



WORK GUIDELINE No. 5

Damages repair on concrete surfaces

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1 Purpose and scope

The present guideline defines material types and methods for damages repair on concrete surfaces based on their extent and depth.

With regard to the type and extent of established damages on individual reinforced concrete structural members and to the foreseen method of surface preparation and execution of the final concrete surface protection, the following re-profiling types can be chosen in relation with damage depth and, consequently, the required lining thickness:

- a) Thin-layer surface levelling up to 3 mm thickness on inner beams where no damages due to corrosion can be noticed, but some local surface porosity is evident.
- b) Damages in areas of surface corrosion centres where the concrete will be removed up to a depth of 30 mm (this probably applies to larger areas).
- c) Damages to concrete deeper than 30 mm (this probably applies locally only).
- d) In areas of visible corrosion centres where the protective concrete cover above reinforcement is less than 10 mm thick a repair mortar shall be applied to a thickness of 20 - 25 mm to carry out a camber.

2 Reference documents

Technical Data Sheet MORTAR/1 for #108 MORTAR C (Coarse Aggregates up to 2.5 mm Ø) and for #108 MORTAR F (Fine Aggregates up to 1.5 Ø).

Technical Data Sheet MORTAR/3 for #108 Mortar F.F. (Very Fine Aggregates up to 0.6 mm Ø).

3 Preliminary conditions

Before repairing damages to concrete surfaces the following conditions shall be fulfilled:

- The personnel employed to apply the #108 MORTAR shall be trained in detail on the material preparation and properties, and shall be instructed in all requirements related to the #108 MORTAR application;
- During the application of repairing mortars the minimum ambient temperature shall be 5°C, the minimum and the maximum substrate temperature shall be between 5°C and 35°C.
- Mixing ratios of #108 MORTAR with fresh water, shall be in strict accordance with the manufacturer's instruction indicated in the Technical Data Sheets;
- Mixing shall be carried, for small quantities, by a drill with helical mixer and, for large quantities, by an appropriate mechanical mixer
- Products must be within the self-life and not damaged by frost;
- At the construction site, the product must be kept away from direct sun. The storing temperature shall be between 5 °C and 35°C. Only bags containing the same material may be piled up.

4 Handling and health protection measures

For any accidentally contamination of eyes flush with plenty of water and get medical treatment as soon as possible. The use of solvents to cleanse the skin shall be avoided.

5 Instructions for damages repair

5.1 Damages repair (re-profiling) with thickness up to 3.0 mm shall be performed with #108 MORTAR F.F. (Very Fine aggregate up to 0.6 mm Ø) ready to use thixotropic, fibres reinforced non-shrink, sulphate resisting mortar.

5.1.1 Surface preparation

Surface shall be free of loose particles, dust, grease, cement laitance and clean. Surface roughness shall be increased by water-jet or mechanical tools. Surface shall be properly wetted to achieve a capillary saturation.

5.1.2 Levelling mortar preparation and application with appropriate trowels.

#108 MORTAR F.F. shall be mixed and applied according to instructions contained in the Technical Data Sheet MORTAR/3.

The mortar shall be manually smothered immediately after application.

5.2 Damages repair with depth up to 30 mm shall be performed with #108 MORTAR F (Fine Aggregates up to 1.5 mm) ready to use, thixotropic, fibres reinforced, non-shrink, sulphate resisting mortar.

5.2.1 Information on #108 MORTAR F.

See Technical Data Sheet MORTAR/1.

5.2.2 Application of #108 MORTAR F by spray machine.

In areas, where concrete has been removed to a depth of 30 mm, the repair (re-profiling) shall be performed by spraying #108 MORTAR F with a machine type Turbosol.

The mortar shall be manually smothered immediately after application.

The following procedure shall apply:

- Checking the equipment, e.g. if the spray machine is operating properly.
- Surface shall be free of loose particles, dust, grease, cement laitance and clean. The surface shall be properly wetted to achieve a capillary saturation. Remove any water with air hose or rags before applying the mortar.

- If layer are thicker then 20-25 mm over large areas, a welded wire reinforcement shall be anchored to the concrete to be treated, leaving some space between the mesh and the surface.
- Spraying #108 MORTAR F with machine type Turbosol may only be executed by skilled manpower preliminarily trained on safety at work and on technological requirement;
- #108 MORTAR F shall be applied to a uniform thickness. If the specified thickness cannot be attained by one application, two layers are required. When applying the second layer, the first one shall be partly cured to prevent separation of mortar from substrate.
- Areas behind steel reinforcement shall be filled up and thoroughly compacted;
- Mortar shall be thoroughly smoothed with appropriate trowels. For this purpose the surface of the sprayed mortar may be slightly moistened to allow an easier smoothing. When the mortar is smoothed immediately after application, this shall be carried out very carefully to prevent separation of mortar from the substrate.

5.2.3 In small areas where spray application of #108 MORTAR F is not convenient the latter shall be applied manually with a trowel.

5.2.4 Curing of repaired surfaces

All surface covered with #108 MORTAR F exposed to air should be damp cured using wet canvas sheets (jute or PVC foil) soon after completion operation and for subsequent 48 hours especially in hot climate.

5.3 Damages repair with depth exceeding 30 mm shall be performed with #108 MORTAR C (coarse aggregate up to 2.5 mm) ready to use thixotropic, fibres reinforced, non-shrink, sulphate resisting mortar. (See 5.2).

In case of vertical damages deeper than 25-30 mm, the #108 MORTAR shall be applied in two or more layers.

The mortar shall be manually smothered immediately after application.

6 Sealing the joint between reinforced concrete slab and outer beams

To prevent the water to flow into the joint between the cantilever part of the reinforced concrete slab and the upper web of the outer beam the mentioned joints shall be sealed. The following procedure shall be carried through:

- Washing the surface by high-pressure water-jet;
- Removal of loose particles both in the joint and at the joint, by chisel;
- Moistening the joint surfaces;
- Press into the joint #108 MORTAR of adequate grain size;
- Finishing the joint.

7 Criteria for decision whether to repair minor local damages to beam webs

- 7.1 Local defects in beam webs such as surface porosity, hollows, crumbled spots, surface peeling-off of concrete, etc., which depth does not exceed 5 mm, and the diameter is less than 10 mm, need no repair.
- 7.2 When a substantial density of defects mentioned in 7.1 above occurs on a concrete surface, so that the defects are close one to another (continuous surface roughness), and their depth exceeds 3 mm, such areas shall be repaired with levelling mortar.

8 Assuring the quality of applied mortar

The quality of applied mortar shall be assured by the following measures:

- Mortars shall be prepared in full accordance with the manufacturer's instructions;
- Mortars shall be applied within the prescribed weather and temperature conditions;
- Mortars shall be properly cured;
- Mortar samples for the current quality control shall be regularly taken (in compliance with the regular current control frequency).