INTERNATIONAL

Realtà MAPEI

ISSUE 72

EVERYTHING'S OK WITH MAPEI

Year XIX - No. 72 - December 2018

72

ADRIANA SPAZZOLI.
Realtà Mapei International's
Editor-in-Chief

The paths to constructing progress

Seas have always provided opportunities for learning new things; rivers and canals transport goods and people slowly but safely; tunnels shorten distances by cutting through mountains and beneath cities; new excavation technology has allowed the construction of motorways and railways to move goods and people around more easily; dams can salvage land that would otherwise lie arid by drawing on natural resources and also protect territories; viaducts and bridges join together nations and people spreading the kind of cultural interaction that has been familiar since ancient times. That is why we decided to provide an international overview of lots of major works, neatly defined as infrastructures, in this year's final issue, almost as it to reassure everybody that new technology and high-performance products can, indeed, be designed and manufactured safely.

MAPEI'S CORNERSTONES: HARD WORK, PROFESSIONALISM, COMPETITIVENESS, SUSTAINABILITY

We also decided to focus on a real landmark for Italy: the Redipuglia War Memorial that Mapei si currently helping to restore 100 years after the end of the Great War.

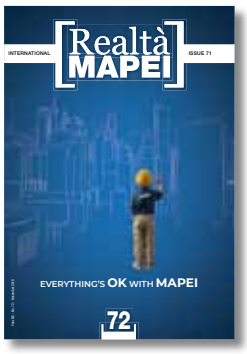
And to draw this year to a close, Giorgio Squinzi's encouraging message to all those operators with faith in Mapei and its experts involved in everything from research and manufacturing to on-site support. Hard work, professionalism, passion, competitiveness, transparency and respect for product sustainability and corporate behaviour. There is a lot more to read about in the following pages, covering everything from social responsibility to sport.

I would also like to take this opportunity to wish everybody a happy festive season and wonderful start to the New Year, in the firm belief that you will keep on supporting us with your ideas and suggestions.

Enjoy your reading,

SUMMARY

MAPEI
FOLLOW US
/mapeispa



COVER STORY
The city of the future and projects for the present day. Mapei products and technical assistance can make both big and little dreams come true.
Photo courtesy of Mapei Suisse.

EDITOR IN CHIEF
Adriana Spazzoli

EDITORIAL SUPERVISOR
Guido Palmieri

EDITORIAL CONTRIBUTORS AND ENGLISH TRANSLATION
Martyn Anderson, Nicholas John Bartram, Federica Pozzi, Tiziano Tiziani, Federica Tomasi, Alessandro Brambilla

PRODUCTION AND EDITORIAL COORDINATION
Metella Iaconello

PHOTOGRAPHIC RESEARCH
Davide Acampora

SOCIAL MEDIA
Francesca Molteni

GRAPHIC DESIGNER
Barbara Mennuni

PRINTED BY
Rotolito SpA - Pioltello (Italy)

PUBLISHED BY
Mapei SpA
Via Cafiero, 22 - 20158 Milan (Italy)
Tel. +39/02/376731
Fax +39/02/37673214
website = www.mapei.com
E-mail = realtamapei@mapei.it

PRESIDENT & CEO
Giorgio Squinzi

OPERATIONAL MARKETING DIRECTOR
Adriana Spazzoli

REALTÀ MAPEI
Registered by the Tribunal of Milan n. 363/20.5.1991

Realtà Mapei International is published 6 times per year

CREDITS
Sassuolo Calcio, Master Group Sport, Mapei China Ltd, Mapei Nederland B.V., Mapei de México, Mapei India, Fili & Forme, Mapei France, Fondazione Sodalitas.

Sent off to be printed on the 10th of December

"Responsible Care" is the world chemical industry's voluntary program based on implementing principles and lines of action concerning staff health and environmental protection.

MIX
Paper from responsible sources
FSC® C005461
FSC www.fsc.org

Giorgio Squinzi
CEO of the Mapei Group

Investing to keep on growing

GIORGIO SQUINZI: MAPEI PLANS TO BECOME INCREASINGLY COMPETITIVE ON INTERNATIONAL MARKETS

IN 2018 WE ARE SETTING A NEW RECORD FOR INVESTMENT IN PRODUCTION AS WE SET ABOUT PAVING OUR COMPANY'S WAY INTO THE FUTURE

The Mapei Group's income reached 2.4 billion Euros in 2017. Is the goal now 3 billion Euros?
Turnover of 3 billion Euros? It will take a few more years, but I have reason to believe we will get there. I am simply basing my assumptions on the facts and figures.

What can we say about the markets in their entirety in 2018?
2018 has been a particularly complicated year due to some negative factors affecting the overall trend in the global economy. More specifically, increases in the cost of raw materials and the financial instability that affected certain extremely important markets like, for example, Turkey and Argentina. This has been further proof of how financial workings can have even heavy consequences on the real economy.

So, what have been the effects of the international economic situation on Mapei's results?
The combination of these two negative factors has had its impact on Mapei's results: indeed, income has risen by over 5% compared to 2017, if exchange rates had remained stable the increase would have been greater than 8%. So, we had to deal with negative currency exchange effects throughout this year. The internationalisation process, one of the strong points of Mapei's strategy, has, however, allowed us to mitigate the effects of negative factors emerging globally. Our drive towards internationalisation has continued even more this year through new acquisitions that have reinforced our presence globally. Ever since we opened our first foreign plant in Canada in 1978, we have never stopped. And this will continue to be our strategy.

What is Mapei's secret?
We operate on a global market through a widespread network of business companies and manufacturing plants. A network we have built up over time, so that we can supply our products everywhere. What is our secret? I would say it is the fact that we operate in close proximity to consumers of Mapei materials and products.

Nevertheless, the Italian building industry is still struggling to really take off.
The Italian market is still going through a tricky period. The economic situation is being complicated even further by political uncertainty and a lack of guidelines and decision-making in decisive sectors. This is the case, for example, of major works and infrastructures, which are a real driver behind the nation's overall growth, which incidentally has slowed down even further over the last few months. The biggest cause for concern in Italy is the fact that the government is not paying suppliers, causing financial imbalances that are likely to impact on even big companies.

The figures of the Mapei Group

2,5 BILLION EUROS: ESTIMATED CONSOLIDATED TURNOVER IN 2018

31 MAIN RESEARCH CENTRES IN 21 COUNTRIES

50,000 TONS OF CO_2 OFFSET

1,000 NEW FORMULATES EVERY YEAR OF THE MAPEI GROUP

10,000 EMPLOYEES, WITH 12% WORKING IN R&D

66,000 CLIENTS AROUND THE WORLD

87 COMPANIES, INCLUDING THE PARENT COMPANY, IN 56 DIFFERENT COUNTRIES

25,000 TONS OF PRODUCTS SHIPPED EVERY DAY

161,000 PROFESSIONALS FROM THE SECTOR INVOLVED IN MAPEI TRAINING COURSES

3,000,000 FEWER TONS OF CO_2 THANKS TO MAPEI CEMENT ADDITIVES

5,000 PRODUCTS FOR BUILDING OF THE MAPEI GROUP

81 PLANTS IN 5 CONTINENTS, IN 35 DIFFERENT COUNTRIES

Mapei is a global company and internationalisation continues to be its trump card.

As I have always said, it is our winning strategy because it has safeguarded us against those problems inevitably arising on individual markets or against the potential negative effects of more international phenomena. We have spoken about the volatility of exchange mechanisms, but trade wars and the issue of tariffs, which have been very much to the fore over the last year, are not a serious cause for concern for us because Mapei is a global company. Our business operations are located in the countries where we sell, and this provides greater protection and a competitive edge. Even the possibility of North American tariffs does not scare us. Our sales in America are almost 1 billion US dollars, but it is all generated locally.

Which are the most promising markets for Mapei?

At the moment, North America is a rapidly expanding market, but we are achieving positive results everywhere; in Western Europe (from Greece to Scandinavia) in the East and right throughout Asia.

Mapei broke its record in terms of investment in 2017: over 110 million Euros. Has it risen even further in 2018?

In future we will continue to adapt to what will undoubtedly be a tricky global economic situation by focusing on internationalisation and our ability to innovate and improve the sustainability of our products. These are the necessary conditions for reinforcing the positive trend in growth that Mapei will continue to pursue in order to become increasingly competitive on international markets.

By the end of 2018, we will have beaten our 2017 record for investment in new products and manufacturing operations to strengthen our production lines worldwide and, most notably, in North America. Investments in 2018 amount to around 120-125 million Euros. This strategy will allow our company to look to the future.

These operations are progressing hand-in-hand with an increase in staff: our total number of staff this year is over 10,000. This increase follows the 880 new members of staff employed in 2017 that took the overall figure to 9516 back then.

Acquisitions have continued to be made this year.

We have been focusing on an acquisitions process aimed at very specific business realms. This explains our acquisition of the Italy-based company Fili & Forme, which will allow us to extend our range of products, and the Spanish company Tecnopol, which has made us one of the leading players on the chemicals for the building industry market in Spain as regards waterproofing products.

Over the last few weeks Mapei has published its 2017 Sustainability Report. What is new?

The Report does not just refer to Mapei SpA, but also the Group's Italian subsidiaries: the decision to include these businesses in the report is the most significant novelty. Proof that our subsidiaries share the parent

company's belief in honest and transparent communication with stakeholders, making sustainability one of the key factors in their business operations. The focus on sustainability stands alongside such concepts as internationalisation, Research & Development and specialisation, our traditional bearing columns.

SUSTAINABILITY at the focus of Mapei's strategy

THE 2017 SUSTAINABILITY REPORT HAS NOW BEEN PUBLISHED

As Adriana Spazzoli recently pointed out, the Mapei Group's Operational Marketing and Communication Director and President of the Sodalitas Foundation (the first association to promote business sustainability in Italy): "As regards sustainability and other corporate issues, if you do not let people know about your achievements, it is as if you had never achieved them".

In accordance with this line of thinking, Mapei has always placed sustainability at the focus of its own manufacturing and business system. So, this year it has decided to carry on along the important path it first trod in 2017 by reporting on its sustainability in a truthful and transparent manner and informing people about the Group, its corporate values, and its performance on an environmental, social and economic level.

Providing the opportunity to fully comprehend what Mapei is all about based on the projects it has undertaken and the results it has achieved in the realm of sustainability, this document - drawn up in accordance with the GRI's (Global Reporting Initiative) Sustainability Reporting Standards - spotlights the most important aspects of 2017 and the distinctive traits and operations of the Group's Italian subsidiaries (CerCol SpA, Adesital SpA, Mosaico+ Srl, Polyglass SpA, Vaga Srl, Vinavil SpA).

The latter's involvement in the realm of reporting is the most important novelty in this Report: businesses that share the parent company's belief that stakeholders should be kept informed in an honest and transparent manner and that sustainability should be a key factor in a company's business operations.

A clear and logical operating policy, bearing in mind that the Mapei Group's international operations are centred in Milan, where the parent company's headquarters are located. This is where Mapei S.p.A. coordinates, supports and guides its manufacturing plants, commercial and services companies and Research & Development centres located all over the world. Altogether the six Italian companies and Mapei S.p.A. employed a total of 2,111 staff on 31st December 2017, mainly working for the parent company (67% of all Italian staff).

HOW THE REPORT IS STRUCTURED

To guarantee continuity, this new document is structured in the same way as the old report, featuring four chapters devoted to the key ingredients of any winning Mapei recipe: Research and Development, an efficient manufacturing system, investment in its own staff and a focus on the community.

The content of the report clearly shows that, as far as Mapei is concerned, working closely with its customers and staff and, more generally speaking, the community means constantly investing in the design of high-quality, long-lasting products that are as sustainable as possible.

For this reason, for many years now, time and resources have been allocated for studying and developing innovative systems and products aimed at minimising environmental impact during every stage in their life cycle, safeguarding people's health (first and foremost, end users and applicators) and ensuring the buildings in which these products are used are as safe comfortable as possible.

When addressing the stakeholders in his letter of presentation, Giorgio Squinzi introduced the Sustainability Report by pointing out that "for Mapei being sustainable also means investing in and promoting talent, being proactive and developing the kind of team spirit characterising the approximately 9500 staff working for the Group, as well as placing its professional know-how at the community's service driven on by a powerful sense of social responsibility. As the Mapei Group, we love to take the field and get actively involved in the life of the surrounding community by sponsoring sports, cultural and solidarity projects and events".

The 2017 analysis includes such new aspects as:

- **Focusing on the customer**, which combines such previous factors as "Customer satisfaction" and "Customer assistance and training and service efficiency", crucial issues for Mapei, which has always placed customers and their interests at the focus of its business strategy.

SUSTAINABILITY FIGURES

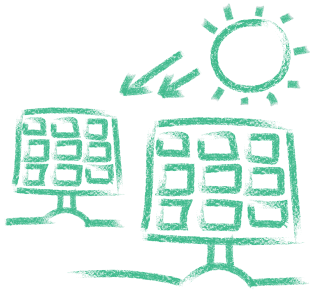
All the figures refer to the realms of Mapei SpA in Italy*

ABOUT
34
MILLION EUROS SPENT ON R&D IN 2017

2,111
STAFF IN 2017 (+11% COMPARED TO 31/12/2014)

APPROXIMATELY **32** MILLION EUROS SPENT ON SPORTS, CULTURAL AND SOCIAL PROJECTS

95
NEW PRODUCTS LAUNCHED ON THE MARKET IN 2017



2,577
TONS OF CO_2 AVOIDED IN 2017 (DUE TO SELF-GENERATION OF ENERGY FROM PHOTOVOLTAIC PLANTS AND HIGH-PERFORMANCE COGENERATION)

- Product quality and safety, which combines "Product quality and compliance" with "Consumer health and safety" to form one single factor. Indeed, a quality product must necessarily be a safe product for its user.
- Product sustainability and the LCA (Life Cycle Assessment) viewpoint, which brings together "Product impact and LCA" and "Sustainability of raw materials/recycling and re-usage", strictly correlated factors that are vital in creating sustainable products.
- Bio-diversity, a new issue introduced to take into account the multifarious and limited impact that the Group's manufacturing operations can have (both in terms of chemical plants and quarries) on the natural surrounding environment.

COMMITTED ON SEVERAL FRONTS

As President of Sodalitas, Adriana Spazzoli notes that "over the last few years, the standard of sustainability reports has risen, a key tool, which, however, is mainly designed for official stakeholders. The challenge now is to develop effective and reliable means of communication to inform a much wider range of people about the tangible efforts businesses are making".
Mapei has been working along these lines for some time now. The company has also a Code of Ethics, which also applies to all its subsidiaries, setting down all the ethical principles governing the Mapei Group's business operations, as well as the obligations and responsibilities of its administrators, managers and other staff.
As part of the company's commitment to sustainable behaviour, it publishes an annual Environmental Declaration in compliance with EU Regulations and EMAS (Environmental Management and Audit Scheme) for its manufacturing site in Robbiano di Mediglia (near Milan), which aims to provide a concrete and transparent overview of the results attained in the field ofenvironmental safety.
For many years now Mapei has adhered to Federchimica's (the Italian Federation of the chemical industry) international Responsible Care program to promote the sustainable development of the global chemicals industry in accordance with values and behaviour focused around safety, health and the environment.
The 2017 Sustainability Report will soon be available at www.mapei.it

* The figures exclude Sassuolo Calcio S.r.l., Mapei Stadium S.r.l. and Mosaico+ S.r.l.

Fogliano (Italy)

THE REDIPUGLIA WAR MEMORIAL


© collezione Ten. Col. Norbert Zorzitto, direttore del Sacrario Militare di Redipuglia

WORK STARTED THIS YEAR ON THE CONSERVATIVE RESTORATION OF THIS MONUMENT DEDICATED TO THE SOLDIERS WHO FELL IN THE GREAT WAR

During the celebrations for National Unity of Italy and Italian Armed Forces Day on the morning of 4th November, a ceremony was held at Redipuglia War Memorial to remember all those who died in the First World War. This year's ceremony, which was attended by the President of the Italian Republic, Sergio Mattarella, was particularly poignant because it coincided with the centenary of Italy's victory in the First World War. After placing a laurel wreath in honour of all the fallen soldiers, the President of the Republic travelled on to Trieste where the official celebrations were concluded.

The Redipuglia War Memorial is the largest of its kind dedicated to the Great War in Italy: it is here that the remains of more than 100,000 soldiers who fell in the surrounding area were laid to rest. The Memorial can be found on the side of Monte Sei Busi, one of the Austrian-Hungarian strongholds on the Karst plateau which, during the First World War, was the scene of a series of battles, starting with the 1st Battle of the Isonzo. It was finally conquered by the Italian army in October 1915. The Memorial also gave a worthy final resting place to all those who were unable to be buried in the cemetery on Sant'Elia Hill opposite Monte Sei Busi.

Construction of the Memorial, designed by the architect Giovanni Greppi and the sculptor Giannino Castiglioni, was entrusted to the contractor Marchioro from Vicenza and 300 workers started work on the site in 1928. The Memorial was inaugurated 10 years later on the 18th of September 1938.

The Memorial and the area around the site are owned by the Italian Military and managed by the Commissioner General for the War Memorials Trust belonging to the Italian Ministry of Defence.

The restoration project to carry out a radical overhaul of the monument, for which 7 million Euros have been allocated, includes a complete refurbishment of Piazzale delle Adunate, the stone terraces, the bronze plaques, the trenches and the observatory situated at the top of the mausoleum.

THE MONUMENT

The monument was built on three levels and represents the army descending from heaven, headed by its commander, and following the so-called "Heroic Path". At the top of the monument there are three crosses representing Golgotha Hill and the crucifixion of Christ.

The "Heroic Path". 105 m long, 20 m wide and extending over an area of around 2,100 m^2, it leads to the steps that provide access to Piazzale delle Adunate. The path is made from concrete cast on site, with joints in an orthogonal square pattern. It is flanked by 38 bronze plaques embedded in the ground (19 on each side) embossed with the names and heights of the peaks in memory of the battles fought on the Karst plateau.

Piazzale delle Adunate. At the end of the Heroic Path you reach the Piazzale or large piazza (which has a surface of around

IN THE SPOTLIGHT

MAPEI COLOR PAVING®

MAPEI COLOR PAVING® is a product line proposed by Mapei to help you create architectural exposed aggregate concrete surfaces.
MAPEI COLOR PAVING® floors are characterized by their high mechanical performance characteristics and durability, as specified in EN 206:2014 standards for external concrete floors. Unique, customisable, integrating perfectly with its surroundings, less maintenance required and easy to install: these are just a few of the main characteristics of the solutions proposed by Mapei.

PHOTO 1. The damaged slabs on the piazza before restoration works.
PHOTO 2. Testing to find the right mixture for the MAPEI COLOR PAVING®.
PHOTO 3. Pouring concrete made using the MAPEI COLOR PAVING® system.

16,500 m^2). At the centre of the access steps to the piazza there is a large tombstone with an inscription dedicated to the Duke of Aosta, commander of the III Italian Army during the First World War, and to the fallen soldiers buried inside the Memorial. On the piazza, near to the first step, there is the tomb of the Duke of Aosta, Emanuele Filiberto of Savoia who died in 1931, and of the Generals Antonio Chinotto, Tommaso Monti, Giuseppe Paoloni, Giovanni Prelli and Fulvio Riccieri.
The piazza is partially paved with 1.5 m square concrete slabs, which are also placed in an orthogonal square pattern, and with limestone from the Karst plateau.
The steps. The steps are in a trapezoidal shape with a large base that gradually narrows as you climb them. Then you reach the imposing stairway made up of 22 terraces, each one 2.5 m high and 12 m wide, with a footprint of around 29,000 m^2. It is here that the remains of 39,857 soldiers are enshrined. At the top of the stairway, on the last terrace, there is a chapel, alongside which there are two large tombs containing more than 60,000 unknown soldiers. The terraces are also paved with exposed aggregate concrete.
The Votive Chapel. At the top of the Memorial there is a chapel surmounted by three large bronze crosses, characterised by a gate with, at its centre, the cross of the III Army. On the large open top, at a height of 89 m, there is the Observatory and a model representing the surrounding land showing the boundary line at dawn on the 24th of October 1917, the day of the 12th battle of the Isonzo.
House of the III Army. At the foot of the terraces is the building that acted as base for the III Army, commanded by the Duke

PHOTO 4. MAPEWASH PO set retardant was applied on the substrate.
PHOTO 5. Hydro-blasting was carried out to complete the concrete paving.
PHOTO 6. After removing the damaged stone slabs, new ones were installed on an installation bed made from SABBIACEMENTO by Vaga.
PHOTO 7. MAPESTONE PFS2 mortar was used to grout the joints.

of Aosta, which today houses the offices and the museum that are scheduled to be restored and redecorated to mark the Centenary of the Great War.

CONSERVATIVE RESTORATION PROJECT

The large site for the restoration project was opened this year and the memorial will be practically off-limits until next year. Work has been divided into three zones: the Piazzale delle Adunate and the Heroic Path, the stairway, and the upper part of the large piazza and the Observatory. The client and the designers have opted for a conservative restoration of the Memorial which would not modify the appearance and characteristics the passing years have given the monument, preferring to carry out a series of interventions to solve the problems and deterioration that have appeared over the years.

The first interventions carried out on the Heroic Path, Piazzale delle Adunate and the first terrace of the stairway got underway with the renovation and refurbishment of the flooring in exposed aggregate concrete and the cleaning, consolidation, partial replacement and grouting of the stonework. In two specially equipped warehouses prepared for the occasion, restoration work has also commenced on the 4,989 bronze plaques bearing the names of the fallen soldiers.

MAPEI INTERVENTION ON A HISTORIC SITE

Concrete paving. Many of the blocks in the concrete paving had been badly damaged by the bad weather, settling and general wear and tear. The first part of the work was carried out urgently in order to be ready for the ceremony on the 4th of November, which consisted in reconstructing the damaged blocks in Piazzale delle Adunate and on the first terrace. The second phase will be to complete work on the other 21 terraces and should be completed in the next few months.

After getting in touch with the client, designers and contractor carried out a series of surveys and tests on site. Mapei Technical Services proposed using the MAPEI COLOR PAVING® system. This system is made up of a series of products specially developed for making architectural exposed aggregate concrete paving with a textured washed effect. These types of surfaces have excellent mechanical properties and durability, require little maintenance and are easy to create.

After taking several samples, 5 different types of aggregate were selected (3 from crushed rock and 2 from river gravel), 2 types of cement (one grey and one white variety), and two MAPECOLOR PIGMENT powdered colorants in red and yellow. Once the COLOR PAVING ADMIX ready-mixed, multi-purpose, powdered admixture had been added and the concrete had been mixed on site, it was transported to the area to be restored in wheelbarrows to prevent damaging the old paving even further.

A first layer of concrete was poured and PLANICRETE syn-

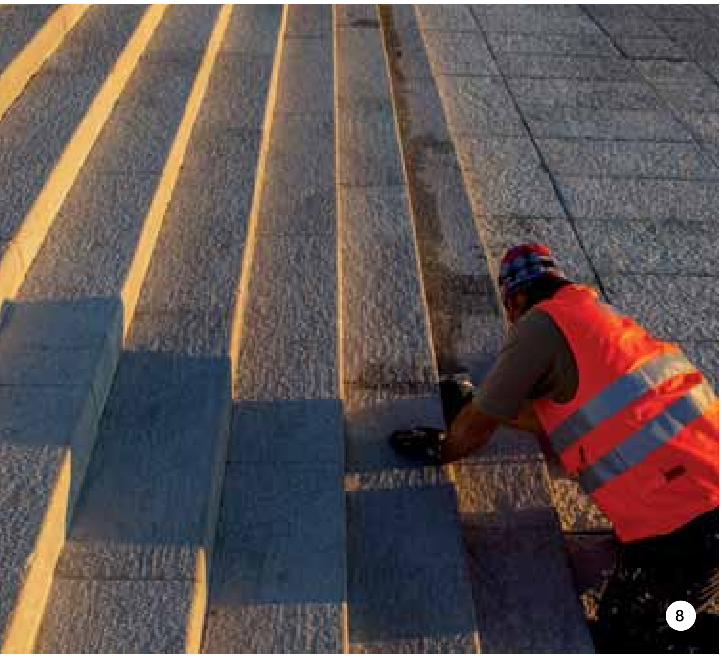


PHOTO 8 . Skirting was bonded in place with KERAQUICK MAXI S1.
PHOTO 9. The sealing plates for the crypts were rebuilt with PLANITOP SMOOTH & REPAIR and sealed with MAPEFLEX PU 45.

thetic-rubber latex was applied thereupon to improve adhesion of the cementitious mix. Once the concrete had been downloaded, MAPEWASH PO set retardant was sprayed on the surfaces which, apart from delaying the setting of the concrete, also provided sufficient protection for the concrete (curing effect) until the washing operations could be carried out the following day. After around 24 hours, it was then hydro-blasted to remove the 1 mm layer of sand and cement from around the aggregates to create the aesthetic effect required. After around 24/48 hours, the surface was cut according to the pattern and layout specified during the design phase.

Stone paving. To renovate the stone paving, once the damaged slabs had been removed, the new material was installed on a bed of SABBIACEMENTO by Vaga (a subsidiary of the Mapei Group), while the joints were grouted with either MAPESTONE PFS2 pre-mixed, high-strength mortar, exposure class XF4 and XS3, or MAPESTONE PFS PCC 2 pre-blended, polymer-modified, high-strength mortar with a low modulus of elasticity and good resistance to de-icing salts and freeze-thaw cycles.

Crypts. The special sealing plates for the crypts, which were badly deteriorated, were rebuilt with PLANITOP SMOOTH & REPAIR cementitious mortar and sealed with MAPEFLEX PU 45 sealant. Limestone skirting from the Karst plateau was then bonded around the base of the crypts using KERAQUICK MAXI S1 cementitious adhesive.

Work on the Redipuglia War Memorial is scheduled to last until the end of 2019.

TECHNICAL DATA
Redipuglia War Memorial, Fogliano (Gorizia, Italy)
Original Designers: Giovanni Greppi and Giannino Castiglioni
Period of construction: 1928-1938
Year of the Mapei intervention: 2018
Intervention by Mapei: supply of products to renovate architectural concrete paving and to install slabs for the renovation of stone paving
Designers: Francesca Brancaccio and Ugo Brancaccio - B5 Srl
Client: Presidency of the Italian Council of Ministers – Department for the Anniversaries of National Interest
Director of the Redipuglia War Memorial: Lieutenant Colonel Norbert Zorzitto
Head of procedures: Maria Graziella Monaco
Works director: Major Nicola Stalteri
Operational works director: Francesca Bertozzi, Beatrice Cuccioletta, Anna Pia Parente and Angelo Renzetti
Site inspectors: 1st Marshall Lieutenant Nicola De Vito and Sergeant Giuseppe Lovino
Safety coordinator for the design: Francesca Brancaccio
Safety coordinator for the executive phase: Giovanni Molteni
Building contractors: Italiana Costruzioni SpA, Fratelli Navarra Srl
Project manager and site director: Silvio Songini
Site manager: Ugo Cappello
Site accounts: Giuseppe Frigerio
Head of technical office: Davide Allevi
Head of restorations: Giulia Putaturo
Health & safety officer: Maurizio Ferri
Paving contractors: Sebastianelli Pavimenti Srl; Calini Srl
Photo: Photo Première Roberto Munizzi Fotografo
Mapei coordinators: Giuseppe David, Ettore Menegaldo, Katiuscia Venturini, Ivan Carlon, Claudio Azzena, and Marcello Deganutti, Mapei SpA (Italy)

MAPEI PRODUCTS
Installing exposed aggregate concrete floorings: Mapecolor Pigment, Mapewash PO, Planicrete, Color Paving Admix
Installing stone slabs: Keraquick Maxi S1, Mapestone PFS2, Mapestone PFS PCC2
Sealing the plates for the crypts: Planitop Smooth&Repair, Mapeflex PU 45

VAGA PRODUCTS
SabbiaCemento

For further information on products visit www.mapei.com and www.vagaedilizia.it

Keraquick Maxi S1 is the new high-performance, **rapid-setting** adhesive suitable for installing ceramic tiles and stone materials for floors that may be **set to light foot traffic after just 3 hours** and to heavy traffic after just 24 hours.

3h MAPEI

FLOORS ARE SET TO LIGHT FOOT TRAFFIC AFTER 3 HOURS!

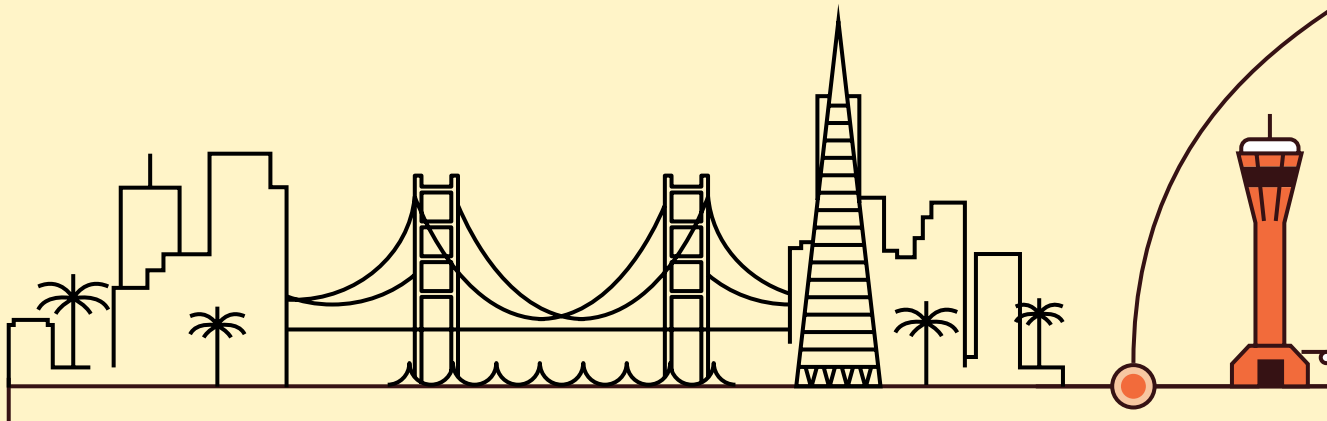
EVERYTHING'S OK WITH MAPEI

Learn more on **mapei.com**

MAPEI®
ADHESIVES · SEALANTS · CHEMICAL PRODUCTS FOR BUILDING

THE INFRASTRUCTURES underpinning international economic growth

THE WORLD'S BIGGEST INFRASTRUCTURAL WORKS ARE INCREASINGLY ITALIAN-DESIGNED



INCOME FOR ITALIAN COMPANIES
2008-2017 in millions of euro

	2008	2017	Growth rate (in %)	Average annual growth rate (in %)
National income	6,824.0	5,036.7	-26.2	-3.3
Foreign income	6,462.5	14,390.6	122.7	9.3
Overall income	**13,286.5**	**19,427.3**	**46.2**	**4.3**

74.1%
overall foreign income for Italian companies

811
Italian-designed building projects in **92** countries worldwide

Source: ANCE (Italian Association of Building Contractors)

"If you want to make your city grow, build a road". This old proverb neatly sums up the principle that sees the reinforcing of infrastructures as one of the mainstays of a nation's economic growth.

Nowadays we cannot confine our horizons to just a city, macro-region or nation. We are currently witnessing high-speed epoque-making changes, such as the rising population, scarcity of resources and growing urbanisation, with megalopolises being connected to form macro-regions.

The infrastructures industry is really booming globally: a growing number of people are moving into and around cities (soon 60% of the world's population will live in metropolises), thereby notably increasing the need for new infrastructural works.

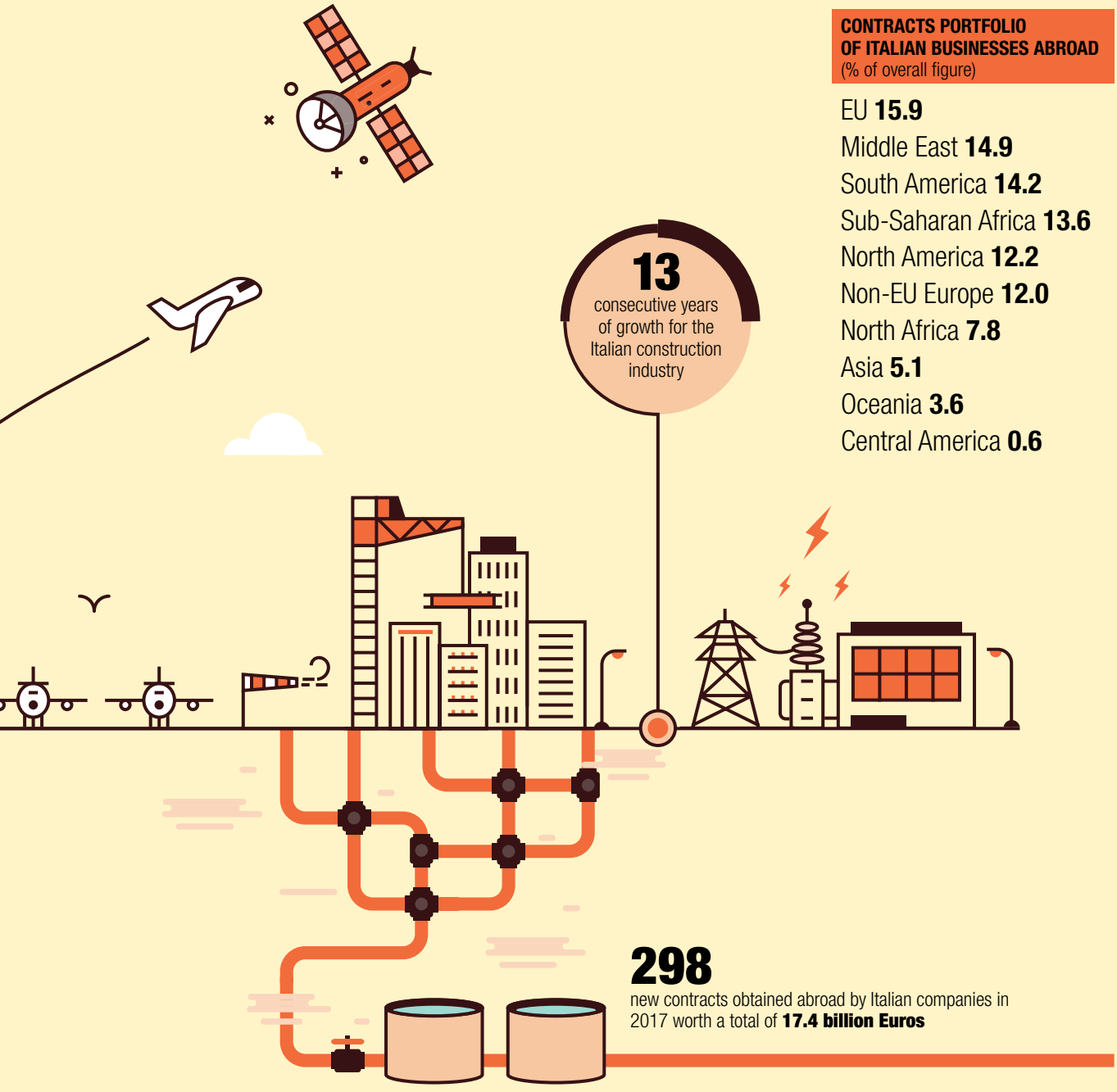
As the British economist Richard Baldwin has noted, "the big worldwide business of infrastructures is quintessential to the very concept of globalisation, i.e. by far the most important economic phenomenon of our times". It is only by working on these underlying assumptions that we will be able to tackle these crucial aspects of globalisation based on a long-term strategy.

This has been underlined on a practical level by the Organisation for Economic Co-operation and Development (OECD): by 2030, 50,000 billion US dollars will need to be invested in intercontinental infrastructures, equal to approximately 2.5% of the world GDP.

Major infrastructural works are not just a powerful accelerator for a nation's socio-economic development and growth, they are also a decisive factor in defining future geopolitical scenarios and the risks for global balances they entail, with repercussions in terms of well-being, safety and prosperity.

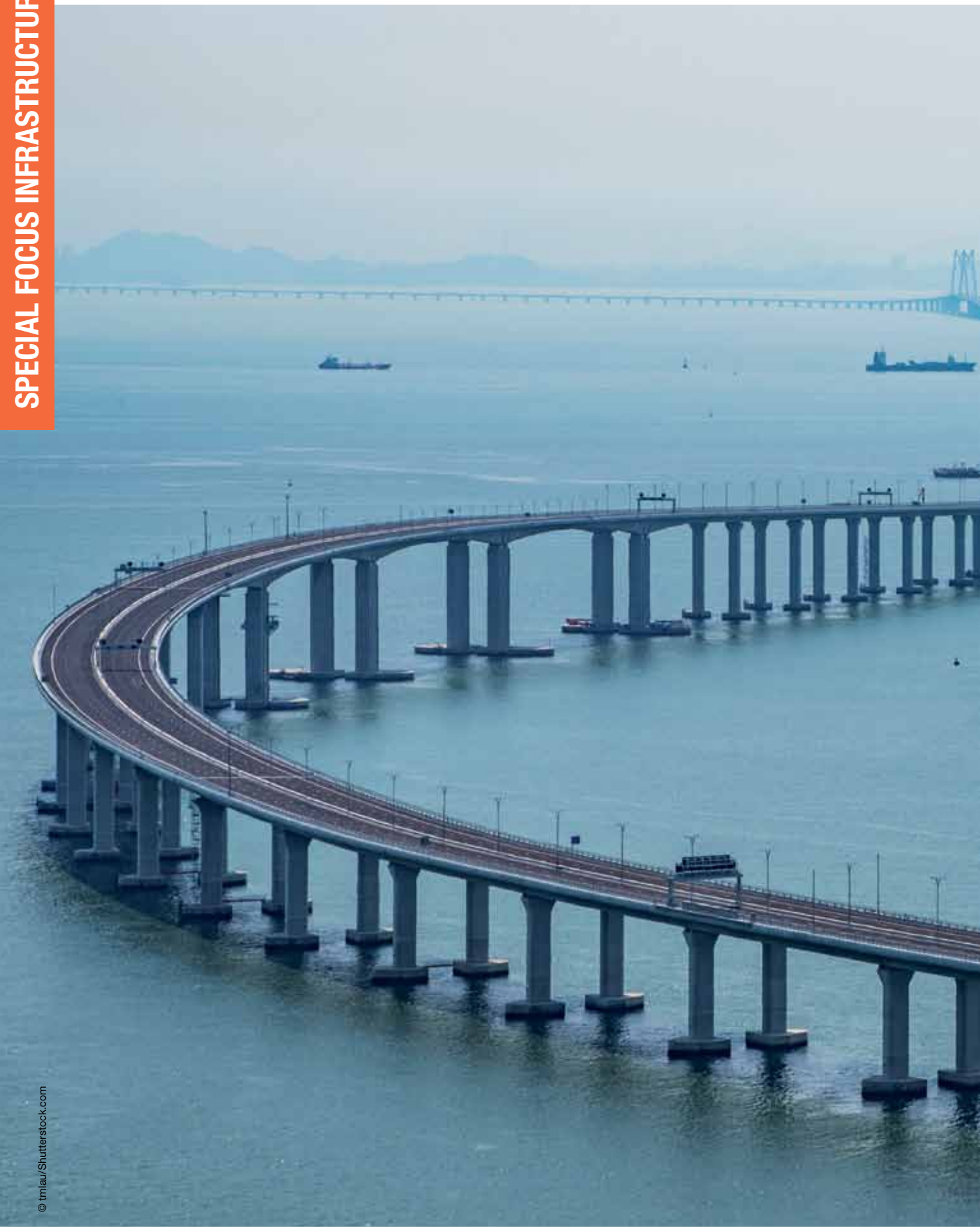
ITALIAN-DESIGNED WORKS AROUND THE WORLD

Over the last 10 years there has been a noticeable drop in investment in infrastructures in Italy.



A 26% decrease corresponding to approximately 11 billion Euros. This means that Italy is now one of the European countries investing least fixed capital in this field, i.e. just 2% of its GDP compared to a European average of 2.7%.
Italy is third from bottom along with Spain (only Ireland and Portugal are doing worse) and even though the European average is 2.7%, the figure exceeds 4% in certain Nordic and Baltic countries and also, surprisingly, in Greece, too.
600,000 jobs have been lost in this sector in Italy since 2008, with 120,000 companies going bankrupt, according to data from ANCE (Italian Association of Building Contractors).

Although the building industry is the sector growing least within the realms of Italy, the "2018 ANCE Report on the Operations of Italian Construction Companies around the World" talks about 13 consecutive years of growth for the Italian building system abroad.
An increasing number of infrastructures worldwide are Italian-designed, but the domestic market is being left by the wayside. Over the last 10 years the average annual growth of foreign income has been 9.3% compared to a drop in the national turnover of 3.3%-a-year. In 2017, overall foreign income was over 14 billion Euros, a 2% increase compared to 2016 and equal to 74.1% of total production, a complete turnaround compared to the first year when studies were made (2004), when foreign production was just a little over 31%. In overall terms, Italian businesses operate in 92 countries working on more than 800 building projects worth an overall total of over 82 billion Euros, with a works portfolio steady at over 51 billion Euros.
The success of Italian businesses abroad is proof of Italy's ability to operate effectively on a global market that is constantly changing.
A winning strategy that has made Mapei a global player thanks to its products, services and operations across five continents.



Hong Kong-Macao-PRC

THE HONG KONG ZHUHAI-MACAO BRIDGE

THE ONLY INFRASTRUCTURE OF ITS KIND IN THE WORLD AND ONE OF THE BIGGEST PROJECTS EVER COMPLETED

On the 23rd of October this year, in the presence of President Xi Jinping of the People's Republic of China, the longest bridge-tunnel sea crossing in the world connecting Hong Kong, Zhuhai and Macao, was inaugurated. This futuristic structure, with a total length of 55 km is part of a large-scale technological and economic development plan to promote the Greater Bay area integrating 11 cities in the South of China. The bridge was constructed to meet the demand for passenger and goods traffic between Hong Kong, mainland of China and Macao, to improve economic development and stimulate growth in tourism.

A FUTURISTIC DESIGN

Work started in 2009 and was completed in February 2018, two years behind schedule, and cost a total of around 20 billion Euros. With its two three-lane carriageways, the bridge stretches over a large river system in the South China Sea called the Pearl River Delta. This large viaduct is an engineering structure of the highest order which was designed to counter winds and tides. The structure was built to withstand earthquakes up to magnitude 8, typhoons and the impact of a cargo ship weighing around 300,000 tonnes. The bridge was also designed to last 120 years while most large bridges crossing the sea have been designed to last 100 years as observed from historic figures.

The main bridge is a 29.6 km long bridge-cum-tunnel system supported by three cable-stayed spans from 280 to 460 m high. Construction of the bridge required 400,000 tonnes of steel, the equivalent of sixty Eiffel towers, 420,000 million m^3 of concrete, a workforce of 14,000 and a fleet of 100 ships to transport the materials.

The Pearl River Delta is one of the busiest shipping areas in the world, with 4,000 vessels between passenger ferries and gigantic cargo ships passing through every day. Around three quarters of the way along the bridge, a 6.7 km subsea tunnel had to be constructed because it was not feasible to interrupt their passage. The tunnel is at maximum up to 45 m below the seabed and has two artificial islands running alongside it to accompany the transition between the submerged part and the elevated part towards Hong Kong on one side and towards Macao/Zhuhai on the other side.

A KEY INFRASTRUCTURE

Thanks to the new bridge it is now possible to travel from Zhuhai and Macao to Hong Kong and vice-versa in less than one hour, while previously it took 4 hours to drive all the way around the Pearl River Delta to Zhuhai or around an hour on high-speed ferry to Macao. Experts estimate that around 290,000 cars and heavy goods vehicles will cross the bridge every day.

The structure is intended to help form an integrated economic hub that, apart from the two former English and Portuguese colonies, also includes nine cities in the province of Guangdong, amongst which there are Guangzhou and Shenzhen. 68 million people live in the region and there are numerous businesses and companies operating in the area, including the financial centre of Hong Kong, the Shenzhen technological hub and the Dongguan industrial hub, which produce around one eighth of the total Chinese GDP. In Hong Kong there is also one of the most important container ports in the world and an air-cargo hub on a global scale.

According to experts, reducing travelling times will double the volume of goods transported between Hong Kong and the mainland, that is, the western part of the Pearl River Delta and the provinces of Guangdong and Guangxi. These areas are the home of various logistics companies that were in need of the space that Hong Kong could no longer offer, and vehicles had to reach the port or airport by using the Humen Bridge, a long and particularly congested route.

MAPEI INTERVENTION

Mapei Technical Services provided site assistance for the main contractor working on three different sections of the project: in 2011 on the section between Scenic Hill and the Hong Kong Boundary Crossing Facilities, in 2012 directly on the subsea tunnel in the Tuen Mun-Chek Lap Kok Link area and in 2013 during construction of the toll area.

Intervention between Scenic Hill and the Hong Kong Boundary Crossing. Initially, Mapei Technical Services have collaborated with the contractor on the stretch that connects the Hong Kong Link Road between the main Hong Kong-Zhuhai-Macao Bridge and the Hong Kong Boundary Crossing Facilities. The Hong Kong Link Road includes a section of viaduct around 9 km long that runs from the border of Hong Kong SAR (Special Administrative Region) to Scenic Hill, which is on the island where the airport is located. The project included land reclamation and the construction of tunnels and link roads.

To waterproof the external area (a surface area of 83,000 m^2), after priming the surfaces with MAPEFLOOR I900 two-component, epoxy resin-based binder, Mapei Technical Services recommended treating the surface with PURTOP 400M HK two-component, solvent-free, hybrid polyurea membrane applied in situ using a high-pressure, bi-mixer type pump to form waterproof coatings on bridge decks, cut and cover tunnels and flat roofs. The product, which is distributed locally by Mapei China Ltd based in Hong Kong, has excellent tensile and

PROJECT FIGURES

Construction period: **2009-2018**

Overall length: **55 km**

Length of subsea tunnel: **6.7 km at 45 m below** the seabed

Cost: **20 billion Euros**

400,000 tonnes of steel

420,000 million m^3 of concrete

14,000 total workforce

625 m and 100,000 m^2: length and surface area of the two artificial islands

PHOTO 1. The layout of the Hong Kong-Zhuhai-Macao bridge.
PHOTO 2. The area worked on at Scenic Hill.
PHOTO 3. Waterproofing work in the Scenic Hill area was carried out with PURTOP 400M HK and POLYFOND KIT DRAIN.
PHOTO 4. MAPEPLAN TU S waterproofing membrane was applied to the internal surfaces of the tunnel.

IN THE SPOTLIGHT

MAPEPLAN TU S

It is a single-layer PVC P waterproofing membrane with orange signal layer.
It can be applied as a fluid barrier in tunnel and underground structures construction.
It can also be used for drill and blast tunnel waterproofing, as well as for open cut tunnel waterproofing and underground structures waterproofing.
MAPEPLAN TU S performs both high mechanical properties and workability and welding characteristics.

PHOTO 5. The largest tunnel boring machine in the world while boring the subsea tunnel section.
PHOTO 6. MAPEFILL HS special mortar was used for anchoring the metal elements.
PHOTO 7. MAPEFILL HS was also applied in the underground corridors.

tear strengths, high resistance to chemical agents and excellent flexibility.

The intervention was completed by installing POLYFOND KIT DRAIN, a protective and drainage system by Polyglass, a subsidiary of the Mapei Group. The system is made from high-density extruded polyethylene (HDPE) laminated with a polypropylene needle-punched nonwoven. It is particularly effective in protecting and waterproofing below grade structures, also providing excellent drainage capacity.

The connection tunnel (80,000 m^2 of surfaces), which was excavated using the "drill and blast" method, was waterproofed with MAPEPLAN TU S, a single-layer PVC P waterproofing membrane with orange signal layer for waterproofing natural and artificial tunnels and underground structures. Manufactured by Polyglass, MAPEPLAN is a line of synthetic waterproofing membranes made using exclusive "multi-extrusion coating" technology to form high-performance, highly durable PVC-P membranes with excellent workability and good welding characteristic.

Other products used included MAPEPLAN GEO 500, MAPEPLAN DISKS and MAPEPLAN COLLARS.

Tuen Mun-Chek Lap Kok Link intervention - Northern Subsea Tunnel Section.

This two-lane tunnel is 40 m below the seabed and is more than 6 km long and will wind its way between the Northwest New Territories and Hong Kong – Zhuhai – Macao Bridge (HZMB), the airport and North Lantau and also provides an alternative route to the airport. The largest tunnel boring machine in the world, with a bore diameter of 17.6 m, was used to bore the tunnel.

For this operation Mapei supplied MAPEBENT API natural sodium bentonite, MAPEFILL HS high-strength, non-shrink, anchoring grout and MAPEGROUT HI-FLOW SP shrinkage-compensated fibre-reinforced mortar (all products are distributed by Mapei China Ltd.).

Toll areas. To gain access to the Tuen Mun-Check Lap Kok Link and drive across it, a toll needs to be paid and vehicles must have a permit.

To carry out this service, a dedicated area and service areas covering a surface of more than 5 hectares had to be built. Mapei provided solutions to waterproof the area (18,000 m^2) by supplying MAPEPLAN TU S, MAPEPLAN GEO 1000, MAPEPLAN DISKS, MAPEPLAN ANCHORING and MAPEFIX VE SF.

TECHNICAL DATA
Bridge linking Hong Kong, Macao and Zhuhai, Hong Kong and PRC
Period of construction: 2013-2018
Period of the intervention: 2017-2018
Intervention by Mapei: supplying products for underground waterproofing and anchoring
Client: Highway Department, HK SAR Government
Main contractor: Dragages-Bouygues Joint Venture
Works direction: Ove Arup & Partners Hong Kong Ltd
Mapei coordinator: Stuart Watt, Mapei China Ltd (Hong Kong)

MAPEI PRODUCTS
Underground waterproofing: Mapebent API*, Mapefill HS*, Mapefix VE SF, Mapegrout Hi-Flow SP*, Mapeplan Anchoring, Mapeplan Geo 1000, Mapeplan Geo 500, Mapefloor I 900, Purtop 400M HK*

*These products are distributed by Mapei China Ltd

POLYGLASS PRODUCTS
Underground waterproofing: Polyfond Kit Drain, Mapeplan TU S, Mapeplan Disks, Mapeplan Collars

For further information on products visit www.mapei.com and www.polyglass.com

The **Mapei** range of certified chemical anchors for all your design and site needs: light, heavy, structural and seismic loads.

ETA certification and CE marking

EVERYTHING'S OK WITH MAPEI

Learn more on **mapei.com**

MAPEI®
ADHESIVES · SEALANTS · CHEMICAL PRODUCTS FOR BUILDING

Netherlands

ZEELAND BRIDGE

A LONG BRIDGE SUSPENDED OVER THE SEA REQUIRING CONSTANT, METHODICAL MAINTENANCE USING CUTTING-EDGE PRODUCTS

In 1962 the Province of Zeeland – an area in the south-western part of the Netherlands – decided to build a quick connection between the isles Noord-Beverland and Schouwen-Duiveland with the industrial area around the city Vlissingen-Oost, which was then going through a period of strong development. At the time, work on the Delta Plan project – a series of construction projects consisting of dams and infrastructures which have been protecting coastal areas from flooding since 1953 – was still in full swing. The Province of Zeeland, however, decided not to wait for the Oosterschelde dam to be built, which was to include a new road connecting various local towns, and went ahead on their own. The dam was completed in 1987, whereas the Zeeland Bridge had already been in service for more than twenty years: construction work on the bridge started in 1962 and it was inaugurated by Queen Juliana of the Netherlands on the 15th of December, 1965.

In order to recover the cost of the work, which had not received any form of state funding, from the inauguration date until the 31st of December 1992 anybody using the bridge, including pedestrians, cyclists and bus passengers, were required to pay a toll. In 2000 the road received a major overhaul to make it safer and bring it in line with the latest highway regulations and work included replacing the old guardrails on both sides of the road with concrete barriers and the introduction of a by-law that prohibited overtaking. On the 15th of December, 2015, the Zeeland Bridge was declared a Monument of National Interest by the Netherlands National Cultural Heritage Agency.

A STRUCTURE SUSPENDED OVER THE SEA

The Zeeland Bridge is an imposing, 5,002-m-long structure and, up until the inauguration of Öland Bridge in Sweden (6,072 metres long), it was the longest bridge in Europe. It is made up of 54 pillars and 52 spans of 95 m and has a mobile section 40 m long. The Zeeland Bridge, which has two lanes and a cycle lane, is suspended over the water and its entire length is supported by pillars in the form of an upside-down "V" placed on reinforced concrete bases which, in turn, sit on the seabed. The bases are of different lengths. Where the water is particularly deep they are 60 m long, while in other areas they are up to 30 m long. The bridge also has many different parts that are connected together by strong steel cables for a total length of 300 km.

The bridge is exposed all day and all night to the effects of the sun, winds and, above all, the sea, as well as carbon dioxide emissions from passing vehicles, which means it needs to be constantly and methodically checked and maintained. New coloured coating is applied to the pillars every 10 years and the products used are evaluated to check their adhesion proper-

PHOTOS 1 AND 2. The intervention also included a corrosion-inhibiting treatment using MAPEFER 1K on reinforcing rods and concrete repair with PLANITOP SMOOTH & REPAIR R4.
PHOTO 3. Application of two coats of ELASTOCOLOR WATERPROOF paint.

ties when applied to the substrate, their durability, the stability of their colour and their resistance to atmospheric agents. In 2016 the owners of the bridge tested a number of products from different manufacturers on the surface of some of the pillars, including products proposed by Mapei. After 6 months the product that had demonstrated the best performance characteristics in terms of adhesion, flexibility, resistance and colour maintenance was ELASTOCOLOR WATERPROOF acrylic paint for permanent contact with water, which is easy to clean and resistant to all types of atmospheric phenomena and smog.

Before proceeding with painting the pillars, the concrete on some of the pillars was found to be badly deteriorated. Mapei Technical Services recommended removing the deteriorated areas until the reinforcing rods were exposed. It was recommended to apply two coats of MAPEFER 1K one-component, protective mortar on the reinforcing rods.

Once MAPEFER 1K had dried, the surface of the pillars was repaired with PLANITOP SMOOTH & REPAIR R4 structural, rapid-setting, shrinkage-compensated, thixotropic, fibre-reinforced mortar. The pillars were then finished off by applying two coats of ELASTOCOLOR WATERPROOF.

IN THE SPOTLIGHT

ELASTOCOLOR WATERPROOF

It is a flexible, protective paint for outdoor applications made from acrylic resin in water dispersion.
ELASTOCOLOR WATERPROOF may be used as the final finishing coat wherever a highly water resistant paint is required.
It offers excellent resistance to all types of climatic conditions, aggression from smog and sunlight and forms a hard-wearing, protective layer on substrates which resists the rigors of time. It ensures it a highly attractive, smooth finish.

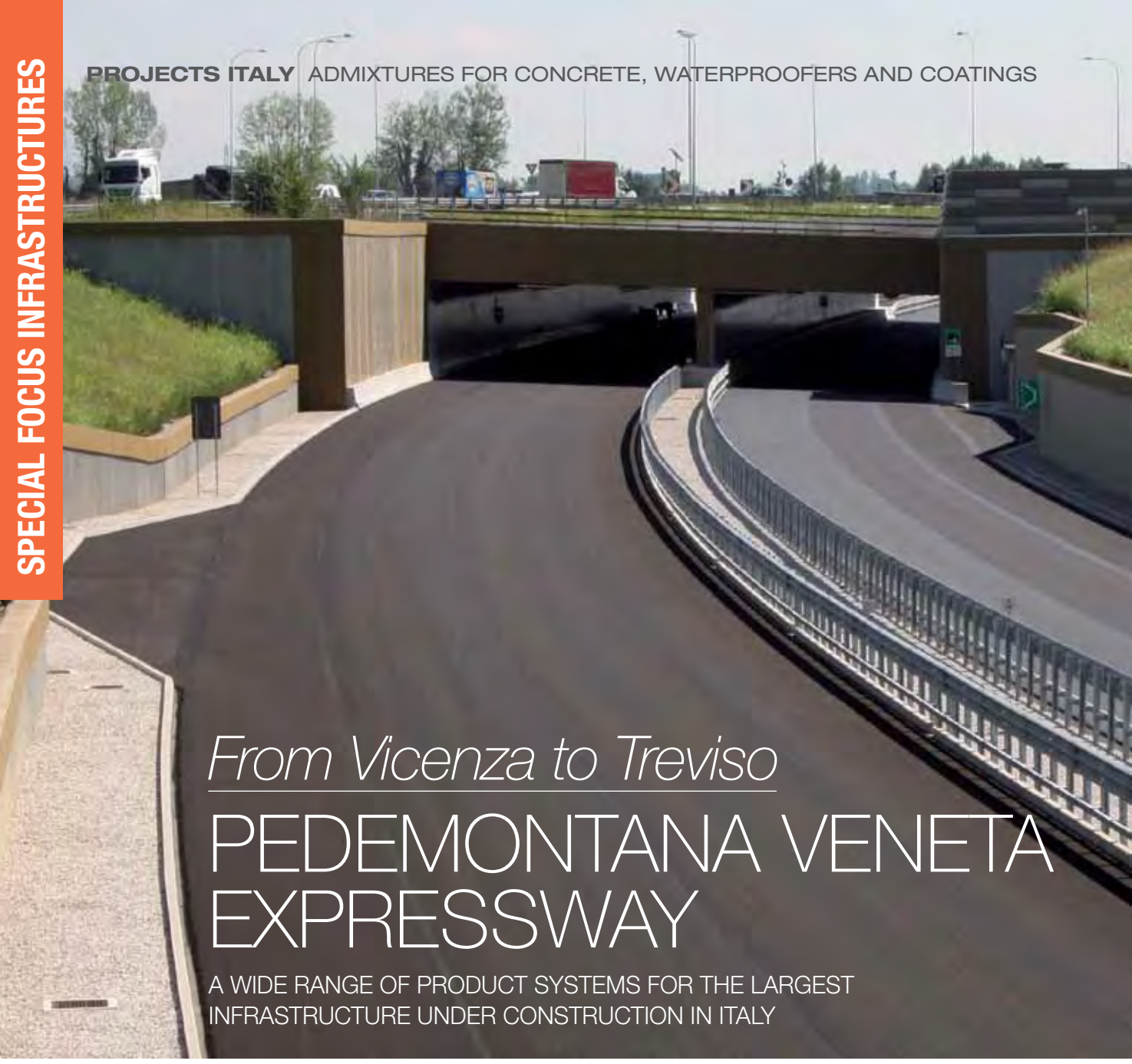
TECHNICAL DATA

Zeeland Bridge, Province of Zeeland (Netherlands)
Period of construction: 1962-1965
Period of the intervention: 2017-2018
Intervention by Mapei: supply of products to protect the reinforcing rods, repair concrete and protect and paint the pillars
Design: Rijkswaterstaat
Client: Province of Zeeland
Works director: Joost Sluiter
Main contractor: Gebr. Van Kessel Speciale Technieken en Producten B.V.
Photo: A.o. Erik Hendriks
Mapei coordinators: Erik Hendriks (Mapei Netherlands B.V.) and Gino Kuijpers (Mapei SpA, Italy)

MAPEI PRODUCTS

Concrete repair: Mapefer 1K, Planitop Smooth&Repair R4
Decorative and protective coating: Elastocolor Waterproof

For further information on these products visit www.mapei.com and www.mapei.nl



From Vicenza to Treviso

PEDEMONTANA VENETA EXPRESSWAY

A WIDE RANGE OF PRODUCT SYSTEMS FOR THE LARGEST INFRASTRUCTURE UNDER CONSTRUCTION IN ITALY

One of the Major Projects currently underway in Italy is the Pedemontana Veneta Expressway, 94 kilometres from the Province of Vicenza to the Province of Treviso (Northern Italy), that will help reduce the level of traffic on the A4 Turin-Venice motorway. It will end up linking to the A28 motorway that winds its way through the Dolomites around Belluno, carrying goods over the border. The first stretch near Vicenza will be inaugurated in January 2019 while around 50% of the planned construction sites have already been opened.

The Pedemontana Veneta Expressway is currently the largest infrastructure under construction in Italy and its estimated cost will be over 2.2 billion Euros.

Once completed, the expressway will feed the industrial districts around Thiene-Schio and Bassano del Grappa and, to the north of Treviso, provide a link to 3 motorways from the west (the A4, A31 and the A27).

It will be 94.747 km long and will be the only expressway in Italy where a toll will need to be paid.

CHARACTERISTICS OF THE INFRASTRUCTURE

The Pedemontana expressway will have two independent carriageways with two 3.75-m-wide lanes running in each direction. The hard shoulder on the right-hand side of each carriageway will be 2.5 m wide (3 m wide in the tunnels), there will be a 75 cm wide stretch of road surface on the left-hand side of each carriageway running parallel to the central reservation and the central reservation itself will be 3 m wide, for a total cross-section of 24.5 m. Of the 90 km of road, 50 km will run through cuttings, 26.5 km will run along embankments, 7.8 km will run through natural tunnels and 5.6 km will run through artificial tunnels. Reinforced concrete will be used for the walls and decks of the artificial tunnels and to build the retaining walls to shore up the cuttings.

The estimated volume of precast concrete required for the whole of the Pedemontana Veneta Expressway is around 1 million m^3, while the amount of ready-mixed concrete required will be around 2 million m^3.

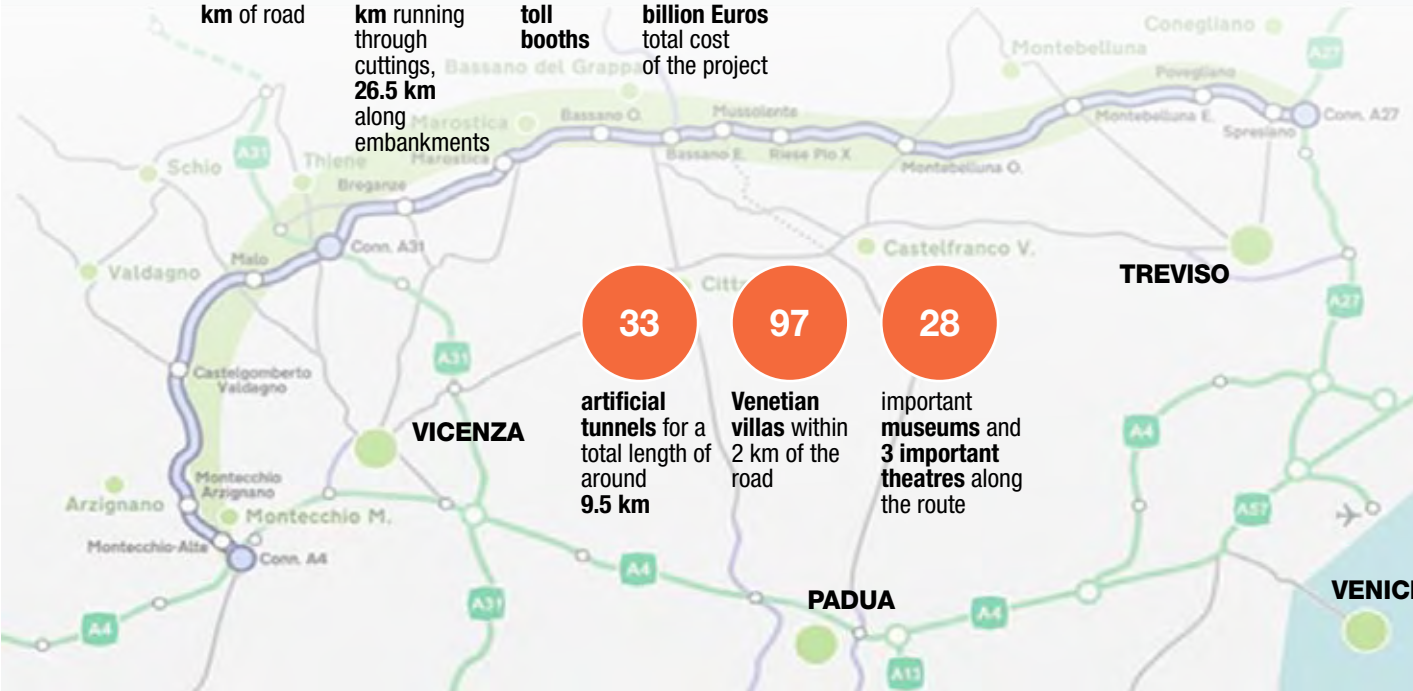
PEDEMONTANA VENETA

94.5 **km** of road

51 **km** running through cuttings, **26.5 km** along embankments

16 **toll booths**

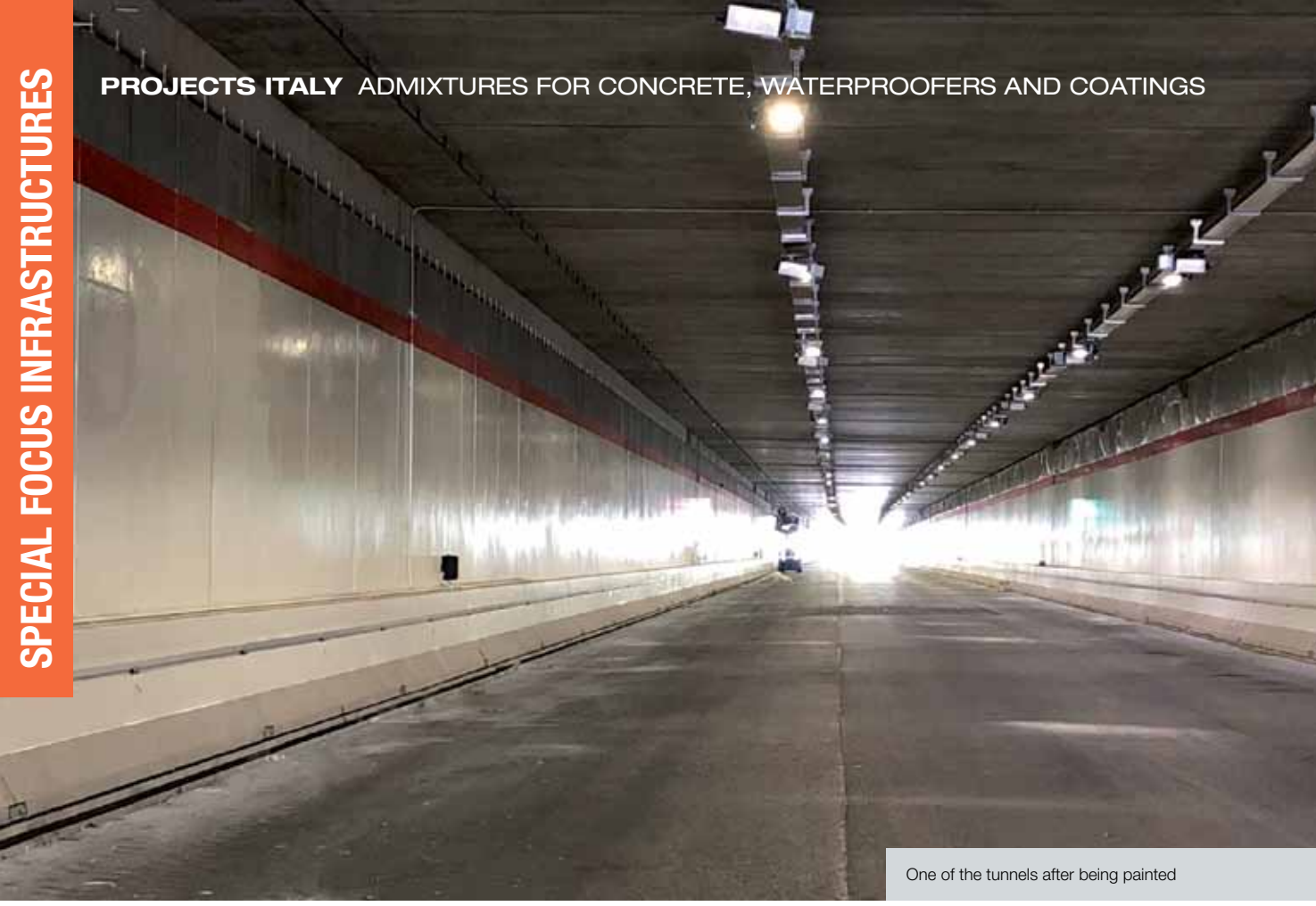
2.258 **billion Euros** total cost of the project



33 **artificial tunnels** for a total length of around **9.5 km**

97 **Venetian villas** within 2 km of the road

28 important **museums** and **3 important theatres** along the route



One of the tunnels after being painted

Trials of the skimming compound

The first artificial tunnel under construction

Micropiles for the new bridge over the Brenta River

HIGHLY ADVANCED PRODUCTS FOR EVERY NEED

Numerous Mapei products have been used to construct this important link on the Italian roads network.

The concrete mixes for all the precast structures include the super-plasticiser DYNAMON NRG 1022 and the concrete will be stripped with the help of MAPEFORM ECO OIL form release agent.

Ready-mixed concrete has been admixed with the superplasticizers DYNAMON SX 44 and DYNAMON SX 42 with added aerating agent MAPEPLAST PT1 for concrete resistant to freeze-thaw cycles.

The lanes for the toll booths have been made using concrete admixed with MAPETOP N AR6 pre-blended, ready-to-use dry shake hardener along with MAPECURE E curing compound to prevent rapid evaporation of water in concrete.

The load-bearing concrete walls for the toll booths have been covered with rough-cut natural stone bonded with grey ELASTORAPID adhesive, while joints have been grouted with MAPE-ANTIQUE ALLETTAMENTO mortar and expansion joints have been sealed with MAPESIL LM neutral silicone sealant.

WALLGARD GRAFFITI BARRIER graffiti-resistant barrier has been used to protect the stone walls, while MAPECOAT I24 epoxy paint has been used to protect the run-off channels for rainwater and fuel at the toll booths.

MALECH undercoat and ELASTOCOLOR PAINT have been used to finish off precast concrete surfaces along the sides of the expressway.

The joints in the road surface in the lanes of the toll booths have been sealed with MAPEFLEX PU70 SL and MAPEFLEX PU65 sealants and the internal walls of the toll booths where the offices are located have been skimmed with PLANITOP 530.

The two main tunnels, one 2x1.5 km long and the other 2x6 km long, are of the twin-tunnel type and have been built using the plasticizing and expanding agent CABLEJET for preparing shrinkage-free, highly-fluid pumpable slurries for injection, as well as MAPEQUICK AF1000 alkali free accelerator for shotcrete in combination with MAPEFIBRE CN54 structural polypropylene fibers and MAPEFORM ECO OIL.
The walls have been painted with MAPECOAT W HRI two-component epoxy tunnelling paint in water dispersion with low dirt retaining surface for concrete walls.
The firefighting tanks used to collect rainwater have been waterproofed with MAPELASTIC FOUNDATION, while some of the concrete partition walls have been waterproofed with PLANISEAL 88 osmotic cementitious mortar.
As for the viaducts, the following products were used: MAPEGROUT SV FIBER flowable, shrinkage compensated, quick setting and hardening, high-ductility cementitious mortar; ADESILEX PG1 two-component, thixotropic epoxy adhesive for structural bonding; PLANIBOND BA 100 two-component fluid epoxy resin for anchoring steel bars and MAPEFLOOR EP90 three-component, epoxy screed consistency mortar
Numerous other products have also been used for the problems encountered on site: MAPEFER 1K, PLANITOP SMOOTH & REPAIR R4, MAPEFILL, LAMPOSILEX, EPORIP, EPOJET, MAPEFINISH, MAPEGROUT T60, MAPEGROUT BM T3, MAPEFLEX MS CRYSTAL, MAPEBAND TPE and MAPELASTIC SMART.

IN THE SPOTLIGHT

MAPETOP N AR6

Pre-blended, ready-to-use dry shake hardener for concrete floors made of special well-graded quartz, Portland cement and special admixtures.
Thanks to its high mechanical strength and resistance to abrasion, MAPETOP N AR6 is particularly suitable for creating anti-wear layers on concrete floors in industrial and commercial environments with intense goods traffic in interiors.
It also has excellent resistance to atmospheric agents, freeze/thaw cycles and de-icing salts.

Specific products that help solve any problem on site effectively and quickly.
A construction project still underway which, once completed, will bring enormous benefits to the transport network and to the whole of north-eastern Italy.
But there is also a cultural aspect that we would like to bring to your attention. If you follow the route of the expressway from east to west, you will come across numerous examples of the Italian cultural, environmental, architectural, urbanistic, humanistic and artistic heritage.
And the route is almost like leafing through a book where the kilometres are the pages, the towns and villages are the chapters, the road signs are the captions and the landscapes and views are the illustrations.

Trials of the shotcrete in the Sant'Urbano tunnel

Sealant applied along the lanes of the toll stations

Installation of the stone covering on the toll stations

TECHNICAL DATA
Pedemontana Veneta expressway, Provinces of Vicenza and Treviso
Period of construction: 2012-on-going
Period of the Mapei intervention: 2012-on-going
Intervention by Mapei: supplying products for building, waterproofing, finishing, and admixtures for concrete
Client: Veneto Regional Government
Design: IGO - Ingegneria Grandi Opere Srl, Carlo Dogliani
Works director: Vittoriano Picca
Technical director: Giovanni Salvatore D'Agostino
Site directors: Lucio Cerato, Christian Toscano, Luigi Cordaro, Nicola Ruggiero
Main contractors: SIS Scpa and Itinere Infraestructuras S.A.
Concrete suppliers: Betonrossi SpA, Facchin Calcestruzzi Srl, Superbeton SpA, Meneghini Attilio Calcestruzzi Srl, General Beton Triveneta SpA, C&P for SIS Scpa
Mapei coordinators: Paolo Toniolo, Mauro Orlando, Ettore Menegaldo, Katiuscia Venturini, Giorgio Tansini, Claudio Azzena, Cristiano Bordignon, Sonia Murer, and Paolo Banfo, Mapei SpA (Italy)

MAPEI PRODUCTS
Dynamon NRG 1022, Mapeform Eco Oil, Dynamon SX 44, Dynamon SX 42, Mapeplast PT1, Mapetop N AR6, Mapecure E, Elastorapid, Mape-Antique Allettamento, Mapesil LM, Wallgard Graffiti Barrier, Mapecoat I 24, Elastocolor Paint, Malech, Mapeflex PU70 SL, Mapeflex PU65, Planitop 530, Cablejet, Mapequick AF 1000, Mapefibre CN54, Mapecoat W HRI, Mapelastic Foundation, Planiseal 88, Mapegrout SV Fiber, Adesilex PG1, Planibond BA 100, Mapefloor EP 90, Mapefer 1K, Planitop Smooth&Repair R4, Mapefill, Lamposilex, Eporip, Epojet, Mapefinish, Mapegrout T60, Mapegrout BM, Mapeflex MS Crystal, Mapeband TPE, Mapelastic Smart.

For further information on products visit www.mapei.com

New products and technologies for infrastructures and design work

The 53rd edition of SAIE, the building and built environment exhibition which was held in the Bologna exhibition district from the 17th to the 20th of October, ended on a positive note.
Proceedings at the event were animated by the more than 400,000 professionals who came together to meet, exchange ideas and projects and see at first hand the new products and technologies from the 450 companies exhibiting their wares.
This year, Mapei took part at SAIE by dividing its proposals over three exhibition areas, rather than within the confines of a single stand. This proved to be a winning solution as far as effective communication and visibility were concerned, with the company, its technicians and its specific systems and products on display on the stands of three important organisations from the world of building it often collaborates with: ISI (Italian Seismic Engineering Association), ANAS (Italian Highways Agency) and BIM (Building Information Modeling).
A three-fronted approach at an exhibition to confirm, once again, the completeness of Mapei's range of solutions to meet the needs of professionals and experts from the building sector and to help them find the most innovative and most suitable tools to hone their own range of skills.
The next edition of SAIE will be held in Bari (Southern Italy), at the Fiera del Levante exhibition ground, from the 24th to the 26th of October, 2019.

Products for structural strengthening

Mapei presented technologies and solutions for the structural strengthening, refurbishment and seismic upgrading of buildings in the ISI Area. Mapei used this space to showcase products from the FRP SYSTEM line, a complete range of composite materials made up of high-strength fibres and epoxy resins; products from the FRCM SYSTEM line comprehending high-ductility, fibre-reinforced mortars and basalt or alkali-resistant glass fibre structural meshes; the high performance, fibre-reinforced mortars PLANITOP HPC and PLANITOP HPC FLOOR, for strengthening work on

PRODUCTS FOR STRENGTHENING FRP system

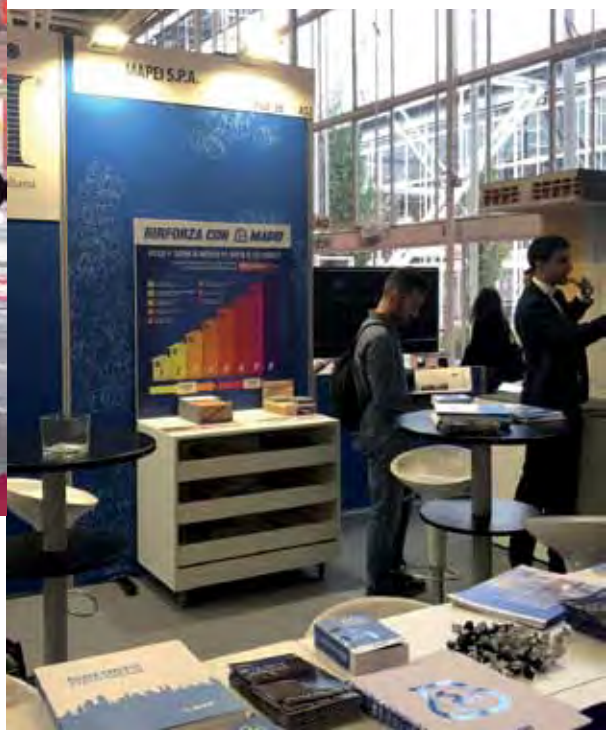
Structural strengthening systems for **reinforced concrete, masonry or wooden structures** composed of carbon or glass fibre fabrics or pultruded carbon composite plates and rods and epoxy resins.
MapeWrap System
Carboplate System

PRODUCTS FOR STRENGTHENING FRCM system

Low-thickness structural **strengthening systems for masonry,** composed of fibre-reinforced, high-ductility mortars and alkali-resistant (A.R.) glass or basalt fibre structural meshes.

STRENGTHENING CONCRETE STRUCTURES Planitop HPC

Strengthen your concrete structure with a **compact layer and no extra steel reinforcement.**
Use the innovative **PLANITOP HPC**, a high-performance, high-ductility, cementitious mortar with **steel fibres**.



areas up to 40 mm thick without using steel reinforcment and MAPEWRAP EQ SYSTEM, the certified anti-seismic protection system, which is used as “anti-tipping” protection for non-structural walls and as “anti-collapse” protection for ceilings. Also showcased at the exhibition was the new product for strengthening masonry structures, PLANITOP INTONACO ARMATO, a two-component, fibre-reinforced, natural hydraulic lime- and Eco Pozzolan-based mortar that does not require extra strengthening mesh or mechanical anchors. In line with Mapei’s strategy of investing in sustainability, PLANITOP INTONACO ARMATO only one contains 30% of recycled materials.

On the 19th of October Mapei took part in a convention organised by ISI, which discussed building materials and their role in the quality of architectural projects, with the presentation of a study entitled *“Consolidation and mitigation of the seismic vulnerability of masonry buildings through the use of cutting-edge technologies and materials”*.

ISI - The aim of the ISI (Italian Seismic Engineering) Association is to get all key players in Italy from the field of seismic engineering involved in a dynamic group to represent and promote them. ISI organises activities to divulge information and communicating with official bodies, institutions, certification bodies, the scientific community, industry and professionals from the sector.

DO YOU NEED TO STRENGTHEN A SLAB? Planitop HPC Floor (High Performance micro-Concrete)

From Mapei, exclusive technology that allows you **to strengthen a slab with a compact layer just 1.5 ÷3 cm thick, thanks to the use of ultra high-strength fibre-reinforced concrete**. PLANITOP HPC FLOOR high performance micro-concrete has been created to strengthen slabs without the need for rebar.

PROTECTION OF NON-STRUCTURAL ELEMENTS MapeWrap EQ System

Patented and certified safety system: quick, simple and compact solution for the **“anti-tipping”** protection of structural walls. Suitable also for the **“anti-collapse” protection** of ceilings.

STRENGTHENING MASONRY STRUCTURES Planitop Intonaco Armato

Two-component, ready-mixed, fibre-reinforced, natural hydraulic lime- and Eco Pozzolan-based mortar for the **structural strengthening of masonry buildings** without extra strengthening mesh or mechanical anchors.

On the ANAS stand

Mapei was also an important feature on the ANAS stand, which was entirely dedicated to best practices and new technologies in the infrastructures maintenance sector. Particular emphasis was put on investments into the development and testing of cutting-edge monitoring systems and how they are deployed to inspect the enormous existing stock of bridges, viaducts, and tunnels and keep them in the best condition possible.

The display area was divided into two parts: one part was equipped for presentations, while the second part was used for partners invited to the event and to display prototypes and equipment.

Mapei played its part in the training/information sessions with four twenty-minute presentations, which were repeated throughout the three days of the event. In the display area, Mapei exhibited the prototype of a reinforced concrete structure with galvanic cathodic protection (MAPESHIELD E25), along with technical documentation about this kind of solution and the types of mortars used to repair concrete around reinforcement rods.

The stand was visited on Thursday the 18th by Gianni Vittorio Armani, the CEO of ANAS at the time, and, on Friday the 19th, by the Italian Minister of Infrastructures and Transport Danilo Toninelli. On both occasions Fulvio Soccodato, Head of maintenance for the areas hit by earthquakes for ANAS, explained how the Mapei galvanic cathodic protection system works.

ABOVE. On the ANAS stand, Mapei presented a prototype of a reinforced concrete element to which MAPESHIELD E25 galvanic cathodic protection had been applied.

BELOW. Mapei and its product systems took part in an initiative which offered visitors the chance to live the experience of BIM (Building Information Modeling) applied to a site.

ANAS - In January 2018, ANAS – the Italian National Highways Agency – was integrated into the Italian National Railways Group. The aim of the agency is to guarantee continuity in the road and motorway network under its control throughout Italy. In order to do this, ANAS designs, constructs and maintains Italy's patrimony of road infrastructures, thereby contributing to the development of the country and the economy.

Designing, planning and building a structure in BIM

Mapei, along with its product systems, was an active participant in an initiative in collaboration with SAIE Digital&BIM, BIMobject, IIPLE and BIM Foundation, which offered visitors the chance to experience how BIM is applied to site work.

On the BIMobject stand, starting from a digital model of a structure, a team of skilled workers built the structure over the course of the four days of the exhibition to show the interactions between the digital and real versions and highlight the numerous benefits in terms of speed and project execution.

The BIM Experience was a unique chance to find out more about the opportunities offered by the choices of the digital version and to talk about them in real time with technicians, designers and skilled site workers.

Visitors were also able to see at first hand products offered by companies sponsoring the event (Caleffi, JVP, Mapei, Mosaico+, Olie and Valsir), whose BIM articles are available to the public on the BIMobject Cloud.

For the project built during the exhibition, Mapei supplied its own brand products to make the screeds and to skim and finish off internal and external surfaces.

Building Information Modeling: what is BIM

A DESIGN MODEL THAT CAN STORE ALL THE INFORMATION ABOUT A BUILDING

BIM - Building Information Modelling – is an operational method that covers the programming, design, construction and maintenance processes of a building. Using BIM, a model can be created that contains all the information on the entire life cycle of a building, from initial design to final decommissioning. BIM is based on the collaboration between the different players involved in the phases of the life cycle of a construction. Architects, engineers, design consultants and energy analysists, to name but a few, work on a shared BIM model, within which the different modules of BIM software (structural design, architectural design, plant and services design, energy performance, site safety, etc.) communicate with each other in a coordinated manner. This leads to fewer errors being made during the design and execution phases, reduces the number of times a design has to be modified or updated, saves the amount of time required, reduces overall costs and makes the entire process more effective and efficient.

Thanks to the BIM method, a dynamic model of a "virtual" building, with information on the materials used and on its load-bearing structure, thermal characteristics, energy performance, plant and service systems and safety features, is created before constructing the building itself.

The work method on which BIM is based uses modules ("BIM Authoring" and "BIM tools") with the ability to elaborate a virtual model specific to each individual discipline that dialogues with all those participating in the process.

From the 1st of January 2019 all public works in Italy costing more than 100 million Euros will have to be designed using the BIM model. This limit will be gradually lowered until 2025, after which it will be mandatory to use BIM methodology for all works for the public sector.

BIM offers clear advantages in terms of efficiency, for both small projects and major works, because it guarantees interoperability, optimisation of time and costs and a shared platform to all those using it.

A BIM project also allows clients to have a virtual image of the life of a building once the design phase has been completed.

In the future, BIM will become the standard process for all buildings and is being integrated into legislation for public contracts throughout the whole of Europe. Also, the European Directive 2014/24/EU on public tenders expresses the intention to introduce BIM into procurement procedures for all Member States and, since 2016, has been encouraging EU member to use it for projects financed by European Union public funds.

Making buildings safe the Mapei way

MAPEI PRODUCTS AND SYSTEMS TO OVERCOME STRUCTURAL PROBLEMS IN THE EVENT OF SEISMIC SHOCK

The Church of Camposanto (Italy), damaged by the earthquake, was renovated using Mapei systems for structural strengthening.

Thanks to the experience gained on sites all around the world and the company's experience and commanding knowledge of materials, over the years Mapei Group has developed a comprehensive range of products for static strengthening work and to improve and upgrade the seismic capabilities of buildings. Every Mapei technology, product and system has been created and developed to overcome specific structural requirements and all play a vital part in the strengthening of concrete, masonry and wooden structures and precast buildings.

Mapei also promotes regular initiatives to bring themes such as safety and seismic upgrading to the attention of design engineers and building contractors. The technologies specifically developed by Mapei for structural strengthening work and seismic upgrading have proven to be the ideal solution in order to qualify for tax relief.

And it is precisely the technologies available for structural strengthening work and for the improvement and seismic upgrading of buildings that are the key features of the *Structural Strengthening Manual*, through which Mapei presents its leading strengthening technologies, with indications on typical areas of use for each one, accompanied by the benefits achievable and the scientific research and testing behind them.

Depending on the type of structure – reinforced concrete buildings, masonry and wooden buildings and the strengthening of non-load-bearing elements and components – the manual presents the most appropriate Mapei systems for each one.

Mapei's commitment to making buildings and structures as seismically sound as possible is implemented in various forms which, apart from the supply of products for restoration work, also includes the support of the Technical Services Department during the design phase and then on site to help identify the most suitable solutions.

THE FRP SYSTEM

The Mapei FRP System is a complete range of composites made from very high strength and extremely high mechanical strength fibres and polymeric resins specially formulated for the strengthening and static and seismic upgrading of structures made from normal, pre-stressed and reinforced concrete, steel, masonry or wood.

The term FRP stands for Fibre Reinforced Polymer. FRP's are part of the vaster family of "structural composites" and are made from strengthening fibres set in a polymer matrix. In fibre reinforced composites, the fibres act as loadbearing members to offer strength and stiffness, while the matrix, apart from protecting the fibres, acts as an element that transfers the stresses between the fibres and matrix and the structural member to which the composite has been applied.

The fibres may be subdivided into carbon fibres, glass fibres, basalt fibres and metallic fibres. The fibres may be disposed

FRP SYSTEM

FRG SYSTEM

HPC SYSTEM

MAPEWRAP EQ SYSTEM

in any direction, depending on design specifications, in order to optimise the mechanical properties of the composite in the directions required.
The particular characteristic of structural composites is that they provide better, or at least more "complete", mechanical properties than those that would otherwise be provided by the single components. The use of FRP's in the construction industry applies mainly to the renovation of weak or damaged structures and the static and seismic upgrading of structures.
In this context, repair work based on the use of high performance composites is more cost effective than traditional methods if the overall economic valuation takes into consideration the time required and the tools and equipment employed for the intervention, the costs involved in putting a structure out of service and the estimated working life of the structure itself once the intervention has been completed.
The Mapei FRP System for structural strengthening work consists of a wide range of:

- uniaxial, biaxial and quadriaxial carbon fibre fabrics (MAPEWRAP C) available in various weights, sizes and moduli of elasticity;
- uniaxial and quadriaxial glass fibre fabrics (MAPEWRAP G) available in various weights;
- uniaxial, high-strength basalt fibre fabric (MAPEWRAP B) available in various weights;
- steel fibre fabrics (MAPEWRAP S FABRIC), a wide range of cords in carbon fibre (MAPEWRAP C FIOCCO), glass fibre (MAPEWRAP G FIOCCO) and steel fibre (MAPEWRAP S FIOCCO);
- pultruded carbon fibre plates (CARBOPLATE), available in various sizes and moduli of elasticity;
- pultruded bars in carbon fibre (MAPEROD C) and glass fibre (MAPEROD G);
- pultruded carbon fibre tubes (CARBOTUBE) and a vast range of epoxy adhesives for impregnating and bonding (MAPEWRAP PRIMER 1, MAPEWRAP 11/12, MAPEWRAP 21 and MAPEWRAP 31).

THE FRG SYSTEM

The Mapei FRG System (Fibre Reinforced Grout) is a complete range of composites which, unlike traditional FRP, uses an inorganic mortar rather than a polymer matrix to guarantee excellent chemical-physical and mechanical compatibility with masonry substrates (stone, bricks and tuff), and alkali resistant glass, basalt or carbon fibre meshes. They are used for the repair or static and seismic upgrading of all types of concrete and masonry structures.
These types of material offer a series of advantages, including

Strengthening a beam-pillar junction with MAPEWRAP C SYSTEM.

Application of a compact strengthening layer to increase the shear and tensile strength of masonry walls using the FRCM System.

when used on buildings of historical or artistic interest, such as high mechanical strength, high compatibility with masonry characteristic, and ease of application.
The application of this type of material overcomes the problem of the inherently low tensile and shear strength of masonry and increases the ductility of the element.
This innovative strengthening system is made of a series of highly ductile, two-component, ready-mixed mortars, available in both the cement and the lime based (cement free) versions, and a series of glass, basalt or carbon fibre meshes.

The Mapei FRG System can be divided into:

- CRM SYSTEM (Composite Reinforced Mortar) comprising mortars suitable for covering very uneven masonry, combined with alkali-resistant glass fibre meshes (MAPENET

EM line). Because of the thickness applied, the system needs to be connected mechanically to the masonry with glass fibre connectors.

- FRCM SYSTEM (Fibre Reinforced Cementitious Matrix) comprising special fibre-reinforced mortars applied in combination with strengthening meshes made from various types (glass, basalt or carbon) of fibre (MAPEGRID line).

These systems allow to reduce the increase of mass and stiffness compared with the traditional strengthening systems.

PLANITOP HPC SYSTEMS

Amongst the various technologies available to strengthen existing structures, Mapei proposes a new family of mortars from the PLANITOP HPC line: fibre-reinforced cementitious mortars with very high mechanical properties containing stiff metal fibres dispersed evenly throughout the cementitious matrix.

- PLANITOP HPC, two-component, ultra high-performance, shrinkage-compensated, free-flowing, high ductility, fibre-reinforced cementitious mortar with stiff steel fibres for restoring and repairing concrete.
- PLANITOP HPC FLOOR one-component, ultra-high-performance, free-flowing mortar designed to make structural screeds suitable for strengthening floors and form rigid diaphragms. It is a rapid and compact solutions for strengthening floor slabs in a more compact layer. It does not require the use of steel connectors or electro-welded mesh.

MAPEWRAP EQ SYSTEM

To safeguard non-structural elements, an innovative system to provide protection against seismic activity is represented by the MAPEWRAP EQ SYSTEM.

The system is presented in the form of “seismic wallpaper” to give people more time to evacuate a building in the event of seismic activity.

It is used as “anti-tipping” protection for non structural walls and “anti-collapse” protection for ceilings.

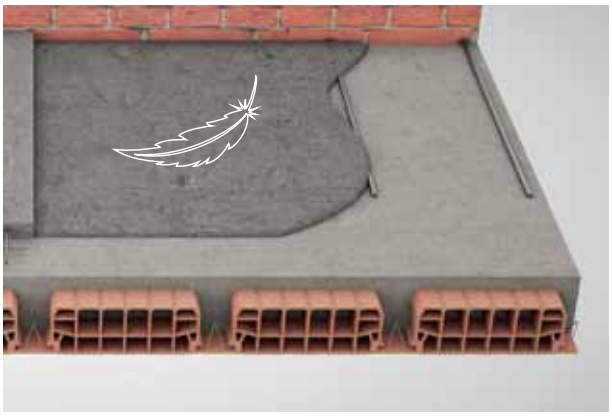
It is made up of:

- MAPEWRAP EQ NET primed bi-directional glass fibre fabric.
- MAPEWRAP EQ ADHESIVE one-component ready-mixed water-based adhesive in polyurethane dispersion.

The system offers the following advantages:

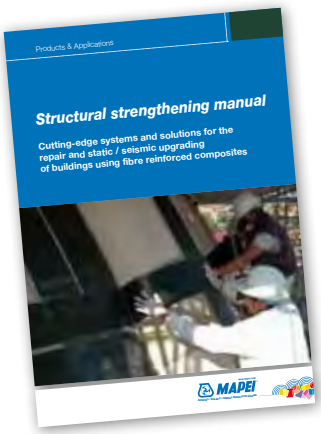
- compact and quick;
- may be applied over existing plaster;
- easy to apply;
- tested and certified system;
- unobtrusive;
- doesn’t take up any space;
- with very low emission of volatile organic compounds (VOC-FREE);
- fire rating B S1 d0 (UNI EN 1351-1).

Strengthening a wooden floor using PLANITOP HPC FLOOR.



HPC FLOOR lightweight system: no need for steel connectors or mesh.

Applying MAPEWRAP EQ NET, a component of the MAPEWRAP EQ SYSTEM.



Find out more by downloading the *Structural Strengthening Manual* at www.mapei.it!

MapeWrap® EQ System

THE SURE AND SAFE ANSWER IN THE EVENT OF EARTHQUAKES

PROTECTION FOR ANTI-COLLAPSE

Patented and certified safety system: prevent the **collapse** of ceilings with this quick, simple and compact solution.

MapeWrap EQ Adhesive
One-component ready-mixed water-based adhesive in polyurethane dispersion

MapeWrap EQ Net
Primed bi-directional glass fibre fabric

PROTECTION FOR ANTI-TIPPING

Patented and certified safety system: prevent the **tipping** protection for non structurals walls floors in the event of **seismic activity**.

Learn more on **mapei.com**

MAPEI®
ADHESIVES · SEALANTS · CHEMICAL PRODUCTS FOR BUILDING

Camerino (Italy)

SANTA MARIA ANNUNZIATA CATHEDRAL

AFTER BEING SEVERELY DAMAGED BY THE EARTHQUAKE THAT HIT CENTRAL ITALY TWO YEARS AGO, THIS CATHEDRAL UNDERWENT SEISMIC UPGRADING WORK

The earthquake and after-shocks that hit central Italy from the 24th of August 2016 reduced dozens of places of worship to heaps of rubble or left them badly damaged, and the most striking example was what happened to the Basilica of San Benedetto in Norcia, with just the façade that was left standing. These regions have a much higher density of places of worship than the rest of Italy: in the parishes in the Camerino area (in the Province of Macerata) alone census records have counted 454 churches, 222 of which were declared unfit for use following the earthquake two years ago.
In the city of Camerino, the bell-tower of the Church of Santa Maria in Via collapsed, the Church of San Filippo – which features a painting by Tiepolo – was left with part of its roof in ruins and the main Basilica dedicated to the city's patron saint, San Venanzio, is still inaccessible. The Santa Maria Annunziata Cathedral was also badly damaged.

A BRIEF HISTORY OF THE CATHEDRAL

The Church of Santa Maria Annunziata is the main church in Camerino and is the Cathedral of the archdiocese of Camerino-San Severino Marche. The current building was constructed following a strange twist of fate when an earthquake struck on the 28th of June, 1799 and damaged the previous church, built between the 12th and 13th centuries. The structure was so badly damaged that it needed to be rebuilt.
The current building was constructed at the beginning of the 19th century according to a design by Andrea Vici, a student of Luigi Vanvitelli, with whom he collaborated on the construction of the Royal Palace of Caserta (Southern Italy). After suspending work on the church in 1807 following the arrival of French troops, it recommenced 10 years later. Clemente Folchi took the reins following the death of Vici and abandoned the original project and built the current façade featuring two bell-towers and a portico which forms the continuation of the portico of the Bishop's residence. The Church was finally consecrated on the 8th of September, 1832.

© Christian Sordini

LEFT. Santa Maria Annunziata Cathedral during the repair work.
TOP OF THE PAGE. A view of the apse.

POST-EARTHQUAKE INTERVENTIONS

After the seismic activity in 2016, the Marche Regional Crisis and Coordination Unit was set up at the Regional Secretariat of MiBACT (Italian Ministry of Cultural Heritage and Activities and Tourism), in coordination with other local institutions, to check the condition of the artistic and cultural works and to assess the level of damage caused by the earthquake to the local monuments and buildings.
Mapei Technical Services were contacted by engineers from the Marche Heritage Trust and, in collaboration with Engineer


1


2

3

Alberto Balsamo of the Federico II University of Naples, followed the complex seismic upgrading work at the Santa Maria Annunziata Cathedral very closely.
Eng. Balsamo, who had already worked with Mapei Technical Services on other delicate consolidation works (see Realtà Mapei International no. 17), presented examples of previous interventions to show that FRP (fibre-reinforced polymer) systems are reversible in case of need at a later date.
With this method, an alternative to the use of traditional materials and strengthening techniques, fibre-reinforced polymer (FRP) materials are used to clad and consolidate curved structures, such as arches and vaulted ceilings, and to increase the shear and/or flexural strength of masonry panels. These types of material offer various advantages, such as high mechanical properties, little impact on the form and geometry of structures, high durability, ease of application and the possibility to remove them if required, a particularly important feature when used on buildings of particular historical and monumental significance, such as this one.
In the case of the Santa Maria Annunziata Cathedral, the local Heritage Trust asked for consolidation work to be evaluated for the apse, which was badly fractured and cracked. The intervention consisted in adding 6 bands using the FRP system to prevent the heavy facing walls that form the area around the apse from shifting out of plane.

APPLICATION OF THE MAPEI FRP SYSTEM

First of all, the cracks in the masonry were repaired using MAPEI STEEL DRY 316 ultra high-strength "dry-applied" helical AISI 316 stainless steel bars. The bars were inserted into the masonry by drilling a series of holes slightly smaller than the helical bars. The bars were then inserted in the holes using the special SPINDLE FOR MAPEI STEEL DRY. Once the bars had been inserted, the holes were filled with PLANITOP HDM RESTAURO mortar.
The first phase of the banding intervention was to form the levelling layer by applying PLANITOP HDM RESTAURO two-component, pre-blended, fibre-reinforced, high-ductility hydraulic lime (NHL) and Eco-Pozzolan based light-coloured mortar. PLANITOP HDM RESTAURO was specifically developed to smooth and level layers on stone, brick and tuff surfaces. When used in combination with glass and basalt fibre meshes, it helps strengthen facing walls.
The bands were made from products from the MAPEWRAP SYSTEM line, particularly recommended for the repair and statical and seismic strengthening of damaged structures.
Mapei Technical Services recommended using MAPEWRAP C UNI-AX 600 high strengh uni-directional carbon fibre fabric with high modulus of elasticity, which is particularly recommended for seismic upgrading work. The first step was to apply MAPEWRAP PRIMER 1 epoxy primer and then, on the fresh layer, an even coat of MAPEWRAP 31 T adhesive on the area to be strengthened.
Thereafter, MAPEWRAP C UNI-AX fabric was applied and pressed down firmly to make sure it adhered to the substrate and to avoid creases or folds. To prevent the formation of gaps or breaks in the bonding layer, and to make sure the adhesive penetrated into the fibres of the mesh, MAPEWRAP ROLLER was passed over the surface. A second coat of MAPEWRAP 31 T was then applied over the fabric.

IN THE SPOTLIGHT

MAPEWRAP C UNI-AX

High strength, uni-directional carbon fibre fabric with high modulus of elasticity. It is suitable for the repair of reinforced concrete elements damaged by physical-mechanical action, for the confinement of axial loaded or bent concrete elements and for seismic strengthening of structures in earthquake zones. It can be also used for the reinforcement of load bearing elements in buildings that have been restructured for architectural reasons or change of use.

PHOTO 1. Some of the deep cracks in the apse, repaired using MAPEI STEEL DRY 316 helical bars.
PHOTO 2. The substrate was made from PLANITOP HDM RESTAURO mortar.
PHOTOS 3, 4, 5, and 6. MAPEWRAP PRIMER 1 primer and MAPEWRAP 31 T adhesive were applied on the substrate, followed by MAPEWRAP C UNI-AX 600 fabric.
PHOTO 7. Restorers were able to "recreate" the original appearance of the wall on the new substrate.

A particularly interesting aspect of the intervention was the request by the local Heritage Trust to use a team of specialised restorers to decorate the FRP bands so they would blend in with the rest of the architecture.
Firstly, the surfaces to be decorated were skimmed by applying a layer of PLANITOP 200 water-repellent cementitious skimming mortar. Then, once the mortar had dried, a team of restorers from a specialised company redesigned and decorated the mortar in very fine detail.
Once completed, the strengthened area was hardly noticeable and blended in perfectly with the rest of the original facing wall.

TECHNICAL DATA
Santa Maria Annunziata Cathedral, Camerino (Italy)
Design: Andrea Vici and Clemente Folchi
Period of construction: 1800-1832
Year of the intervention: 2018
Intervention by Mapei: supplying products to strengthen and protect the apse
Design: Pierluigi Salvati
Assistance to design work: Diego Battistelli
Consultant: Alberto Balsamo
Client: Italian Ministry of Cultural Heritage and Activities (Marche Regional Bureau)
Works director: Pierluigi Salvati
Contractor: Impresa Costruzioni Fratelli Rinaldi (Giulio Traini)
Mapei coordinators: Lorenzo De Carli, Dominica Carbotti, Luca Consorti, Gabriele Zamperini, Paolo Baldon, Riccardo Chiodoni, Massimilano Petti, Mapei SpA (Italy)

MAPEI PRODUCTS
Structural strengthening: Spindle for Mapei Steel Dry, Mapei Steel Dry 316, MapeWrap Primer 1, MapeWrap 31 T, MapeWrap C UNI AX 600, Planitop HDM Restauro, Roller for MapeWrap
Smoothing surfaces: Planitop 200

For further information on products see www.mapei.com

NO MORE CORROSION with galvanic anodes

CATHODIC PROTECTION AND PREVENTION IN REINFORCED CONCRETE STRUCTURES

An increase in the level of damage caused by corrosion has opened new horizons in order to achieve the durability and the stability of reinforced concrete structures, especially in highly aggressive areas.

Various phenomena contribute to the onset of corrosion in steel reinforcement in concrete. In this article, we will discuss the most common causes of corrosion, with particular reference to carbonation and chlorides.

Because of its inherent alkaline nature, concrete creates a protective environment around the steel, but this environment is not eternal. Studies show that damage due to corrosion occurs when critical amounts of aggressive agents penetrate through the pores in the concrete, attack and destroy the passivation protective film around the steel and expose the reinforcement rods to the corrosion process.

There are two main types of aggressive agents that can create this phenomenon:

- Carbonation: the carbon dioxide and moisture in the surrounding air penetrate into the pores of the concrete and lower the level of pH to values close to neutral. In such conditions the reinforcement rods may corrode;
- Chlorides: by penetrating into the concrete, this type of aggressive agent might break the protective film and produce localised corrosion (pitting), including in alkaline conditions, that may even lead to a failure of the steel reinforcement.

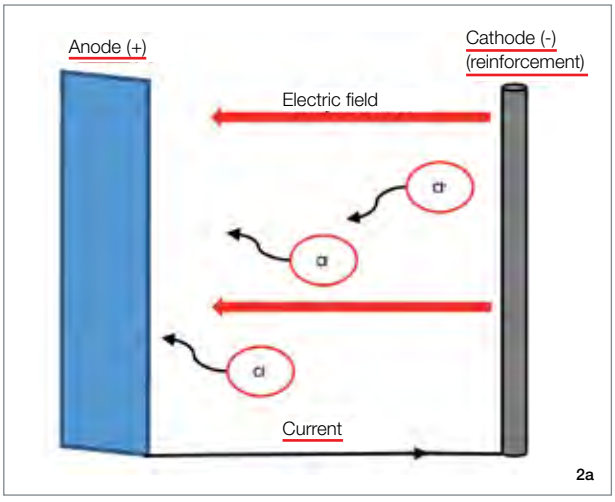
Corrosion of reinforcement rods generated by these phenomena form iron oxide (Fe_2O_3). Since iron oxide (rust) is much more voluminous than solid steel (5-6 times more), even a small loss of metal (e.g. ~ 0.1 mm) from the surface of the reinforcement rods can cause sufficient corrosion products to generate internal stresses that crack and damage the concrete (Figure 1).

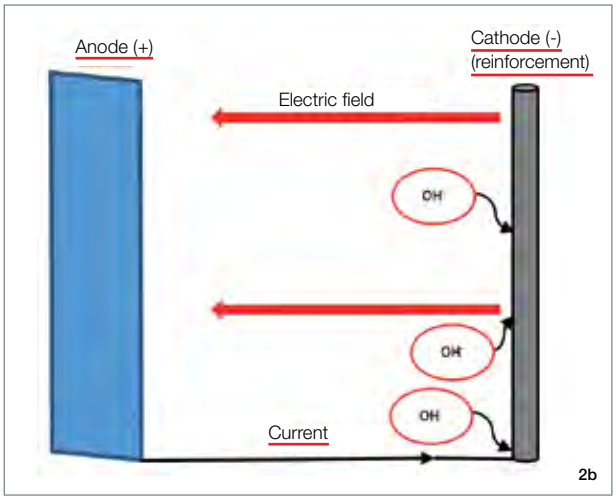
Chloride corrosion acts in a local and highly destructive way and is undoubtedly the most aggressive and dangerous type for the structural stability of a reinforced concrete element.

According to a report by the Federal Highways Administration, an agency

PHOTO 1. An example of a reinforced concrete damaged by corrosion of the reinforcement rods.

FIGURE 2. Dechlorination (a) and re-alkalisation (b) phenomena.





within the US. Department of Transportation, cathodic protection (CP) has proven to be the most effective technique to reinstate reinforced concrete structures contaminated by chlorides and stop corrosion, whatever their level [1]. By applying cathodic protection, the potential for corrosion is transferred towards a zone of immunity and the corrosion process is terminated. To apply cathodic protection, only the damaged part of the concrete needs to be removed and it is not always necessary to remove the solid, contaminated part.

The application of cathodic protection to a reinforced concrete structure transforms the surroundings around the reinforcement and produces a number of positive effects. Inside the concrete with cathodic protection, the current is transported by the ions in proportion to their concentration and mobility. The positive ions move in the same direction as the current, that is, from the anode to the cathode, whereas the negative ions move in the opposite direction. In so doing, the current flowing through the concrete contaminated by chlorides cause the chlorides (Cl-) to migrate from the area around the cathode (-) to the area around the anode (+). In such cases, the flowing current determines a reduction of the chloride content on the surface of the reinforcement rods, which is known as “dechlorination” (Figure 2a).

Also, oxygen and water on the surface of the reinforcement rods (cathodic zone) are consumed and form hydroxyl ions (2OH-) according to the equation:

$$H_2 + ½\ O_2 + e^- \rightarrow 2OH^-$$

The hydroxyl ions restore the alkalinity of the surface of the metal to a pH level of up to around 12, known as the “re-alkalisation effect” (Figure 2b) and induce re-passivation of the reinforcement.

New structures situated in aggressive surroundings may be fitted with a CP system that is applied at the start of their service life. This type of protection is called “cathodic prevention” and may be used on new structures, or on existing structures in which the corrosion process has not initiated but is likely to occur due to the progressive penetration of aggressive agents over the months and years. In such cases, cathodic prevention may be applied very simply by using a low, continuous current sufficient to protect the structure and guarantee long-term protection that is also cost-effective if we consider the low level of current required for reinforcement rods that have already been passivated [2].

There are two types of cathodic protection: impressed current (ICCP) or galvanic with sacrificial anodes (SACP). When correctly designed, installed and put into service, both systems have proven to have the capacity to control or mitigate corrosion by providing the level of protection required. The main difference between the two systems is that the impressed current type requires a power supply and a source of electrical energy to make it work, whereas the galvanic system is based on the principle of two different metals joined together in the same surroundings that generate electrical energy, similar to a

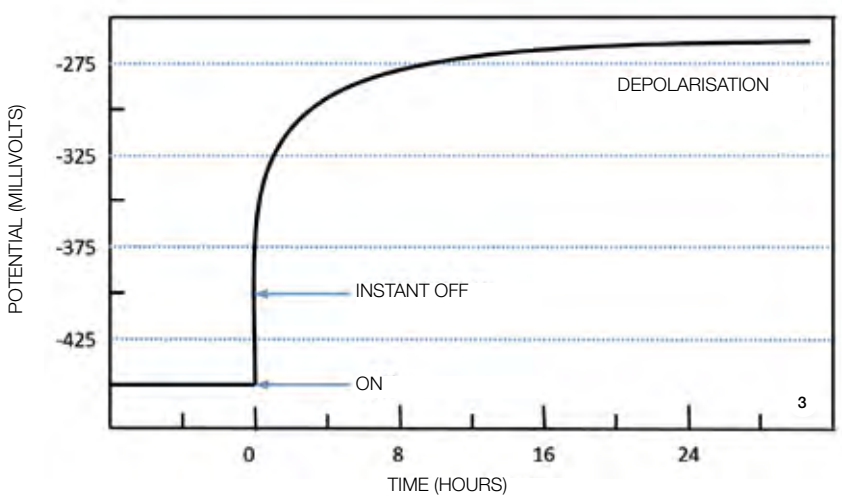


FIGURE 3.
Typical potential measurement to evaluate system performance [4].

battery.

One of the main advantages of SACP is that it only requires a minimum level of maintenance once it has been installed. Also, since it does not require a source of electrical energy, the system is immune to interruptions in the current or a sudden failure of the power supply. What is more, galvanic systems use relatively low natural currents (the difference in natural potential between the sacrificial anode and the steel to be protected) which prevent the possibility of problems occurring due to hydrogen embrittlement and stress corrosion of pre-stressed steel, which could occur, on the other hand, in the case of high protection with ICCP systems. The simplicity of its design and the low level of maintenance required are seen, therefore, as the main advantages of SACP systems. In an SACP system the current is self-regulating according to the rate of corrosion of the steel reinforcement, which means the system functions as and when required and without being forced and without overloads [3].

An SACP system also has limits. The main operational limit is that galvanic systems have their own fixed, natural potential and, as a result, in heavily reinforced elements, the current generated may not always be sufficient to guarantee polarisation of the steel. In such cases, increasing the number of sacrificial anodes and using low resistivity mortar can be an effective solution. The service life of anodes in SACP systems is determined by various factors and these may vary as time goes by. The relationship between the anodic current that consumes the anode and the rate of corrosion, expressed as loss in mass over time, may be obtained by applying Faraday's first law. The mass of anodic material required, which also includes efficiency and usage factors, is calculated by applying this law according to the equation:

$$W = (ARC * CR * L) / (E * U)$$

Where:

- ARC is the average current required (typically from 2 to 20 mA/m^2 for old structures and from 0.2 to 2 mA/m^2 for new structures according to ISO 12696:2012 "Cathodic protection of steel in concrete");
- CR is the consumption rate of the anode;
- L is the design life;
- E is the efficiency of the metal used;
- U is the usage factor of the anode used.

For example, if we consider a zinc anode generating a constant current of 1 mA for one year, the consumption rate would be around 12-14 g of anodic material.

Considering the standards for "Cathodic protection of steel in concrete" [4, 5], the most widely adopted criteria for assessing the performance of a CP system applied to a structure is to measure depolarisation starting from the potential "Instant OFF". In practical terms, the potential of the reinforcement rods with the anodes attached must be measured (polarisation), following which the anodes are disconnected from the reinforcement rods and the measurement is repeated. There will be depolarisation phenomenon that consists of an increase in the potential of the steel reinforcement to more positive values (e.g. polarisation -450mV; depolarisation -285mV). According to ISO 12696, this shift in potential must be at least 100 mV within a maximum of 24 hours or at least 150 mV over a longer period. A typical depolarisation graph is shown in Figure 3.

The instruments used to measure potential include manual or portable devices or ones that are installed permanently on the structure. The use of a permanent, online monitoring system is preferable because it allows data to be accessed at any time and also identifies problems immediately. For most important structures, inspections are generally carried out according to a set schedule that may vary from months to years, unless there are particular conditions that require more frequent inspections. It is to be hoped that, in the not too distant future, large infrastructures will be equipped with systems of this type in order to overcome safety problems, but also to monitor and gain a better understanding of the mechanisms associated with the deterioration of structures.

Eng. Hadi Beirami. PhD Corrosion Engineering, Specialist in corrosion and protection of concrete structures, Nace Member

REFERENCES

1- Scheffy, C. F. (1981). *Bridge deck deterioration - A 1981 perspective.* FHWA Memorandum, Federal Highway Administration Office of Research.

2- Pedeferri, P. (1996). *Cathodic protection and cathodic prevention.* Construction and building materials, 10(5), pp. 391-402.

3- Item No. 24224, (2005). *Sacrificial cathodic protection of reinforced concrete elements.* Houston, TX: NACE International.

4- ISO, B. (2016). 12696 -2016. *Cathodic protection of steel in concrete.*

5- SP0216 (2016). *Sacrificial cathodic protection of reinforcing steel in atmospherically exposed concrete structures.* Houston, TX: NACE International.

MAPESHIELD ANODES

PROTECTING REINFORCEMENT RODS IN REINFORCED CONCRETE FROM CORROSION

Galvanic cathodic protection is based on the principle of joining two metals together with different natural potential: carbon steel which is used to make the reinforcement rods and zinc in the anodes. By joining the two metals, the concrete or repair mortar acts as an electrolyte and a continuous electrical current is generated which protects the steel from corrosion. The metal with the most negative electric potential oxidises, thereby protecting the less negative of the two metals which becomes passivated.

The zinc contained in MAPESHIELD anodes oxidises over time and is sacrificed in favour of the reinforcement rods inside the concrete, thereby delaying or interrupting the corrosion process and considerably increasing the durability of the structure. Also, thanks to the electric charge in the anodes, they are able to attract chlorides and keep them away from the reinforcement rods, which in turn has a beneficial effect against corrosion.

One aspect that characterises and increases the effect of MAPESHIELD anodes is the type of electrolyte they are coated with, a material made from conductive acrylic binders and a pH regulator that ensures the zinc does not become passivated in alkaline surroundings, such as concrete, which would then prevent the anode from functioning incorrectly. This particular electrolyte also ensures the efficiency of the anodes remains constant, even in surroundings with very little moisture.

The best position for the MAPESHIELD anodes is calculated according to the density of the reinforcement rods, that is, the ratio between the surface area of the steel to be protected and the surface area of the concrete in contact with the pollutant, but also by taking into consideration the geometry of the structure and its exposure to aggressive agents.

MAPESHIELD anodes offer various advantages, they can be used on both new (prevention) and old (protection) structures and they can be placed selectively and precisely, that is, only in the areas of the structure with the highest risk of corrosion. What is more, they do not require maintenance during their normal service life and they may be monitored during operation by installing a simple control system.

PHOTO 1. An example of MAPESHIELD I applied to a new structure.
PHOTO 2. An example of MAPESHIELD E applied to a restored structure.
PHOTO 3. A close-up of how MAPESHIELD I is joined to the reinforcement rods by simply tying it in place with a piece of iron wire.
PHOTO 4. A close-up of how MAPESHIELD E can be connected to the reinforcement rods by welding a piece of threaded galvanized bar to the reinforcement rods.


1


2


3


4

MAPESHIELD I AND MAPESHIELD E ANODES

MAPESHIELD I are internal anodes with a special zinc core which, for the same volume, increase the protective surface area, a characteristic which, along with the special electrolytic material it is coated with, makes the product efficient as well as durable over time. There are four different types of internal galvanic anodes in various sizes and masses of zinc to guarantee protection for most types of reinforced concrete structures. The anodes are fastened to the metal reinforcement rods that requires protection before pouring the concrete or before applying the repair mortar.

MAPESHIELD E are self-adhesive zinc plates that are applied directly to the surface of the concrete. This type of anode can be applied easily and quickly by simply removing the protective film from the conductive gel and pressing the plate onto the surface of the concrete. The plates are then connected to the reinforcement rods inside the concrete with electrical connections previously attached to the rods.

MAPESHIELD anodes comply with ISO 12696 “Cathodic protection of steel in concrete” according to the principle of depolarising the steel reinforcement.

Architects and creative people: everybody in Mexico City

ARCHITECTURE, ART, FASHION: THE 2018 WORLD CAPITAL OF DESIGN IS GOING THROUGH A PERIOD OF EXTRAORDINARY VITALITY

The New York Times described it as the "coolest" capital of the moment. It is a "new Berlin" for young people. In 2018 Mexico City showed the world how it had changed face and certainly made a real impact on the international community of architects and creative people as the global capital of design. This honour is bestowed on a selected city every two years as a reward for making design the driving force behind its economic, social and cultural growth. In 2008 Turin was the first "showcase" chosen by the World Design Organisation that has recently elected the French city of Lille as the 2020 global capital of design.

Despite all its great contradictions, Mexico City is now one of the liveliest and most innovative hubs of international architecture. The capital of Mexico has regained its status as a magnet for design and creative people from all over the world and is becoming an incubator for a new type of design worth exploring. It is a city that manages to combine the legacy of its past with innovations in the present. Many people have emphasised the richness of Mexico's modern-day architecture that really comes from its complexity; a real weave of styles and trends. Today more than ever, at a time of extraordinary vivacity, many parts of the city are managing to mix together art, fashion and design. Where for example? The Roma district of Mexico City with its combination of art galleries and fashion houses. A neighbourhood that came to fame thanks to the film "Roma" by the Mexican film director Alfonso Cuarón, who won the Golden Lion'at the last Venice Film Festival. Shot in black-and-white, the film was inspired by the film

director's own life growing up in the Roma neighbourhood in the 1970s.

But it is not just style and design, the whole of Mexican architecture is bubbling. This particularly applies to its capital city, a gigantic megalopolis, whose population has risen from 3 million in 1952 to 21.5 million in 2018, an incredible figure if you consider that the overall population of Mexico is 131.4 million in 2018 according to the World Population Review. The boom in the metropolitan area has developed alongside various urbanisation processes. An often dishevelled and chaotic explosion that is now being counteracted by greater attention to sustainability.

The city's sheer numbers call for strategic decision-making from an urbanistic viewpoint. Major works currently underway, such as the upgrade and extension of the city airport and

MANUEL GÓMEZ MORÍN CULTURAL CENTRE. In Queretaro, the Cúpula del Péndulo de Foucault, a 2,000 m² dome overlooking the library of this Cultural Centre, was waterproofed with AQUAFLEX TECHOS FIBRADO*.
The cupola was then painted with murals by local and international artists.

1. KAANA. Stone slabs for this eco-sustainable residential district were installed on the walls waterproofed with MAPELASTIC AQUADEFENSE. They were bonded with ULTRAFLEX 2, KERABOND and KERALASTIC, while joints were grouted with KERACOLOR FF and protected with ULTRACARE PENETRATING PLUS*.
2. MEXICO MONUMENTAL SCULPTURE. This monument, dedicated to Mexico, was built during the 1968 Olympic Games and it is currently being restored with PLANITOP X*, PLANISEAL 88, MAPECEM QUICKPATCH*, EPORIP, TILT FINISH* and PLANISEAL WR*.
3. EL SOL BÍPEDO. This monument can be found along one of the main arteries in Mexico City and has been exposed to the weather and smog for 50 years. Once the damaged parts had been repaired (MAPECEM QUICKPATCH*), the monument was waterproofed (MAPELASTIC SMART) and painted (ECO PRIM GRIP and MAPEFLOOR FINISH 58 W).

THE NEW HEADQUARTERS
OF MAPEI DE MÉXICO
IN QUERÉTARO, IN CENTRAL MEXICO

the completion of the México-Toluca inter-urban railway line that connects the Toluca valley with the western zone of Mexico City, representing a great solution for millions of people who move daily from the capital city to the State of Mexico, spending around 4 hours in transportation. The interurban train will provide transportation for 230,000 passengers a day: only 39 minutes for 58 km between 2 terminals with 4 intermediate stations.
Major works, a booming construction industry and the conservation of old buildings are all catching the eye and attracting foreign investment to Mexico.
The country is growing all the time. After closing 2017 with a 2.1% increase in its GDP, the trend is expected to continue this year and is estimated to rise by 2.5% in 2019. Mexico's economic potential has been pointed out by many people and, if it manages to solve issues related to internal safety and security, there is no reason why its GDP should not rise by between 3 and 5 % in the medium and long term.
The country is expanding around its capital. Everybody remembers the "milagro Mexicano" ("Mexican miracle"), which contributed to urbanisation on an unprecedented scale between the early 1950s and end of the 1960s. This produced a number of landmarks in terms of architecture and major works, like the UNAM campus (National Autonomous University of Mexico) with its Central Library and spectacular mural designed by Juan O'Gorman or the Azteca Stadium by the architect Pedro Ramírez Vázquez.

MAPEI IN MEXICO

The Mapei Group is betting on this Northern American nation's future prospects, providing innovative solutions and Italian technology: it is extending its portfolio of products available in Mexico, increasing investment and boosting its manufacturing output in this country. The aim is to become a leading player on the local market and further afield.

The Mapei Group is currently involved in the most important projects in Mexico City. First and foremost, the airport expansion where Mapei know-how ranges from solutions for bonding ceramic tiles and products for the installation of marble coverings in buildings or coatings for the service areas and decorative cementitious floors. As for the interurban Mexico-Toluca train line, Mapei has provided admixtures for concrete, foaming agents, and technology for the construction of the bi-tunnel. As well as looking to the future, the company is also helping restore the city's cultural heritage. Like, for example, refurbishment works on the National Autonomous University of Mexico, where Mapei products helped bring these landmark buildings back to their former glory. Not forgetting the restoration of El Sol Bípedo and La Torre de Los Vientos monumental sculptures along the Ruta de la Amistad (Friendship road) with Mapei supplying its products and technical assistance for carrying out the work.

4. WATER BASIN. This basalt basin in front of the grandiose O'Gorman's mural of the UNAM Central Library was damaged by gaps and cracks. Because of that, it had to be grouted and repaired (PLANIGROUT 740*, PLANITOP XS* and PLANICRETE AC*) and then waterproofed (PLANISEAL 88).

5. UNAM-NATIONAL AUTONOMOUS UNIVERSITY OF MEXICO. The main campus was nominated a UNESCO World Heritage Site in 2007. Mapei took part in the complex restoration work on seven different sites, as the façade of the Faculty of Humanities building, by supplying a wide range of products.

6. UNAM HIGH SCHOOL. MAPEWRAP PRIMER 1, MAPEWRAP 31 T e MAPEWRAP C UNI-AX were used for the renovation and structural strengthening of 4 classrooms of the UNAM High School in Mexico City. PLANITOP SX* and PLANITOP 12* were used for concrete repair.

7. SAN AUGUSTIN. Restoration work on this 16th century monastery was carried out in collaboration with UNAM-National Autonomous University of Mexico. The external walls required the application of a transpirant paint and Mapei recommended using SILANCOLOR PAINT PLUS.

*These products are distributed on the Mexican market by Mapei de Mexico.

Mexico City

NEW RAILWAY LINE

› 57
km: length of the line

› 300,000
passengers every day

› 160
km/hour: speed of the trains

A LOT OF UNDERGROUND WORK WAS REQUIRED TO CONSTRUCT THE NEW RAILWAY LINE BETWEEN MEXICO CITY AND TOLUCA

The project for the new commuter line between Mexico City and Toluca – for a total cost of 3.18 billion US dollars – is just part of a more far-reaching national infrastructural plan inaugurated by the Mexican government. The line will have two terminuses, in Zinacantepec and Observatorio, and four intermediate stations in Pino Suárez, Tecnológico, Lerma and Santa Fe. Trains will reach speeds of up to 160 km/hour and reduce travelling times between the two cities to around 40 minutes, whereas the same journey by car takes around 3-4 hours. According to estimates the new line will be used by around 300,000 passengers every day and this figure should grow to around 500,000 passengers by 2047. The overall length of the line is 57 km and will include an underground stretch with an 8.7 m diameter, 4.7 km long twin tunnel and then cross-tunnels every 320 metres.

The mountainous terrain and environmental conditions in which the tunnel was constructed proved to be particularly challenging. One of the problems faced by the contractor was to use two full-section boring machines to bore out the tunnels in complete safety and in the presence of water under high pressure. The twin Tunnel Boring Machines (TBM) worked in tandem to extract around 570,000 m^3 of material and, while boring out the tunnels, 6,312 concrete rings were installed.

IN THE SPOTLIGHT

MAPEQUICK AFK 888

It is an alkali-free, inorganic salt-based liquid accelerator for shotcrete characterized by rapid setting times and a very quick development of its strength after only a very short curing time. Concrete admixed with MAPEQUICK AFK 888 adheres better to surfaces, has a higher capacity to penetrate between the various layers and reduces waste.

LEFT. The walls of the tunnel were repaired and skimmed with PLANITOP X.
PHOTO 1. The entrance to the tunnel.
PHOTO 2. DYNAMON XTEND W500R and MAPEFIBRE TR06 were used to make the precast concrete rings.
PHOTO 3. MAPEBLOX EP2 grease and MAPEBLOX H sealant were used during boring operations with TBM.
PHOTO 4. PLANIGROUT 712 epoxy mortar was used to make anchor points.

UNDERGROUND INTERVENTION

Mapei Technical Services worked with the designers to help choose the most suitable products for the underground work during all excavation operations (boring, material extraction, concrete ring lining and back-fill injections).

POLYFOAMER FP/CC liquid foaming agent, which is suitable for conditioning all types of ground bored with a TBM, was injected to generate foam with excellent lubricating properties that remained stable over time. The foam created by this product reduces friction between the particles of soil, which in turn minimises wear on the cutting tools.

The mechanical components of the two TBM were lubricated with MAPEBLOX EP2 grease and the boring heads were sealed with MAPEBLOX H to prevent material flowing back from the boring front.

In some of the sections conditions were particularly difficult due to the presence of water on the walls of the tunnel, which required the use of MAPEDRILL M1 liquid synthetic polymer for water-based fluids used in mechanized tunneling and MAPEDRILL SA1, an organic-based liquid polymer with high absorption capacity.

Using these two products increased the productivity of the boring machines quite significantly and helped make boring operations quicker and easier.

Other products used included RESFOAM SS 75 polyurethane grout to stabilise soil, PLANIGROUT 712 mortar to create anchor points and PLANITOP X mortar to repair and skim the walls of the tunnel.

DYNAMON XTEND W500R acrylic superplasticiser for concrete was used along with MAPEFIBRE TR06 structural polymer fibres to make the precast concrete segmented rings.

To increase the level of safety in the tunnel during boring operations the walls were sprayed with shotcrete admixed with MAPEQUICK AFK 888 set accelerator.

RESFOAM SS 75, PLANIGROUT 712, DYNAMON XTEND W500R and MAPEFIBRE TR06 are distributed on the Mexican market by Mapei de Mexico.

TECHNICAL DATA
Mexico City-Toluca railway line, Mexico
Period of construction: 2016-2018
Year of the intervention: 2016
Intervention by Mapei: supplying products for tunneling and admixtures for concrete
Client: Secretaria de Comunicaciones y Transportes (SCT)
Main contractor: Ingenieros Civiles Asociados (ICA)
Works Director: Ismail Benamar (ICA)
Mapei Distributor: Francisco González
Photos: Sergio Zarate
Mapei Coordinator: Sergio Ocampo, Mapei de México

MAPEI PRODUCTS
Underground works: Dynamon Xtend W500R, Mapeblox EP2, Mapeblox/H, Mapedrill M1, Mapedrill SA1, Mapefibre TR06*, Mapequick AFK 888, Planigrout 712*, Planitop X*, Polyfoamer FP/CC, Resfoam SS75*

*These products are distributed on the Mexican market by Mapei de México S.A. de C.V.

For further information on products see www.mapei.com

MAPEI in INDIA

WITH JUST THE RIGHT STRUCTURES, PERSONNEL AND STRATEGIES, MAPEI IS OUT TO CONQUER A HIGHLY PROMISING MARKET

In line with the Group's strategic plans for Asia, the Indian subsidiary Mapei India was founded in 2011. It is based in Bangalore, in the state of Karnataka, in southern India and the objective was to exploit the opportunities offered by this country and supply the Indian market with innovative and cutting-edge products.

RECORD-BREAKING MARKET

The figures alone show that this is already a record-breaking country with a very interesting future: the population accounts for 18% of the total for the entire planet; GDP grew at a rate of 5% in the last five years, reached 6.7 in 2017, is set to reach 7.4% for the period 2018-2019 and will have an increasingly heavy impact on global GDP (from 1.6% in 2000 to 3.4% last year); inflation should remain stable at around 5% for several years.

But, what is even more important for a company operating in the building industry, is that the figures for this particular sector are staggering: it is the fourth largest market in the world with total investments of around 320 billion Euros. This accounts for 4.3% of the world's total construction output and, according to the latest forecasts, it will grow by around 7% in 2018 and then by around 8% in 2019.

If we go a little more into detail, we can also see that the Indian ceramics market is returning record-breaking figures: 1 billion square metres of tiles produced every year, a total consumption rate of 819 million square metres and constant growth since the 1990's which, over the years, has seen India overtake Italy, Spain and Brazil to become the second largest ceramics producer in the world.

If we consider that pro-capita consumption for ceramic tiles in India is still very low (around 30% of the global average) and is set to rise, that the amount of available income is growing and that there is a significant demand for high-end and cutting-edge products, then it is clear that, for Mapei India, it is a land of excellent opportunities.

PRODUCTION FACILITIES, WAREHOUSES, OFFICES

To be in a position to supply its materials to professionals operating on the Indian market, Mapei first needed to open a manufacturing facility in Bangalore in 2012 and then, because of the increase in business in other areas of India, a warehouse near Mumbai, in the state of Maharashtra, in the western part of the country. The last step was to open another manufacturing facility in 2016 in an industrial park near Vadodara in the state of Gujarat, in north-western India, to manufacture powdered, liquid and epoxy products.


1


2

Thanks also to this new structure, Mapei India can now provide its clients with admixtures for concrete and cement additives, waterproofing products, solutions for repairing and strengthening structures, cementitious and resin flooring solutions, products for installing ceramic, stone and resilient materials (including for sports surfaces), sealants and solutions for constructions below ground level.

Mapei India currently has offices in Bangalore, New Delhi, Mumbai and Vadodara, a group of over 130 people and a highly qualified sales team to cover the entire country and a Technical Services department to provide support and work alongside architects, contractors, interior designers, installers, etc.

Thanks to all this, and also to the support from the mother company, Mapei India has grown consistently over the last seven years and is forecasted to reach a turnover of around 15 million Euros in 2018. The company also took part in various important building projects completed in India over the last few years, such as Mumbai International Airport, the J.W. Marriott Hotel in Pune, the Statue of Unity (currently under construction in the state of Gujarat), the Trump Tower in Pune, the largest ever Hare Krishna temple, the Iskcon temple at Mayapur, and various strategic tunnels commissioned by the Indian government.

A sign of the Indian subsidiary's determination to grow is that it was also present at this year's edition of ACETECH, the

most important Indian trade fair dedicated to architecture and construction, that was held in Delhi from the 13th to the 16th of December.

COMMITMENT TO SUSTAINABILITY

And as a clear sign of its commitment to the theme of sustainability, Mapei India decided to make "World Environment Day", an annual event held on the 5th of June dedicated to the environment, a memorable event.

After holding special training sessions for its staff on Mapei's commitment to eco-sustainability and collecting suggestions for the celebrations, special "World Environment Day" banners were made to mark the day.

On the 5th of June, the management and employees spent the day planting around 250 plants in the land around the offices. Once they had finished planting, they watched a video about the importance of protecting the environment and took part in quizzes and a prize draw.

MAPEI INDIA IN NUMBERS

2 MANUFACTURING PLANTS: IN BANGALORE AND VADODARA

4 OFFICES IN NEW DELHI, BANGALORE, MUMBAI AND VADODARA

130 STAFF

15 MILLION EUROS OF SALES IN 2018

PHOTO 1. Mapei India's manufacturing plant in in Vadodara, in the state of Gujarat.
PHOTO 2. Mapei India's brand-new headquarters in Bangalore, in southern India, which were inaugurated last September.
PHOTO 3. The company's production facility in Bangalore.
PHOTOS 4 AND 5. On the 5th of June, the management and employees of Mapei India spent the day planting around 250 plants in the land around the offices to celebrate the "World Environment Day".

TRUMP TOWERS

APARTMENTS CHARACTERISED BY QUALITY MATERIALS NEEDED PRODUCTS THAT WERE UP TO THE JOB

© Sandeep Gore/Shutterstock.com

Situated in the state of Maharashtra around 150 km to the south-east of Mumbai, Pune has more than 2,500,000 inhabitants and is the fourth most important industrial city in India. And it was right here that the client, the second largest real estate investment company in the whole of India, wanted to build the two Trump Towers.

The glass-façade twin towers, with their elegant and modern lines, rise up in the Kalyani Nagar district and have redefined the urban skyline of the entire city.

The towers are 25 storeys high and have a total of 46 apartments, each one measuring 400 m^2 characterised by a 360° panoramic view, and they have also been awarded IGBC Green Homes Platinum certification from the Indian Green Building Council.

Trump Towers represented a complex challenge, not only for the actual construction, but also when defining the interior design, which stand out on the Indian real estate scene for their blend of modern architecture, high standard of wellbeing, luxury finishes and comfort typical of other constructions sporting the Trump brand.

The interior design of the entire residential complex and the selection and coordination of the suppliers of the furnishing and fittings was all entrusted to an Italian design studio which, apart from the apartments, was also responsible for the interior design of the common areas: from the lobby on the ground floor characterised by columns covered with stone to the open-air swimming pool on the first floor and the fitness and yoga areas, two massage rooms, a multi-functional zone and a business centre.

IN THE SPOTLIGHT

KERAFLEX MAXI S1

It is a high performance, deformable cementitious white adhesive with extended open time and no vertical slip, for ceramic tiles and stone material, with Low Dust technology and very low emission level of volatile organic compounds. It is especially suitable for the installation of large-size porcelain tiles and natural stone. It features low viscosity, high thixotropy, good capability to accommodate the different deformation of the covering from the substrate, perfect adherence to all materials normally used in building, particularly extended open and adjustability time.

ABOVE. Granite and marble slabs was installed in the living areas with KERAFLEX MAXI S1 adhesive.
RIGHT. Before installing the floor and wall coverings, the surfaces in the kitchens and bathrooms were waterproofed with MAPEGUM WPS.

INSTALLATION OF QUALITY MARBLE

The Mapei India Technical Services Department was on hand to assist the flooring contractor in choosing the best products to cover the surfaces in the apartments with large-size stone slabs.

The first step was to treat the substrates with PRIMER G synthetic resin-based primer in water dispersion. This product is used to improve the adhesion of smoothing compounds on cementitious or anhydrite and gypsum-based surfaces, as well as to provide uniform absorption in cementitious or gypsum surfaces. When used before the application of self-levelling compounds as it was in this case, PRIMER G reduces the formation of air bubbles and helps prevent over-rapid drying making self-levelling easier.

The next step was to apply a skim-coat of ULTRAPLAN ECO 20 self-levelling mortar, a product manufactured and distributed in India by Mapei India, which was used for levelling and removing differences in thickness on the existing substrates. Before installing the marble, the floors and walls of the bathrooms needed to be waterproofed with MAPEGUM WPS quick-drying, flexible, liquid membrane. After rapid evaporation of the water content, MAPEGUM WPS forms an excellent surface which bonds perfectly to adhesives used for installing ceramics, marble and natural stone.

The floor and wall coverings were installed with different types of adhesive, depending on the surroundings and installed materials. Granite and marble slabs were bonded with KERAFLEX MAXI S1, deformable, cementitious adhesive with extended open time and no vertical slip. KERABOND T cementitious adhesive with no vertical slip, mixed with ISOLASTIC elasticising latex instead of water, was used to install marble slabs on walls. ADESILEX P9 adhesives was used to install ceramic tiles in the terrace, while ceramic tiles in the swimming pool were bonded with ADESILEX P10.

KERACOLOR FF high performance, polymer-modified, water-repellent, cement-based mortar was used to grout the joints.

TECHNICAL DATA

Trump Towers, Pune, Maharashtra (India)
Period of construction: 2013-2017
Year of the intervention: 2017
Intervention by Mapei: supplying products to prepare and waterproof the substrates and install stone and ceramic tiles
Client: The Trump Organization
Contractor: Panchshil Realty
Interior Design: Studio Matteo Nunziati
Stone installation company: Panchshil Realty
Mapei coordinators: Madhukar Ghare, Mapei India

MAPEI PRODUCTS

Preparing substrates: Primer G, Ultraplan Eco 20*
Waterproofing substrates: Mapegum WPS
Installing stone and ceramic tiles: Adesilex P9, Adesilex P10, Isolastic, Kerabond T, Keracolor FF, Keraflex Maxi S1, Keralastic T

* This product is manufactured and distributed in India by Mapei India

For further information see www.mapei.com and www.mapei.co.in

PROJECTS IN INDIA

MAPEI PRODUCTS HAVE BEEN USED TO BUILD VARIOUS STRUCTURES IN INDIA OVER THE LAST FEW YEARS. INFRASTRUCTURES, RELIGIOUS, RESIDENTIAL AND COMMERCIAL BUILDINGS, MONUMENTS AND MANY MORE BESIDES

STATUE OF UNITY
NARMADA DISTRICT GUJARAT

The statue, which stands at 182 m high, is the tallest statue of the world. It pays homage to India's most celebrated statesman and freedom fighter Sardar Vallabhbhai Patel. About 565 states were unified under his strength to form the unified India, so the statue was named the "Statue of Unity". The monument is an engineering marvel and strategically designed to counter the forces of nature and endure through time. It encloses a few museums, viewing galleries, an exhibition hall, etc. Mapei supplied several products for its construction, such as waterproofing materials (IDROSTOP, IDROSTOP MASTIC, PLANISEAL 88), wall coatings (ANTIPLUVIOL S), products for concrete repair (MAPEGROUT EASY-FLOW), soundproofing materials (MAPESONIC CR), adhesives for ceramic tiles (KERAFLEX MAXI S1, KERALASTIC) and for resilient materials (ULTRABOND ECO V4 SP), as well as admixtures for concrete (DYNAMON SX).

CHANDRODAYA MANDIR AND TEMPLE OF VEDIC PLANETARIUM
MAYAPUR - WESTERN BENGALA

ISKCON Mayapur is the world headquarters of ISKCON (International Society for Krishna Consciousness). ISKCON has a big campus in Mayapur which includes the Chandrodaya Mandir Temple, the Temple of the Vedic Planetarium, and many more. The centrepiece of the Temple of the Vedic Planetarium is a giant rotating model that demonstrates the movements of the planetary systems as described in the sacred texts of this religion. Mapei has been a partner in providing cutting-edge building products for both the Mayapur Temple and the Planetarium: waterproofing compounds such as PURTOP 600, MAPELASTIC SMART, PLANISEAL 288, and MAPEBAND and products to install ceramic tiles such as KERALASTIC T and KERAPOXY.

AUDI SHOWROOM - SURAT, BARODA, AHMEDABAD AND RAJKOT
GUJARAT

Nixynona Motoren Pvt is Audi's dealer in the state of Gujarat in north-west India. It has various showrooms and service centres in the cities of Surat, Baroda, Ahmedabad and Rajkot. These facilities were built with the help of Mapei India from 2012 to 2017. More specifically, the Indian subsidiary supplied materials for waterproofing substrates (MAPELASTIC SMART), installing ceramic tiles and mosaics (ADESILEX P9, KERAFLEX MAXI S1) and grouting joints (KERAPOXY).

Z MORH TUNNEL
GAGANGEAR-SONAMARG
JAMMU AND KASHMIR

This 6.6-kilometre-long twin-tunnel is located along a stretch of the Srinagar-Leh motorway near the town of Gagangear-Sonamarg in the Ganderbal district of northern India. Construction work started in May, 2015 and is still ongoing. The aim of the tunnel is to provide permanent access to the tourist district of Sonamarg throughout the year and improve traffic conditions in the Ladakh area. Certain sections of the tunnel were waterproofed with MAPEPLAN TU S 20 synthetic membrane made by Polyglass, a subsidiary of the Mapei Group. Various Mapei admixtures were used to make the concrete mixes, such as MAPEQUICK AF 70 and DYNAMON SX, as well as MAPEFIBRE BG 55 fibres. MAPEFAST CF/L chloride-free, anti-freeze admixtures was also added to the concrete used to build the tunnel.

ON THE ROAD TO INNOVATION

FILI & FORME, MANUFACTURER OF STRUCTURAL FIBERS FOR CONCRETE, JOINS MAPEI GROUP

Fili & Forme was founded in San Cesario sul Panaro near Modena, on March 15th, 1994 by Lorena Gamberini. Together with former colleagues and shareholders with consolidated experience in this activity, they decided to start a new plastic extrusion business, producing filaments for the household cleaning industry. Within few years, thanks to the high quality of the products and the efficient service provided, the company became one of the most important players in the entire sector. Turnover grew rapidly while the company expanded its presence in the main overseas markets. The polymers extruded were essentially PVC for the broom industry and PP (polypropylene) for household brushes.

Over the years, Fili & Forme consolidated its leadership in its branch of activity, while always looking for new opportunities of increasing its product portfolio with innovative high-added-value products, to cater to totally different applications. The turning point showed up in 2007 when, thanks to a joint project in collaboration with the University of Modena and Reggio Emilia, Fili & Forme patented the first structural fiber for concrete reinforcement. The company found itself playing

in a completely brand-new market and, for this purpose, the new ISTRICE brand was created, which since the very beginning brought aboout a growing motivation to engage in further researches and new developments to produce a wide range of fibers dedicated to the world of construction.

These new fibers offer indeed clear advantages: even three-dimensional distribution, corrosion resistance, no installation costs, reduction of working hours and transport costs; they are very light-weighted and easy-to-handle while providing outstanding mechanical performance properties and allowing the reduction or even elimination of the traditional steel reinforcement.

The market response was extremely positive and despite the years of deep crisis affecting the construction sector, the demand kept unceasing both on the domestic and the foreign markets.

Collaboration with important Universities such as Politecnico in Milan and Alma Mater in Bologna never stopped. New fibers were launched on the market: iBETON dedicated to the industrial concrete flooring sector, iSHOTS for shotcrete employed in underground sites, iPREFS for precast concrete elements and iSCREED for cement and sand screeds.

New distribution networks were established and consolidated in particularly receptive markets such as Poland, Turkey, Spain, and Belgium. Investments on the company know-how continued with the installation of new dedicated production lines.

THE ARRIVAL OF MAPEI

Fili & Forme has been supplying Mapei Group since 2010 with MAPEFIBRE branded structural fibers. For a Group that has always dedicated plenty of attention to Research and Development and that sets itself the goal to satisfy the needs of an increasingly demanding and competitive market, the company has soon become an interesting prospect.

References for Fili & Forme

Some of the prestigious projects in which Fili&Forme has taken part: the SS 17 Nicosia Expressway in Sicily (left) and the logistics platform for the Deep Water Container Terminal in Gdansk, in Poland (in the middle).

In April 2018 Fili & Forme was fully acquired by Mapei Group. For the new subsidiary this surely is a strategic opportunity to implement industrial and commercial synergies together with a multinational entity, who has been operating for many years in the branch of products for the building industry.
The merger will surely strengthen the Istrice brand both locally and internationally. On the other side, it will offer Mapei Group the chance to further consolidate its leadership in the construction market. Lorena Gamberini, former majority shareholder of the company, is now operating as Fili & Forme Managing Director carrying on the management and strategic continuity of the company within the Mapei Group.

THE FUTURE

As of today, the goals achieved by Fili & Forme are certainly not few: 9.7 million Euros turnover in 2017; it is the only manufacturer of macro synthetic structural fibers in Italy and one of the most important European players in terms of production capacity; export sales of 65% to over 30 different countries; an enviable technical and commercial know-how; participation in several research projects such as the regional tender "POR-FSER Asse 1".
In 10 years over 10,000,000 m^2 of flooring and more than 50 km of tunnels have been built using Istrice fibers.
Among the references one finds prestigious projects such as the flooring for the new Fiat works in Kragujevac (Serbia) and the Lamborghini and Maserati works in Central Italy, the foundations slab for Expo Milan 2015 and the Deep Water Container Terminal project in Gdansk (Poland). In the infrastructures sector, the hydroelectric power station in Ingula (South Africa), the Elmadag tunnel in Turkey, several tunnels for the National Flood Relief project in the Island of Malta and other tunnels along the Salerno-Reggio Calabria highway in Italy.
The future of Fili & Forme lies in its complete integration into Mapei Group, while continuing to preserve its peculiarities related to the specific production processes. The development of second generation fibers is also among the company's future goals. These compounds improve mechanical performances, thus paving the way to new applications and new major projects.

ABOVE. The Managing Director of Fili & Forme, Lorena Gamberini, founder of the company in 1994.
PHOTOS 1 AND 2. Fili & Forme head office and production facility in San Cesario sul Panaro in the Province of Modena (Italy).
PHOTO 3. Fili & Forme is also owner of the Istrice brand, a well-known name on the market.
PHOTOS 4 AND 5. The company is leader in the production of PVC and polypropylene fibres used in different applications.

THE FIGURES FOR FILI & FORME

1994: FOUNDATION OF THE COMPANY

6 PRODUCTION LINES (4 FOR PVC FIBRES AND 2 FOR POLYPROPYLENE FIBRES)

7000 M^2: THE SURFACE OF THE PLANT

6 MILLION KG: ANNUAL PRODUCTION CAPACITY

65% SHARE OF TOTAL PRODUCTION EXPORTED TO 30 COUNTRIES

38 EMPLOYEES

10 MILLION M^2: INDUSTRIAL FLOORING CREATED WITH ISTRICE BRAND FIBRES IN 10 YEARS

50 KM: TUNNELS CREATED WITH ISTRICE BRAND PRODUCTS

RIMINI 6TH-9TH NOVEMBER 2018

ECOMONDO

THE GREEN TECHNOLOGIES EXPO

SUSTAINABLE BUILDING FOR CIRCULAR ECONOMY

The Ecomondo exhibition was held from the 6th to the 9th of November in Rimini (central Italy). It is the most important exhibition for the green and circular economy in the Europe-Mediterranean area, an international event with an innovative format that brings all sectors of the circular economy together under one roof: from the recovery of waste materials and energy to sustainable development.

As far as the green and circular economy is concerned, Italy is one of the leading countries in Europe, particularly in the field of energy efficiency, the recycling of waste and the productivity of its workforce.

During the first two days of the event, "States General of the Green Economy", the annual meeting of Italian green economy discussed the prospects for green investments, highlighting how an annual investment of 7-8 billion Euros of public funds for the next five years would attract 21.4 billion Euros from private investors and create 440,000 new jobs each year.

Figures that clearly illustrate that this sector is going through a period of strong development, further demonstrated by figures from the exhibition itself, which registered a 4% increase in professional visitors. There was also a positive result regarding overseas visitors, which account for 10% of the total number, with the exhibition being attended by representatives of 115 different countries: 70% from Europe, 9% from the Mediterranean area and a high number of visitors from China and the Russian Federation.

There was massive interest on behalf of the media: at the end of the four days, there had been approximately 170 million contacts. A world represented by large corporations, consortiums and new start-ups. Enterprises which, just like Mapei, have undertaken a path typical of those who adopt a green approach in their business model.

RE-CON: A MORE COMPREHENSIVE PRODUCT LINE FOR SUSTAINABLE CONCRETE

Mapei was at Ecomondo to present its new products from the RE-CON line, a line specifically created to meet the growing demand for sustainable concrete for a more responsible building industry with more awareness of our ecosystem and dwindling non-renewable resources.

The RE-CON line offers operators from the building sector a complete range of products specifically developed to produce concrete using recovered and recycled aggregates from demolished buildings (as stipulated by the Minimum Environmental Criteria for the building industry, which were introduced in Italy with a Ministerial Decree on the 11th of January 2017, but also for the production of concrete with clay bearing aggregates and for the recovery of waste concrete resulting from the production process.

The benefits obtained by using products from the RE-CON line can be divided into three main areas:

- technological: through the use of recycled aggregates and/or clay bearing aggregates, in compliance with institutional specifications, without affecting the quality of the concrete produced;
- environmental: less waste that would normally be sent to landfill sites, fewer natural resources extracted and processed and the production of concrete with a high level of environmental sustainability;
- economic: elimination of costs incurred to dispose of returned concrete.

RE-CON ZERØ EVO is just one of the products from this particular line: a two-component powdered product for recovering all returned concrete from mixer trucks. Thanks to this solution, returned concrete is transformed into aggregate with no waste

LEFT. Mapei took part in this trade fair with its products and experts.

that may be used to partially replace natural aggregates when mixing normal concrete, or directly as is to make embankments or sub-layers.

Two new solutions for mixing concrete made with clay bearing aggregates and/or recycled aggregates from demolition work have also been added to this technology: RE-CON AGG100 and RE-CON AGG200.

RE-CON AGG100 is an absorption-inhibiting liquid admixture which, when used in combination with a super-plasticiser from the DYNAMON line, allows for better control of the increased amount of water required when using recycled aggregates and/or clay bearing aggregates, bringing the water/cement ratio back to within design limits.

RE-CON AGG200 is a super-plasticising and absorption-inhibiting admixture. Thanks to its combined action of reducing the water demand and controlling its absorption rate, it allows the extra water needed when using recycled aggregates and/or clay bearing aggregates to be reduced. Recovering concrete scrap and off-cuts, the production of concrete with a lower impact, the recovery of asphalt, earth and rubble from excavations, tunnel spoil, silt, slag from steelworks and soil washing were just some of the themes discussed during the seminar held during the exhibition, “The circular economy applied to extraction and mining activities: by-products and alternative raw materials and solutions for the recycling of aggregates” organised by Anepla – the Italian National Association of Extractors and Producers of Stone and Similar Materials.

Another opportunity for Mapei to present a detailed overview of its solutions and products from the RE-CON line for the recovery of returned concrete.

The 23rd edition of Ecomondo will be held in Rimini from the 5th to the 8th of November 2019.

CIRCULAR ECONOMY

A circular economy is designed to regenerate itself. There are two kinds of flows of materials in a circular economy: biological materials that can be fed back into the biosphere; and technical materials designed to be recovered and restored without entering the biosphere. So, a circular economy is an economic system carefully planned to reuse materials in sequences of manufacturing loops, reducing waste to a minimum.

RE-CON zerø EVO

Concrete becomes sustainable

Thirteen billion cubic metres of concrete are produced every year all around the world, the equivalent of around thirty billion tonnes or almost four tonnes per year for each inhabitant of the planet. This material owes its enormous success to its excellent characteristics and properties: cost-effectiveness, the wide availability of raw materials, excellent mechanical properties and durability. Each and every day, in every corner of the planet, hundreds of thousands of trucks transport fresh concrete from mixing plants to building sites to be used in the construction of every possible type of building and infrastructure.

Not all the concrete that is produced, however, is actually used on site. A certain amount, from just a few hundred litres to several cubic metres, is returned to the mixing plant, in its original state, as what is known as "leftover" or returned concrete. For various reasons, the production of returned concrete is unavoidable and, as such, has to be considered as an integral part of the production process. According to estimates, returned concrete accounts for around 3% of the total amount produced, or around 900 million tonnes per year at a global level.

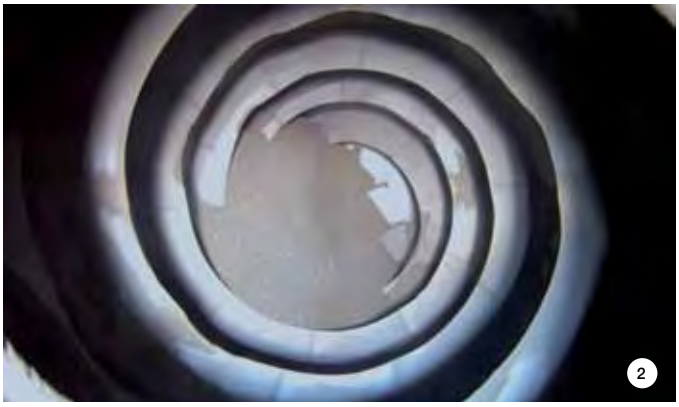
Only a fraction of all returned concrete may be reused as is in concrete works, while for the most part, due to the lack of a viable possibility of using it again and transforming it, it has to be disposed of and it is by far the most abundant waste product at the concrete batching plants. Disposing of returned concrete in landfill sites has a heavy impact on the environment which may be expressed in terms of "equivalent" CO_2, the gas responsible for global warming. In numerical terms, one cubic metre of returned concrete sent for landfill is the equivalent of 267 kg of CO_2 which, if multiplied by the amount of returned concrete produced annually in the world, amounts to almost 105 million tonnes of CO_2, the same amount produced in one year by around 47 million medium-sized cars, more than the cars currently in use in Germany.

FROM WASTE TO RESOURCE

Today, with RE-CON ZERØ EVO, the new product by Mapei for more sustainable concrete, it is possible to recover and transform returned concrete, thereby going from a "linear" economic model, based on the production of waste, to a more "circular" economic model, in which waste no longer exists and becomes a resource. A circular economy is a regenerative type of industrial system. It replaces the "end of life" concept with a concept of "restoration", prevents the depletion and decline of natural resources, encourages the use of renewable energy, eliminates the use of toxic chemical substances that impede its reuse and return to the biosphere and aims at eliminating waste by improving the design of materials, products, systems and business models.

But how is it possible to transform returned concrete from waste material into a resource with RE-CON ZERØ EVO? When RE-CON ZERØ EVO is added to returned concrete in a mixer truck, or in any other suitable mixing system, in the space of just a few minutes the special additives contained in the product absorb any free water present and "dry" the concrete, and in so doing transforms it into aggregates characterised by a grain size distribution and mechanical characteristics that make them perfectly suitable to be used again to make new concrete without generating any waste, neither liquid nor solid.

The advantages of this innovative product are clear: the production of aggregates from returned concrete enables the acquisition of natural aggregates to


2


3

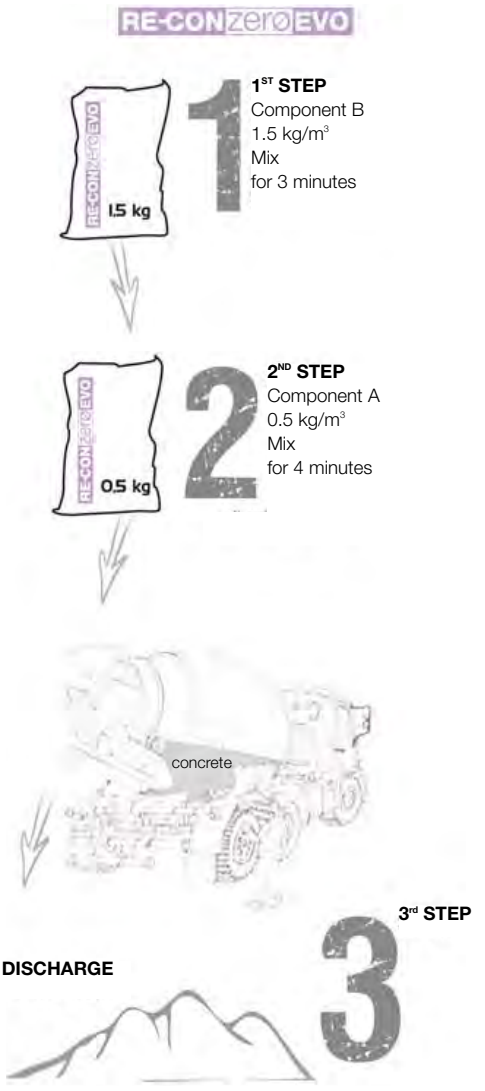
be reduced by a corresponding amount, which in turn limits the depletion of raw materials, and it also completely eliminates the use of landfill sites which, in turn, further reduces its impact on the environment: with RE-CON ZERØ EVO, one cubic metre of returned concrete produces only 6.75 kg of CO_2, almost 40 times less compared with disposing of it as landfill. Apart from these environmental benefits, there are also corresponding advantages associated with its use for the entire industrial system: a significant reduction in costs for production, the acquisition of raw materials and the disposal of waste.

Today, thanks to RE-CON ZERØ EVO, there is now the certainty that all returned concrete can be recovered and reused, by means of a process of industrial transformation based on the principles of a circular economy, to produce aggregates with all the technical and environmental requirements for its correct use in the production of concrete and in other civil engineering works.

PHOTO 1. Approximately 400 million m^3 of returned concrete requires treatment every year.
PHOTOS 2 AND 3. After mixing for a few minutes with RE-CON ZERØ EVO, concrete is transformed into granular material which, once cured, may be used as aggregate in concrete.
PHOTOS 4 AND 5. After discharging the material, the mixing drum is left clean. The cleaning water for the mixer drum may be completely recycled and used again for mixing.

Giorgio Ferrari and Amilcare Collina,
Mapei SpA Research & Development

SUSTAINABLE RECOVERY OF RETURNED CONCRETE



Complete kit to treat 1 cubic metre of returned concrete:
RE-CON ZERØ EVO Comp. B:1x1.5 kg water-soluble bags
RE-CON ZERØ EVO Comp. A:1x0.5 kg water-soluble bags

FOAMING AGENTS

for conditioning soil during tunnelling operations with EPB type TBM equipment

ENVIRONMENTAL CHARACTERISTICS OF THE NEW GENERATION OF MAPEI POLYFOAMER ECO PRODUCTS

When using EPB type TBM (Tunnel Boring Machine) equipment to bore tunnels, foaming agents and/or polymer additives need to be added to improve the characteristics of the soil in order to modify its rheological properties and consistency and to improve TBM performance during tunnelling operations. When conditioning soil, a large quantity of natural material is mixed with chemical additives (conditioning agents) to form a uniform material known as "spoil", which must meet the specific technical and environmental requirements of that project.
Amongst the various conditioning products available, foaming agents are the most widely used. These products differ quite considerably in terms of their technical characteristics, and even more so for their impact on the environment, due mainly to their biodegradability and toxicity and how they interact with the soil being excavated and, as a result, with the surrounding environment.
For a number of years, the level of awareness regarding environmental issues has become so important that it is now common practice for local authorities to ask for in-depth laboratory testing to be carried out, before commencing tunnelling operations with a TBM, in order to evaluate the impact they could have on the environment, starting from the soil in its natural state ("raw soil") and then following on with an analysis of the conditioned soil. The various test protocols include degradation tests of the surfactant (which is the main component of foaming agents) within the conditioned matrix and other tests to measure toxicity. Various reference organisms (Danio Rerio fish, Vibro Fisheri bacterium, tec.) are used for these tests and the aim is to provide an indication of the impact conditioning will have on the environment and, as a result, on the soil to be conditioned and then deposited back into the environment. As a result, when choosing which products to use to condition soil, technical and economic issues are not the only factors affecting this decision: the right foaming agents also need to be chosen so that they comply with environmental restrictions specific to the area where the project is located and the final destination of the "spoil" as waste material or as a by-product of the process.

COMPOSITION OF FOAMING AGENTS

There is quite a large difference between the various foaming agents available, depending on their chemical composition. Each component in the product, and its level of concentration, has a certain impact from both a technical point of view and from an environmental point of view. Apart from water, the main components are:

- Surfactants: these are the main ingredients and may be of a various chemical nature (cationic, anionic, etc.).
- Polymers: they improve the technical characteristics of the foam and may be of synthetic or natural origin.
- Solvents: available in various compositions (glycol, alcohol, etc.).

A NEW GENERATION OF FOAMING AGENTS

Thanks to constant, significant investment into Research and Development, Mapei has formulated and launched a new generation of foaming agents for tunnelling operations: the products from the POLYFOAMER ECO line, formulated with

Toxicity to mammals	LD_{50} = > 2000mg/kg weight
Toxicity to fishes	LC_{50} = 880 mg/l
Toxicity to daphnia	EC_{50} = 650 mg/l
Toxicity to algae	IC_{50} = 200 mg/l
Biodegradability	> 75%

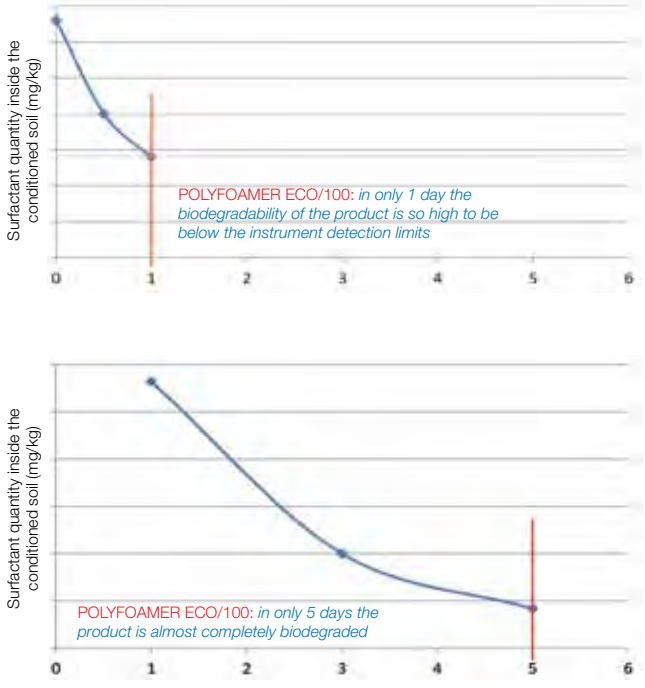
TABLE 1. Toxicology and biodegradability of POLYFOAMER ECO/100 PLUS foaming agent: figures taken from WGK certification tests.

- Biodegradable surfactants with minimum toxicity.
- Natural polymers that improve the technical characteristics of foam.

Glycol and other solvents, which have a high level of impact on the environment and are still widely used in a number of traditional foaming agents available on the market, have been eliminated as for this product line.

BIODEGRADABILITY AND TOXICITY TESTS ON SOIL CONDITIONED WITH POLYFOAMER ECO

A series of tests have been carried out on samples of soil conditioned with foaming agents from the POLYFOAMER ECO line taken from various tunnelling sites using TBM equipment.
Firstly, degradation of the surfactant in the conditioned soil was evaluated. This parameter is an important key in order to define its classification and, as a result, whether it will be classed as waste or a by-product. This has considerable influence on waiting times before the soil removed by tunnelling operations can be considered "safe", that is, before it can be removed from the site and sent to its final destination.
The instrument used for degradation tests is an HPLC-MS, which is used to evaluate the amount of surfactant present in a sample of conditioned soil. This type of instrument is less influenced than others by the surrounding conditions and by the presence of other chemical components in the soil.
As shown in the graphs in Figures 1 and 2, degradation of the surfactant in POLYFOAMER ECO/100 found in two soil samples was very quick and commenced within just a few days of being conditioned.
Apart from degradation tests, eco-toxicity tests were also carried out on samples of soil conditioned with products from the POLYFOAMER ECO line.
Some of the most significant results are illustrated in the following tables and show how adding POLYFOAMER ECO/100 or POLYFOAMER ECO/100 PLUS has only a minimal effect on the toxicity of the soil and that this effect reduces very quickly.
As a result of Mapei's commitment in this sector, the products from the POLYFOAMER ECO line are the only foaming agents approved for the conditioning of soil in various projects where a detailed environmental study has been performed, by taking soil samples and subjecting them to continuous degradation and eco-toxicity tests. The use of products from the POLYFOAMER ECO line, therefore, provides contractors with the necessary technical performance characteristics required for rapid advancement of tunnelling operations and ensures a lower impact on the environment, thereby guaranteeing a successful outcome and the sustainability of a project from all possible viewpoints.



FIGURES 1 AND 2. Reduction in the level of surfactant present in two types of soil (one cohesive and one granular) conditioned with a foaming agent from the POLYFOAMER ECO line. Degradation in the soil was very quick and commenced within just a few days of being conditioned.

	Mortality of Vibro Fisheri at 15' ISO 11348-2:20077	Mortality of Vibro Fisheri at 30' ISO 11348-2:2007
Natural soil - time 0	< 2.0%	< 2.0%
Soil + POLYFOAMER ECO/100 – time 0	8.0%	14.0%
Soil + POLYFOAMER ECO/100 – 7 days	6.0%	11.0%

TABLE 2. Toxicity towards Vibro Fischeri bacterium in raw soil and soil conditioned with POLYFOAMER ECO/100 after 0 and 7 days (results measured in the LabAnalysis laboratory).

	Survival of Danio Rerio at 96 h (OECD 236)
Natural soil - time 0	> 98.0%
Soil + POLYFOAMER ECO/100 PLUS – time 0	85%
Soil + POLYFOAMER ECO/100 PLUS – 7 days	> 98.0%

TABLE 3. Toxicity towards Danio Rerio fish in raw soil and soil conditioned with POLYFOAMER ECO/100 after 0 and 7 days (results measured in the LabAnalysis laboratory).

MAPEI CEMENT ACADEMY 2018

TECHNICAL TRAINING SEMINAR ON INNOVATION IN THE CEMENT SECTOR

From the 6th to the 8th of June this year a highly important technical training event, the "Mapei Cement Academy 2018", was held at the Mapei headquarters in Milan. This edition of this annual event attracted around 90 participants from all five continents and involved three full days of technical discussions between Mapei specialists and Cement Works Directors, Quality Managers and Process Engineers from leading cement manufacturers from Italy and all over the world.

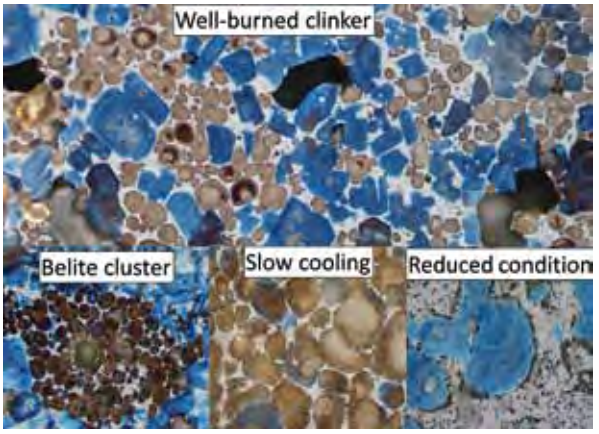
For Mapei, the main aim was to consolidate its image as an Industry Leader of excellence regarding technical support and innovation in the cement sector and to promote the company as a long-standing, global partner for all cement manufacturers. In addition, due to the lack of high-level technical conferences for this industry (as most events of this kind focus on commercial issues), Mapei decided to raise the level of discussions by organising a specific conference aimed at more technical and informative themes. Therefore, for the first time, the company invited an authoritative external speaker from KHD, a German manufacturer of equipment for cement factories.

In fact, cement is the starting point for the entire construction sector and its associated technologies – in which Mapei has a wealth of experience – and the challenge for the cement industry is to produce cement with increasingly high performance properties while reducing costs and its impact on the environment. Mapei's attention towards sustainability shows the most important long-term path the cement industry needs to take at a global level and this event was a great platform for sharing thoughts on this topic. Over the last few decades, the cement industry has made significant progress by gradually replacing traditional fuels with mixtures of various substances from renewable sources or recycled materials. Optimisation of the performance properties of cement has taken on a multi-disciplinary approach, which means that all the data regarding its physical-mechanical properties and its mineralogical and microscopic characteristics need to be analysed and managed correctly.

The three days of the "Mapei Cement Academy 2018" were split into a number of different technical sessions, with each session focusing on a key theme related to the production of cement, covering both its chemical aspects and manufacturing process issues.

The first session was opened by Jaleel Mohamed from Mapei Construction Chemicals (based in Dubai, UAE) who presented the way in which Mapei technologies are applied in the field of operation and optimisation of Vertical Roller Mills in terms of dosage rates and systems for Cement Additives.

Raffaele Albano, Technical Manager Cement Additives for Mapei SpA (Italy), presented the Mill Auditing services offered



A sample of clinker analyzed using the optical microscope at the Mapei R&D Center in Deerfield Beach (USA).

SUSTAINABILITY REPRESENTS THE MOST IMPORTANT LONG-TERM PATH THAT THE CEMENT INDUSTRY NEEDS TO TAKE AT A GLOBAL LEVEL

by Mapei C-ADD (Cement Additives Division) and described the development of cutting-edge optimisation methods for ball mills. Hugh Wang, from Mapei Corp. (USA), illustrated the results obtained from optical microscopy studies of clinker phases considering the various production steps of clinker, highlighting the numerous problems one could encounter and how to overcome them. Matteo Magistri, Global R&D Manager C-ADD for Mapei SpA, lead discussions during a number of sessions with an in-depth look at recent scientific studies on cement hydration, the chemical aspects of calcium silicates and calcium aluminosilicates, the problem of hexavalent chromium in cement and the technologies adopted to reduce it (for which Mapei is owner of three highly innovative patents).

The event was rounded off by Paolo Forni, Mapei SpA R&D Lab, who illustrated the different families of Cement Additives available, from basic grinding aids to performance- and quality enhancing chemicals, specifying their action mechanisms and their potential to reduce clinker content in cement and provide additional technical and economic benefits for cement manufacturers. York Reichardt from KHD, a German company which is a world leader in the field of technology, equipment and technical assistance in the cement sector, focused on the introduction of the most recent technological developments in Roller Press technologies for the grinding of cement and other secondary cementitious materials.

One of the key features of the event was the possibility for cement manufacturers from around the world to share experiences. Mapei provided an exciting platform for them to compare ideas and professional knowledge within a different context to the one they would normally experience as competitors. Promoting inter-personal exchanges on a professional level is just one of the core values of a global leader such as Mapei, a company characterised by its desire to conduct its business both ethically and sustainably.

The wrap-up event of the “Mapei Cement Academy 2018” was a visit to the Mapei Research & Development Centre in Milan for a first-hand glimpse behind the scenes of a company firmly committed to research and innovation, considered within Mapei the real driving force behind growth.

Cristiana Galli. Mapei Cement Additives Division

Optimising the performance of cement with grinding aids

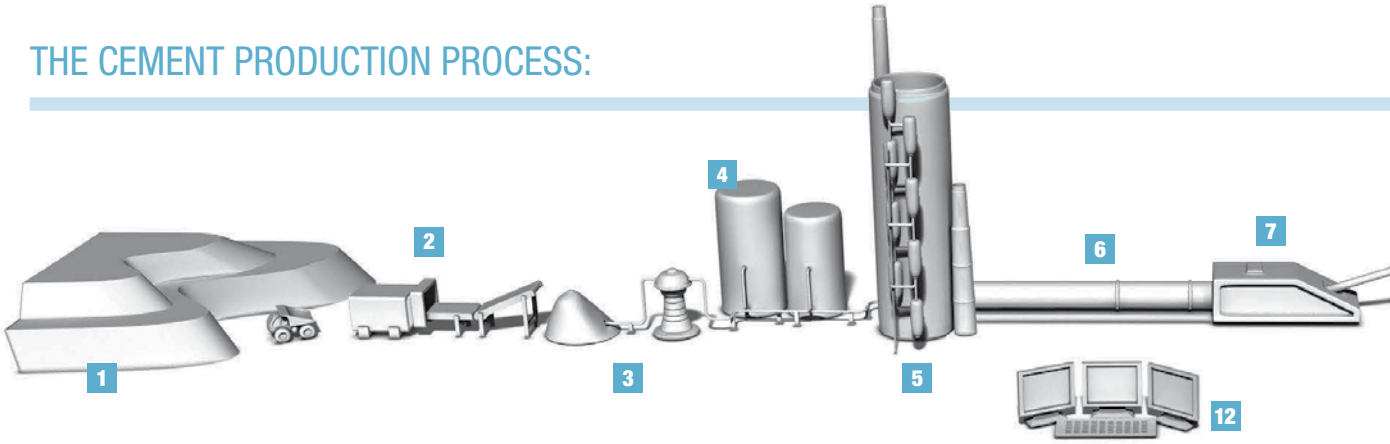
WHAT IS CEMENT?

Cement is a finely ground mineral powder and is the main component of concrete. When mixed with water, it forms a binder that sets and then hardens through a complex process of hydration reactions. Once hardened, it maintains its strength and stability, even under water. The production process of cement starts by heating clinker, a mixture of lime and clay, to its melting point (1450-1550 °C). Once it has cooled down, the clinker is ground, and precise amounts of additives are added to give the cement its particular characteristics.

WHAT ROLE DO GRINDING AIDS PLAY?

These additives are used to facilitate the grinding of cement. Grinding aids usually contain organic liquids and can be made up of components of varying nature, such as amines, polyols, alcohol and lignosulfonates, as well as fatty acids. The addi-

THE CEMENT PRODUCTION PROCESS:



tives are added as the clinker enters into the grinding mill and perform the following actions:

- **optimise the effectiveness of the grinding process and reduce $C0_2$ emissions;**
- **improve the mechanical properties of cement**

They also improve the placing of concrete by reducing the amount of water required, act on the setting times, optimise and facilitate the handling and transportation of fresh concrete. Mapei grinding aids rely on two types of effects:

1. PHYSICAL EFFECTS:
optimisation of the grinding process is measured by controlling the fineness of the cement and the improved distribution of its particle size. Mapei cement additives improve the effectiveness of grinding operations by increasing the output of grinding mills while maintaining the same specific energy consumption and the same fineness of the cement or by producing finer cement with the same specific energy consumption.

2. "CHEMICAL ACTIVATION" EFFECTS
Grinding aids may also perform a chemical action on the hydration process of cement, a phenomenon general known as "activation".

Depending on the objectives targeted, the various formulas of grinding aids can lead to the following:

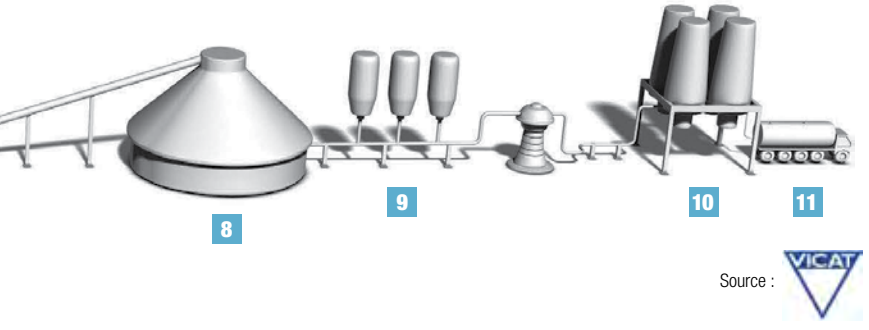
- A higher level of strengths in the short term (1-3 days)
- A higher level of strengths after 28 days
- An acceleration or delay in setting times.

Mapei grinding aids lead to an optimisation of energy consumption during the grinding process and to an approximate 5-10% reduction in CO_2 emissions. At the same time, they also reduce the amount of clinker in the cement while ensuring the same strengths: this implies a reduction of non-renewable raw materials. 3 million tonnes CO_2 have been saved thanks to Mapei cement additives on average in the last 15 years.

This article was taken from Mapei & Vous, no. 47, the magazine published by Mapei France, whom we would like to thank.

THE C-ADD DIVISION

Founded in Italy in 2000, Mapei C-ADD Division (Cement Additives Division) supplies the world's leading cement manufacturers, thanks also to a dedicated Research & Development team and local technical support.
It works with cement producers to help them define their objectives by proposing grinding aids with the most suitable formulations. Samples of locally-sourced raw materials are taken and sent to the Mapei Research & Development Centre in Milan. After carefully analysing the clinker and cement, we are then able to propose a tailor-made solution to our clients.
Mapei offers a complete range of grinding aids that allow different objectives to be achieved. The additives belong to two families: MA.G.A. (MAPEI Grinding Aids) and MA.P.E. (Mapei Performance Enhancers). The additives are added in modest quantities and continuously while grinding, to increase mill output and enhance cement performance.
The philosophy driving the Division is, of course, Mapei's utmost care for the quality of its formulations and for customer satisfaction, never hesitating to select raw materials that ensure constant quality over time; the goal is to "deliver quality", minimizing fixed costs (transport, production, etc.) when comparing the total expenditure per ton of cement produced, in order to meet the cement industry's real needs.
In addition to those we consider to be basic products, the Cement Additives Division is more than willing and able to formulate tailor-made additives.



Source : VICAT

1. Quarrying (mainly clay and limestone)
2. Crushing and pre-homogenisation
3. Drying and raw grinding
4. Homogenisation
5. Preheating
6. Firing in the kiln
7. Cooling
8. Clinker storage
9. Production of cement by grinding clinker and other materials (gypsum, etc.)
10. Storage of cement
11. Shipping
12. Quality control

Prize for Mapei research

THE MARIO GIACOMO LEVI MEDAL IS AWARDED TO MAPEFAST ULTRA

The Mario Giacomo Levi Medal 2018 was awarded during the 20th edition of the National Congress of the Industrial Chemistry Division of the Italian Chemistry Society (Società Chimica Italiana) , which was held in Milan on the 6th of September this year. The award, which was established to honour the memory of Professor Mario Giacomo Levi, is given to two representatives from the public and industrial research field who have worked together on a joint research project and successfully introduced it on an industrial scale.
This year the award went to MAPEFAST ULTRA®, an admixture for concrete developed by Mapei in collaboration with the University of Padua (Northern Italy).

AN ALTERNATIVE TO STEAM-CURED CONCRETE

Construction technology requires materials with increasingly high levels of performance, durability and environmental compatibility. In the field of concrete technology, which at 13 billion m^3/year is the most widely used material in the world, chemical admixtures are often added to modify its characteristics and achieve the desired performance properties.
In the case of pre-cast concrete, components are manufactured using production cycles in which the curing and hardening phases of wet concrete is accelerated with steam at a temperature of 50-70 °C. By using this method, it is possible to remove components from moulds after just 12 hours and

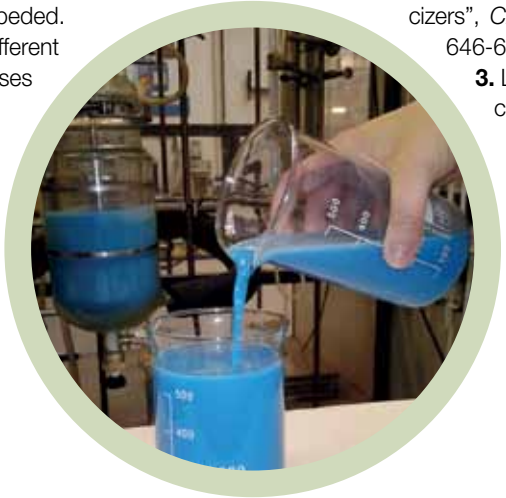
Mario Giacomo Levi

Born in Padua in 1878, Mario Giacomo Levi graduated in Chemistry in 1900 from the University of Padua, and then continued his research in the field of Electrochemistry, a subject he also taught at Padua.
In 1909 he was nominated for Full Professorship in Chemical Technology and taught students from the Engineering Faculty at the University of Palermo (Southern Italy). In 1918 he founded the Higher Commercial and Colonial Institute in Palermo, of which he was Director until 1920.
In 1921 he became Professor in Chemical Technology at the University of Bologna. In 1922 he founded the Higher School of Industrial Chemistry. His research work focused on liquid and gaseous combustible materials, with particular attention on the resources available in Italy. This led to the Italian Ministry for the Economy opening a special Section to study combustible materials, which was headed by Levi.
In 1927, Levi was called to Milan to teach Chemical Technology at the Institute of Industrial Chemistry at Milan Polytechnic. The Combustible Materials Section was also transferred to Milan and was housed in a new building next to the Institute.
After Italy was invaded by German troops in September 1943, Levi took refuge in Switzerland where he taught Industrial Chemistry at the Engineering School in Lausanne from January 1944 until July 1945. He made his return to Italy in 1945 and took up teaching again at Milan Polytechnic. In 1946 he became President of the Lombardy section of the Italian Chemistry Society and then became its National President in 1950. He died in 1954.

continue with the next phase of the production cycle.
Producing the steam needed for curing, however, is costly, in terms of both energy and plant maintenance. Also, steam-cured components are characterised by micro-cracks caused by the stresses induced by the steam during the plastic phase, which reduce the concrete's mechanical properties and durability.
Mapei, with scientific support from the University of Padua, has developed a new admixture, MAPEFAST ULTRA®, that helps overcome the problems caused by steam curing.
It is a water suspension containing nanoparticles of complex hydrated silicates that significantly accelerate hydration and, therefore, hardening of the cement, including when there is no steam.
With 2-5% of MAPEFAST ULTRA® on the weight of the cement it is possible to completely eliminate steam curing and obtain components characterised by better mechanical properties and durability in the same amount of time.
Eliminating the steam-curing cycle leads to a net reduction in the amount of CO_2 released into the atmosphere from precast concrete works by about 12-15%.
Once the nanoparticles of hydrated silicate present in MAPEFAST ULTRA® have been introduced into the paste, they catalyse the hydration phase of the cement by means of what is known as a "seed catalysis" mechanism and reduce the initial so-called "induction period" in which the hydration reactions are actually impeded.
This effect is associated with a different hydration mechanism that passes from heterogeneous nucleation to homogeneous nucleation, with a positive effect on the microstructure of the hydrated cement paste, making it less porous and permeable to water and aggressive agents.
The synthesis process of the new product consists in the precipitation of hydrated silicates from a solution containing a polyether carboxylate-based polymer that disperses the nano-sized hydrated silicates from the moment they start to form (bottom-up synthesis).
The introduction of copper ions, in combination with calcium, considerably increases the specific surface area of the nanocrystals (from 250 to more than 400 m^2/g) and, as a result, makes them extremely reactive and effective in triggering the "seeding" process.
The action mechanism of the new product has been studied using advanced analytical techniques, such as Synchrotron XRD-μ Tomography.
The rated production capacity of the new product at the Mapei production facility in Mediglia (near Milan) is 10,000 litres/day, which can be further increased according to market demand. The product is now marketed in Scandinavian countries in particular, where a delay in the development of the concrete's mechanical strength due to the rigid temperatures can become critical, but other countries have also shown a great deal of interest.
An application has been made for an international patent for the new product (WO 2015/086453), which has already been granted a patent in the United States (US 9617185).

The scientific aspects of the new product have been the subject of numerous studies and the results have already been published in the following publications:

1. G. Artioli, L. Valentini, M.C. Dalconi, M. Parisatto, M. Voltolini, V. Russo and G. Ferrari, "Imaging of Nano-seeded nucleation in cement pastes by X-ray diffraction tomography", *International Journal of Materials Research*, 105, pages 628-631, 2014
2. L. Valentini, Favero, M., Dalconi, M.C., Russo, V., Ferrari, G, Artioli, G., "Kinetic Model of Calcium-Silicate-Hydrate Nucleation and Growth in the Presence of Superplasticizers", *Crystal Growth & Design*, 16 (2), pages 646-654, 2016
3. L. Valentini, G. Ferrari, Russo, V., Stefancic, M., Serjun, V.Z., Artioli, G., "Use of Nanocomposites as Permeability Reducing Admixtures", *Journal of the American Ceramic Society*, https//:doi.org/10.1111/jace.15548, 2018.



TOP, LEFT. An image of the awards ceremony. From left on: Gilberto Artioli (University of Padua), Amilcare Collina (Mapei SpA), Francesco Pignataro (Società Chimica Italiana) and Giorgio Ferrari (Mapei SpA).
TOP, RIGHT. Ferrari and Artioli with the award.

Amilcare Collina, Giorgio Ferrari.
Mapei SpA Research & Development

ADMIXTURES of the future

AN ANSWER TO THE SHORTAGE OF RAW MINERALS

DAVID SEDAN. Concrete Admixtures Technical Manager, Mapei France

What is the definition of an admixture?
According to current standards (such as the French standard NF EN934-2 and the European standard CE EN 934-2), "An admixture for concrete, mortar and slurry is a material added to a concrete or mortar mix during the preparation phase at a rate of up to 5% by weight of the cement to modify the properties of the mix in the wet and/or hardened state". In simple terms: an admixture is an "ingredient" added to the other components of a mix in order to modify and control certain final characteristics of concrete or mortar.

What are the various families of admixtures and how many are there?
There are various families of admixtures, and they are defined on the basis of their primary function, although they may also have one or more secondary functions. There are seven main families divided into three groups:

- ADMIXTURES USED TO MODIFY THE RHEOLOGICAL PROPERTIES OF CONCRETE:
  - Plasticisers and water-reducing agents
  - Superplasticisers and highly effective water-reducing agents
- ADMIXTURES TO MODIFY SETTING AND HARDENING RATES
  - Set accelerators
  - Hardening accelerators
  - Set retarders
- OTHER CATEGORIES OF ADMIXTURES:
  - Water-repellent admixtures
  - Air-entraining agents

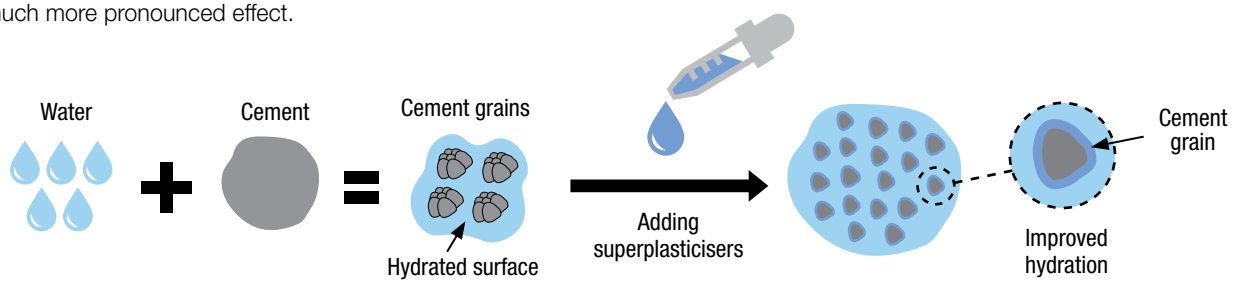
Are there any other products that can modify the properties of concrete?
Actually there are other products – also considered to be admixtures according to NF EN 934-2 standard – that can modify the intrinsic or aesthetic properties of concrete.
Amongst these products, we could mention structural fibres that are used to improve compressive or flexural strength, microfibers as a substitute for anti-cracking mesh, viscosity modifying admixtures, colloids which are used for concrete to be cast under water and/or concrete subjected to segregation during placing, shrinkage-reducing agents, foaming agents and pigments for concrete.
And let's not forget admixtures used for underground work, such as liquid retarders with a stabilising and plasticising effect for cementitious injection systems, as well as accelerators for shotcrete.

Can you give us a few examples of how admixtures are used in industry?
Let's use the examples of deep foundations or precast concrete walls, for which it is necessary to work in operating conditions for more than 6 hours with a high reduction of water. In this case, it is very important to use one of the latest generation of plasticisers, or even a synergic combination between a super-plasticiser and a set retarder. For instance, DYNAMON EASY 70 and DYNAMON EASY 74 (produced and distributed in France by Mapei France) allow you to achieve excellent results with just a single admixture, depending on the type of cement used.

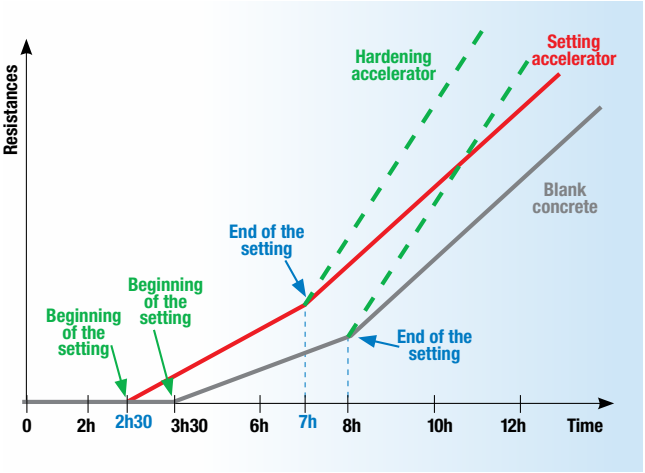
What does the future hold for the development of admixtures?
We are concentrating more and more on the development of admixtures that allow you to formulate concrete using materials normally defined as difficult, such as sand with high clay or even recycled content. In fact, the scarcity of raw materials is a problem that lies at the very heart of research into new admixtures because the materials used to formulate concrete are, for obvious economic reasons, often sourced locally. Which is why research work conducted in the lab is looking into the existence and the development of alternative mineral admixtures that can be – at least partially – used as a substitute for cement, blast furnace slag, fly-ash, which is a by-product of the combustion of coal in power stations, or metakaolin, which is obtained by grinding kaolin and firing it at 750°C.

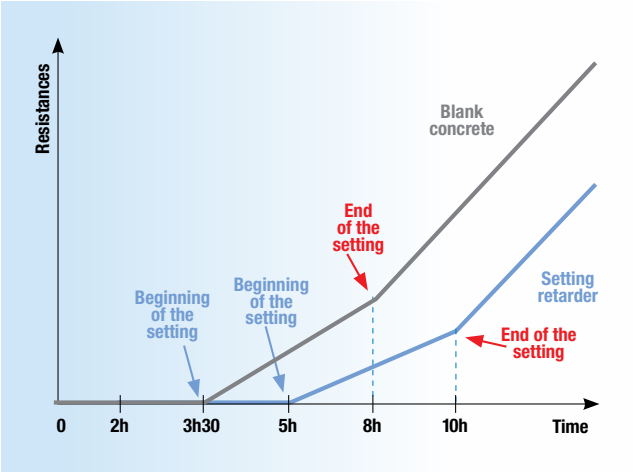
Can you explain to us how admixtures work?

Plasticisers and superplasticisers allow the amount of water in concrete to be drastically reduced (water-reducing agents) or considerably improve the consistency of concrete without altering the amount of water or produce these two effects at the same time. Super-plasticisers reduce water by a much higher amount than plasticisers and have, therefore, a much more pronounced effect.



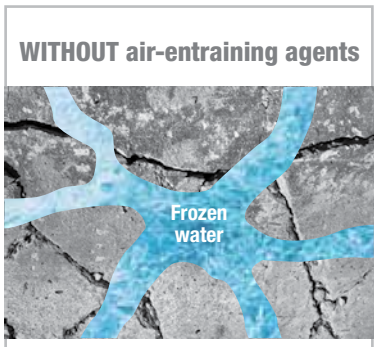
Set accelerators act as a catalyst in initial cement hydration reactions, especially at low temperatures, and accelerate the concrete setting (see graph below, left). **Hardening accelerators** improve the early compressive strengths, with or without modifying its setting time. **Set retarders** delay the moment at which concrete starts to set (see graph below, right).





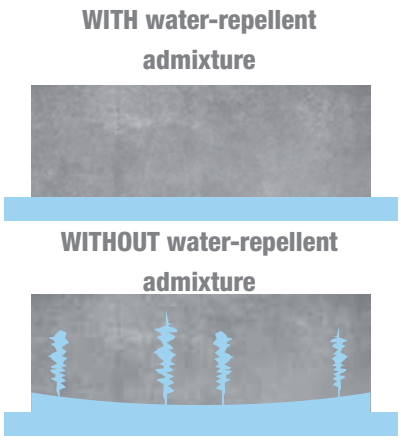
Air-entraining agents create a stable network of microscopic air bubbles in concrete, which improves the durability of concrete exposed to freeze/thaw cycles and the action of de-icing salts.

And lastly **water-repellent admixtures**, which react to form water repelling particles. These reduce the capillary action within concrete and can reduce the infiltration of water under pressure.



When freezing, water increases its volume by 9%. It can create cracks in the concrete.

The air bubbles work as expanding tanks.



Capillary absorption

*This article was taken from **Mapei & Vous**, no. 48, a magazine published by Mapei France, whom we would like to thank.*

ARCHITECTURAL ROAD SURFACES in stone and concrete

AESTHETIC QUALITY WITH HIGH MECHANICAL PROPERTIES AND DURABILITY: A FEW PROJECTS CONFIRMING MAPEI'S EXPERIENCE IN THIS SECTOR

TRIESTE PROMENADE
LIGNANO SABBIADORO (ITALY)

The aim of this complex urban redevelopment project, which had been so firmly desired by the Lignano Sabbiadoro local council, was to combine current norms with the latest technology to create an area open to everybody and designed to last well into the future.
The area worked on during the intervention is around 20 m wide and runs in a straight line for around 1.8 km. The main aim of the new design was to leave the rows of trees and parking spaces intact, by repaving the entire area to highlight a series of focal points and points of visual interest through the use of different paving materials and varying the installation techniques, reinforcing the idea of "bridging the divide" between the town and the sandy shoreline.
The entire area has been reorganised to provide more space for pedestrians and bikes than for vehicles by having a richer array of plants on display (flowerbeds and large planters featuring bushes and flowers), without penalising the flow of traffic, which was achieved by reorganising and rationalising the spaces available for vehicles to help maintain the flow and provide parking areas.

AESTHETICS AND FUNCTIONALITY FOR LONG-LASTING PAVING

The materials used for the new paving have played a key role on this site. With the aim of combining aesthetics and functionality – and durability in particular – two cutting-edge Mapei technologies have been used: the MAPEI COLOR PAVING® system for the coloured architectural exposed aggregate concrete and the MAPESTONE line for architectural stone surfaces for vehicle traffic. The latter were made from MAPESTONE TFB CUBE and MAPESTONE PFS2, in compliance with Italian standard UNI 11714-1:2018. The MAPEI COLOR PAVING® system meets the aesthetic requirements specified by the Local Heritage Board by creating an evocative visual effect, thanks to which the sea and the sand seem to become part of the road.
The flexible, tailor-made technology of MAPEI COLOR PAVING® provides the surfaces with a particular finish similar to terrazzo and, therefore, has the ability to meet all the aesthetic requirements of designers without compromising on mechanical performance and exceptional durability.
The MAPESTONE system, on the other hand, guarantees long-term durability for paving exposed to high stresses induced by the constant passage of vehicles. Going into detail, MAPESTONE TFB CUBE is a pre-mixed mortar for architectural stone pavings, suitable for class of exposure XF4 and XS3, with high compressive strength and resistance to de-icing salts, freeze-thaw cycles, and seawater. MAPESTONE PFS 2, on the other hand, is a pre-mixed, high-strength mortar with good resistance to de-icing salts, seawater and freeze-thaw cycles, exposure class XF4 and XS3, for grouting architectural stone paving.

© Photo Première Roberto Munizzi Fotografo

IN THE SPOTLIGHT

MAPESTONE TFB CUBE

It is a premixed ready-to-use mortar for the installation of natural stone units for external paving and road finishes. MAPESTONE TFB CUBE is the core product of MAPESTONE system, which allows to realize architectural stone paving with high durability even in environments subject to rain and freeze and thaw cycles, in the presence of de-icing salts and seawater (environmental conditions classified by EN 206 as XF4 and XS3). It is easy to use and may be prepared in either a plastic or "no-slump" consistency, depending on the type of paving units to be laid.

TECHNICAL DATA

Trieste Promenade, Lignano Sabbiadoro (Italy)
Year of construction: early 1950s
Period of the Mapei intervention: 2018 - ongoing
Intervention by Mapei: supplying products to build exposed aggregate concrete floors and stone floorings
Design: Archest Srl
Main contractors: A.T.I (Associazione Temporanea Impresa) Lungomare Lignano S.C.A R.L., Impresa Polese SpA, and Adriacos Srl
Concrete flooring contractor: Lithos Pav Di Leone Savino
Works director: Lucio Asquini
Works assistant director and coordinator: Samuele Gialuz
Site director: Carlo Versolato (Polese S.p.A)
Deputy site director: Stefano Mariotti (Adriacos S.r.l.)
Stone installation companies: Posatori Porfido Meta Sas; Posa Porfidi 3000 Srl; Friulpose Snc.
Mapei coordinators: Ivan Carlon, Marcello Deganutti, Giuseppe David, Claudio Azzena, and Luca Nordio, Mapei SpA (Italy)

MAPEI PRODUCTS

Mapestone PFS 2, Topcem Pronto, Keraflex Maxi S1, Planicrete, Mapefoam, Mapestone TFB Cube, Color Paving Admix, Mapewash PO, Mapewash Protex

PROMENADE
MILANO MARITTIMA – ITALY

The promenade in Milano Marittima, a seaside district in the City of Cervia (Central Italy), has been renovated by creating cycle paths and footpaths out of natural materials and adding rest areas.
The promenade has been re-surfaced with various types of material and now includes areas made from the decorative MAPEI COLOR PAVING® system with a thickness of around 8 cm.
COLOR PAVING ADMIX, a ready-mixed, multi-purpose powder, was used. The surfaces were then treated with MAPEWASH PO, a biodegradable vegetable oil-based surface set retardant with a curing effect. MAPEWASH PROTEX, a temporary protective gel for substrates, was also used to prevent MAPEWASH PO from being absorbed.
Lastly, a strip of land next to the beach was stabilised with the new product MAPEI COLD PAV 1, a fibre-reinforced powder binder used for the construction of foundation layers and road surfaces with a high working load.

TECHNICAL DATA
Year of construction: 1912
Year of the intervention: 2018
Client: Cervia City Council
Project manager: Daniele Capitani
Project and works direction: Stefano Bottari, Stefania Giovannini
Green areas project managers: Flavia Masson, Federica Villini
Main contractors: Impresa Coromano Srl, Pesaresi Giuseppe SpA
Flooring contractor: Lithos Pav di Leone Savino
Mapei coordinator: Fratelli Costanzi Snc, Fabrizio Maltoni, Mapei SpA (Italy)

ISABELLA D'ARAGONA PUBLIC GARDENS
BARI - ITALY

At the beginning of the 16th century the Duchess of Bari, Isabella D'Aragona, managed to calm the hostility of the people of Bari towards the Imperial power represented by the city's Swabian-Norman castle. The gardens running around the castle were named in her honour.

Extensive redevelopment of the gardens commenced at the beginning of 2017 and, over the next few years, they will become a large park and pedestrian area running around the outside of the castle.

During the works the old asphalt paths were completely replaced with decorative exposed aggregate concrete, using aggregates from local quarries.

The use of sustainable, locally-sourced materials and the system's ease of installation, cost-effectiveness and low maintenance requirements were the main reasons for choosing MAPEI COLOR PAVING® system.

On the side of the road, a 170 m long cycle path was also created using the MAPECOAT TNS FAST TRACK system.

TECHNICAL DATA

Period of construction: 19th century
Year of the intervention: 2017
Client: Bari City Council
Contractors: Terlizzi Srl, Cocco Srl
Design and works management: Raffaella Fiaschetti, Bari City Council
Building works operational director: Fernando Ciavarella, Bari City Council
Consultancy and supervision: Emilia Pellegrino, Superintendent for the Italian Ministry of Cultural Heritage and Activities and Tourism
Mapei coordinators: Antonello Marcuccio, Carlo Vitulli, Flavio Laricchia, Giuseppe David, Achille Carcagnì, Mapei SpA (Italy)

AREA IN FRONT OF THE CASINO AND PALAZZO DEL CINEMA
VENICE LIDO – ITALY

With the construction of the paved area in front of the entire block incorporating the Casino and Palazzo del Cinema, it looks like Venice International Film Festival wants to make an even more concrete display of its artistic renaissance.
The system of choice for the installation, sealing and grouting of the 12,000 m^2 of new surface in white, natural stone was the MAPESTONE system.
MAPESTONE TFB CUBE pre-mixed screed mortar for decorative stone road surfaces was used to install the stone.
The grouting operations were carried out with MAPESTONE PFS2, a pre-mixed mortar with high mechanical properties used for grouting joints.
Sealing of the expansion joints was carried out with MAPESIL LM, a neutral silicone mould-resistant sealant with BioBlock® technology for movements up to 25%.

TECHNICAL DATA
Period of renovation: 2016-2018
Period of the intervention: 2017-2108
Client: Venice City Council
Direction: Manuel Cattani
Design: Steam Srl - C+S Associati (Marco Cappai), Saico Ingegneria Gruppo SpA (Zanchettin), Iconia (Renato Vitaliani)
Works direction: Venice City Council, Simone Agrondi, Marco Buranelli
Site technical direction: Sacaim SpA, Graziano Maggio, Michele Merlo, Carmine Ricci
Contractors: A.T.I. SACAIM SpA, Officine Tosoni Lino SpA, Gemmo SpA, Picalarga Srl
Installation company: Adarte Srl
Stone supplier: Canzian Fratelli Srl
Mapei distributor: Nalon Srl
Mapei coordinators: Marcello Deganutti, Mauro Orlando, Davide Lavota, Claudio Azzena, Michele Orlando, Mapei SpA (Italy)

PIAZZA DEL MERCATO AND OLD TOWN CENTRE
SPOLETO – ITALY

Emergency maintenance work was recently completed in Spoleto on the underground water, sewage and gas systems in Piazza del Mercato and some streets in the old part of the town.
The renovation work included demolishing the existing road surfaces and replacing them with new ones. To resurface the roads, 144,970 old basalt cubes setts measuring 12 x 12 x 20 cm thick, were removed and then reinstalled using the MAPESTONE system.
The installation bed, with an average thickness of around 10 cm, was formed from MAPESTONE TFB CUBE pre-mixed mortar consisting of special binders and graded aggregates. To guarantee the durability of the work, the specified thickness of the substrate on which the stone surface was installed was 15 cm and it was made from concrete reinforced with synthetic structural fibres.
The joints were grouted with MAPESTONE PFS2 pre-mixed mortar, characterised by its high mechanical properties and its excellent resistance to de-icing salts, seawater and freeze-thaw cycles.

TECHNICAL DATA
Year of the intervention: 2018
Executive design: Stefania Schiaroli, Stefano Benedetti
Architectural design: Spoleto City Council
Client: Valle Umbra Servizi Spa
Project manager: Bruno Papini (Valle Umbra Servizi Spa)
Tester: Mirko Tosti (Ingegno)
Installation company: AL.CO. Srl
Works direction: Stefania Schiaroli, Stefano Benedetti
Archeological consultant: Matelda Albanesi
Contractor: Carcone Arch. Giuseppe Srl
Mapei coordinator: Marcello Deganutti, Mapei SpA (Italy)

1


2

WORLDWIDE RECOGNITION for Mapei Sport Research

CERTIFYING THE CENTRE'S SCIENTIFIC EXCELLENCE

Mapei SpA's commitment to sport is testified by the work carried out by the Mapei Sport Research Centre, a centre for sports research located in Olgiate Olona (Northern Italy), based along three main lines:

- **Support for sport:** analysis and optimising of key factors in sporting performance, individual assessment of psycho-physical fitness, training plans, biomechanical analysis of athletic movement, medical-sports support aimed at identifying ways of guaranteeing optimum performance, and guidance for healthy activities;
- **Scientific research in the field of sports:** crucial work for maintaining an innovative and rational understanding of all the issues associated with sport at every level, attempting to steer clear of and debunk clichés or "fleeting trends" and to focus on providing scientifically valid solutions;
- **Sport culture:** promoting and spreading scientifically validated knowledge to help divulge an increasingly rational approach to both competitive and health-oriented sport aimed at achieving the best possible results not only in terms of performance but also, and above all, in terms of looking after and improving people's health and fitness.

THE ALDO SASSI GRANT

Mapei Sport's commitment to applied research involves lots of young people, who take advantage of the training opportunities offered by the Centre to contribute to international research projects. Every year Mapei awards a research grant for graduates in the motor sciences that is named after the late Aldo Sassi (Director of Mapei Sports Centre until 2010 and a great innovator in the field of training for sport, particularly as regards cycling). In 2018 Mapei Sport Research Centre and Varese Sport Commission awarded a research grant worth 10,000 Euros to a graduate from Cattolica University in Milan called Marco Martin. He was set a research project in the field of Exercise Physiology - Motor Sciences and will study the "Relationship between the training loads and physical performance of soccer players".

The first Aldo Sassi Grant was awarded to Andrea Petruolo in 2012 for his project entitled the "Physiological profile of competitive BMX riders and the metabolic cost of racing", which was carried out in partnership with the International Cycling Union. Petruolo then got a job as a professional football trainer on Marco Baroni's staff, the team manager of Benevento.

The following year Lorenzo Francini was rewarded for his research project connected with young footballers that was carried out in partnership with the Italian Football Federation's technical department: "Physiological determinants of physical match performance in young football players". Francini is currently working as a trainer for AC Milan's women's first team.

In 2014 Davide Ferioli studied "The use of eccentric pedalling in warming up for a time trial", eccentric pedalling that was tested out using a special ergometer designed by Professor Aldo Sassi. This season Ferioli has been working as a trainer for Pallacanestro Reggiana's first team that plays in the Italian A1 basketball league.

The first woman to win the Aldo Sassi research grant was Marica Bizzi, who completed a project in 2015 entitled "Brain Endurance Training: a new strategy to reduce mental fatigue and improve performance in football?", a project carried out in partnership with Sassuolo and Juventus teams. Federico Donghi, who carried out a research project in 2016 entitled "Delayed potentiation: its effect in vari-

PHOTO 1. Mapei Sport staff at work.
PHOTO 2. Andrea Petruolo was the first young person to be awarded the Aldo Sassi research grant.
PHOTO 3. Marica Bizzi shows the results of her work on Brain Endurance Training.
PHOTO 4. Davide Ferioli, from Mapei Sport to Pallacanestro Reggiana.
PHOTO 5. Mapei Sport Research is based on work carried out with top-flight athletes.

ous sports", is currently still working on the staff of Mapei Sport and, last but not least, last year Luca Cattaneo focused on studying a special training method involving the use of special cuffs that artificially reduce peripheral blood flow: "The acute effect of training with blood flow restriction in football and cycling".
Over the last year, people mentored by Aldo Sassi have published five articles in peer-reviewed scientific journals (see the box below): three focused on basketball and were written by, among others, Davide Ferioli.

INTERNATIONAL LITERATURE

The prestigious British magazine *BMJ Open Sport & Exercise Medicine* carried out an international study aimed at mapping out all the scientific literature devoted to football. The results of showed that 6 of the 50 most widely quoted medical-scientific articles in worldwide international scientific literature came from the Mapei Sport Research centre.
The global top 50 includes: "Use of RPE-based training load in soccer" (Impellizzeri and others, 2004), "Physiological and performance effects of generic versus specific aerobic training in soccer players" (Impellizzeri and others, 2006), "Variation in top level soccer match performance" (Rampinini and others, 2007), "Factors influencing physiological responses to small-sided soccer games" (Rampinini and others, 2007), "Technical performance during soccer matches of the Italian Serie A league: effect of fatigue and competitive level" (Rampinini and others, 2009), and "Validity of simple field tests as indicators of match-related physical performance in top-level professional soccer players" (Rampinini and others, 2007).
The fact that studies carried out by Mapei Sport have been quoted in the specialist bibliographies of numerous cutting-edge projects carried out by foreign researchers pays testimony to the high standard of all the work in the field of applied scientific research carried out by the Research department at the Mapei Sport centre, a department headed and coordinated by Professor Andea Bosio.

Giulia De Maio. Mapei Sport, Olgiate Olona (Italy)

MAPEI SPORT PUBLISHED FIVE ARTICLES IN SCIENTIFIC MAGAZINES IN 2018

- *The physical profile of adult male basketball players: differences between competitive levels and playing positions.*
  Ferioli D, Rampinini E, Bosio A, La Torre A, Azzolini M, Coutts AJ. J Sports Sci. 2018 Nov;36(22):2567-2574. doi: 10.1080/02640414.2018.1469241.Epub 2018 Apr 26. PubMed PMID: 29697296.
- *Bilateral asymmetry of skin temperature is not related to bilateral asymmetry of crank torque during an incremental cycling exercise to exhaustion.*
  Trecroci A, Formenti D, Ludwig N, Gargano M, Bosio A, Rampinini E, Alberti G. ; PeerJ. 2018 Mar 1;6:e4438. doi: 10.7717/peerj.4438. eCollection 2018. PubMed PMID: 29507831; PubMed Central PMCID: PMC5835345.
- *The preparation period in basketball: training load and neuromuscular adaptations.* Int J Sports Physiol Perform.
  Ferioli D, Bosio A, Bilsborough JC, La Torre A, Tornaghi M, Rampinini E. 2018 Sep 1;13(8):991-999. doi: 10.1123/ijspp.2017-0434. Epub 2018 Sep 10. PubMed PMID: 29345555.
- *Different training loads partially influence physiological responses to the preparation period in basketball.*
  Ferioli D, Bosio A, La Torre A, Carlomagno D, Connolly DR, Rampinini E. J Strength Cond Res. 2018 Mar;32(3):790-797. doi: 10.1519/JSC.0000000000001823. PubMed PMID: 28146032.
- *Validity and reliability of submaximal fitness tests based on perceptual variables.*
  Crotti M, Bosio A, Invernizzi PL.; J Sports Med Phys Fitness. 2018 May;58(5):555-562. doi: 10.23736/S0022-4707.17.07199-7. Epub 2017 Mar 30. PubMed PMID: 28362074.

SASSUOLO KEEPS ON PRODUCING PLAYERS FOR ITALY

When the going gets tough, the tough get going and, most importantly, keep on going. Now that autumn is drawing to a close, Sassuolo has managed to maintain his position in the top eight of the Italian Serie A League despite all the tough competition. The team still hopes to end the season in the top six and qualify for the 2019-2020 Europa League.

On the ninth day of the season, Sassuolo lost 2-0 away from home against Napoli at San Paolo Stadium, but it made up for that by gaining a very important point against Sampdoria: the match in Genoa finished 0-0. "We played a good match", so the team manager Roberto De Zerbi was quick to point out. Berardi hit the post: "We also came close to scoring on other occasions - so the team manager went on to say - but the crucial final pass was never quite right as we failed to read the play properly. Overall, we did well".

THE TEAM SPONSORED BY THE MAPEI GROUP IS FIGHTING TO QUALITY FOR THE EUROPA LEAGUE AND PROVIDING PLAYERS FOR ITALY'S NATIONAL TEAMS

The team sponsored by the Mapei Group failed to make the most of home advantage in the derby against Bologna that ended up a 2-2 draw.

The away team took the lead twice at Mapei Stadium, but wonderful goals by Marlon Santos da Silva Barbosa and Boateng gave Sassuolo a draw and Matri almost scored the winner well into stoppage time.

"We allowed Bologna to play the way they wanted. My team kept on trying to play good football, even though we were not on top form. Both Bologna's goals came from place kicks and they deserve credit for taking advantage of their set plays."

Sassuolo was back to winning ways in its eleventh match of the season against Chievo at Bentegodi Stadium thanks to a goal by Di Francesco right on the stroke of half-time, adding a second right at the end of the match through an own goal by Giaccherini. "We wanted to win at all costs – so De Zerbi noted - showing just the right attitude and right approach. The great determination we showed in Verona is just as important as the quality football we have played in other matches".

De Zerbi's lads also got a more than honourable draw against Lazio. The match, which finished 1-1 at Mapei Stadium

SASSUOLO'S LATEST RESULTS

8	Napoli-**Sassuolo**	2-0	(07-10-18)
9	Sampdoria-**Sassuolo**	0-0	(22-10-18)
10	**Sassuolo**-Bologna	2-2	(28-10-18)
11	Chievo-**Sassuolo**	0-2	(04-11-18)
12	**Sassuolo**-Lazio	1-1	(11-11-18)
13	Parma-**Sassuolo**	2-1	(25-11-18)

OPPOSITE PAGE. Stefano Sensi making his debut for Italy. **LEFT.** Domenico Berardi in action against the USA.

saw goals by Lazio's midfielder Parolo and Sassuolo's excellent defender Ferrari.

Here is what De Zerbi had to say about the match: "We tried to control the game. We did not always manage to do so, partly due to our own mistakes. We are not happy with the result: bearing in mind our potential, it would be wrong if we settled for what we got".

On the thirteen day of the season Sassuolo took a step backwards, losing 2-1 away to Parma. After two early goals for Parma scored by Gervinho and Bruno Alves, Sassuolo pull one back after being awarded a penalty after Babacar was brought down in the area. Babacar then stepped up himself and scored from the spot.

The match against Parma was quite electrifying and a really hard game, although the Sassuolo players did not look ready for the fight in the first 25 minutes. The team manager had to admit that: "My players were still in their hotel rooms in the first 25 minutes, but they played well for the 65 minutes after that. We created 4 chances to make it 2-2: Duncan, Berardi, Babacar and Matri all went close to scoring. It is not easy to create four clear chances against a team like Parma that likes to sit back and then counter-attack. It would have been a completely different story if we had taken our chances. I take full responsibility for the goals the team conceded at the start of the match: we are working hard to improve on this aspect of our game".

SASSUOLO, ITALY

Under its new manager Roberto Mancini, the Italian national football team is more black-and-green than ever. Stefano Sensi, aged 23, made his debut for Italy in the 1-0 win against the United States, playing a key part in adding fluidity to the team's play. Sensi has been with Sassuolo since summer 2016. Berardi also made his third appearance for Italy in the match against the USA.

"Playing for the national team and representing a country like Italy is a unique and unforgettable experience", so Sensi said. "I was a little bit tense and nervous while the national anthem was being played before the game. I tried to keep calm and my teammates helped me a lot, giving me plenty of advice. I am happy with how I played. The time spent with the Italian national team was wonderful and the most important thing is that I was ready to do my bit. I gave everything out on the pitch and I would like to thank my teammates for their help. The entire team was magnificent. I am glad Berardi was playing too, I think he is a really great footballer and deserves to play at the very highest level. Mancini's project has got off to a good start with lots of young players. Belonging to a club like Sassuolo has really boosted my chances of playing for Italy: De Zerbi's methods are very similar to Italy under Mancini".

Some former Sassuolo players are also doing extremely well for the national team.

The winning goal against the USA was scored by Matteo Politano, while Francesco Acerbi put in a magnificent performance in defence.

The club sponsored by Mapei also keeps on providing players for Italy's youth teams as well.

LEFT. Gian Marco Ferrari takes on Luiz Felipe in Sassuolo-Lazio. **RIGHT.** Magnanelli and Boateng celebrate Babacar's goal against Parma.

MAGNANELLI: "LET'S QUALIFY FOR EUROPE AGAIN!"

FRANCESCO IS THE CAPTAIN AND RECORD-HOLDER FOR THE MOST MATCHES PLAYING FOR SASSUOLO

Francesco Magnanelli, aged 34, has played for Sassuolo more times than anybody else. This midfield player joined the club in July 2005 and after playing one season in the Italian Serie C2, two in Serie C1 and five in Serie B, he is now captaining the team in his sixth season in the Italian Serie A. Magnanelli is the only survivor from the Sassuolo team that played in Serie C2 against small teams from provincial towns and villages.

"Even I did not expect to climb so far up the ladder – so captain Francesco told us - and achieve such important goals; I'd like to express my thanks to Sassuolo and Mapei. We have come a long way together and we still have a long way to go. I made my debut in the Italian Serie A at the age of 28 years and 10 months, a lot older than the average professional footballer who makes it into the top flight, but I have no regrets because I am just one of those players who took longer to reach their prime".

Have you been inspired by any players in particular?

"As regards midfielders, before I turned professional I supported A.C. Milan and Andrea Pirlo was my favourite player. My absolute hero, in any position, was Paolo Maldini".

Do your teammates think of you as a sort of coach out on the pitch?

"I do not think of myself as a coach, but they know that I like to give advice even when I do not have the ball at my feet, in the changing rooms or before matches. That's really important for me".

Even though you were late in making it into the top flight, did you ever think you were close to being called up for the Italian squad?

"All players dream of playing for the national team and it was my dream too, when I was a child. Later in my career, I think I almost got called up at least a couple of times, when Conte was the team manager. Yes, despite being a late

LEFT. Magnanelli in action against Inter Milan at Mapei Stadium.

RIGHT. Magnanelli on the ball marked by Petagna.

BELOW. Carlo Rossi, Sassuolo Calcio's President, with Francesco Magnanelli in 2005, when he joined Sassuolo.

2013

Is the year when Francesco made his debut in the Italian Serie A playing for Sassuolo. The team lost 2 -0 away to Torino

14

The total number of seasons Francesco has worn the Sassuolo shirt since July 2005

starter, I did get close to being called up for national duty with the Italian team".

When do you think you played the best football of your career?

"Definitely the 2015-16 season when we qualified for the Europa League for the following year. Qualifying to play in a continental competition is something I want to experience again.

It will be hard to get there, but I would like to play in the Europa League again or make my debut in the Champions League".

When do you think you played your best during the first part of the 2018-19 season?

"Definitely when we beat Inter Milan 1-0 at Mapei Stadium. Inter Milan had bought some great players on the transfer market and it was the first game of the season. It was an unexpected win".

In contrast, at the end of the match at San Paolo Stadium against Napoli, which you lost 2-0, you were really disappointed.

"That's true. We handed Napoli the lead and then created three chances to equalise but then, unfortunately, we conceded a second goal.

I think experience made all the difference between the two teams: Napoli has gradually progressed over the last few years, while we had a number of new players in the team, many of them young, and we did not really play our best.

To be honest, we haven't really been on top form in any of our other matches so far this season, but if we work hard, we will get there.

Napoli's hard work and progress over the last few years makes them Juventus's main rivals for this season's league title".

You drew 0 - 0 against Sampdoria at Ferraris Stadium. Would you say that was to some extent a bad result?

"Not at all. It is always hard to play away from home against Sampdoria; they are a good team. Perhaps we deserved to win but a draw against Sampdoria is more than acceptable, but we failed badly to build on that result when we drew our following game 2-2 against Bologna at Mapei Stadium. If football was like boxing or, in other words, if you could win on points, we would certainly have won. But we were constantly chasing the game against Bologna, coming from behind twice to eventually draw 2-2. Bologna sat back in their own half and then counter-attacked effectively. Perhaps this match came along during a period when we were off-the-boil, that can happen sometimes".

Fortunately, you recovered straight away in the next match against Chievo in Verona.

"We won 2-0 proving we know how to fight hard for victory".

Last year, your team manager was Iachini, now you have De Zerbi on the bench. What do you think the difference is between the two of them?

"They are both extremely good managers. Iachini joined us during a tricky period for the team and showed what he could do: he is somebody who knows how to get the results his club needs. De Zerbi is very demanding and has a different approach; he has a more European playing style and is good at passing on his ideas to the team. De Zerbi is now our team manager and we hope to qualify for Europa League with him".

SASSUOLO LADIES GET OFF TO A FLYING START!

MANAGER PIOVANI'S GIRLS ARE HOT ON THE HEELS OF AC MILAN AND JUVENTUS

Sassuolo women's football team's second season in the Italian Serie A has got off to a fine start. The team has reached the first break in the league championship (for international matches) behind only AC Milan and Juventus in the league table. "We have got off to a great start - so Gianpiero Piovani noted, the team manager of Sassuolo women's team since July – because here at Sassuolo we work as a team and that is extremely important. Our owner Mr. Squinzi, as well as Mr. Rossi, Mr. Carnevali, Mr. Terzi and all the other management staff have put me in charge of a team that is like a family. The most wonderful thing for a manager like me is to see everybody helping each other out, working in synergy and improving together. I would like to thank Sassuolo football club for all the facilities it provides, so that we can work in the best way possible".

Mr. Piovani is a pragmatist: "Our main aim was to get enough points to avoid relegation. We should not forget that we started this season with just five or six of last season's first-choice players in our team and our squad is full of young players. This means we need to build our team and our target this season is not to finish first, second or third, but rather to cause problems for the bigger teams, so it was extremely important to get off to a good start".

Sassuolo beat Roma 3-2 in the first game of the season. "I think it was our best game so far this season", so Mr. Piovani told us, who was a striker and played in the Italian Serie A for many years. The approach to the match against Roma was extremely tense for Gianpiero, who was making his debut as Sassuolo's team manager: "Despite all the excitement and the tension of it being my first

LEAGUE GAMES: RESULTS AND SCORERS

(22/9/2018) **SASSUOLO-ROMA** 3-2
11' Iannella (S) penalty, 22' Ferrato (S), 59' Serturini (R) penalty, 74' Di Criscio (own goal for Sassuolo), 80' Bartoli (R)

(29/9/2018) **ATALANTA-SASSUOLO** 0-2
56' Daleszczyk and 88' Iannella (S)

(14/10/2018) **SASSUOLO-MILAN** 2-2
28' and 46' Ferrato (S), 34' Giacinti and 39' Alborghetti (M)

(20/10/2018) **BARI-SASSUOLO** 0-4
6' Iannella, 33' Pettenuzzo, 61' Tudisco, 75' Ferrato (S)

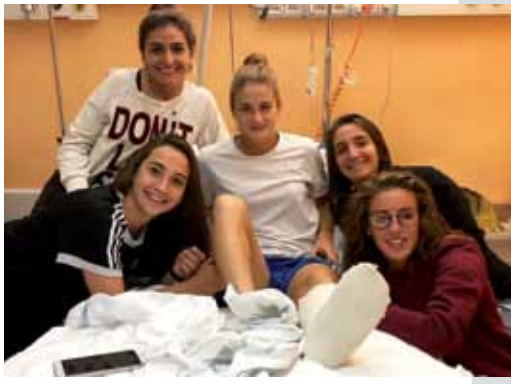
(27/10/2018) **SASSUOLO-FIORENTINA** 0-2
26' and 73' Guagni (F)

(3/11/2018) **CHIEVO-SASSUOLO** 1-1
41' Giurgiu (S), 78' Sardu (C)

ABOVE. From left, Sabrina Tasselli, Lara Barbieri, Zoi Giatras, the assistant manager Samantha Dolci, and team manager Piovani.

FROM LEFT. The striker Adina Giurgiu, this season's revelation Claudia Ferrato, and the goalkeeper Gaelle Thalmann.
BOTTOM. Tecla Pettenuzzo, Giusy Faragò, Claudia Ferrato and Martina Tomaselli gather around Valeria Monterubbiano, who has been injured.

game, I managed to fire up my team in the right way and our win against Roma really gave us confidence".
In the very next match Sassuolo "ladies" beat Atalanta 2-0 away from home.
This was followed by a 2-2 home draw against AC Milan. "Against AC Milan - so Mr Piovani went on to say - my team showed plenty of character". Claudia Ferrato scored the goal that gave Sassuolo the lead. "She is a striker who I think will be one of the revelations of this season's league championship", so Piovani was quick to point out. But then AC Milan equalised five minutes later and went on to take a 2-1 lead. "That was hardly surprising, considering what a great team AC Milan is, with eight really top players in the team I know very well, because I coached them last season at Brescia. Nevertheless, my team reacted well and Ferrato got the equaliser". Sassuolo's overwhelming 4-0 win away from home against Bari made up for the two points dropped in the team's fine performance against AC Milan. Sassuolo's fantastic run came to an end in the next home game against Fiorentina: the team from Florence won 2-0. "Fiorentina - so Piovani had to admit – are a better all-round team than us. They were much better at set pieces: that was the main difference. We conceded both goals from set pieces. The game against Fiorentina showed us that lots of matches are decided and will be decided by taking advantage of free kicks and their aftermaths. It cannot be denied that Fiorentina had other chances to score, even from open play, but we had just as many chances as them. The law of averages says that 75-80% of football matches are now decided by set pieces. And this is something we need to work really hard on".
The draw in the next match away from home against Chievo settled everybody down again at Sassuolo. "We can and must keep on improving", so Mr. Piovani said.
The new team manager places great emphasis on playing formations: "I think a 3-5-2 formation is fine when the other team has the ball. When we have the ball, I prefer to play 3-3-1-3". Mr Piovani has another reason to feel proud: "Taking into account the youth team as well, 10 Sassuolo players were called up to Italian national teams in November. Not to mention our foreign players Thalmann, Daleszczyk and Giurgiu, who were called up for international duty in their own countries. Having players called up for international duty adds to Sassuolo's prestige and is a reward for my work".
Gianpiero has a squad of 26 players. These include the midfield player, Giada Pondini aged 22, who was back in the team for the match against Fiorentina. Pondini was out of action for eight months after rupturing the front cruciate ligament of her right knee. The striker Valeria Monterubbiano has also been side-lined since breaking her left fibula in training on 17th October. She will be fit to return to action in the second half of the season.



PIOVANI'S SQUAD

GOALKEEPERS: Gaelle Thalmann (Switzerland), Martina Galloni, Sabrina Tasselli.

DEFENDERS: Eilish McSorley (Scotland), Elisabetta Oliviero, Giulia Bursi, Martina Lenzini, Martina Tomaselli, Saga Fredriksson (Sweden), Sara Novelli, Tecla Pettenuzzo, Zoi Giatras.

MIDFIELDERS: Adina Giurgiu (Rumania), Benedetta Brignoli, Giada Pondini, Giorgia Tudisco, Katarzyna Daleszczyk (Poland), Lara Barbieri.

FORWARDS: Claudia Ferrato, Benedetta Orsi, Francesca Imprezzabile, Giusy Faragò, Melania Martinovic, Riikka Hannula (Finland), Sandy Iannella, Valeria Monterubbiano, Veronica Battelani.

Cyling is always great with Mapei

THE BRAND WAS IN THE SPOTLIGHT WITH THE TRE VALLI VARESINE CLASSIC ONE-DAY RACE AND UNDER 23 TOUR OF LOMBARDY

Mapei's ties with cycling are as strong as ever. As well as the 2018 UCI World Road Championships (see *Realtà Mapei International* no. 71), in 2018 Mapei sponsored the Tre Valli Varesine one-day professional road race over a distance of 197 km from Saronno to Varese, Northern Italy. Mapei has equally close and enduring bonds with the Società Ciclistica Alfredo Binda, the race organisers. Indeed, Mapei sponsored the 2008 UCI Road World Championships held in Varese (Italy) that were carefully coordinated and organised by the Società Ciclistica Alfredo Binda team.

The 2018 Tre Valli Varesine race was won by Toms Skujins, a Latvian cyclist with the Trek-Segafredo team, who beat Thibaut Pinot, Peter Kennaugh and a couple of other members of the breakaway in a sprint finish. Trek-Segafredo draws on the expertise of the Mapei Sport Centre for testing its riders and planning their training schedules. The Tre Valli race was Alejandro Valverde's first wearing his new world champion's rainbow jersey. Lots of other great cyclists also joined the new world champion in the race.

Italian TV channel, Rai 3, broadcast the race live for over two hours and it was televised in 101 countries.

Mapei also sponsored the international Under 23 Tour of Lombardy (174.700 km). The race, which is also called "Lombardia-Memorial Giorgio Frigerio" after its most passionate promoter and late President of Frigerio Ceramiche, was won by the Australian rider Robert Stannard in a sprint finish between a small group of riders that included Andrea Bagioli, who crossed the line in second place. This classic one-day race sponsored by Frigerio Ceramiche started and finished in the town of Oggiono (Northern Italy). The race carries the most points of all races of its kind and Italian channel Rai Sport broadcast extensive highlights of the race. Sara and Davide Frigerio, Giorgio's children, awarded the winner's prize to Stannard.

Aldo Sassi, the late deviser-director of Mapei Sport Research Center, is still very much in many people's memories in the province of Como (Northern Italy). The "Pedala con Aldo (Pedal with Aldo)" fun ride (sponsored by Mapei) was held again this year over 50 km. Marina Marini, Aldo's wife, was the official starter of a race whose ranks included former cyclists of the Mapei Professional Cycling Team such as Daniele Nardello and Stefano Zanini, as well as Andrea Morelli (Mapei Sport) and the young cyclist Alice Gasparini.

ABOVE. Skujins wins the Tre Valli Varesine cycling race.
RIGHT. Sara and Davide Frigerio present the winners' prizes to the top three in the Under 23 Tour of Lombardy.
BELOW. Marina, Aldo Sassi's wife, with Zanini and Nardello at the "Pedala con Aldo" cycling event.

LEFT. The forward Laura Macchi in action.
RIGHT. Gabrielle Williams, a forward from France.

Mapei supports Saces in Europe

WOMEN'S BASKETBALL: SACES-MAPEI CHALLENGING FOR LEAGUE TITLE AND EUROCUP

They will be travelling around Europe with Mapei on their kit and in their hearts. We are talking about the girls from Saces-Mapei-Sorbino Napoli, a team featuring in both the Italian Serie A 1 league championship and Eurocup in the 2018-19 season. Last season the team belonging to the Dike Napoli Basket club finished third in the A1 Championship, eventually losing in the semi-finals of the play-offs. The club president is Filomena D'Angelo and the team manager is young Alessia Guardascione. The team can also boast having won the Italian cup in 2013-14. Saces-Mapei-Sorbino is the only Italian team sponsored by Mapei to be taking part in a continental competition this season. "Playing in the Eurocup - so the team manager claimed - is a real boost for the entire club".

Until three years ago, 80% of its players came through its youth programme but the need to be competitive on all fronts means this is no longer the case. The 2018-19 Saces-Mapei roster is completely different from last season. The club has kept on the captain Chiara Pastore and Debora Gonzalez, both playmakers, and the forward Diene Nene, an invaluable alternative to the main centres. There are seven new players in the squad and a completely different set of foreign players with the squad also being strengthened by athletes coming from the highly rated WNBA Championship in the USA: the shooting guard Courtney M. Williams, who used to play for Connecticut Sun, and the forward Gabrielle Williams, formerly a Chicago Sky player. The coach Nino Molino can also count on the center Isabelle Harrison, who has played for Sant'Antonio Stars and more recently gained experience playing in the Korean league.

A number of new Italian players have also been joined the ranks, including Laura Macchi, a real legend of Italian basketball, Marzia Tagliamento, and the center Kathrin Ress. The new Saces-Mapei team has also drafted the shooting guard Elisa Mancinelli, who caught the eye while playing for Alpo Basket from Verona in the Italian A2 league, and Maria Giuseppone, a very young play who has come through Dike's youth programme.

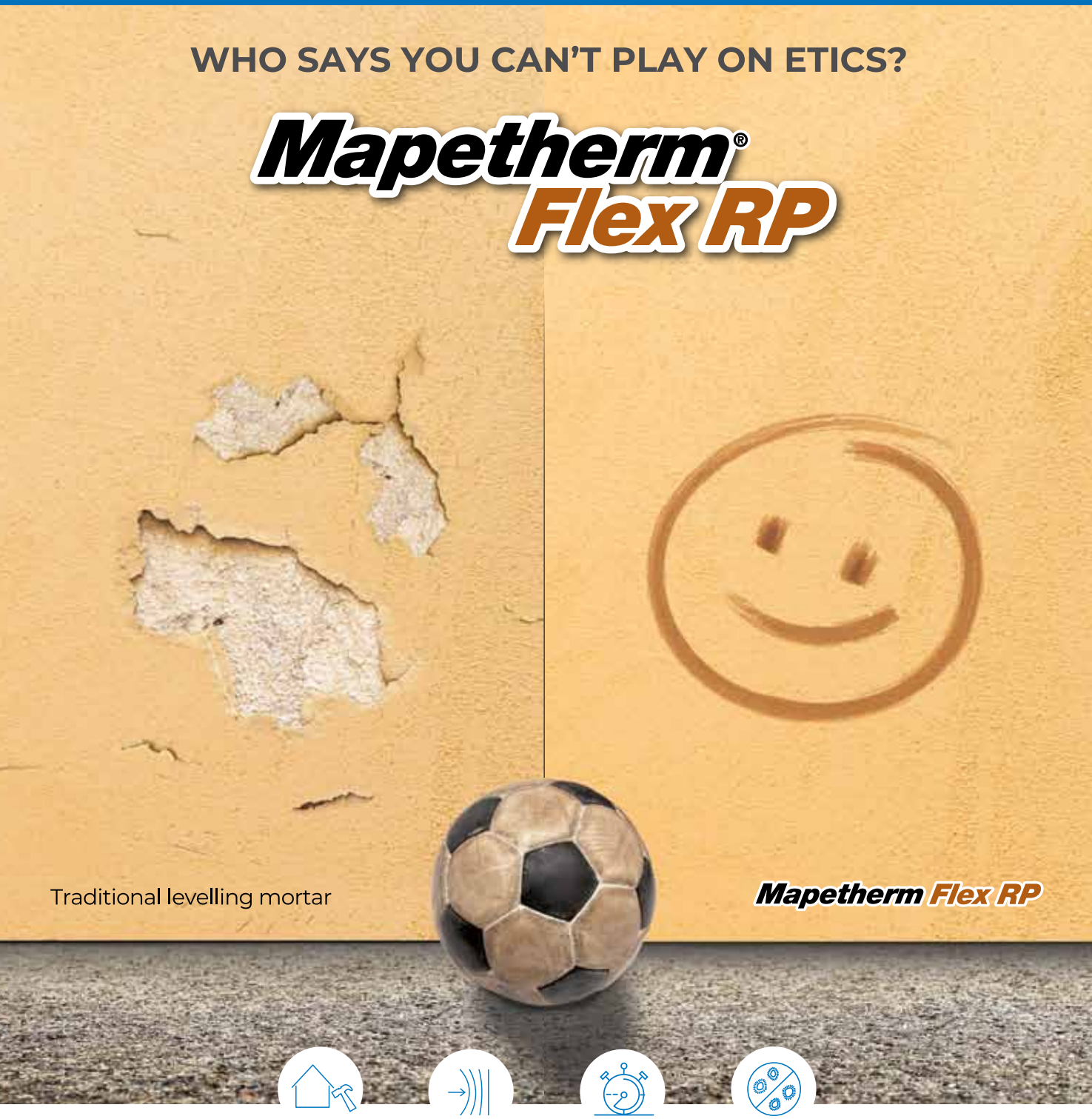
"The team has been assembled to compete at the very top of Serie A1 and give the fans from Naples plenty to cheer and dream about", so we were told by coach Molino, whose assistants this season will be Stefano Scotto Di Luzio and Giancarlo Natale. Alessia Guardascione is quick to point out that "We are focusing on both the league title and Eurocup, without forgetting our highly successful youth programme and commitment to social work".

ELEVEN PLAYERS FOR SACES MAPEI

N.	Surname and Name	Years	Nationality	Position	Height
2	**Macchi Laura**	1992	Italy	Forward	188
3	**Pastore Chiara**	1986	Italy	Playmaker	175
7	**Diene Nene**	1992	Italy	Forward	180
8	**Tagliamento Marzia**	1996	Italy	Forward	181
10	**Williams Courtney**	1994	USA	Shooting guard	173
13	**Gonzalez Debora**	1990	Argentina	Playmaker	171
15	**Williams Gabrielle**	1996	France	Forward	180
18	**Mancinelli Elisa**	1995	Italy	Shooting guard	175
20	**Harrison Isabelle**	1993	USA	Center	190
22	**Ress Kathrin**	1985	Italy	Center	193
23	**Giuseppone Maria**	1999	Italy	Center	185

WHO SAYS YOU CAN'T PLAY ON ETICS?

Mapetherm® Flex RP



HIGH IMPACT RESISTANCE

HIGH ELASTICITY

RAPID INSTALLATION

MOULD RESISTANT

Mapetherm Flex RP is a **ready-mixed**, **cement-free**, **mould** and **algae resistant skim coat**. It features **high impact resistance** and it can also be used for **repairing deteriorated thermal insulation systems**.

EVERYTHING'S OK WITH MAPEI

Learn more on **mapei.com**

MAPEI®
ADHESIVES · SEALANTS · CHEMICAL PRODUCTS FOR BUILDING

THERMAL INSULATION and energy-efficiency

A PROPER THERMAL INSULATION SYSTEM REDUCES ENERGY CONSUMPTION AND COSTS

Why does external thermal insulation help improve the energy efficiency of a building?
Because it lowers electricity and gas consumption, the production of carbon dioxide (CO_2) and reduces the amount we spend on energy quite considerably. And how does it do this? External thermal insulation (the Mapei Mapetherm System, for example) is made up of insulating panels, a bonding system to install the panels, a reinforced skim-coat and a protective, decorative finish. During the winter months, heating systems raise the temperature in our homes until they reach the level we are comfortable with. Once that temperature has been reached, the heating system stops producing more heat. From that moment on, our homes start to lose the heat they have accumulated because heat tends to move towards cold areas and tries to create a thermal balance with the outside of the building. If the temperature drops, the heating system starts running again and produce new heat, so more energy consumption. Having an external thermal insulation system reduces the amount of heat that is dispersed by moving from the inside of our homes towards the outside. It manages to keep the inside of our homes warmer and more comfortable for much longer. This means the heating system will be running for less time, thereby lowering consumption rates, overall running costs, and, last but not least, the impact on the environment. An European Union Directive, 2002/91/EC, focuses on the energy efficency of buildings and shows the way the EU member states should go. The European Union also issued the "ETAG 004 guidelines for European technical approval of external thermal insulation composite systems with rendering", setting the basic requirements all the products for thermal insulation should comply with.

Does external thermal insulation also work in the summer?
Yes. In the summer it keeps our homes cool. The amount of energy required to lower the temperature, even by just a few degrees, is much higher in this case! External thermal insulation slows down the rate at which heat from the outside enters into our homes and keeps rooms cool for longer, which again means lower consumption rates and overall running costs.

Does external thermal insulation prevent walls from "breathing"?
No. The water vapour produced inside a room escapes through the windows and the gaps in window fittings. Less than 3% of vapour escape through walls.

Does thermal insulation impede the formation of mould?
Mould is able to survive in three conditions: moisture, low temperatures and a source of nutrients. When warm air inside our homes meets a cold wall, it condensates and vapour turns into water, which is then deposited on the surface of the wall. The "nutrients" are normally supplied by organic materials on the surface of the wall, including low quality paints. Well-aired or ventilated surroundings limit the amount of vapour condensation on walls (which turns into water) quite considerably. Having an external thermal insulation system helps maintain the surface temperature of internal walls several degrees higher than the outside temperature, which helps reduce condensation phenomenon. The solution to the problem of mould is more in the use of well-designed construction features than the use of products.

Marco Albelice. Mapei SpA Technical Services Department

3 PRODUCT SPOTLIGHT

LEVELLING SUBSTRATES, SOUNDPROOFING, AND INSTALLING LVT: A FEW SOLUTIONS BY MAPEI

MAPESLOPE

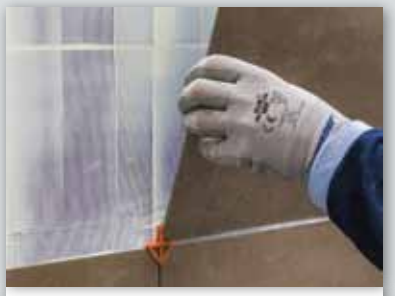
It is a mortar used to level off substrates with hollows on roofs or substrates that are out of flat in order to re-establish slope enough for water to run off and to make them suitable for the application of a waterproofing product. **MAPESLOPE** may be applied in a single layer up to 5 cm thick on various types of substrate such as smooth or granulated bituminous membranes, concrete, cementitious screeds and screeds made from special binders (TOPCEM or TOPCEM PRONTO), existing external ceramic, terrazzo and stone floors. It is easy to use and eliminates premature aging of roofs caused by ponding water and hollows.

TO LEVEL OFF AND REPAIR

MAPESONIC CR

To counteract the transmission of noise through floors caused by footsteps, Mapei proposes **MAPESONIC CR**, a thin section soundproofing membrane applied before laying ceramic, stone, resilient and multi-layered parquet floors. The product has been specifically developed for application in existing buildings to improve soundproofing without removing the floors and screeds. **MAPESONIC CR** is manufactured using recomposed cork and rubber bound together. It easy to apply and has very low emission of volatile organic compounds (EMICODE EC1 PLUS).

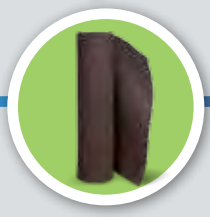
AGAINST THE NOISE CAUSED BY FOOTSTEPS



ULTRABOND ECO MS 4 LVT WALL

For bonding LVT on walls Mapei offers **ULTRABOND ECO MS 4 LVT WALL**, high performance, one-component silylated polymer-based adhesive, also suitable as universal adhesive for all kinds of textile and resilient floorings (including all types of vinyl). It is ideal for interior walls and floors and can be also applied on underfloor heating systems. The product is particularly suitable for static and dynamic loads, including for heavy wear use in domestic, commercial and industrial locations. It is highly resistant to shear loads, which makes it particularly suitable for floors constantly exposed to water or direct sunlight or subjected to intense mechanical stress.

INSTALLING LVT ON WALLS



SOLUTIONS FOR
CONCRETE INDUSTRIAL FLOORS

DYNAMON FLOOR
A COMPLETE RANGE
OF SUPERPLASTICIZERS
FOR ALL SEASONS

EXPANSIVE AND
ANTI-SHRINKAGE AGENTS

CURING AND
ANTI-EVAPORATION
AGENTS

STRUCTURAL AND
ANTI-SHRINKAGE
POLYMER FIBRES

QUARTZ
BROADCASTING SAND

SEALANTS

Mayoral Logistics Centre
Malaga, Spain

Functionality is the main requirement of **concrete floors** in industrial and commercial surroundings: and apart from their highly attractive finish, Mapei products also provide perfect flatness, high dimensional stability, with partial or total elimination of traditional metallic reinforcement and contraction joints.

EVERYTHING'S OK WITH MAPEI

Learn more on **mapei.com**

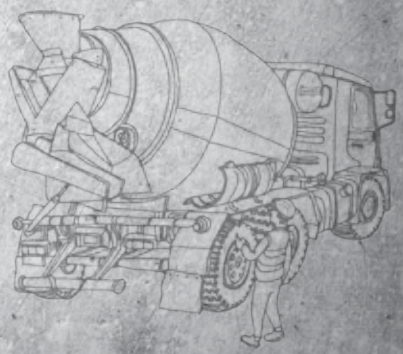
MAPEI®
ADHESIVES · SEALANTS · CHEMICAL PRODUCTS FOR BUILDING

SUSTAINABLE CONCRETE SOLUTIONS

RE-CON LINE

RE-CON AGG 100
RE-CON AGG 200

RE-CON ZERØ EVO



Using sustainable concrete means consuming the least amount of natural resources as possible. Which is why Mapei has developed the **RE-CON** line of products: **RE-CON ZERØ EVO** to **recover all leftover concrete from mixer trucks** and **RE-CON AGG** for mixing concrete made with aggregates containing clay or recycled aggregates from demolition work. **Constructing a sustainable future together**.

EVERYTHING'S **OK** WITH **MAPEI**

Learn more on **mapei.com**

MAPEI®
ADHESIVES · SEALANTS · CHEMICAL PRODUCTS FOR BUILDING