



Milan (Italy)

M4 Metro Line

ADMIXTURES FOR CONCRETE, WATERPROOFING MEMBRANES AND PRODUCTS TO INSTALL CERAMIC TILES AND STONE MATERIALS FOR A NEW METRO LINE FOCUSED ON SUSTAINABILITY



58 years after inaugurating Milan's first underground railway line, six stations opened their doors this year on 26th November to passengers travelling on the city's new line, the fifth in chronological order. Once completed (at the end of 2024), the M4 Line, or Blue Line, will connect the old city centre to the eastern part of the city (the Forlanini district and Linate Airport) and to other districts to the west (Lorenteggio and San Cristoforo railway station).

The new line will carry a rapid, comfortable light-railway service with the latest safety features: in fact, the automatic, driverless trains are equipped with an intelligent traffic-control system to ensure passengers enjoy their journey in complete safety.

Once completed, the line will have a capacity of 24,000 passengers every hour in each direction, thanks also to the frequency of trains that, at peak times, will pass every 90 seconds. In mobility terms, the M4 will have quite an impact on the city: with this line coming into service, the underground rail network will have a total length of 118 km, making it the sixth longest infrastructure of its kind in Europe.

A sustainable project

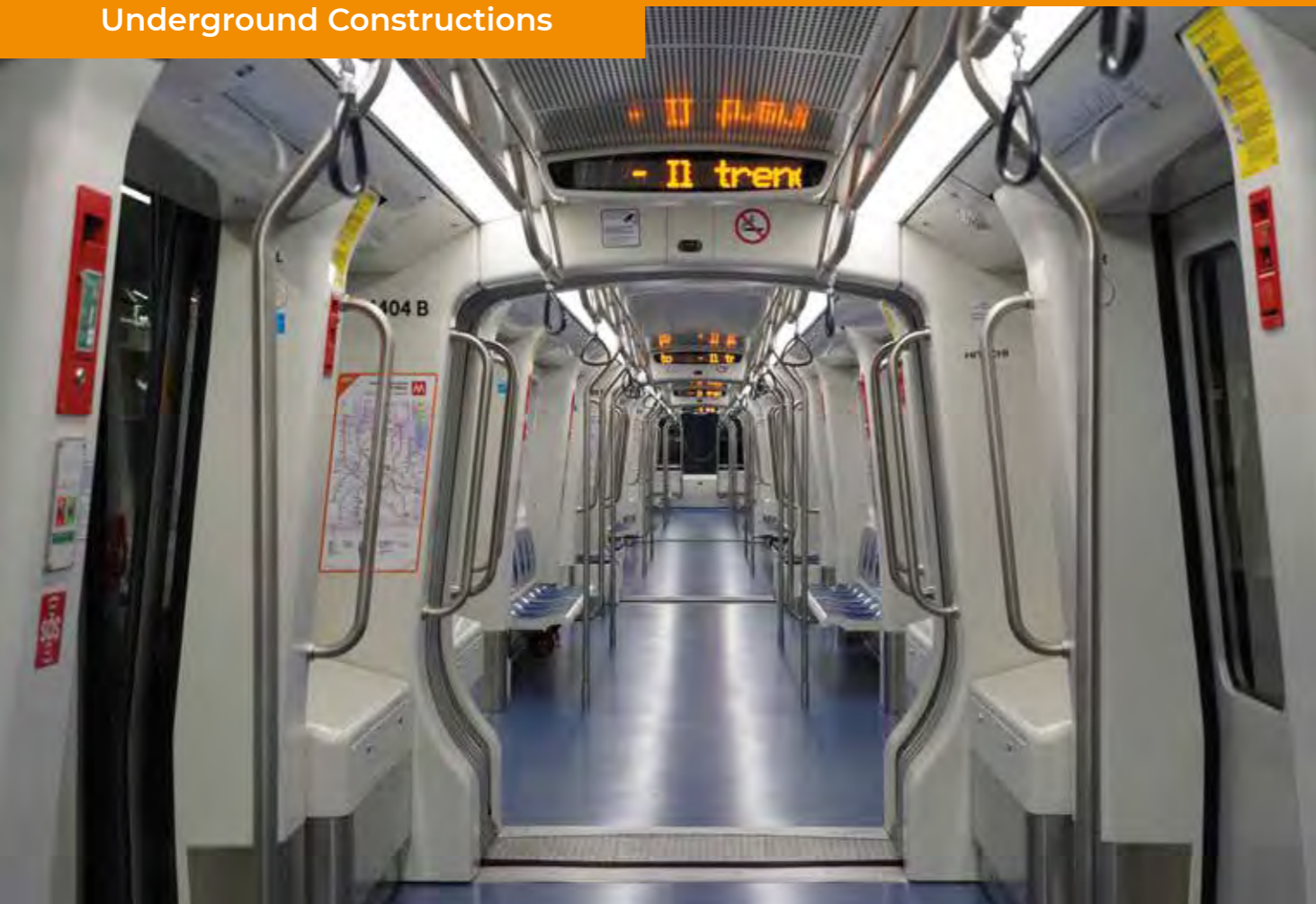
The underground rail line has zero emissions and will have a positive impact on road traffic by encouraging the use of public transport, with considerable benefits for both the environment and for those who live and work in Milan. In fact, the new M4 and M5 lines (the latter was opened between 2013 and 2015) will reduce the number of car journeys by around an estimated 30 million per year and carbon dioxide emissions by around 2%.

The M4 Line is being excavated underground along "blind" tunnels using TBM technology, apart from the "open air" excavation work for the stations, service systems and other structures. The construction phase is also heavily focused on environmental sustainability: non-polluting, non-toxic and non-hazardous products are being used to consolidate the soil and to ensure tunnelling operations advanced as scheduled.

Mapei's contribution: admixtures for concrete

Mapei started to supply concrete admixtures for the M4 in 2013 when preparation work got underway and retaining walls were built where the ground was being excavated for the construction of the stations.

Concrete admixed with DYNAMON XTEND W400R was



Figures for the M4 Metro

15 km
LENGTH OF THE LINE

21
NUMBER OF STATIONS

86 million
PASSENGERS PER YEAR
(EXPECTED FIGURE)

80 km/h
MAXIMUM SPEED

6.5 m
DIAMETER OF TUNNELS
EXCAVATED IN THE EXTERNAL
SECTIONS

9.15 m
DIAMETER OF TUNNELS
EXCAVATED IN
THE CENTRAL SECTION



ABOVE. The Mapei Group supplied concrete admixtures and waterproofing membranes for the M4 line.

IN THE FACING PAGE

The new M4 line will carry a rapid, comfortable light-railway service with the latest safety features and a capacity of 24,000 passengers every hour. In the previous pages: ceramic and stone floorings were installed in the stations with Mapei products.

used for this phase and made by Monvil Beton. In a following phase of the works, concrete was produced by Holcim, Colabeton and Betonrossi using the latest generation of Mapei admixtures, such as the acrylic super-plasticisers DYNAMON XTEND W300 N and DYNAMON XTEND W300 R. The same admixtures were also used in the construction of the support bases for the tracks. Mapei is also currently supplying products to repair and restore the roads and piazzas around the stations.

SILEX P9 EXPRESS high performance rapid-setting cementitious adhesive, while ULTRALITE S2 FLEX one-component, highly-deformable, lightweight cementitious adhesive with extended open time was used to install the thin porcelain tiles on the walls. The joints were grouted with ULTRACOLOR PLUS mortar and the expansion joints were sealed with MAPESIL LM and MAPESIL AC silicone sealants, used for ceramic and stone coverings respectively.

Waterproofing membranes

MAPEPLAN TU S, MAPEPLAN TT D, MAPEPLAN WATERSTOP and MAPEPLAN PROTECTION synthetic membranes were used to waterproof the foundations of numerous stations (San Cristoforo, Gelsomini, Segneri, Tolstoj, Washington Bolivar, De Amicis, Vetra, Santa Sofia and San Babila), along with POLYFOND KIT drainage system, MAPEPLAN INJECTION VALVE and IDROSTOP MULTI PVC-P re-injectable hoses. These products are all manufactured by Polyglass SpA, a subsidiary of the Mapei Group.

Protective finishes

The surfaces ventilation shafts located at the exits of the stations were protected with WALLGARD GRAFFITI BARRIER graffiti-resistant, reversible protective coating and painted with ELASTOCOLOR WATERPROOF easy-to-clean, waterproof acrylic paint.

Vaga's contribution

Vaga, a subsidiary of Mapei Group (see articles dedicated to this company in this issue of the magazine), supplied HR15 high strength, fire-resistant cementitious mortar and INTO+FIBRO fiber-reinforced rendering mortar.

Installing ceramic and stone floor and wall coverings

Before installing the stone and ceramic floorings in the stations, the screeds were repaired where required with EPOJET two-component epoxy resin. Waterproofing work was carried out using MAPELASTIC TURBO two-component cementitious mortar. The product chosen to install the diorite paving was ADE-



Find out more
MAPEPLAN TU S



Find out more
ULTRALITE S2 FLEX

TECHNICAL DATA

Metro M4 Line, Milan
Period of construction: 2013-ongoing
Period of the Mapei intervention: 2013-ongoing
Owner: MM SpA
Works direction: M4 SpA
Contractors: We Build Group, Astaldi, Hitachi Rail, Sirti
Waterproofing contractor: Tecnomanto srl
Ceramic installation

contractor: Ettore Bosisio srl
Concrete production: Holcim, Colabeton, Betonrossi, Monvil Beton
Mapei coordination: Luca Pretini, Andrea Siboni, Alessio Riso, Mapei SpA; Mapei UTT Technical Services

MAPEI PRODUCTS
Concrete admixtures: Dynamon XTEND W300 N, Dynamon XTEND W300 R, Dynamon XTEND W400 R

Waterproofing: Idrostop Multi, Mapelastic Turbo
Concrete repair: Epojet, Mapegrout Thixotropic, Mapefer 1K
Installing ceramic tiles: Adesilex P9 Express, Ultralite S2 Flex
Grouting tile joints: Ultracolor Plus
Sealing expansion joints: Mapesil LM, Mapesil AC
Wall coatings: Wallgard Graffiti Barrier, Elastocolor Waterproof

POLYGLASS PRODUCTS
Waterproofing products: Mapeplan Waterstop, Polyfond Kit, Mapeplan Protection, Mapeplan Injection Valve, Mapeplan TU S, Mapeplan TT D

VAGA PRODUCTS
HR15, Into+Fibro
For further info: mapei.com, utt.mapei.com, polyglass.com, vaga.it