

CEDIM Forensic Earthquake Analysis Group

(Status: Tuesday October 25, 2011 15:00 Central European Time)

(Built with support of earthquake-report.com, SOS Earthquakes)

Summary

The only sound loss estimate currently available is provided by KOERI with 700 to 1000 fatalities, with PAGER reanalysing their data to bring the value from 10,000 fatalities to just over 1000 fatalities. We estimate the direct economic loss to be in the order of 500-1000 million USD given past Turkish earthquakes, damage and intensities seen and the current economic status of the region.

As there is still uncertainty on the intensity of ground motion these numbers can change in the forthcoming days. Currently we have to assume that in the epicentral area the ground motion exceeded the code level, however, this statement will have to be confirmed or rejected by forthcoming data.

The counted **death toll is at 366** at the moment (as of 25.10 14:00CET). 1301 people have been injured, and 2262 buildings destroyed. Earthquake-report.com has the latest updates.

Collapses of schools remains a critical issue in Turkish earthquakes and requires full attention of government agencies in the future. Had the event occurred on Monday morning instead of Sunday afternoon an additional drama were likely.

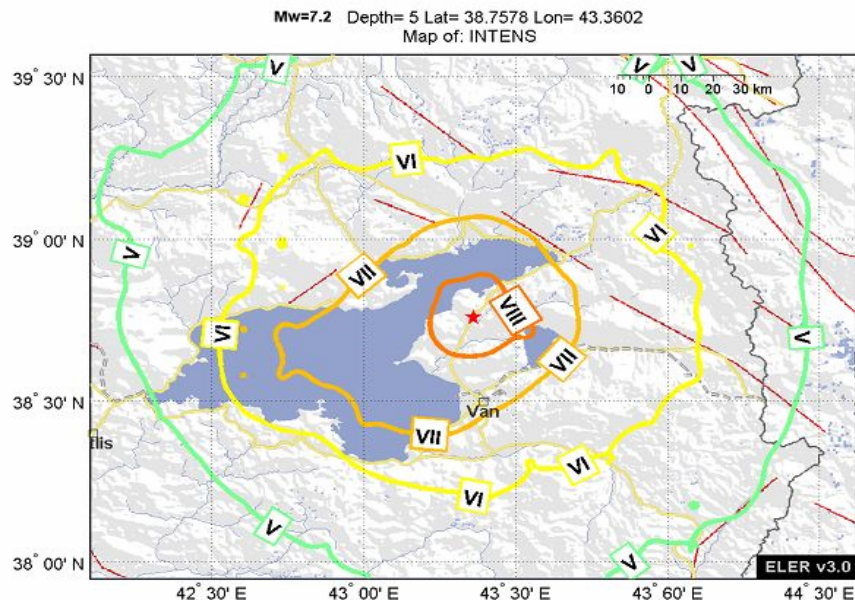
The Turkish Catastrophe Insurance Pool (TCIP) contributes quite substantial to loss mitigation, although a higher insurance penetration would have been helpful as in the Van region there is only a 14% take out of TCIP policies as compared to the possible number.

CEDIM research will contribute to improve future rapid loss estimations with innovative data-driven approaches. An analysis of socio-economic implications regarding shelter needs and reconstruction issues will be released within the next 24 hours.

Ground Motion and Intensity

Ground motion estimates have been published by Kandilli Observatory and Earthquake Research Institute (KOERI, <http://www.koeri.boun.edu.tr/>). In the epicentral area they reach values of 60% of gravitational acceleration and peak ground velocities of 50 cm/s. This would be beyond standard code levels. EMS intensities are estimates as above VIII within an area with 25 km diameter. However, these values are computed, not measured and must still be validated by field observations of the Turkish strong motion networks.

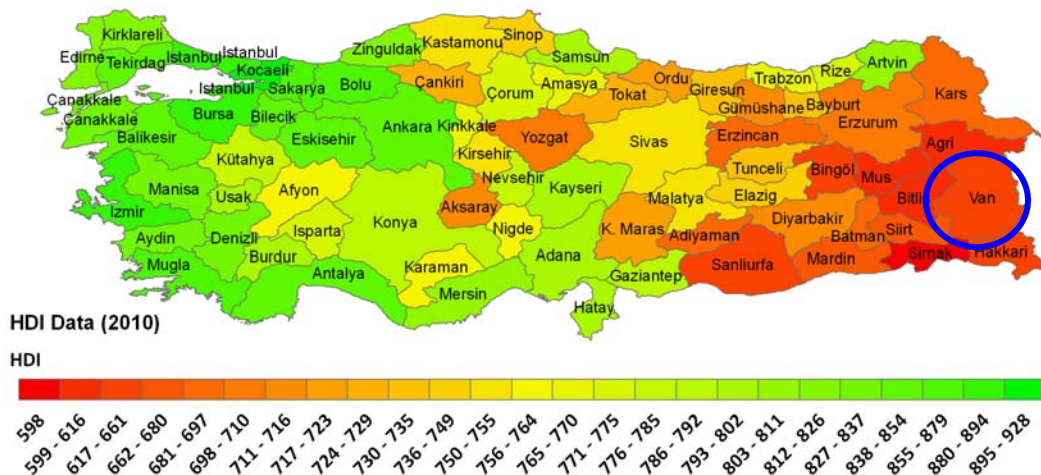
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Courtesy of KOERI (<http://www.koeri.boun.edu.tr/>)

The Area affected

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.



Van Province has a population of 1.035 million (as of 31.12.2010, ABPRS) with a very low population density corresponding to 54.3/km². Compared to other provinces, the average household size is relative

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high (between 7 and 8 persons). It has 539,619 residents living in cities, and a village population of 495,799.

The official population of Van City was 367,000 in 2010 as per the Address Based Population Registration System (ABPRS), but values of 500,000 and 600,000 have been estimated by government sources. The Ercis part of the province has Ercis City (approx. 77,000) and many other settlements. (Urban=78,397, Rural=66,832). Based on the available Census data 1985, 1990, and 2000 the population of Van province increased substantially during from 1985 to 2000, both cities at least doubled their number of inhabitants during the last 25 years.

City	1985 Census	1990 Census	2000 Census	2009-12-31 Registered	2010-12-31 Registered
Van	110653	155623	284464	360810	367419
Erciş	36582	40481	70881	74858	77065

Data Source: State Institute of Statistics, Turkey.

Current Losses

The current (25.10. 14:00 CET) death toll is reported as 366. 1301 people have been reported as injured, and 2262 buildings destroyed. No economic loss estimates from government sources are currently available.

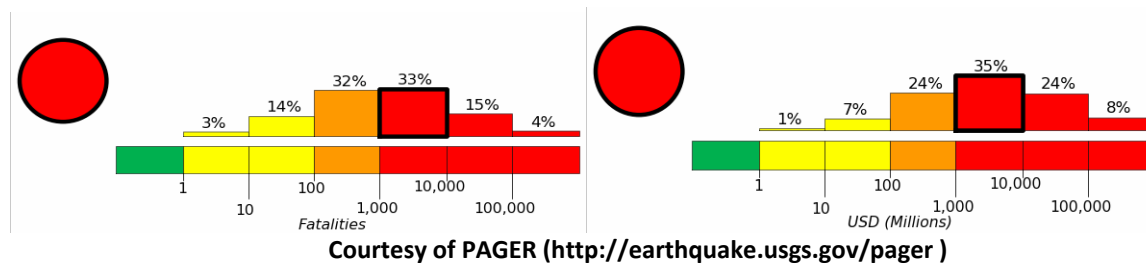
13,000 tents have been dispatched through the Turkish Red Crescent point to about 40,000-45,000 homeless people. 3000 units of temporary housing have been planned for creation within a month. 263,000TRY (around 146,000USD) has been collected from donations so far. It has been suggested by the Prime Minister's Emergency Management Department (Başbakanlık Afet ve Acil Durum Yönetimi Başkanlığının) that 3 million TRY (around 1.66 million USD) is required for initial emergency relief.

The ministry of education announced (24.10.2011) many schools in the area collapsed or have been seriously damaged. As no children were at school on Sunday, apart possibly those attending boarding schools a particularly high death toll may have been avoided. There have been reports however of teachers and students being killed. School collapses are a notorious problem, as seen in the 1999 Izmit earthquake and more recently in the 2003 Bingöl event.

Loss Modelling

PAGER has released a 3rd version of their estimate, after the previous much higher estimates of around 10000 casualties, to now calculate slightly over 1000 fatalities (median), by moving Van City from IX to VIII intensity. The economic loss has also moved from over \$10 billion USD, to a median of around \$2 billion USD, with large variability.

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This now much closer mimics the loss values envisaged by the ELER program of KOERI which were between 700 and 1000 deaths.

Generally such disasters have taken around 10-25% of provincial GDP in the past, and using a factor system, it still seems that around \$500 million-\$1 billion USD is a reasonable estimate. Van is one of the poorest regions of Turkey.

Total economic damage is estimated in the low single-digit billion USD from EQECAT CatWatch mimicking the PAGER model estimate. Although this is 1/10th of the 1999 Izmit earthquake, it also should be noted that this earthquake is in a region around 4 times poorer (GDP-based) than Izmit. EQECAT has brought forward an insured loss estimate of around \$100-200 million through their models which would also fit in reasonably well.

The GDP of Mus, Hakkari, Van and Bitlis together (4 provinces) was in the order of 8.66 billion TRY back in 2008 (around 6.45 billion USD 2008). 21.3% was Agriculture, around 15.8% was industry and 62.9% was services. Due to the economy of Turkey changing significantly from 1995-2010, much change has occurred in the region creating many economic uncertainties for analysis.

Insurance Exposure (TCIP)

An important tool to mitigate losses via insurance is available with the Turkish Catastrophe Insurance Pool (TCIP, www.tcip.gov.tr). It has been established after the 1999 Izmit earthquake by Decree Law No.587 "Decree Law Relating to Compulsory Earthquake Insurance" the same year and started being operational in 2001. It is a compulsory insurance for private residential buildings in municipalities and offered by 29 insurance companies in Turkey. As any insurance it redistributes losses in space and time and thus mitigates the regional and temporal impact, but also stipulates code compliancy for modern buildings.

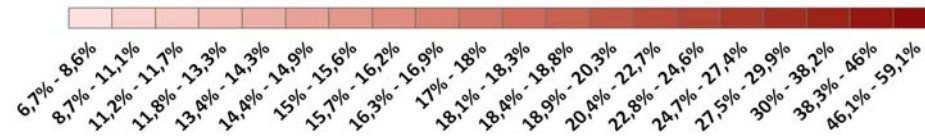
The number of sold policies was at 2.43 million in 2001 (19% of the insurable buildings), fell after this but grew again constantly since 2003 with fewer policies in the past two years. The average national insurance penetration is around 20% with notable differences across the regions and provinces. For instance the TCIP 2009 annual report indicates a 32.5% penetration in the Marmara Region, but only 13.7 in the East Anatolian Region.

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Policies as a percentage of buildings per Province

POLICIES / BUILDINGS

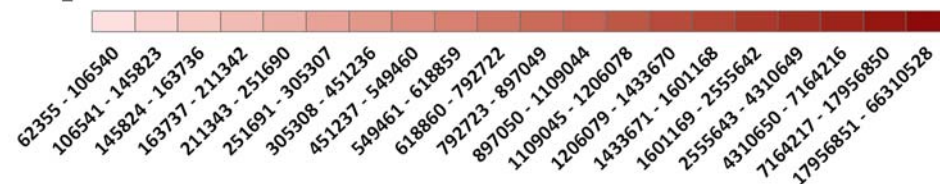


The latest data from the Turkish Insurance Compensation Pool showed that in Bitlis there are 28,919 houses/buildings, of which 4047 have insurance (around 14%). The premium each year is 411,433TRY. For Van Province (Ercis and Van cities) which is much more affected by this quake, for the 64,081 buildings, 7312 of them have TCIP insurance for earthquakes, **equivalent to 11.4%** with a 814,670TRY premium. Hakkari which was also affected has 16,314 houses/buildings with a much lower takeout of 1399 buildings. Only 8.6%, with 144,469TRY premium.



Premiums (USD) paid annually per province (\$198 million USD total - 2011)

PREM_USD



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In summary the TCIP insurance scheme does contribute significantly to loss mitigation, even in the Eastern Anatolian regions.

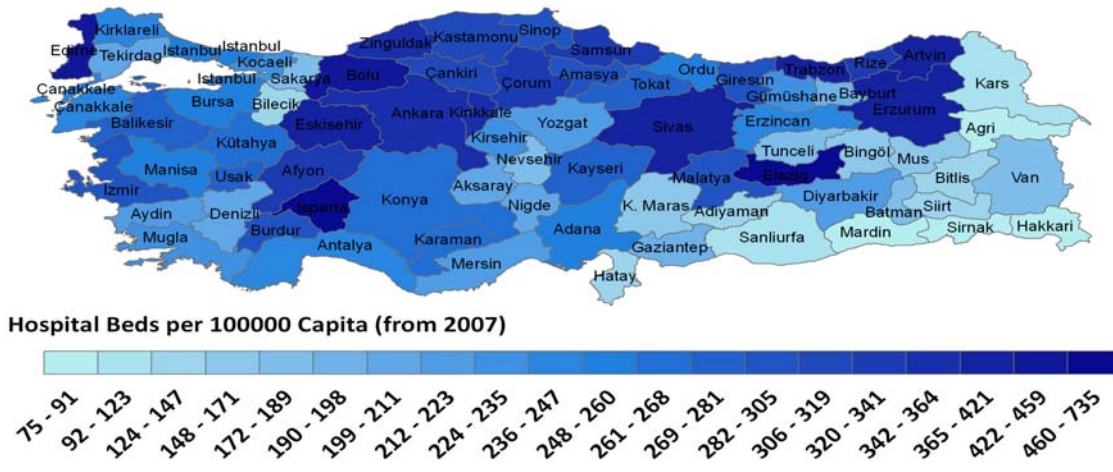
Implications for Research and Innovation

Rapid loss assessment (direct economic losses, casualties, downtime of infrastructure and services) is a research topic of several institutions, among them CEDIM. These estimates depend critically on precise epicenter information. The KOERI estimate - using a better location of the epicenter - provides a realistic number of expected fatalities. KOERI utilized the Open Source Tool ELER, that it developed in the European Research Project NERIES. CEDIM believes that fatality estimates should be done very carefully and published only if enough confidence is given. Using the CATDAT database new data-driven approaches to loss estimation are under development.

Aid Issues

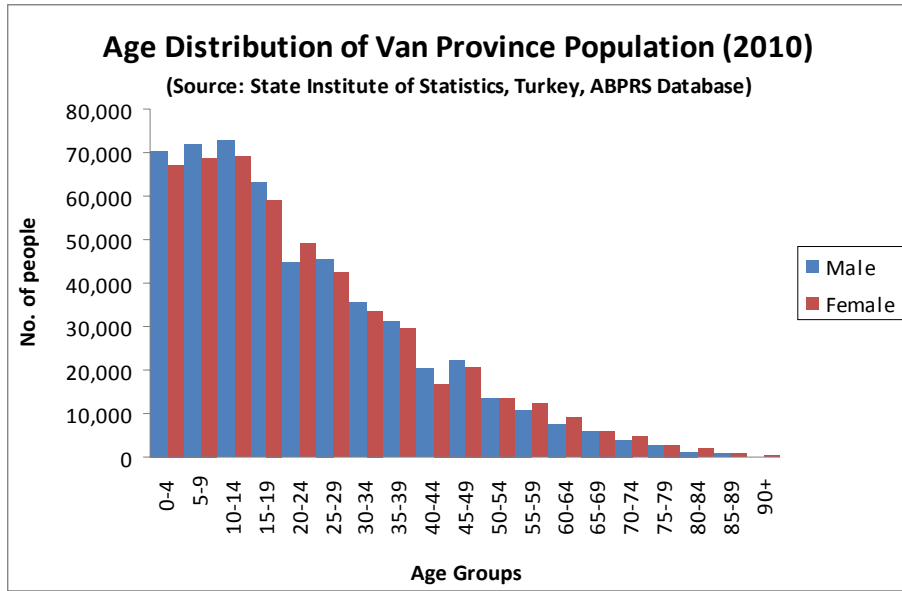
Turkey at this point has refused international aid. Given the development status of the region, the economic and social loss of the earthquake should be able to be easily covered by the government.

Hospital capacity is also an issue at play in this case. The hospital in Ercis was badly damaged in the earthquake according to reports from earthquake-report.com, with medical tents being deployed instead of using the hospital. With 179 hospital beds per 100,000 capita in Van Province as of 2007 (1851 total beds in the province) and over 1300 people injured, this puts a strain on the local medical situation given that people would have been inhabiting most of the beds when the earthquake hit. Already, patients have been moved to Ankara and Erzurum.



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It is interesting to note that the age of the Van Province population is very much contained in the younger age brackets. 52% of the population is less than 20 years old as of 2010 which is a very low average.



Update Contributors

Producing this report have been James Daniell, Friedemann Wenzel, Tina Kunz-Plapp, Bijan Khazai (CEDIM) and Armand Vervaeck (earthquake-report.com).

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CATDAT Damaging Earthquakes Database Median Data – Comparison between previous earthquakes

The October 23, 2011 earthquake in Van can be seen to have some comparisons with other previous Turkish Earthquakes (see tables below). These will be further explored with regard to shelter in the coming days and a separate detailed report published.

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

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

YEAR	Event	Deaths	Injured	Homeless	Affected	Buildings Destroyed	Buildings Damaged	Tents
2011	Van-Ercis	366*	1301*	45000*	700000+*	2262*	n/a	13000*
1966	Varto	2517	1420	108000	217000	20007	n/a	tbc
1971	Bingol	995	1900	45000	88665	5617	6726	9035
1975	Lice	2385	4500	5000++	53372	8149	8453	4144
1976	Muradiye	3840	15000	51000	216000	9552	10175	5000
1983	Narman-Horasan	1400	1137	25000	130000	3241	7000	5473
1992	Erzincan	652	3850	95000**	322000	4783	13385	27250
2003	Bingöl	177	530	45000	245000	5367	12073	14000

*data still being updated – refer to earthquake-report.com for latest updates., ** note due to other causes like power outages etc.



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Forensic Earthquake Analysis Group

Contact

KIT Public Relations

Monika Landgraf

E-mail: monika.landgraf@kit.edu

Tel: +49-72160848126

GFZ Public Relations

Franz Ossing

E-mail: ossing@gfz-potsdam.de

Tel: +49-3312881040