

PROJECTS

**A RUNDOWN FACTORY
TRANSFORMED INTO A CAR-
PARK FOR THE MODERN
DOMINA SHOPPING CENTRE
IN THE CAPITAL OF LATVIA**



From old to new

Latvia's capital city of Riga may now be considered a reflection of the nation as it is today.

For centuries, Latvia has been the prey of Swedish, German and Russian domination. It finally became independent from the USSR in 1991, part of NATO in March, 2004, and of the European Union in May of the same year.

In Riga, a city on the Baltic coast which lies around the River Daugava, traces of the past and the aspirations for a more modern and more European future are both clearly visible.

The ancient city centre still boasts its centuries-old, German-style buildings, the outskirts are littered with huge, faceless grey buildings of the Soviet era, while the new city mostly dates back to the XIX century and is a mix of residential and commercial areas.

This is the most modern area of the city, tangible proof of how the standard of living of the Latvians has risen. Luxury foreign cars flash by, and this is where you will find the Stockmann department store, high-class hotels, coffee-shops and bars which stay open until the early hours of the morning and prestigious restaurants which offer both local and international cuisine.

Strong Beams for the Car-park

The opening of numerous new shopping centres is just a part of the ongoing reclaiming process in the city, to meet the modern demands of its population.

The Domina Shopping Centre is just one of these, and represents the largest showroom in all the Baltic States for purchasing goods.

It was built in 2003, by renovating and extending an old factory in what was the Riga industrial district.

The centre covers an area of 110,000 m² and includes shops, coffee-shops, service centres, offices, a hotel, a beauty salon, a fitness centre and a multi-storey car-park.

The car-park was created by converting an old, three-storey building.

The ground floor is used for storage purposes, while the other two floors, with each one covering a total of 5,000 m², is used to house the cars driven by visitors to the shopping centre. The second floor required strengthening of the main structure of the building, made up of a framework of 110 concrete beams, so that it would resist the flexural and shear stresses deriving from its new use.

In fact, the "double-T" beams are 12 m long and 111 cm high, and had nume-

rous cracks caused by excessive shear stresses, a clear sign of considerable structural fatigue.

The beams had to be repaired without modifying their original dimensions, while maintaining their original purpose and without interfering with the other building operations being carried out, and products from the MAPEI FRP SYSTEM proved to be the most suitable solution.

This innovative system uses composite materials such as fabrics, pultruded carbon fibre sheets and epoxy resins, which help to reduce operational problems and the time required to carry out repair work, strengthening and anti-seismic upgrading of concrete structures.

When the design phase was carried out, the structure was divided into four zones (A, B, C and D respectively), so that the strengthening work for each area could be designed according to the specific stresses calculated for each zone.

Flexural and Shear Strengthening

Flexural stresses were sufficiently contrasted by bonding CARBOPLATE* (E 170/100 and E 170/150 grade) pultruded carbon-fibre plates on the lower surfaces of the beams using ADESILEX

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Background: view of the beams to be strengthened.

Photo 1.
Close-up of beams with shear cracks.

Photo 2.
Application of Mapegrout BM to increase the thickness of the beam in correspondence with the support pads.



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Photo 3.
Close-up of the layer of Mapegrout BM applied on both faces of the beam.

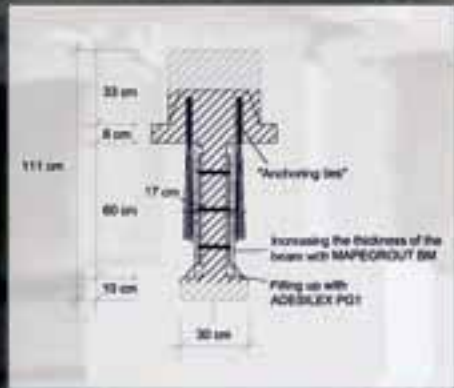
Photo 4.
Application of Carboplate on the inner side of the beam to increase flexural strength.



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PG2* thixotropic epoxy adhesive. To carry out the shear strengthening on the other hand, since some areas were subject to extremely high levels of tangential stress, the core section of the beams had to be increased using MAPEGROUT BM* two-component cementitious mortar with a low modulus of elasticity, after a previous application by brush of EPORIP* epoxy adhesive to promote bonding. After removing the loose material on the substrates by sand-blasting followed by removal of waste material with a vacuum cleaner, all the cracks

were well sealed using ADESILEX PG2* epoxy adhesive. They were then injected with EPOJET* epoxy resin in order to definitively occlude all the micro-cracks which had formed. Electro-welded mesh was then applied on the two vertical faces of the beams using steel connectors, followed by an increase in the sections of the beams using MAPEGROUT BM*, after applying EPORIP* to guarantee high bonding strength. The choice of MAPEGROUT BM* was dictated by assessing the mechanical

and environmental conditions (in this case climatic and dynamic variations) to which the structure would be subject once the strengthening work was completed.

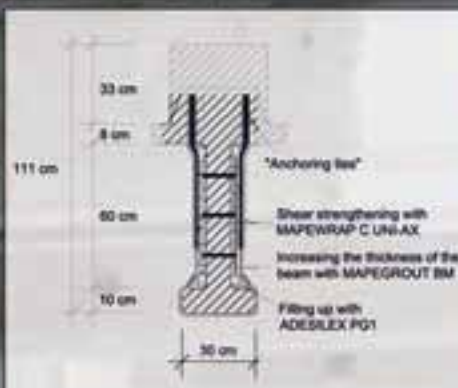
In fact, this product is particularly suitable for repairing the surface of degraded concrete structures (characterised by rather low mechanical strength), which are subject to small deformations under load, thermal cycles or which are exposed to particularly severe climatic conditions. Various layers of MAPEWRAP C UNI-AX* (600/40 and 300/40 grade) uni-



Photo 5.
Positioning anchoring ties made from portions of MapeWrap C UNI-AX 300/20.

Photo 6.
Shear strengthening by applying "rods" of MapeWrap C UNI-AX 300/40.

Photo 7.
Close-up of the shear strengthening.



directional carbon fibre fabric, in various sizes according to the level of shear stress, were applied using the typical MAPEWRAP cycle including an epoxy primer (MAPEWRAP PRIMER*), an epoxy levelling grout (in this case MAPEWRAP 12*) and an impregnation resin (in this case MAPEWRAP 31*). To increase the height of the strengthening and to improve, therefore, its efficiency, a connection system was employed by applying portions of MAPEWRAP C UNI-AX 300/20* fabric. They were rolled up and impregnated with epoxy resin to form a rod, and

then positioned on the upper end of the beams and sealed using MAPEWRAP 12* epoxy grout.

Guaranteed Parking

Thanks to the use of these innovative systems, the consolidation work of the beams was completed according to schedule, guaranteeing sufficient stress-resistance of the structure and, therefore, a building which is perfectly suitable for its new use. Now, visitors to the centre may park their cars with ease and dedicate their time to worry-free shopping.

***Mapei Products:** the products referred to in this article belong to the "Building Speciality Line" range. The technical data sheets are available on the "Mapei Global Infonet" CD/DVD and at the website www.mapei.com.

Adesilex PG2: thixotropic epoxy adhesive with extended workability.

Carboplate: pultruded carbon fibre plates pre-impregnated in epoxy resin and protected by a double plastic film.

Epojet: two-component superfluid epoxy resin for injection.

Eporip: two-component epoxy based adhesive for cold joints and monolithic sealing of cracks in screeds.

Mapegrout BM: two-component thixotropic cementitious mortar with low modulus of elasticity for the repair of concrete.

MapeWrap 12: slow setting, thixotropic epoxy pully for levelling concrete surfaces.

MapeWrap 31: medium viscosity epoxy resin for impregnation with MapeWrap "dry-system".

MapeWrap C UNI-AX: high-strength uni-directional continuous carbon fibre fabric with high modulus of elasticity.

MapeWrap Primer 1: epoxy primer specific for the MapeWrap system.

TECHNICAL DATA

Car-park, Domina Shopping Centre,
Riga, Latvia

Work: static strengthening of the concrete beams

Year: 2003

Customer: P.K. Investment

Project: MSC Associati S.r.l., Como (Italy)

Work Management: MSC Associati S.r.l.

Contractor: RS Levati

Mapei Distributor: Velve M.S. Technologies, Riga

Mapei Co-ordinator: Giulio Morandini, Mapei S.p.A