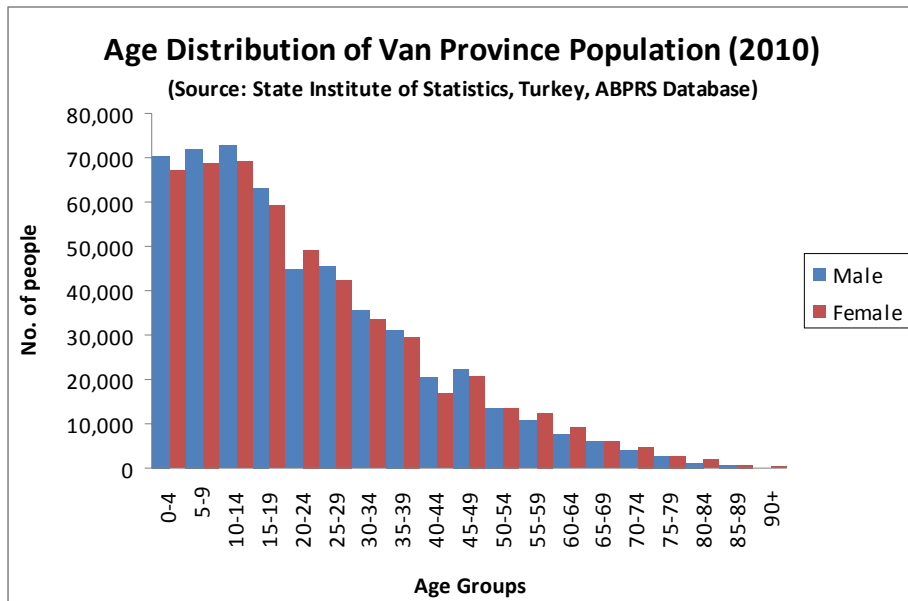


Figure 5 Age distribution of Males and Females in Van Province, Turkey in 2010.

Coping mechanisms of Community: The capability of the community’s social coping mechanisms to provide emergency shelter, the feasibility and likelihood of survivors to organize own emergency shelter from salvaged materials are important determining factor for the need of emergency shelter. Duplication of what the local communities can provide themselves will increase not only dependence but also the cost of post-disaster relief.

The HDI (Human Development Index) in the affected region (Van, Hakkari, Bitlis, Mus) is among the lowest in Turkey. Please note that this is the 2009 definition of HDI and not the current UNDP 2nd version. HDI is a combination of literacy rate, life expectancy and GDP (per capita). In the Van area (0.630), the HDI is equivalent to Bhutan, India or Congo, as compared to the average HDI of Turkey which is 0.810. Thus, the development of the region poses many problems for health issues.

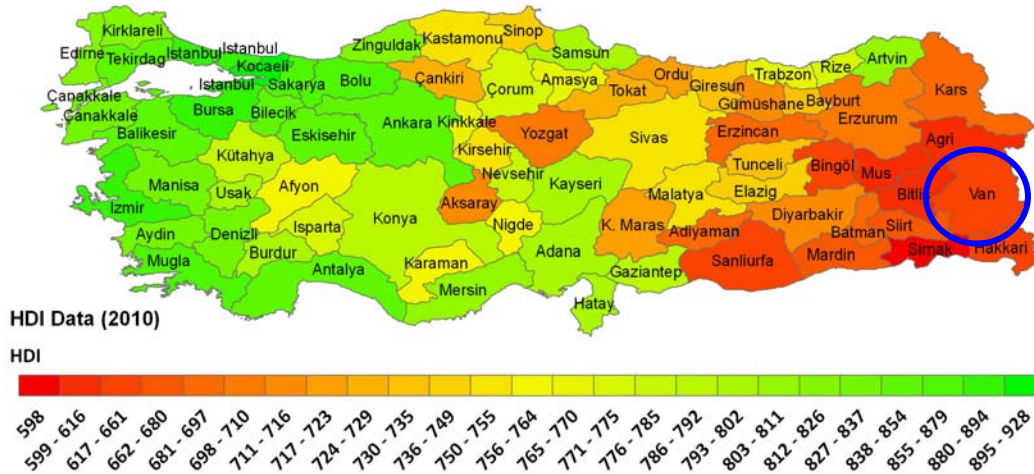


Figure 6 Human Development Index of Provinces in Turkey, showing one measure of coping capacity.

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Coping mechanisms of Responders: Several factors will become important here in setting the shelter policy in the next days.

1. proportion of survivors that have access to emergency shelter provided by the authorities within the first 24 to 48 hours;

(Currently in Van, with the number of 15000 tents and 50000 blankets provided, nearly 100% of survivors have access.)

2. The most appropriate and accessible emergency shelter types available for survivors without shelter;
(Tents are currently the choice, however prefab housing and other temporary housing has already been scheduled for building)

3. The accessibility to the disaster site;

(For emergency services, difficulties came due to debris in the first 24 hours, however streets have been cleared and around 595 construction equipment and vehicles are on site, to allow the 140 ambulances and over 3000 rescue staff clear access)

4. Risks of secondary disasters that may influence shelter needs; and

(Currently there is a risk of strong effects from winter weather, and additional damage from aftershocks, given the height of Van province, landslides can sometimes be an issue)

5. The available manpower at the disaster site, capable of assisting in erecting emergency shelter

(Much manpower is available and continues to increase as per the numbers above.)

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Immediate Lessons for Van as compared to historic earthquakes

The October 23, 2011 earthquake in Van shares is similar to the following historic earthquakes in eastern Turkey in terms of seismic energy measured in moment magnitude (Mw) and surface wave magnitude (Ms) (see table below). The following are the details from the CATDAT Damaging Earthquakes Database of the various shelter, building and casualties of the selected historic Turkish earthquakes.

Table 1: Selected CATDAT Damaging Earthquakes Database Median Data – Provinces affected and hypocentral information

Date, UTC Time	Magnitude, Depth	Main Cities Affected	Primary Province	Other Impacted Provinces/Countries
23.10.2011, 10:41	7.2Mw, 5-20km	Van, Ercis	Van	Hakkari, Mus, Bitlis
19.08.1966, 12:22	6.8Mw, 17km	Varto	Mus	Bingol, Erzerum
22.05.1971, 16:44	6.7Ms, 4km	Bingol	Bingol	Elazig
06.09.1975, 09:20	6.7Ms, 39km	Lice	Diyarbakir	Bingol, Elazig
24.11.1976, 12:22	7Mw, 9km	Muradiye	Van	Agri, Hakkari, Iran, Armenia
30.10.1983, 04:12	6.6Mw, 16km	Narman-Horasan	Erzurum	Kars, Agri, Artvin
13.03.1992, 17:18	6.6Mw, 26km	Erzincan	Erzincan	Gumushane, Bayburt, Tunceli
01.05.2003, 00:27	6.3Mw, 14km	Bingol	Bingol	Tunceli, Elazig, Diyarbakir

Table 2: Selected CATDAT Damaging Earthquakes Database Median Data –Health and Building Aspects

YEAR	Event	Deaths	Injured	Homeless	Affected	Buildings Destroyed	Buildings Damaged	Tents**	Temporary Housing**
2011	Van-Ercis	459*	1352*	50000*	700000+*	2262*	n/a	17836*	3000+
1966	Varto	2517	1420	108000	217000	20007	n/a	n/a	11140
1971	Bingol	995	1900	45000	88665	5617	6726	9035	tbc
1975	Lice	2385	4500	5000++	53372	8149	8453	4144	5805
1976	Muradiye	3840	15000	51000	216000	9552	10175	5000	10000
1983	Narman-Horasan	1400	1137	25000	130000	3241	7092	5473	3000+
1992	Erzincan	652	3850	95000	322000	4783	13385	27250	16000
2003	Bingöl	177	530	45000	245000	5367	12073	14000	tbc

***data still being updated – refer to earthquake-report.com for latest updates,** size of temporary housing and tents differs, and also includes temporary housing and prefab housing in many cases built.**

Fear of Aftershocks:

Due to the continuing aftershocks in the events which occurred during cold and rainy weather (1975 Lice, 1976 Muradiye and 1983 Narman-Horasan) the majority of victims were afraid of repairing and staying even in the less damaged houses. Severe weather conditions caused more damage to the moderately and slightly affected houses.

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Aftershocks are also a key factor in keeping persons in the affected region from returning to their homes. Approaching winter conditions and increased precipitation as in the 1976 and 1983 event there is a risk of further deterioration of slightly and moderately damaged buildings as they do not get repaired.

Weather Conditions:

In the events which occurred in weather conditions approaching winter (1975 Lice, 1976 Muradiye and 1983 Narman-Horasan) the shelter policy was to provide temporary shelter quickly. The 1976 Muradiye earthquake occurred in late November in the worst winter earthquake in Turkey for 40 years, and authorities feared that vast numbers of survivors would die of exposure to harsh climate. Thus winterized tents, with heating and insulation were requested from world-wide sources, however, there were difficulties in obtaining winterized tents, the entire world stockpile being inadequate. The assumed need was also probably incorrect, as is evidenced by the resourcefulness of surviving families who improvised by half submerging makeshift shelters in the ground. After the 1983 Narman-Horasan earthquake the majority of tents were in place within 2 weeks, the most urgently needed having been provided within 2 days. In the 1975 Lice earthquake tents, including winterized models were provided within 6 weeks. In all three event survivors were encouraged by Government to move away from the affected area. Another approach to deal with the weather conditions was to accelerate reconstruction using prefab housing.

Providing winterized tents and other supplies such as sleeping bags, blankets and heater stoves for the thousands left homeless also take top priority in the recent Van earthquake. A particular concern is the high proportion of young persons and children affected in this earthquake who are at risk of becoming sick from the cold weather. As the aftershocks subside and more people return to their homes, the restoration of lifelines (gas and electricity) in the most severely affected areas will also play a part in how people will cope with winter conditions.

Self-Building:

In order to replace the tents which were not adequate for the winter, the majority of the villagers were building single-room shacks out of any materials they purchased, salvaged or collected in the area. The experience of collapsed roofs and anxiety of aftershocks led villagers to take certain precautions in construction of make-shift temporary homes (e.g., indigenous measures developed in the area was to put up boarding on the interior walls in order to prevent the shacks collapsing inwards in case of another earthquake). However wise these precautions were, there were no efforts to train people in construction methods to make permanent houses earthquake resistant later.

As with the previous earthquakes in eastern Turkey, the affected communities are resourceful in coping with the need for temporary shelter using indigenous methods. Duplication of what the local communities can provide themselves will increase not only dependence but also the cost of post-disaster relief. Recovery and reconstruction programs should take self-help into account!

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Building for Change:

The devastating damage in all these events were caused by factors frequently cited in earthquake literature: inadequate materials, improper methods of construction, lack of repair of previous damage and inadequate foundations. An improvement in the local building materials and methods of construction both for repairs and for new buildings is more desirable than the relocation of the villages and towns. In these past events no efforts were made to train people in construction methods to make permanent houses earthquake resistant later. Without enough understanding of locally adaptable earthquake resistant construction techniques, financial incentives and education in new skills, the future vulnerability of the area will remain high.

As with previous events in eastern Turkey as well as post-earthquake reconstruction programs worldwide the best designs brought forward by well-meaning relief agencies and NGOs will not save lives if they are not built properly, or local engineers remain unsure how to design them. Now is the time to plan for reconstruction programs which make it affordable, easy to implement, and leverage the window of opportunity that exists right after an earthquake disaster. It is easier to make minor, low or no-cost changes to existing ways of building than introduce a completely new technology, or reintroduce a traditional building method. There is a need for approaches such as that of BuildChange to place permanent change in construction practice after the earthquake by building local skills and stimulating local demand.

In-place Sheltering:

Most displaced persons do not want to relocate and wanted to remain close to their original homes. In the 1983 Narman-Horasan earthquake temporary shelters built by local means were put up as close as possible to the original houses of victims or any land belonging to the families (e.g., victim's gardens, village commons, agricultural land and any other convenient open spaces). 60% of villagers wanted to remain close to their original land and only 15% wanted government relocation. The remaining 25% either wanted independent local resettlement or settlement in other cities.

As observed in these past events of the key issues in transition between emergency shelter and intermediate housing in Van may also be the reluctance of people to move into shelters far away from their source of livelihood and social networks. The need that temporary shelters and intermediate structures to be put up as close as possible to the original houses of victims or any land belonging to the families should be considered. Past experiences have demonstrated expensive and well-built project left under-occupied when as arena of social and economic life is not considered.

Prefab Housing:

After the 1983 Narman-Horasan earthquake prefab houses were imported from Ankara after people were placed in tents and empty buildings in and around the town centers. For the 1975 Lice earthquake, *the capacity of the Turkish Government to build prefab houses so rapidly (54 days, 1568 units) was an achievement but conversely the houses had many deficiencies: climatic and cultural unsuitability, no provision for animals, they were too small and they did little to generate work* (UNDRO, 1982). Essentially, they reflected an urban middle class set of values in sharp contrast to rural values and priorities. As in Lice in 1975, the Government adopted a policy to provide prefabricated housing, with plans to build 10000 units. Prefab Housing construction started 4 months later after the 1976 Muradiye

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earthquake as building work was not possible during the winter months. No attempt was made to provide resources for training local builders in earthquake resistant construction of traditional buildings.

As Turkey has not had a major earthquake like Izmit 1999 in the last decade a considerable stock of prefab housing may exist, however past events show that accelerating the reconstruction process to provide prefabricated housing may backfire if these ignore climatic, material and cultural conditions.

Resettlement:

The Ministry of Reconstruction and Resettlement moved the town of Lice 2km of the south due to the risk of rockfalls from the old site. The town of Lice was planned for a population of 20,000 (twice the pre-earthquake total). Mitchell commented that *“the decision to relocate Lice was very unpopular with its residents, and was made without their participation. The new site did not possess climatic shelter from the hillside, has taken valuable agricultural land out of use and was initially without water supply. The new choice of flat site may have been influenced by requirements of prefab houses.”* The Government policy of relocating families to other parts of Turkey after the 1976 Muradiye earthquake was interpreted by some critics as being politically motivated. It appears that few families took up the offer which consisted of removal costs, provision of new land and initial grant of livestock. With Van, Ercis and the villages affected around, hopefully the same mistakes will not be made.

Buying Livestock:

Compared with the previous post-disaster situation in Eastern Turkey, there seemed to be less demand on space for livestock and the storage of hay after the 1983 Narman-Horasan earthquake since the Government Meat Cooperation and private entrepreneurs bought up the animals. Buying animals or agricultural land for the rural people in Van should be the top priority and in reality minimum household investments actually goes into improving quality of construction. Detailed estimates of livestock loss in the rural areas are not yet available.

Table 3: Selected CATDAT Damaging Earthquakes Database Median Data –Livestock Losses

YEAR	Event	Cattle Dead	Sheep/Goats Dead
2011	Van-Ercis	Unknown, some	Unknown, some
1983	Narman-Horasan	7483	22864
1992	Erzincan	11000	
2003	Bingöl	288+	1374+

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