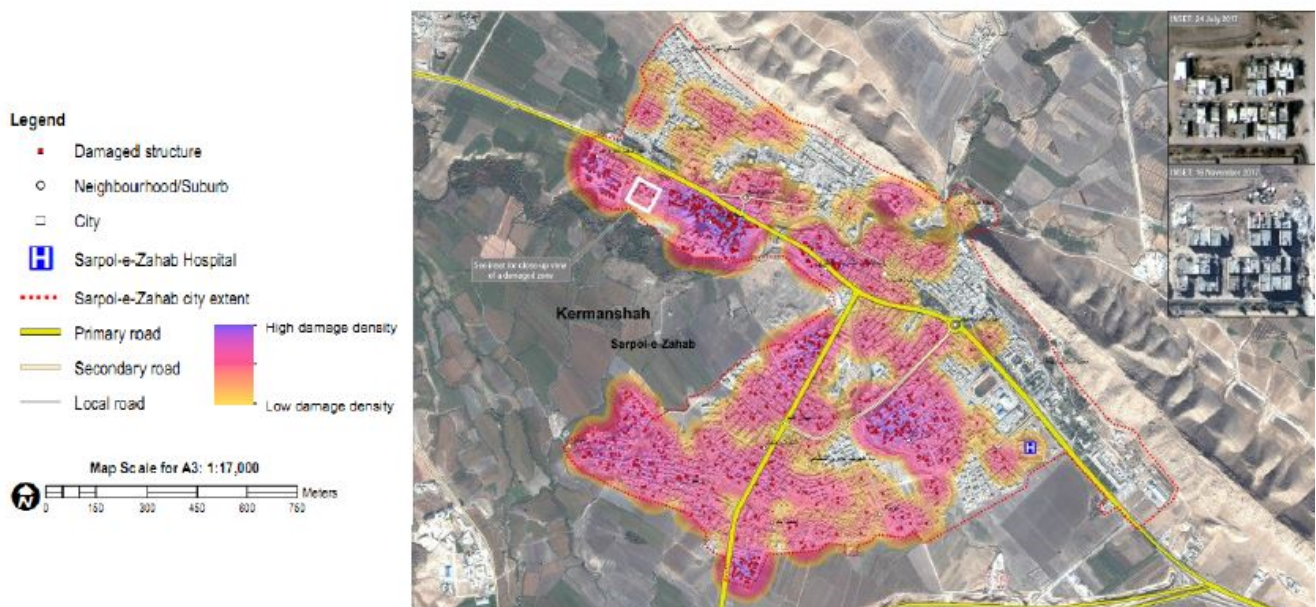


A preliminary report of *Kermanshah* Earthquake M 7.3, Iran earthquake of November 12, 2017

Building damage

Toshikazu IKEMOTO
Masakatsu MIYAJIMA
Abdolhossein FALLAHI
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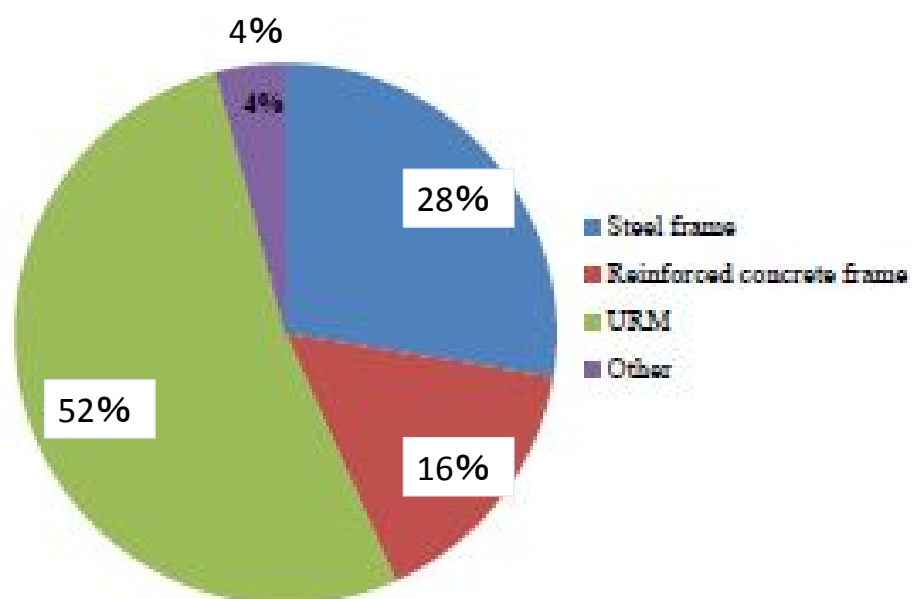
Damaged structures and related density map in Sarpol-e-Zahab (<https://unitar.org/unosat/>)



An example of a collapse residential building (www.tabnak.ir)



Residential buildings taxonomy in Kermanshah province (amar.org.ir) URM



Damage to Houses and Buildings

Reinforced Concrete buildings



Soft story failure at Sarpole-Zahab city.



Severe non-structural elements damage at Maskane-Mehr of Sarpole-Zahab city.



**Horizontal irregularities due to lack of one of the beams
poor quality of concrete and Utilize of 90° hooks
instead of 135° hooks in columns**

Damage to building at Sarpole-Zahab.



(a) Wide spacing between transverse rebar of columns



(b) Short anchorage length at rebar of the beams.

The improper detailing of rebar at Shohada Hospital of Sarpole-Zahab.

Steel buildings



Severe damage to a steel building at Sarpole-Zahab city.



(a) Damage to beams which had no stiffener

(b) Utilize of pinned joints instead of rigid joints at a building with moment-resisting frame system

Stone and adobe buildings



Failure of most of stone buildings in Kuik Village.

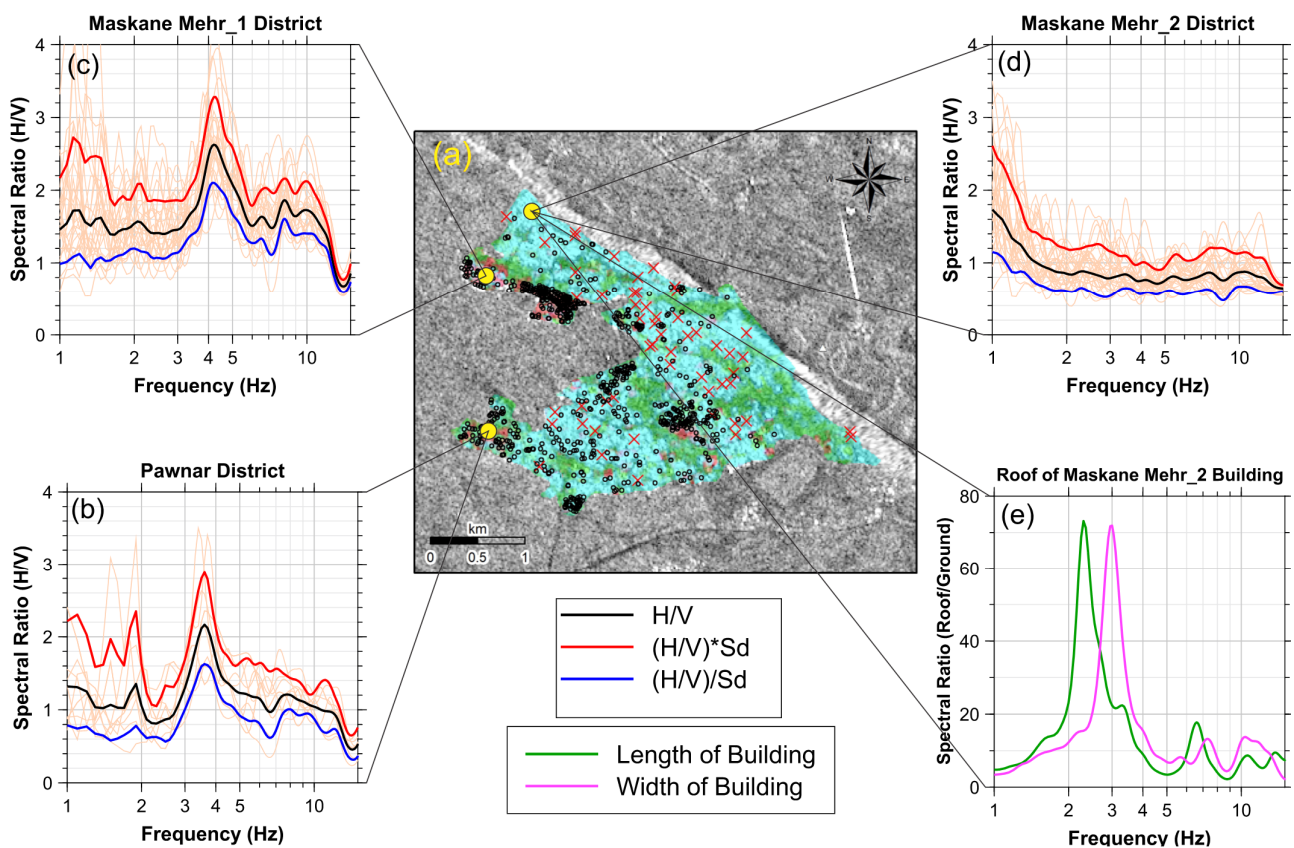


Fig. 1. (a) Location of microtremor measurement points in Sarpole-Zahab city which have been shown by yellow circles; (b), (c) and (d) Obtained spectral ratio (H/V) (black curve), spectral ratio multiplied by standard deviation (red curve), spectral ratio divided by standard deviation (blue curve) in Pawnar, Maskane Mehr_1 and Maskane Mehr_2 districts, respectively; (e) computed spectral ratios along length (green curve) and width (magenta curve) at the roof of a 4-story building in the Maskane Mehr_2 district.

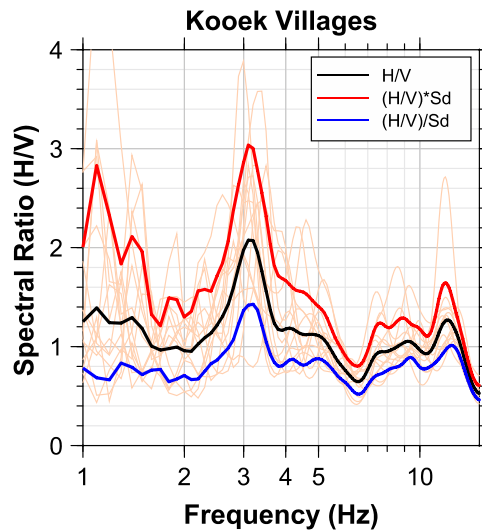
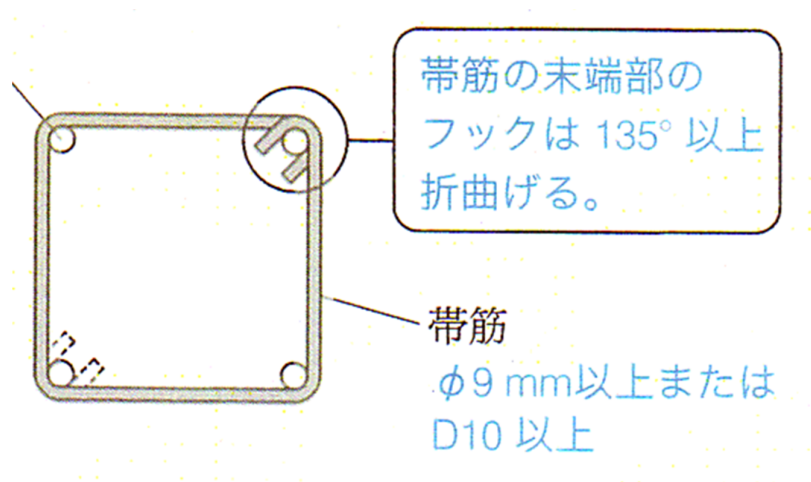


Fig. 2. Obtained spectral ratio (H/V) (black curve), spectral ratio multiplied by standard deviation (red curve), spectral ratio divided by standard deviation (blue curve) in Kooek villages site.

References

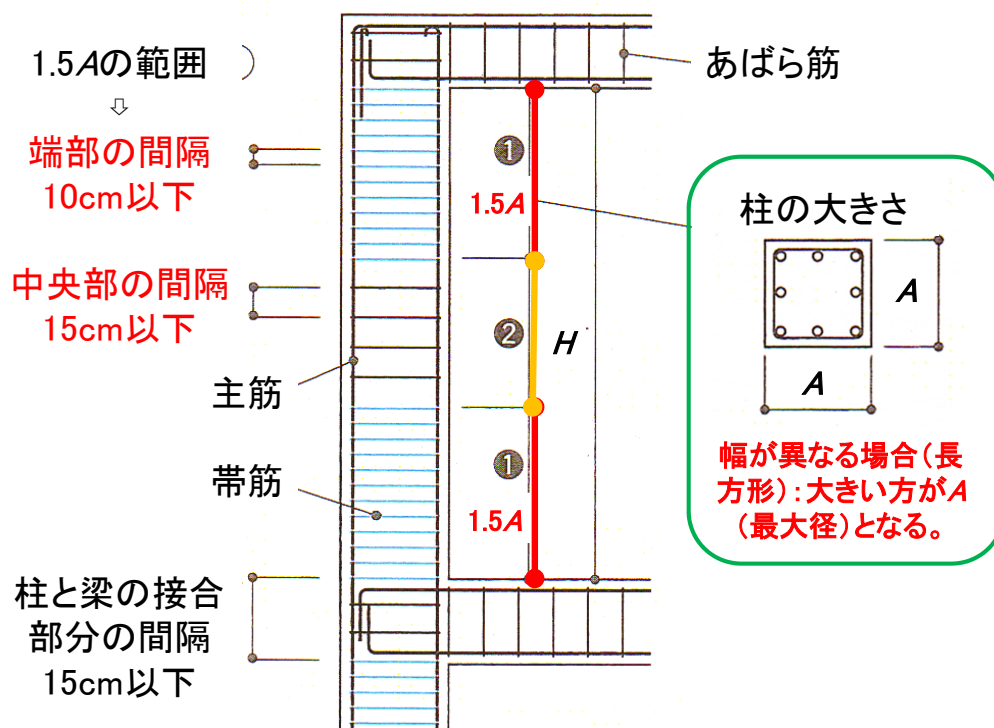
- **Report of the November 12th 2017 sarpol-zahab Kermanshah province earthquake, International Institute of Earthquake Engineering and Seismology, 5th edition, Vol. 3, Iran, December 2017. (In Persian)**
- **Kermanshah Earthquake's damaged 107 million Dollars to infrastructures, Fars News website, Iran, January 12th 2018. (In Persian) (<http://www.farsnews.com/13960923001215>).**
- **260 milliard Tomans damage to water and wastewater Installations, Iranian Students News Agency (ISNA), Iran, January 11th 2018. (In Persian) (<https://www.isna.ir/news/96092312832>).**
- **National Iran gas company's activities at west part of country explained, *PetroEnergy Information Network*, Iran, November 15th 2018. (In Persian) (<http://www.shana.ir/fa/newsagency/279720>)**

Thank you *for your attention.*



$$\text{主筋の全断面積比} = \frac{a}{bD} \times 100(\%) \geq 0.8(\%)$$

②帯筋の間隔



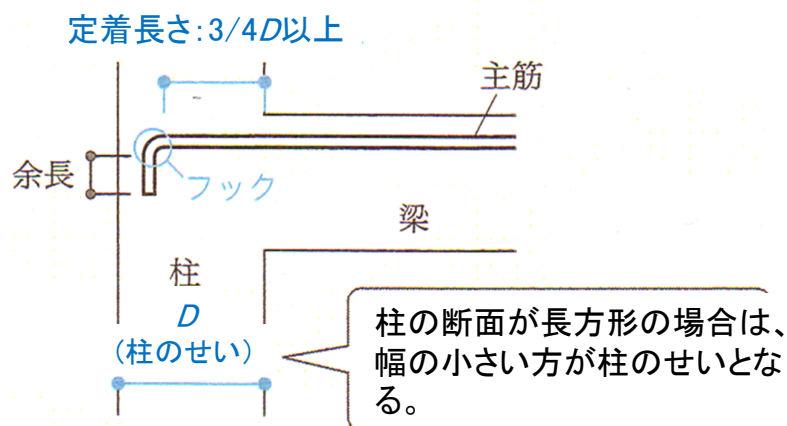
定着長さのはかり方

梁と柱への定着

梁の主筋を柱に定着させる場合の定着長さ(フック付の場合)

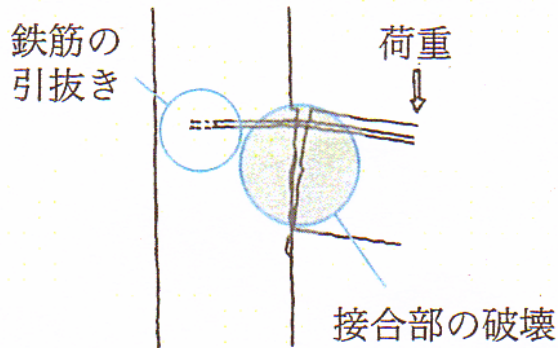
柱のせいの $3/4(0.75)$ 倍以上

* フックは定着長に含まない。

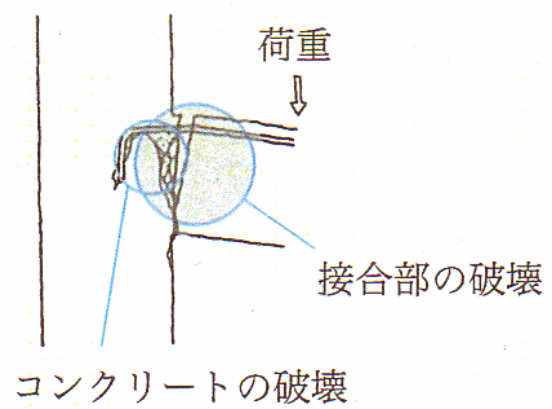


定着長さの不足・位置不良の問題点

- ・接合部の破壊、欠損
- ・コンクリートの破壊 など



定着長さの不足



位置不良の場合