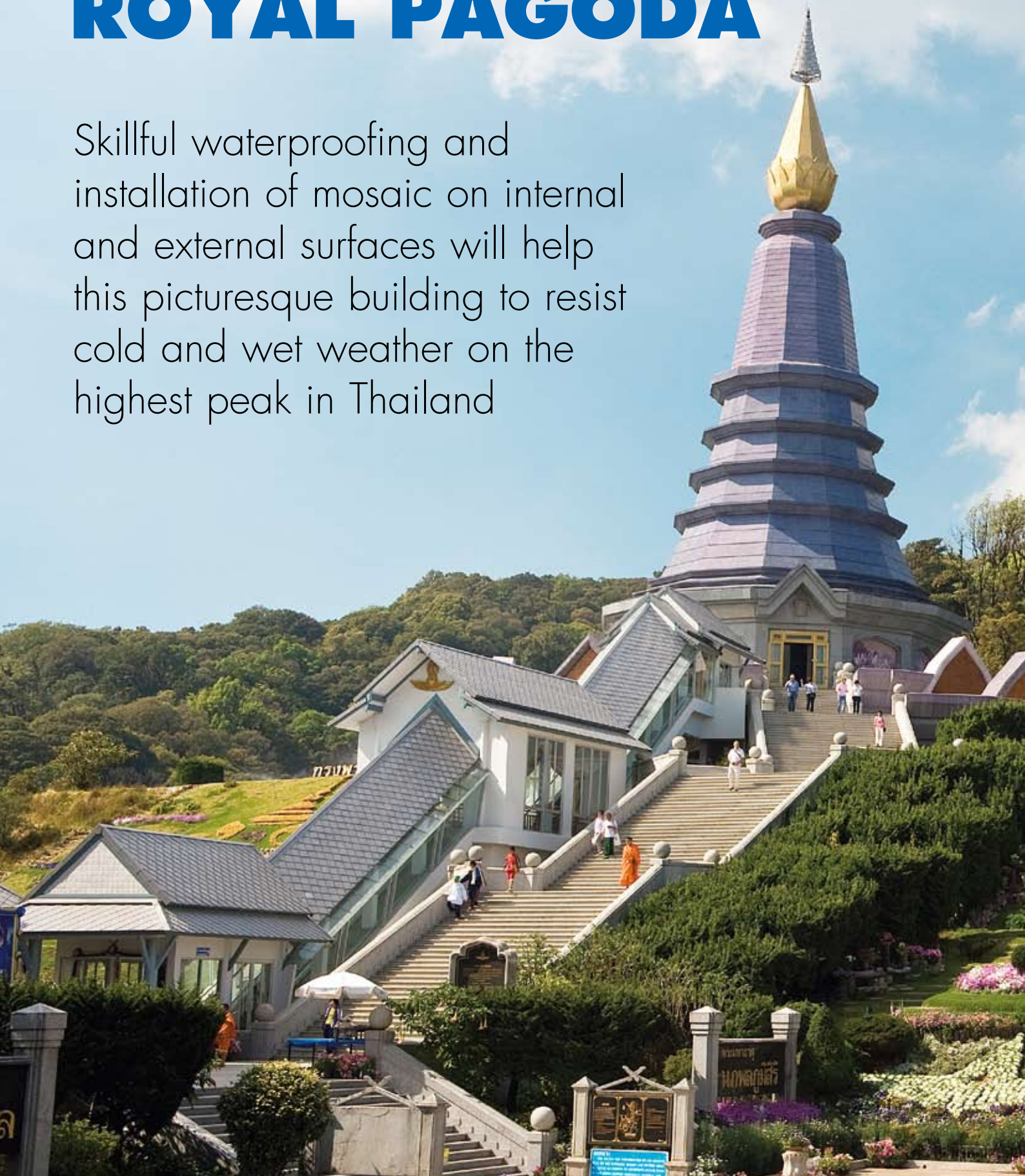


# DOI INTHANON ROYAL PAGODA

Skillful waterproofing and installation of mosaic on internal and external surfaces will help this picturesque building to resist cold and wet weather on the highest peak in Thailand



**D**oi Inthanon is situated within Chiangmai province. It is about 113 km southwest of Chiangmai city, the largest and most culturally significant centre in Northern Thailand. This province encloses some of the most attractive spots of the country: the Ping river valley is filled with paddy-fields surrounded by curved hills and the whole area features forests, rivers and wooded mountains. Here one also finds the Doi Inthanon Mountain belonging to the Himalayan Range which winds from Nepal to Bhutan, passes Burma and ends in Thailand. At 2,565 m above sea-level the Doi Inthanon is the highest peak in Thailand. This area is a popular National Park not only for its breathtaking scenic beauty, diversity in flora, vegetation and forests but also its cool misty and sometimes frosty weather. Another attraction at the Doi Inthanon are the Royal Chedis (Pagodas) built by the Royal Thai Air Force (RTAF). One was built in 1987 to commemorate the 60<sup>th</sup> birthday of His Majesty King

Bhumibol. The other one was built in 1992 to commemorate the 60<sup>th</sup> birthday of Her Majesty Queen Sirikit. The Chedis are built with in-situ cast concrete and covered with Italian glass mosaics while the floors are covered with local granite. No waterproofing

*Photo 1. The Doi Inthanon Royal Pagoda after renovation works.*

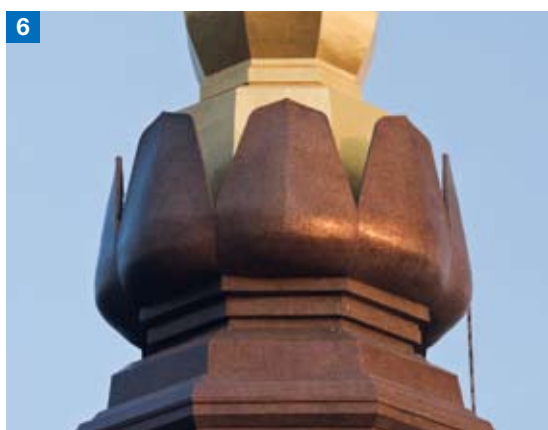
*Photo 2. The Pagoda's roof covered by scaffolding during the works.*

*Photo 3. Removing existing golden mosaics from the walls.*

*Photo 4. Once old mosaics were removed, the original surface came to the light.*

*Photo 5. Applying the second layer of MAPELASTIC cementitious membrane reinforced with FIBREGLASS MESH, for waterproofing purposes.*

*Photo 6. Some details of the pagoda after completion of the works.*





*Photo 7. View of the roof after the works were completed.*

*Photos 8 and 9. Joints were grouted with ULTRACOLOR PLUS before cleaning the surfaces.*

*Photos 10, 11, 12 and 13. Applying ADESILEX P10+ISOLASTIC, bonding the mosaics and removing the paper protecting them.*

treatment was done during the construction works. As time goes by, the installations could not withstand the severe conditions at the peak. In winter, the temperature could be as low as 0°C and from November to April (which is in Thailand a dry season) a thick fog covers the whole park area allowing the forest to endure the lack of rain.

Lately glass mosaics began to be debonded and humidity also seeped through the wall destroying parts of the interior.

It was this problem which set the authorities hunting for the rectification solution which ended up with Mapei being chosen as the ideal supplier.

**Mapei Solutions**

In 2007, the RTAF decided to renovate the first Chedi which is dedicated to the King. The solutions presented by Mapei distributor Bel Vedere Co. Ltd were adopted. Works started in December 2007 and were completed in August 2008.

All external mosaics (about 2000 m<sup>2</sup>) were removed and the surface was replastered using cement/sand mortar mixed with PLANICRETE SP synthetic



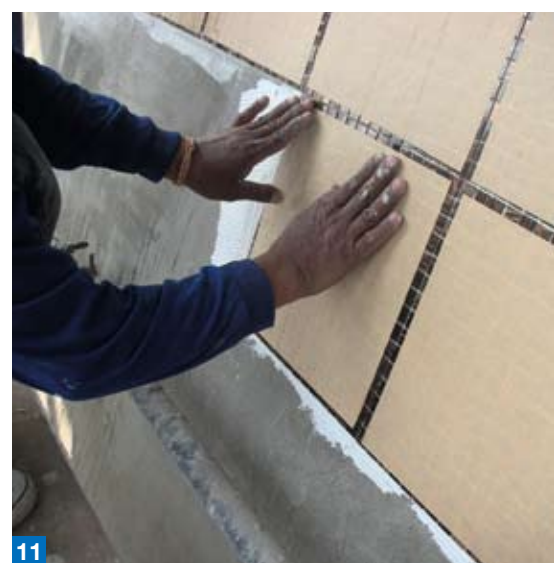
rubber latex which improves mechanical and adhesive strength of cementitious mixes for screeds, renders, etc. PLANICRETE SP is a product especially developed for the Far East markets and is locally distributed by Mapei Far East, the Group's subsidiary located in Singapore and coordinating the Company's activities in Far East countries.

The resultant surface was then waterproofed with MAPELASTIC cementitious membrane reinforced with the FIBREGLASS MESH, a product which has now been substituted in several countries by MAPENET 150.

MAPELASTIC is used for waterproofing bathrooms, showers, balconies, terraces and swimming pools and provide a highly flexible, protective and waterproof coating to concrete struc-

tures particularly subject to cracking. When applying to surfaces particularly stressed or crazed, it is essential to embed a 4 x 4.5 mm square-grid FIBREGLASS MESH or MAPENET 150.

The glass mosaics supplied by the Italian company Trend were then bonded with ADESILEX P10 + ISOLASTIC. When mixing ADESILEX P10 with ISOLASTIC additive as a 50% substitute for water, the performance characteristics and deformability improve, satisfying class S1 (deformable adhesive) according to European standard EN 12004. After the bonding, joint grouting was done with ULTRACOLOR PLUS fast-setting and drying, high performance, anti-efflorescence mortar grout for joints from 2 to 20 mm. This product is water-repellent with DropEffect® and anti-mould with BioBlock® technology.





### The Interior Floorings

All old granite floorings in the interiors (a total of 5.000 m<sup>2</sup>) were removed and new granite slabs of varying sizes (60x120 cm, 60x80 cm, 60x60 cm, 30x120 cm, 130x100 cm) were

bonded in place using KERABOND + ISOLASTIC. When mixing KERABOND with ISOLASTIC additive as a substitute for water, the performance characteristics improve, satisfying class C2ES2 (improved cementitious highly

deformable adhesive) according to European standard EN 12004. Joint grouting was done with KERACOLOR + FUGOLASTIC. FUGOLASTIC is used as a substitute for water to mix KERACOLOR FF and

## IN THE SPOTLIGHT

### ADESILEX P10 + ISOLASTIC

ADESILEX P10 is an improved (2) slip resistant (T) cementitious adhesive (C) with extended open time (E) of class C2TE. ISOLASTIC is a synthetic polymer to be mixed with KERABOND, KERABOND T, KERAFLOOR or ADESILEX P10.



When mixed with ADESILEX P10 it improves its performances and deformability to meet the requirements of class S1 (deformable adhesive) according to EN 12004.

ADESILEX P10 mixed with the correct amount of ISOLASTIC becomes a mortar with the following features:

- white in colour. It enhances the colours of glass mosaic tiles;
- easily workable;
- excellent adhesion to all conventional materials used in building;
- highly thixotropic: ADESILEX P10 can be applied on a vertical surface without sagging

or slipping even when heavy tiles are used. Mosaic tiles can be installed from the top towards the bottom without using spacer pegs;

- particularly extended open and adjustability time, making installation easier.
- ADESILEX P10 mixed with ISOLASTIC diluted 1:1 with water is particularly suitable for bonding mosaic in swimming pools on renders or on substrates waterproofed with MAPELASTIC; internal bonding of mosaic on existing ceramic tiles; bonding small sized ceramic tiles (not larger than 300 cm<sup>2</sup>) on renders in swimming pools.




Photo 14. View of the mosaics featuring the shape of *pho* leaves, which were made in different sizes and bonded with ADESILEX P10+ISOLASTIC on a total of 8 panels on inside walls.

joints were grouted with KERACOLOR + FUGOLASTIC.

For reverence to the Royal Pagoda and Buddhist culture, Bel Vedere Co. Ltd sponsored a series of handcut pre-mounted mosaics in the shape of *pho* leaves for bonding onto the new interior mosaics surface. The *pho* tree (*ficus religiosa*), also called Bo tree and Buddha tree, is a large tree with leaves having long drawn-out tips. It still exists in several Asian countries. It is said that on the full moon day of the sixth month of the lunar year 2597 years ago, the Lord Buddha found his enlightenment while sitting under the *pho* tree beside the Neranchara River in India.

As for the mosaics of the interior walls of the Pagoda, the leaves were made in different sizes and bonded on a total of 8 panels to signify the 8 ways which, according to the Buddhist teachings, lead to Nirvana.

The *pho* leaves were installed in a natural falling position as if they were dropping from Heaven to celebrate the Buddha's enlightenment. These pre-mounted *pho* leaves were bonded with ADESILEX P10 + ISOLASTIC.

In the heart of Thailand mountains there is also Mapei, with all the technology of its advanced products and wide range of solutions for any kind of building problems. In this case they were used for waterproofing, bonding and make proper maintenance of artistic and religious buildings belonging to a country's culture and history. 

**Mapei Products:** the products mentioned in this article belong to the "Products for Ceramic Tiles and Stone Materials" and "Building Specialty Line" ranges. The technical data sheets are available at the web site: [www.mapei.com](http://www.mapei.com). Mapei's adhesives for ceramics and stone materials conform to EN 12004 and have been awarded the CE mark in compliance with Annex ZA, standard EN 12004. Mapei grouts for ceramics and stone materials conform to EN 13888. Almost all the Mapei products for laying floors and walls have been awarded the EMICODE EC1 ("very low emission level of volatile organic compounds") mark by GEV.

Mapei levelling and smoothing compounds and pre-blended mortars for screeds conform to EN 13813 standard and have been awarded the CE mark in compliance with annex ZA, standard EN 13813. Mapei products for the protection and repair of concrete surfaces and structures have been awarded the CE mark in compliance with EN 1504 standards.

**Adesilex P10 (C2TE, EC1 R, CE EN 12004):** white high performance cementitious adhesive with no vertical slip and extended open time for glass, ceramic and marble mosaic coverings.

**Fugolastic:** liquid polymeric additive for Keracolor FF, Keracolor GG and Keracolor SF.

**Isolastic:** flexible latex additive to be mixed with Kerabond, Kerabond T, Kerafloor and Adesilex P10.

**Kerabond (C1, EC1 R, CE EN 12004):** cementitious adhesive for ceramic tiles.

**Keracolor FF (CG2, EC1 R, CE EN 12004):** high performance, polymer-modified, water-repellent, cementitious grout for joints up to 6 mm.

**Mapelastc (CE EN 1504-2, coating (C), principles PI, MC and IR):** two-component flexible cementitious mortar for waterproofing balconies, terraces and bathrooms.

**Planicrete SP:** multipurpose latex additive for mortar and cementitious adhesive.

N.B. The product was specially developed for the Far East market and is here distributed by Mapei Far East, the Singaporean subsidiary of the Mapei Group.

**Fibreglass Mesh:** alkali-resistant fibreglass mesh.

N.B. The product has been superseded in several markets by MAPENET 150.

**Ultracolor Plus (CG2, EC1):** fast-setting and drying, high performance, anti-efflorescence grout for joints from 2 to 20 mm. Water-repellent with DropEffect® and anti-mould with BioBlock® technology.

KERACOLOR GG to improve the grout compactness, abrasion resistance and reduce porosity and water absorption. This system is especially suitable for grouting floors subject to heavy traffic, swimming pools, terraces, balconies and facades.

Damaged natural stones at the interior wall (about 1000 m<sup>2</sup>) were also replaced with glass mosaics bonded with ADESILEX P10 + ISOLASTIC and

## TECHNICAL DATA

**Doi Inthanon Royal Chedi (Pagoda),**  
Chiang Mai (Thailand)

**Period of Construction:** 1987

**Period of the Intervention:** December  
2007-August 2008

**Intervention by Mapei:** supplying products for restoring, waterproofing and laying glass mosaics on the walls; for installing new floors in interiors and laying

glass mosaics on internal walls.

**Client and Works Direction:** Royal Thai Air Force

**Contractor and Laying Company:**  
S. Boonmerit Construction

**Mapei Distributor:** Bel Vedere Co. Ltd.  
Bangkok (Thailand)

**Mapei Co-ordinator:** Zack Woo, Mapei Far East  
(Singapore)