



## *GENERAL BUILDING ENGINEERING*

# *METHODS OF REPAIRING THE BRICK WALLS*



Erasmus+

# ***CAUSES OF DAMAGE***

Damage to the walls may be due to design faults or resulting from poor finishing. The most frequent causes of masonry damage, however, include the improper operation of the facility, in particular the lack of maintenance, especially in relation to the rainwater drainage system and the lack of waterproofing insulation. [1]

# ***CAUSES OF CRACKS***

- loads - generally static, less dynamic
- physicochemical conditions and interactions, in particular moisture, getting into the internal structure, which in turn causes a reduction in the strength of the masonry element, its deformation or damage
- shocks caused by the use of motor vehicles [1]

# EXAMPLES OF DAMAGES



Vertical scratches in the wall. [3]



Cracking of the wall surface. [4]

# EXAMPLES OF DAMAGES



Cracks when connecting the wall with the ceiling. [4]



Open-cast of the plaster near the lynx - bad binding of wall elements. [4]

# ***METHODS OF REPAIRS***

Before accepting the repair method, it is first necessary to determine the causes and nature of damage and technical condition of the structure. In order to determine the manner and scope of the repair, the following shall be taken into account:

- nature and extent of surface damage of the wall, the condition of the mortar combining elements and stabilization of individual elements in the masonry
- type of scratches (movable or permanent), layout and aperture of cracks, number and location of scratches in the aspect of static work of a structural element, i.e. their degree of influence on the behavior of the building's structure
- a tendency to draw into or deepen the process of crack propagation, conditioning the adoption of the appropriate strategy for masonry repair [1]



# ***METHODS OF REPAIRS***

Repair of cracked masonry structures can be done in the following ways:

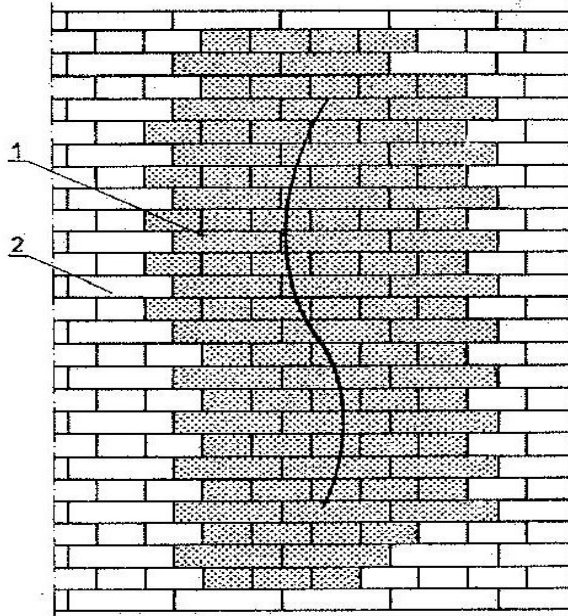
- eliminating the main causes of scratches, such as uneven substrate deformation, thermal movements, overloading etc. changing the spatial rigidity of the building by using wreaths, corsets or dilatation
- replaying the original technical condition of the structure, eg: rebuilding, injection of scratches interfering with the static scheme of construction work, resulting in a more beneficial transfer of forces to individual elements [1]

# ***METHODS OF REPAIRS***

- Small cracks, up to 4 mm wide, especially when they pass along the joints, and the bricks are whole, are filled with cement or cement lime mortar after thorough cleaning and washing with water. With thinner and deeper features, apply injections of mortar or cement milk under pressure.
- Wider cracks are filled with new durable bricks. For this purpose, the wall on both sides of the crack should be dismantled to a width not less than one brick and a depth of not less than half a brick, leaving shreds at least in every fourth layer. Transverse jags are also recommended, in which some of the bricks fall deeper into the wall than the others. For this type of work, use cement mortar. If the building wall has a thickness of 1.5 bricks, you need to re-plan it to the depth of half a brick on one side of the wall and then on the other (do not undress). We use the same principles for walls thicker than 1.5 bricks. [6]

# WALL REBUILDING

The disadvantage of this corrective method: it does not eliminate the cause of the rupture but only removes the crack itself. There is a high probability that the problem will return in the form of two parallel cracks at the junction of new and old bricks. [1]



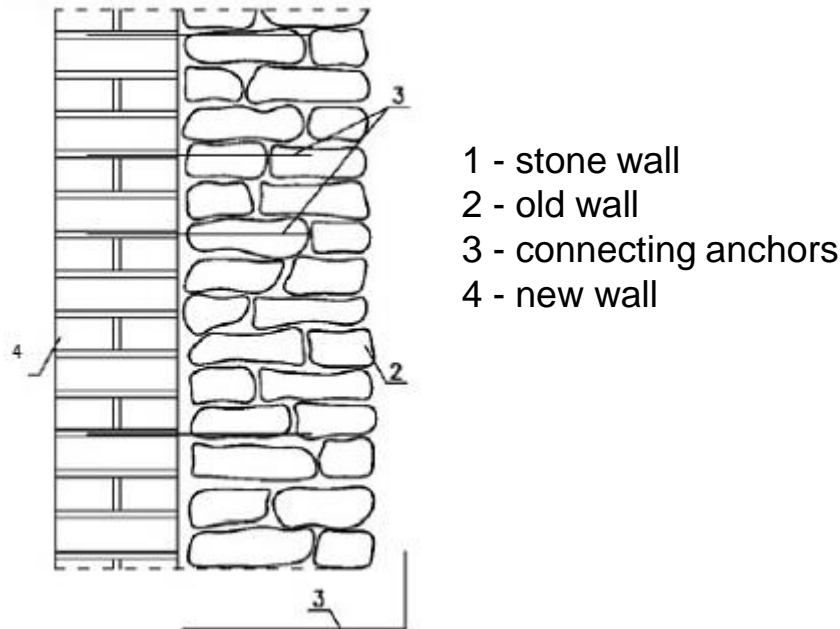
Rebuilding a wall





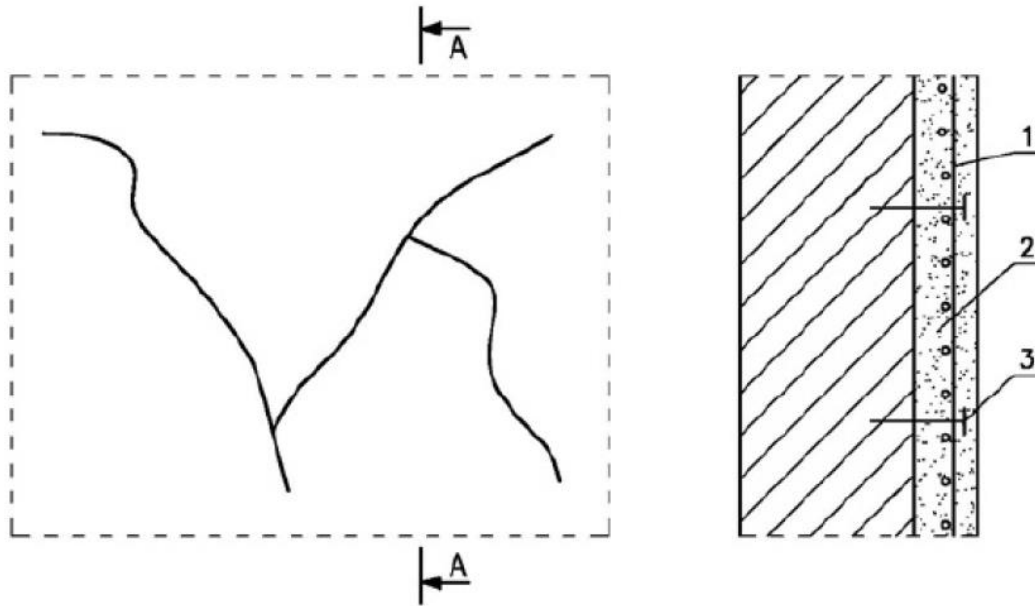
# REPAIR THROUGH THE BRICKWORK

In the case of destruction of the wall material structure in its external layers or reduction of its capacity due to degradation in the material binding small wall elements, its reinforcement is made by one-sided or double-sided brickwork on cement mortar. For example, by reinforcing a wall made of stone using a one-sided brickwork with a layer of one brick thickness, plaster is removed from the reinforced surface, and the joint is 2-3 cm deep. After thoroughly cleaning the surface of the wall and the joints from the remains of plaster and mortar, it is thoroughly washed with water and sprayed with cement milk. To ensure that the new wall is tied with the old one, use steel connecting rods. [6]



# REINFORCED PLASTERS

Strengthening the walls with layers of reinforced plaster consists in creating a reinforced-concrete structure, in which a new, several-centimeter layer of concrete or mortar reinforced with steel reinforced with dispersed synthetic fibers is added to the repaired part of the wall. This method is mainly used for reinforcing walls with scattered, irregular features. Strengthening the walls with reinforced layers can be performed on one or both sides, on the whole surface or its fragments. [6]



1- reinforcement mesh 2 - plaster layers 3 - anchors

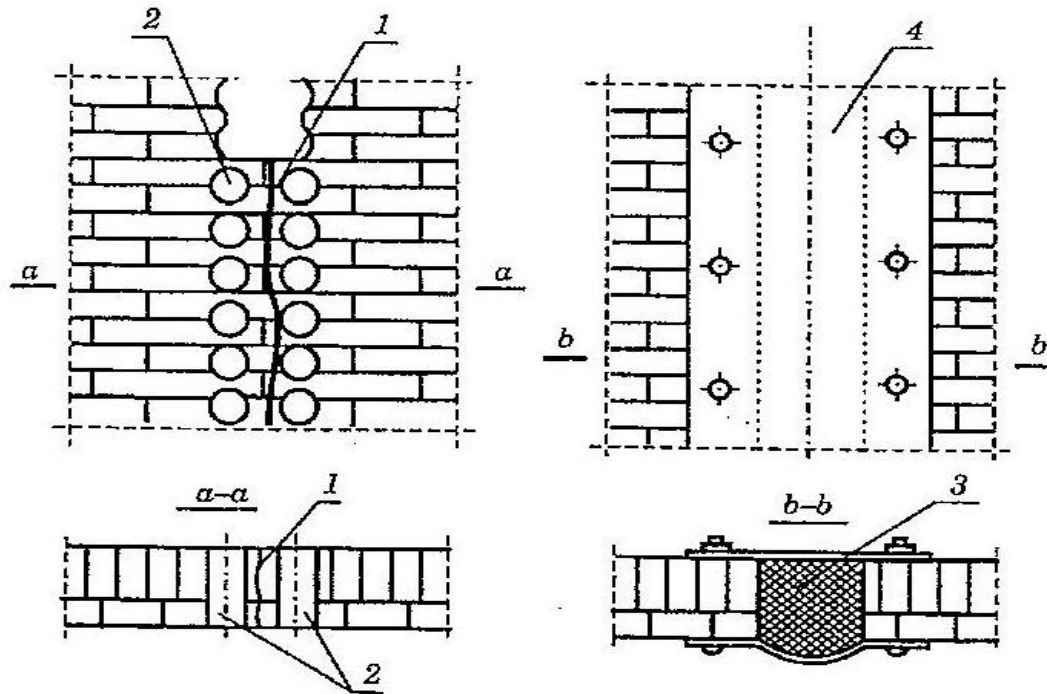
# ***DILATION OF THE BUILDING***

Dilatations are made in zones of accumulation of cracks, especially vertical ones, which somehow are places of natural self-building of the building, resulting from its adaptation to ground movements. This applies mainly to conditions in which the stabilization of ground movements is too expensive or impossible due to technical reasons, eg in mining areas or with large exhale forces. The dilatated building becomes a system of smaller fragments with higher stiffness, more resistant to uneven settlement of the ground. In addition, it is more resistant to thermal movements.

The easiest way to do dilatation is to remove the wall near the scratches on the whole wall height by drilling holes on both sides of the scratch.

The resulting gap is filled with insulating material and masks on both sides with sealing caps. Attaching the covers must allow for expansion joints. [1]

# DILATION OF THE BUILDING



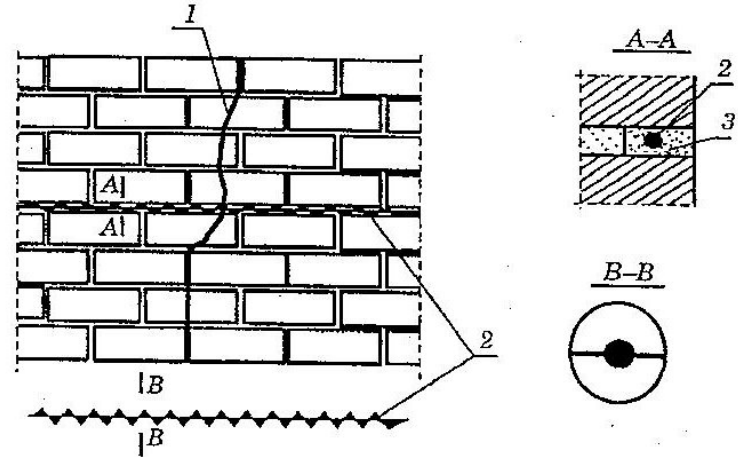
Making the expansion joint.

- 1 - scratch
- 2 - wells
- 3 - insulation
- 4 - sealing covers

# REINFORCEMENT OF THE WALLS

The methods of repairs and reinforcements of masonry structures, presented by Helfix, are based on the use of reinforcement with spiral-shaped rods made of stainless austenitic steel. Rods with diameters 6, 8 and 10 mm and length up to 7 m, used as longitudinal reinforcement of walls, are pressed with cement mortar filling previously cleaned welds creating wide supporting beams. The specific design of the rods ensures both high tensile strength and high deformability of the wall, allowing significant displacement of the structure without additional scratches. [1]

- 1 - scratch
- 2 - spiral rod
- 3 - cement mortar in place of the removed mortar



Strengthening the cracked wall with Helfix spiral-shaped rods. [1]



# REINFORCEMENT OF THE WALLS



Technology of repair performance through stitching scratches. (1 - cleaning the weld, 2 - location of the new mortar, 3 - pressing the rod into the mortar, 4 - making the joint) [9]

## ***OTHER WAYS TO REPAIR***

Repair of damaged single bricks. If only single bricks or blocks are destroyed in the wall, they should be replaced all over the repaired area, avoiding joining different materials (products) in the same wall. Damaged single bricks should be removed with a chisel (possibly after pre-drilling), so as not to disturb neighboring bricks. Then the remaining remnants of the mortar are removed and the space is thoroughly cleaned, preferably with compressed air.

Repairs of corrosion damage. As with other damages, first determine the cause of moisture in the wall, and after removing the cause - the scope and technique of repairing the wall. Damage to the wall, caused by carbonate precipitation, is eliminated by breaking up the corroded plaster and re-plastifying the surface with previously removed plaster. In the case of facing facades damaged elements are replaced with new ones. [1]

# ***PROTECTION OF HISTORIC WALLS - RENOVATION PLASTERS***



Destruction of the brick wall due to the use of cement-based plaster. [2]

For the restoration of historic buildings it is recommended to use renovation plasters that are characterized by low strength, high porosity and steam permeability. As a binder lime and natural or artificial pozzolana are used.

Use in the renovation of historic masonry with high horizontal salinity and humidity, modern cement and cement-lime plasters is unacceptable. [2]

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