

## MEASURES TO ENSURE THE SEISMIC RESISTANCE OF ADOBE AND MUD BRICK HOUSES AND BUILDINGS

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**Abstract:** The cheapest building material for the population of Central Asian countries is clay. A very large part of the population uses mainly raw brick and adobe in the construction of individual houses and structures, and this is certainly a moisture-resistant, seismically weak building material. However, it is possible to increase the seismic resistance of buildings and structures built of adobe and raw brick. To do this, we need to study the rules for the proper use of soil materials and widely promote them among the population.

**Keywords:** soil materials, seismic belt, clay materials, mortar

Measures to ensure the seismic resistance of adobe and mud brick houses and buildings

To prepare the clay mixture for the Pakhsa wall, it is recommended to use straw cut into pieces 8-10 cm long during the preparation of the foundation materials. This will increase the strength of the wall and reduce the appearance and expansion of cracks that occur as a result of the process caused by excess moisture present in the foundation materials.

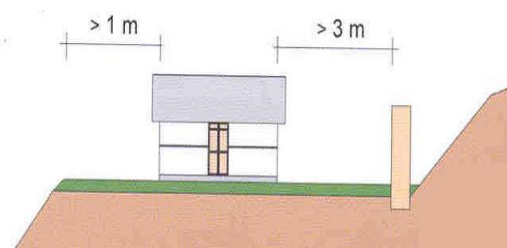
In order to meet the requirements for ensuring strength and plasticity when preparing a mixture for a retaining wall, the following simple tests can be used to check the quality of the soil materials:

- A 2 cm diameter clay ball dried for 48 hours should not break when pressed with fingers. If it breaks, it means that the clay content in the mixture is low.
- After 48 hours of drying, the raw brick should not have large visible cracks;
- To check the quality of the mixture, it is placed between two bricks and after 48 hours the bricks are removed and the condition of the mixture is checked. If there are large visible cracks in the brick or mixture, it is necessary to increase the amount of sand in the clay-mixture mixture and repeat the test.

Requirements for land area allocated for construction

Requirements for the construction site of buildings made of raw brick and flat walls made of soil material:

- the building must be located on a flat area at least 1 m from the edge of the slope below it and away from slopes, slopes and hills;
- a building made of soil materials cannot be built against a slope where the pressure of the soil above can destroy it;
- a building made of soil materials cannot be built on a steep slope where there is a risk of collapse during a landslide;
- a building made of soil materials cannot be built near steep slopes where there is a risk of rockfall and flash floods.



### General requirements for buildings and their structures

The soil materials on which buildings with adobe walls and raw bricks are built are considered to be low-strength materials. The disadvantage of houses built of raw bricks and adobe walls is that they have weak seismic resistance and quickly lose their strength under the influence of moisture. When increasing their seismic resistance, the following should be paid attention to:

- limited dimensions of window openings and distances from them to the corners of the building;
- strong connection of walls with the foundation;
- light roof, longer part protruding from the wall (sves);
- horizontal seismic belt and trusses;
- construction material and quality of construction.

### Requirements for the building plan

In areas with a seismic hazard of 8 points and above, the construction of buildings with raw brick and flat walls is allowed if their walls are reinforced with solid reinforced concrete cores, anti-seismic measures and concrete foundations are available.

In cases where the building plan has a more complex shape (G-shaped, P-shaped, T-shaped, etc.), and the building length exceeds the specified level, anti-seismic joints should be installed and the buildings should be divided into rectangular sections according to the plan.

In accordance with the requirements of the Construction Norms and Rules, in areas with a seismic hazard of 7 points, buildings with concrete foundations, reinforced with solid reinforced concrete cores and built according to anti-seismic measures, the distance between transverse walls should not exceed 6 m, and the distance between load-bearing walls should not exceed 9 m.

In seismic hazard areas with a seismic hazard of 8 points, buildings with concrete foundations, reinforced with solid reinforced concrete cores and built in accordance with anti-seismic standards, the distance between transverse walls should not exceed 5 m, and the distance between load-bearing walls should not exceed 7 m.

In seismic hazard areas with a seismic hazard of 9 points, buildings with concrete foundations, reinforced with solid reinforced concrete cores and built in accordance with anti-seismic standards, the distance between transverse walls should not exceed 4 m, and the distance between load-bearing walls should not exceed 5 m.

The location of doors and windows on each side of the building should not exceed 1/3 of the length of the wall. Door and window openings should not be more than 1.5 m wide, their spacing should not be less than 1.0 m, and the outermost window and door openings should be located at least 1.2 m from the corner of the building. It is desirable that the number and size of doors and windows on opposite external walls of the building be the same, and their locations should be the same.

### Requirements for building floors, structures and their connection to walls

Special requirements are imposed on the foundations of buildings built of clay materials and their connection with walls. The base under the foundation must be flat, strong and have low humidity.

A foundation made of monolithic concrete is considered the best.

The foundation should be deepened to at least 40 cm from the ground surface, and the walls can be raised to a height of 30-50 cm above the ground so that they do not get wet from the effects of atmospheric precipitation.

Waterproofing is created from a layer of cement-sand mixture with a ratio of 1:1 or 1:2 and a thickness of more than 30 mm.

It is necessary to build a ramp not less than 1.2 m wide and with a slope directed outward from the wall, and to dig drainage ditches.

#### Wall structures and their seismic strengthening

In accordance with the requirements of clause 3.7.2 of the Construction Standards and Rules, it is necessary to take the same materials and wall structures on one floor. In two-story buildings, the weight and thickness of the upper floor should not exceed the weight of the walls of the lower floor.

The width of the walls between the windows should not be less than 1.0 m, and the spacing of windows and doors should not be more than 1.5 m.

One of the most important and necessary measures to be taken in houses with raw brick and drywall is a seismic belt. The seismic belt should be installed along the perimeter of all walls of the building and connected with vertical elements to the beams above the windows and doors. It would be advisable to install a seismic belt at the level of the lower part of the window.

The seismic belt can be made of wood or solid reinforced concrete.

The wooden seismic belt is made of two beams with a cross section of 10x10 cm and a wooden beam installed at the edges of the wall and connected to each other by rectangular beams with a pitch of no more than 500 mm, forming a strong triangular grid. The thickness of the boards and beams used should not be less than 5 cm. Mortars are installed at the corners to ensure the strength of the seismic belts.

#### Requirements for the use of buildings

To ensure the normal operation, strength and earthquake resistance of buildings built of soil materials, the following measures should be taken to protect the walls of the building from groundwater and atmospheric precipitation moisture:

The parts of the roof protruding from the wall should not be less than 50 cm;

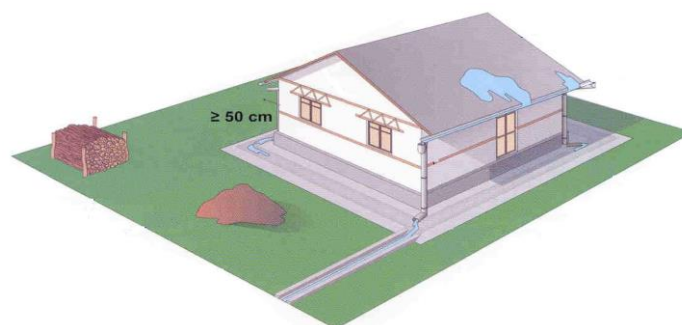
Every six months (autumn and spring), the roof should be inspected, the water collection and drainage devices should be cleaned of debris, and damaged and water-permeable areas should be repaired;

It is necessary to regularly inspect the beams and rafters of the roofing and replace them if necessary;

To protect the walls from moisture, it is necessary to periodically repair the stucco and whitewash it with lime;

It is necessary to build a moat around the perimeter of the building, create an organized system of water collection gutters, devices and pipes to drain roof water, and take measures to remove atmospheric precipitation moisture from the building. At the beginning of the autumn season and after the spring season, these elements should be inspected, cleaned and damaged parts repaired;

Wood piles, bushes and other objects that retain moisture should not be placed near the building.



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