

## Project Profile - Civil Engineering & Infrastructure



### PROJECT

**Como-Brunate Funicular Railway,  
Italy**

### SUMMARY

Repair work to concrete support base  
of 1,084m long line

### PRODUCTS

**Monomix**

### CLIENT

Consorzio Mobilità Funicolare & Bus,  
Italy

### CONTRACTOR

Rivestimenti Speciali SRL, Italy

### BACKGROUND ►

The Como-Brunate funicular railway links the city of Como with the village of Brunate in Lombardy, Italy. In operation since 1894 and the only one of its kind in Europe, the service is used by both tourists and local residents and offers spectacular views over Lake Como and the Alps. The line is 1,084 metres long, of which the lower 130 metres are in a tunnel. The lower station is situated adjacent to Lake Como and it takes six minutes to reach the top to Brunate, a picturesque town situated 750 metres above sea level.

The line has a maximum gradient of 55% and the concrete support base has never undergone substantial maintenance work since it was first constructed over 120 years ago. Due to the vibration and passing movement of the carriages, the concrete had eroded over the years and needed remedial repair work with a cementitious material that would remain impermeable and resistant to attack from chemicals, weathering and atmospheric gases, whilst also reinstating the fire resistance.

### THE SOLUTION ►

Following consideration of various different repair materials, **Monomix** was selected as the ideal product to restore and waterproof the concrete. **Monomix** is a high strength, shrinkage compensated, Class R3 waterproof cementitious mortar which is easily applied up to thicknesses of 80mm in a single application without the need for any formwork, which can significantly reduce costs. For this project, the mortar was built up to around 60mm. The rapid curing nature of **Monomix** was essential, as the repair work was carried out at night time whilst the funicular railway was not in service.

**Monomix** is a single component product and only requires the addition of clean water on-site. Suitable for application to vertical, horizontal and overhead surfaces, it develops exceptional bond strength, excellent tensile and abrasion resistance, high diffusion resistance to acid gases and chloride ions and low permeability to water, even at 10 bar pressure. Its high compressive strength reaches 23.5MPa within just 24 hours, increasing to 42MPa within 28 days. Non-toxic when cured and with a waterborne composition, **Monomix** can be safely applied in enclosed conditions and public areas. It is CE marked in accordance with BS EN 1504, the pan European standard for concrete repair and is also backed by the British Board of Agrément (BBA). In addition, **Monomix** has a very good fire classification of Euroclass A2-s1, d0.



FM 41091  
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