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MyConcrete

The Bulletin of the American Concrete Institute – Malaysia Chapter

(e-Bulletin)

MyConcrete:
The Bulletin of the American Concrete Institute – Malaysia Chapter

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Contents of Bulletin

Editorial Note

American Concrete Institute – Malaysia Chapter (ACI – Malaysia Chapter) publishes MyConcrete as its official bulletin. We are proudly presenting the second issue of the bulletin. Starting from this issue MyConcrete bulletin will be published monthly. The bulletin contains valuable cutting-edge research and case studies on concrete technology.

This issue contains three articles, i.e., industry article, technical report, and a case study. The industry article reports the importance of tensile behavior of membrane type materials commonly used for waterproofing in the concrete structures. On the other hand, the technical report focuses on the behavior of concrete elements under standard fire. It provides valuable insights on the fire behavior of concrete columns under ASTM E119 fire. Finally, a case study on roof waterproofing of the National Mosque, locally known as Masjid Negara, at Kuala Lumpur is presented. The work was conducted by MAPEI Malaysia Sdn. Bhd. and Structural Repairs (M) Sdn. Bhd. during 2016-2018. The editorial team believes these articles provides valuable insights for the concrete technologist and the practicing concrete engineers. We would like to express our gratitude to the individuals contributing articles for this issue of MyConcrete bulletin.

The editorial team would like to thank Adept Technical Services Sdn. Bhd for sponsoring this issue as a premium sponsor. We also would like to thank CRT Specialist (M) Sdn. Bhd., who is our loyal sponsor.

Finally, the editorial team would like to invite concrete technologist and engineers to contribute articles for the upcoming issues of MyConcrete bulletin. The sponsorship for upcoming issues is also open for the concrete companies. The team hopes to get more sponsorship for the upcoming issues.

Thank you very much. Happy reading.

Dr. A. B. M. Amrul Kaish
Editor, MyConcrete Bulletin

Introduction to ACI-Malaysia

American Concrete Institute - Malaysia Chapter (ACI-Malaysia) is a non-profit technical and educational society representing ACI Global in Malaysia, which is one of the world's leading authorities on concrete technology. Our members are not confined to just engineers; in fact, our invitation is extended to educators, architects, consultants, corporate, contractors, suppliers, and leading experts in concrete related field. The purpose of this Chapter is to further the chartered objectives for which the ACI was organized; to further education and technical practice, scientific investigation, and research by organizing the efforts of its members for a non-profit, public service in gathering, correlating, and disseminating information for the improvement of the design, construction, manufacture, use and maintenance of concrete products and structures. This Chapter is accordingly organized and shall be operated exclusively for educational and scientific purposes.

Objectives of ACI-Malaysia are:

- ACI is a non-profitable technical and educational society formed with the primary intention of providing more in-depth knowledge and information pertaining to the best possible usage of concrete.

- To be a leader and to be recognized as one of Malaysia's top societies specializing in the field of concrete technology by maintaining a high standard of professional and technical ability supported by committee members comprising of educators, professionals and experts.

- Willingness of each individual member/organization to continually share, train and impart his or her experience and knowledge acquired to the benefit of the public at large.

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Mr. Martin Gerard Joachim David
President / Funding Committee
Mr. Martin David is the founding Director of Adept Technical Services Sdn. Bhd. since 2004. He has been involved in the Building Industry for more than 30 years.
In the first 10 years of his career, he was a Site Technical Officer in a leading Architectural firm in Penang. He then spent 2 years overseas in Mauritius as a Construction Manager for a Malaysian construction company, building a Malaysian-owned 5-star hotel. Upon his return to Malaysia, he rejoined the architectural firm which he was previously working for in Penang. He worked there as a Project Manager for another 3 years managing mainly the construction of industrial buildings.
Soon after this, he was offered a managerial position in the sales team of one of the largest worldwide construction chemical company and spent another 8 years there.
After years of experience in the building industry and specialist construction chemical field, he decided to set up his own company, which he runs until today. With his vast knowledge and experience he gives good and helpful advice in areas of industrial flooring, waterproofing and concrete repair.

Prof. Dr. Hamidah Mohd. Saman
Secretary / Secretary Technical Committee
She obtained her Bachelor in Civil Engineering Degree in 1988 from the University of Miami, Coral Gables, United States of America (USA). She worked as a Researcher in SIRIM Berhad from 1992 before furthered her study in University of New South Wales, Sydney, Australia and obtained her Ph.D in Civil Engineering in 1999. She joined Universiti Teknologi MARA (UiTM) in 2000 as a Lecturer and was promoted to Associate Professor in 2007. Her active involvement in professional bodies is portrayed by her designation as a Secretary of Concrete Society of Malaysia (CSM) for seven (7) sessions, Treasurer of American Concrete Institute Kuala Lumpur Chapter and Council Member of Confederation of Scientific and Technological Associations in Malaysia (COSTAM). Based on her expertise, she has been appointed as a Chief Editor for Scientific Research Journal (UiTM), a member of editorial board for Malaysian Construction Research Journal (CREAM-CIDB), The Institution of Engineers Malaysia (IEM) Journal, Journal of Engineering Science & Technology (JESTEC) and International Sustainable Construction Journal co-published by UTHM-Concrete Society of Malaysia (CSM). During her service as academic member in UiTM, she has published more than 300 papers in journals and conference proceedings at international and national levels in area of durability in concrete, lightweight concrete, high performance concrete and bio-concrete, international construction, strengthening and repair materials for concrete structures using non-corrodible materials. Nano, bio-concrete and high resistance cement materials to fire are the new area of her interest. She actively involved in research and consultation works and was granted totaling more than RM 1 million for the last five years of research grant from government agencies and industries. At present, she is supervising eighteen Ph.D students and eight of them have graduated. She was promoted to full Professor in 2015.

Mr. Chris Yong

Treasurer / Funding Committee

Started my career as a sales executive in concrete admixture in 1997. With more than 20 years of experience in technical sales and operation for concrete admixture. Over the 20 years of experience manage to start 2 admixture factories in Malaysia. I have been involved in numerous projects such as Terengganu Water Barrage, Pantai STP, Hulu Terengganu Hydro Power, MRT Package 5 and many more. Currently in charge of local and international sales of concrete admixture.

Dr. Zack Lim (Past President)

Board of Director I / Head Technical Committee / Advisor Funding Committee

Lim Eng Hock (Zack) earned his bachelor degree as a production engineer from The City University (London) in year 1981. He worked for 6 years in the construction industry before setting up his own company specialized in building factories and warehouses. Having conducted over 50 seminars and workshops, he was certified as a Trainer by Human Resources Development Fund (HRDF) in July 2016.

Zack introduced Superflat Floor in Malaysia in year 1998 by importing technology from Australia when he was awarded to build the Nestle Distribution Centre as a main contractor. In year 2000, Zacklim Flat Floor Specialist was incorporated to venture into specializing in the construction of super flat floors which Asia lacks and later having achieved building floors of world class standards. Over 33 years in construction, he has amassed great experience and gained international recognition having constructed industrial flooring jobs in Asia. He has been actively involved in working with and advising young engineers, contractors & ready-mixed suppliers and extolling the virtues of best practices of concrete flooring construction.

He was Immediate Past President of American Concrete Institute (ACI) Kuala Lumpur Chapter and had organized seminars, networking sessions to develop the standard of concrete construction and related trades not only in Malaysia but also in Asia.

He is the founding member of Concrete Floors Asia (CFA) consisting 11 international professional members with the objective of delivering best practices in floor construction and to promote world class standard floors in Asia.

He is the Vice President of Concrete Society of Malaysia (CSM) and also a council member of Asian Concrete Construction Institute (ACCI) with objective to foster regional integration for the concrete and construction fraternity and to promote excellence in the industry through pooling of information, seminars, talks and technical visits and also to provide a communication channel for government of the region to solicit advice on construction related matters.

Mr. Mike W. P. Lim
Board of Director II / Funding Committee
Mike Lim has long experiences in raw materials supply to many industry such as Ceramic, Glass, Animal Feed, Road Marking, Asphaltic Premix and Oil & Gas, as well as many parts of Construction Industry – Plaster/Render, Tile Adhesives, Coatings and Concrete Industry. Has vast technical know-how to introduce Innovative use of latest raw materials.
Have Tertiary Education in Computer Science, UK. Started in Granite Quarry Industry for 5 years. Then went in and currently still in the Calcium Carbonate/Limestone Industry for 22 years, Specialize in Construction Segment for Omya Malaysia Sdn. Bhd. as Sales Manager.

Dr. Sudharshan N. Raman
Immediate Past President / Advisor Media Committee
Dr. Sudharshan N. Raman, MASCE, MACI; is a civil engineer by training, specializing in structural and materials engineering. At present, he is a Senior Lecturer at the Faculty of Engineering and Built Environment of The National University of Malaysia (Universiti Kebangsaan Malaysia, UKM). He is also serving as a Committee Member of the Civil & Structural Engineering Technical Division of the Institution of Engineers, Malaysia (IEM), and as a Committee Member of the Kuala Lumpur Chapter of American Concrete Institute (ACI). Dr. Raman completed his PhD at The University of Melbourne in 2011, specializing in structural engineering/protective technologies. He has been involved with several consultancy work in the area of infrastructure protective technologies, within the public and private sectors both locally and internationally. He has published extensively and has been invited as a reviewer by major journals in the field of structural and materials engineering. Dr. Raman has taught structures and construction related courses at UKM, University of Malaya, and Open University Malaysia for the past 13 years. Prior to joining the academia in 2002, he was in employment with an engineering design consultant, and a specialist prestressed concrete contractor.

Upcoming Events: Webinar

Free Webinar - The Tech-Talk Hour

Free Webinar - An Evening with ACI-MY

Speaker: Mr. James Lim / Mr. Smith Yong
Waterproofing Series: EP2
Topic: *To be announced later*
Date: April 2021 *(Date to be announced later)*
Time: 8:00pm - 8:30pm

Speaker: Mr. James Lim / Mr. Smith Yong
Waterproofing Series: EP3
Topic: *To be announced later*
Date: May 2021 *(Date to be announced later)*
Time: 8:00pm - 8:30pm

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Preceding Events

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Article

THE RELEVANCE OF TENSILE STRENGTH & ELONGATION OF WATERPROOFING MEMBRANES

Lee Chiew Fook
MAPEI Malaysia Sdn Bhd

These properties are often headlined as important features of waterproofing membranes:
a) tensile strength
b) elongation at break

How relevant are these properties for waterproofing performance?

In order to answer these questions, it is necessary to first look at these definitions:

Elastic Deformation and Elastic Limit
An elastic material deforms when a force is applied to it. So long as the deformation stays within the elastic limit, the material will revert to its original shape when the force is removed.
Many waterproofing materials which are described as elastic do not show perfect elastic behaviour i.e the recovery is not 100 % after the force is removed.

Plastic Deformation
A plastic material also deforms when a force is applied to it. However, when the force is removed the material will not recover its original shape.
Many plastic materials used for waterproofing exhibit a small recovery but not enough to justify calling them elastic.
Elastic materials which are stretched beyond the elastic limit but before the breaking point will deform plastically i.e. with little or no recovery.

Young's Modulus of Elasticity, E
Young's modulus measures the stiffness of elastic materials or the force needed to deform an object along an axis when the force is applied along that axis; it is measured as the ratio of stress to strain (change in length over the original length).
Comparing two materials with differing E values, the material with lower modulus requires less force to elongate it by a defined amount. In other words, and this is relevant for assessing waterproofing membranes, the material with higher modulus is stressed more for the same elongation compared to a lower modulus material.

a) How important is the tensile strength?
For fully-adhered membranes, consider the stresses imposed on it when the supporting substrate moves due to, for example, settlement or temperature changes. Under these circumstances, the membrane's tensile strength is irrelevant because its function is not to restrain the movement (it cannot, in any case), but to deform and accommodate the movement without suffering functional damage.

Comparing two materials installed on the same structure:

(i) The membrane with a lower tensile strength and lower E modulus may well fulfill this function and retain its waterproofing integrity so long as the movement is within its deformation limit,

(ii) The other material, on the other hand, with a higher tensile strength and higher modulus (stiffer) may fracture because the elevated stress needed to deform it exceeds its tensile strength. Or, if the built-up tensile stresses overcome its adhesion strength, it will delaminate, allowing the lateral migration of water between the membrane and the substrate in case of leaks thus compromising its waterproofing performance.

In general, tensile strength is important during handling and installation of pre-formed membranes and for loose-laid or mechanically-fixed membranes.

a) How important is the elongation value?

The ability of waterproofing membranes to stretch and elongate under stress is undoubtedly important in applications where the substrate is subjected to movement such as on roof slabs. However, the elongation value, taken in isolation, is often misleading.
Superficially, a material with 800 % ultimate elongation looks far superior to another with 300 % elongation. But consider these points:

- Very high elongation values are usually achieved by materials with plastic deformation behaviour or elastic materials which have been stretched beyond their elastic limits. This raises two concerns-

  (i) Over the expected service life of the waterproofing membrane, stress cycles in the support structure are repeated countless times. Therefore, plastic elongation with little or no recovery does not measure the membrane's performance durability;

  (ii) Elongation is achieved at the expense of the membrane thinning out. For materials subjected to very high elongation, this thinning effect would have stretched it way past its useful thickness well before breakage occurs.

- In view of the above, waterproofing membranes are often reinforced with fabrics; these are built-in for preformed sheets and added during installation for liquid-applied membranes. They serve to add elasticity (recovery property) and/or restrict the elongation within useful limits.

Therefore, for a waterproofing membrane applied on structures subject to movement stresses, the elongation value on its own is not sufficient for assessing its fitness for purpose. The important performance property to look for is its dynamic crack-bridging or crack-cycling capability, tested to recognised standards e.g EN 1062-7. This test measures the membrane's
ability to elongate and recover over repeated cycles, simulating conditions you would expect the membrane to undergo during its service life.

(Reference must be made to the manufacturer's technical data sheet for instructions on use of particular products.)

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Technical Reports

1. *EXISTING BUILDING AND FIRE*

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INTRODUCTION

The service life of concrete structures mainly depends upon both the satisfactory design and use of appropriate construction materials. Any In the developing and under-developing countries, fire-fighting aspects are inadequate especially in high- rise buildings. This is because of economic constraints, which makes it difficult to cope with fire in high-rise buildings. High-rise building fires are more injurious as compared to other structure fires based on data from US. Fire Administration [USFA] through National Fire Incident Reporting System; NFIRS [1], estimated 15,400 high-rise structure fires resulted in 46 civilian deaths, 230 injuries, and $219 million of property loss each year.

In Malaysia, Fire and Rescue Department of Malaysia (FRDM) reported an average of 92 cases per day i.e. 33,640 fires in 2013 throughout the country, compared to 29848 fires in 2012. This was the highest annual figure documented with the constant upward trend since 2007 [2], as shown in Fig. 1. Nevertheless, a stable trend in the fire incidents was obvious from 2009 to 2012 [3], followed by a severe increase of fire incidents in 2012 resulting in the death of 72 civilians, although this was the lowest number of fatalities for the last seven years [2], however, the death statistics indicated were the immediate casualties at the place of incidence and the definite number of fatalities as a result of fire are absolutely greater. Overall, as mentioned by [3], the death statistics due to fire eruptions were stable though the occurrence of these events were more frequent.

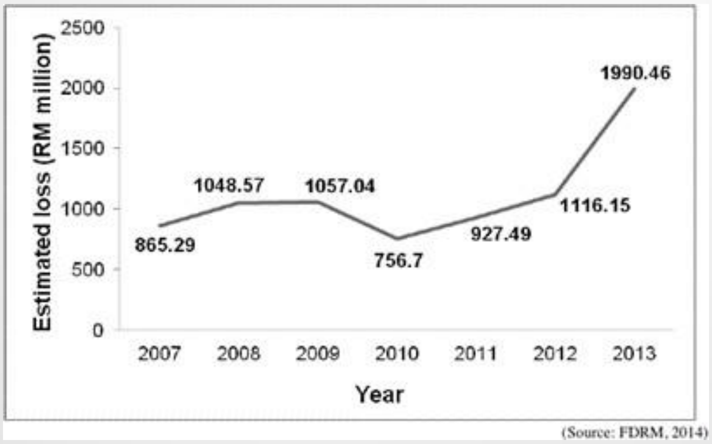

Fig. 1. Estimated Loss (RM million) due to fire breakouts in Malaysia [2]

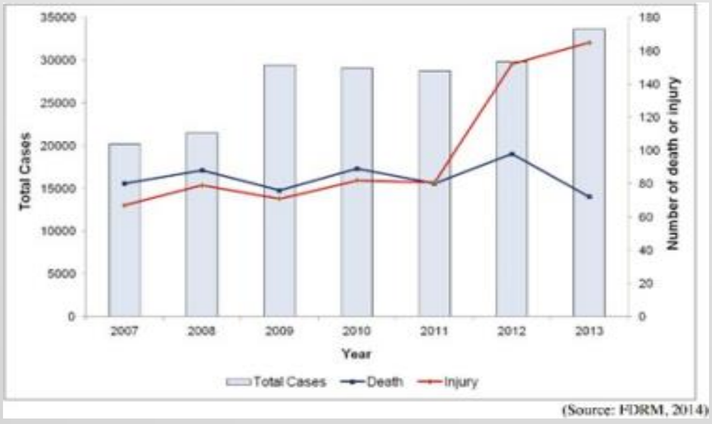

Fig. 2. Buildings fire statistics in Malaysia from 2007 to 2013 [2]

In terms of property loss, millions of dollars were scorched due to fire outbursts, as demonstrated in Fig. 2. In 2013, total 33,640 cases initiated the loss of approximately 20 billion Malaysia Ringgit (USD 6 billion), i.e. 78.3% increase from the year 2012 [2]. Besides property loss, there is also a need to identify the structural loss of existing buildings when a fire breaks out. Most of the existing buildings are not designed to contain fire for a longer period of time and structural elements simply bear the concrete cover of 25 mm – 30 mm. This article reveals the structural fire-resistance rating of the full-scale fire test of reinforced concrete column conducted at the Fire Testing Laboratory Universiti Teknologi Malaysia (UTM) by the researchers from Universiti Teknologi MARA (UiTM). Structural fire-resistance rating is defined in building codes in terms of the length of time (hours) of satisfactory performance taken by the structure during the standard fire test [4]. Another way to define structural fire- resistance rating is in terms of the fire-resistance safety factor, which is the ratio of the critical fire load to the expected fire load. The critical fire load is that for which the respective minimum strength is equal to the applied structural load [4]. The purpose of this study is to increase the resistance of structural members against elevated temperatures, experienced in fire, to a level that will provide adequate time for the occupants of the building to escape to safety.

EXPERIMENTAL METHOD

The full-scale column used in this testing was 200 mm x 200 mm x 2640 mm deigned according to ACI 318-08 (2008). The length of the column (2640 mm) was short to reach the plunger height, so a high strength (Grade 60) cylindrical base lined with a circular thick steel plate of length 2120 mm was provided at the bottom of the column. The extruded main bars from the columns were first welded with the steel plate bolted with the base. The base was in turn bolted with the ground in order to provide fix connection at the bottom. Also, at the top of the column the steel plate was welded that was bolted with the plunger in order to provide a fix connection at the top as well. The top and bottom plates as well as the plunger were protected with rock wool boards. The base was also further protected with ceramic fibres.

The process of preparation of column started from the preparation of steel reinforcement cage. Steel reinforcement used in the preparation of columns was: main bars of 12 mm and stirrups of 10 mm diameter (Ø). According to the column design, four main bars were used in each column, and stirrups were placed at the spacing of 200 mm centre-to-centre. Yield strength of main bar and stirrups was 460 MPa and 280 MPa respectively. The reinforcement cage was assembled (Fig. 3a) and placed in the plywood form, which was properly fabricated, to have the same internal dimensions as designed, shown in Fig. 3b.

Fig. 3. Steel cage (left) and Formwork (right)

After preparation of steel cage and formwork, thermocouples were installed in main steel bars. However, the readings could not be recorded from strain gauges during fire test due to their ineffectiveness at early stage of fire-test. Thermocouples of type 'K' were installed in the rebars, concrete core (at the depth of 100 mm) and concrete surface. In order to record the temperature readings from those points during fire-test. For each point in column, two opposite readings were recorded and then their average was reported in the results.

After fixing of steel cage into the formwork, pre-mixed concrete, ordered from local supplier was poured. The ready-mix concrete was of grade 30 concrete; mix design for grade 30 concrete is given in Table 1, as obtained from the concrete supplier. Cast column was taken out of the formwork after 7 days of casting and then cured using gunnysack in the laboratory for another 7 days. Subsequently, columns were kept in the laboratory till their transfer to the fire-testing laboratory. Casting and curing procedures are shown in Fig. 4.

Raw Materials	Quantity (kg/m³)
Cement (Type 1)	340.0
Siliceous Fine Aggregates	818
Siliceous Coarse Aggregates (20 mm)	861
Water	185.0
Retarder	0.34 Litre/m³
Water reducing agent	0.75 Litre/m³
Water-cement ratio	0.54
Slump	75
Unit weight	2304 kg/m³
Air content	2%

Table 1: Mix Design of Concrete Provided by the Supplier

Fig. 4. Casting of column (left) and curing using gunnysack (right)

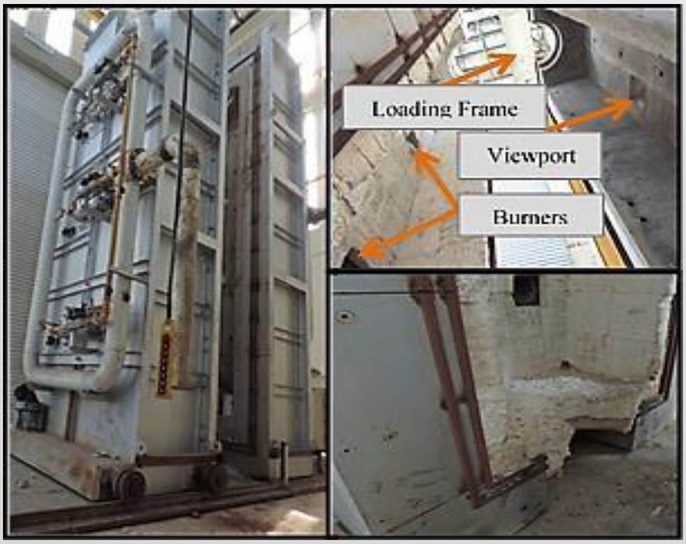

Fig. 5. Full-scale furnace in fire testing laboratory at Universiti Teknologi Malaysia

FULL-SCALE FIRE TESTING

In order to test RC column specimens under ASTM E119 with sustained axial concentric load, full-scale column furnace was used as shown in Fig. 5. Furnace was operated with the gas. The capacity of the loading frame was around one ton. Therefore, columns were designed accordingly. Throughout the test, 40% of experimental failure load (468 kN) was maintained until the hydraulic jack could not sustain the load, at that point, the column was declared failed, and the test was stopped. Thermocouples were connected to the data logger and the temperature readings throughout the test were recorded.

RESULTS

After full-scale fire test, it was found that the control column, as shown in Fig. 6, failed by the yielding of steel rebar. It seems that the temperature penetrated faster in the upper one-third portion of the column resulting in the softening of rebar, leading to the failure of the column. The fire resistance of the column was recorded as 75 minutes only, which means that column was declared failed after 75 minutes of fire. From the viewport, image was also captured during fire (Fig. 7), showing the lose portion of concrete just before the failure due to explosive spalling.

Fig. 6. Column before and after ASTM E119 fire test

Fig. 7. Image of column during ASTM E119 fire test captured from the viewport of furnace

According to Schneider [5], concrete starts to lose its original compressive strength at temperature level above 200°C. As can be seen in figure 6 that temperature level exceeded 200°C in column after 12 min of exposure to fire which shows that the deterioration of the strength of concrete started after only12 minutes of fire. There is a continuous increase in the temperature on the surface as well as in the core of concrete (100 mm depth). However, temperature in the core was recorded lesser than the temperatures on the surface of the column. In steel rebar (Figs. 8 & 9), till first 20 minutes there is a drastic increase in temperature and the temperature in steel rebar reached beyond 400°C which has surpassed the drop of more than 20% of yield strength [6]. Subsequently, temperature increased gradually till the failure of the column.

The measured axial deformations recorded during preload and fire test phase from the instrument from the start of the experiment till the failure point, as graphically shown in Fig. 10. The witnessed axial deformations of the columns were the result of a combination of load effects and thermal expansion. In the pre-load phase, deformations linearly increased up to around 17 mm. After the start of fire test, the column expanded, for some time deformations remained constant followed by the considerable decrease, up to 12 mm at failure point, due to the contraction of column, as also reported in [7]. The contraction of the column is corroborated mainly with loss of strength and stiffness of the concrete and steel as the internal temperatures increased.

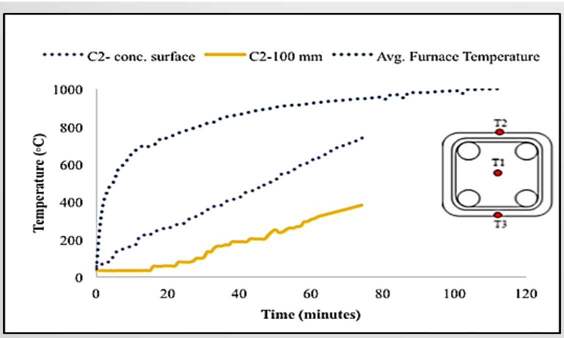

Fig. 8. Concrete temperatures (at the surface and at the depth of 100 mm) for the column exposed to ASTM E119 fire

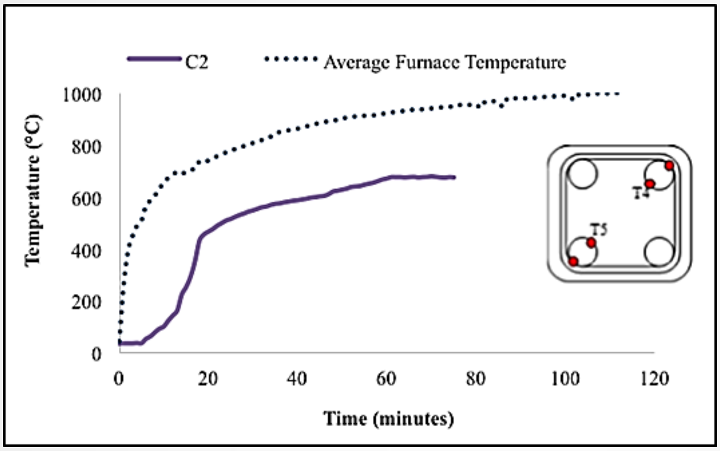

Fig. 9. Steel temperatures for columns exposed to ASTM E119 fire

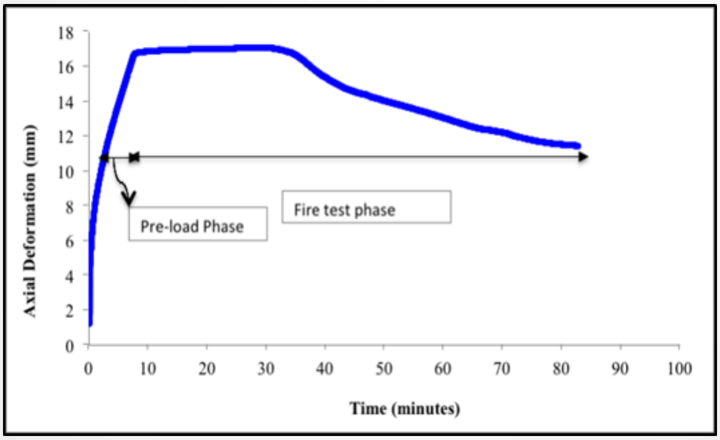

Fig. 10. Measured axial deformation during fire test as a function of exposure time

CONCLUDING REMARKS

Test Results show that there is a dire need to protect the existing reinforced concrete structures with a passive fire protection layer that is easily and cheaply available. Currently available passive fire protection coatings are very expensive and out of the reach of a common man. Furthermore, detailed information on the ingredients of fire insulation systems are proprietary in most cases that could not be reproduced easily, and therefore only limited information about their temperature dependent thermal properties is available restricting their usage for a layman.

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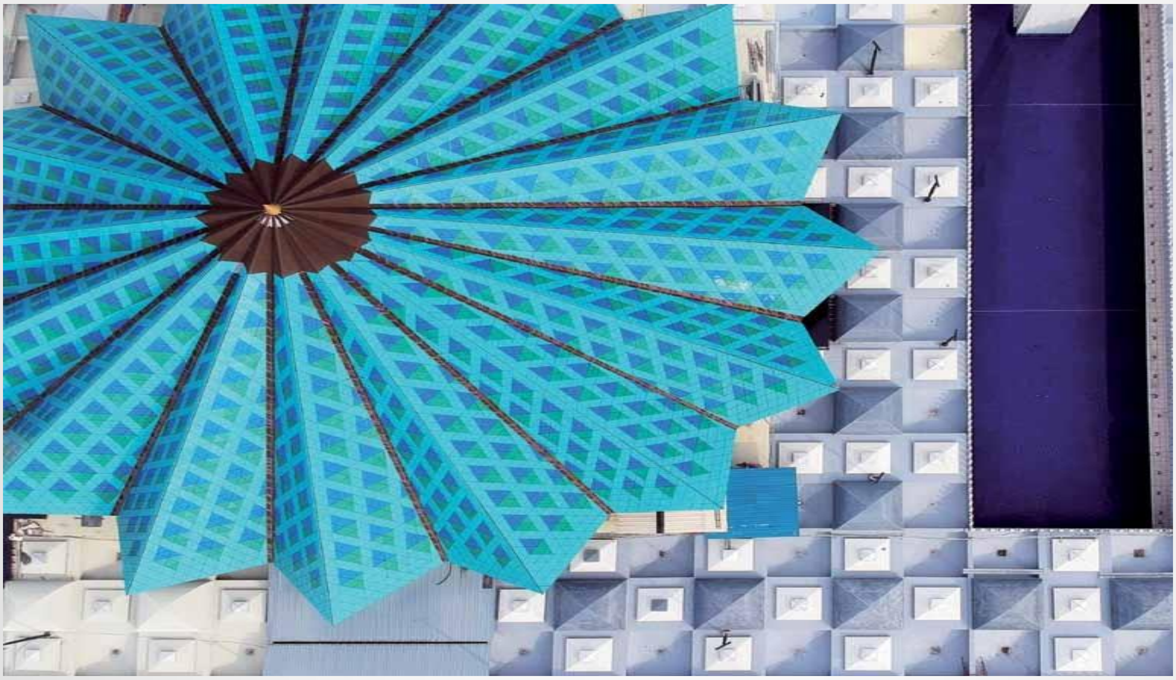
Case Study



Kuala Lumpur, Malaysia

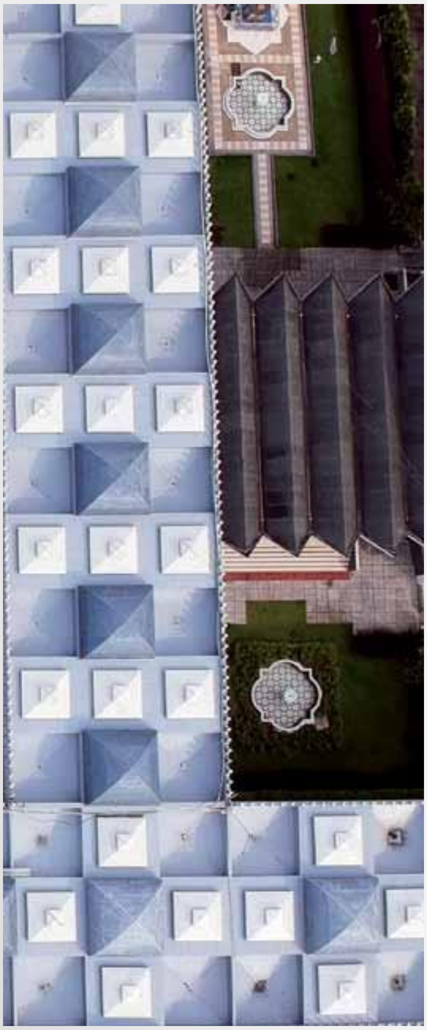
National Mosque

BUILT IN THE 1960'S TO CELEBRATE THE INDEPENDENCE OF MALAYSIA, THE MOSQUE WAS RENOVATED, AND ITS ROOFS WERE WATERPROOFED

Known as Masjid Negara (Masjid is an Arabic word for "mosque", while Negara means "national"), the national mosque of Malaysia has been classified as a Class 1 Heritage Building by the city's authorities and is a well-known national monument around the whole of Malay- sia. In August, 1957 Malaysia won its independence from Great Britain and the Prime Minister of the time, Tunku Abdul Rahman, proposed building a national mosque to celebrate the event. The new government had the idea of creating new symbols that would unite the country and, apart from developing various sectors of industry and the economy, it also considered the promotion of architecture to be of strategic importance.

THE STAR-SHAPED ROOF

Inaugurated in 1965 after two years of building work, Masjid Negara was de- signed by the English architect Howard Ashley and the Malaysian architects Hisham Albakri and Baharuddin Kassim, who proposed a building in a contem- porary style that would be different from the mosques built in the Moorish-Mughal style typical of the Islamic buildings con- structed during the era of British rule.



A view of the National Mosque in Kuala Lumpur

The roof of the mosque has the form of a 16-point star; 11 of the points represent the states of Malaysia (at the time Borneo was not yet part of the federation), while the other 5 represent the Pillars of Islam.The roof covering the entire complex, on the other hand, is characterised by rows of small cupolas and pyramids, which were originally covered with pink mosaic tiles and then replaced with blue mosaic tiles when the mosque was renovated in 1987.

The blue windows were made in Italy and, just outside the main hall, stands the minaret of the mosque (73m high). Behind the central body of the mosque, which can hold up to 15,000 worshippers and is characterised by a roof in the form of a 7-point star, there is the Makam Pahlawan (the Heroes' Mausoleum) which houses the tombs of the Malaysian Prime Ministers.

MAPEI SYSTEMS AT WORK

In 2015, to mark the golden jubilee of the mosque, the government gave the goahead for a series of interventions that had become necessary over the years to repair and waterproof the roof of the religious complex.

The intervention included replacing and repositioning the mosaic tile covering for the cupolas and pyramids.

The Public Works Department commissioned with the task of choosing which products to use decided to present the tender specifications to several companies and to invite them to carry out a survey of the site.

Mapei recommended using PURTOP 1000 two-component, solvent-free pure polyurea membrane and KERAPOXY improved, slip resistant, reaction resin adhesive and the proposal received the approval of the client.

THE SOLUTIONS PROPOSED

The long rows of cupolas and pyramids on the roof of the religious complex had been covered with two layers of ceramic tiles as a result of the work carried out previously. To carry out the waterproofing work, Mapei Technical Services recommended removing the top layer of tiles by hydro-blasting. Once the substrate had been prepared, it was treated with a coat of PRIMER SN two-component, fillerized epoxy primer mixed with ADDITIX PE, a powder used to increase the viscosity and thixotropy of epoxy-based and polyurethane-based resin products.

Then, while the primer was still wet, the surface was broadcast with QUARTZ 30/60, which is distributed in Malaysia by Mapei Malaysia Sdn Bhd.

After removing all the dust from the surface, a 2mm thick layer of PURTOP 1000 two-component, solvent-free pure polyurea membrane was applied by spray with a high-pressure, bi-mixer type pump. PURTOP 1000 membrane

IN THE SPOTLIGHT

PURTOP 1000

Two-component, solvent-free pure polyurea membrane applied by spray with a high-pressure, bi-mixer type pump, to form waterproof coatings for hydraulic works, roofs and bridge decks directly on site. PURTOP 1000 is suitable for waterproofing membranes on storage tanks, basins and hydraulic works in general as well as for the type of structure that requires a high-performance waterproofing membrane.

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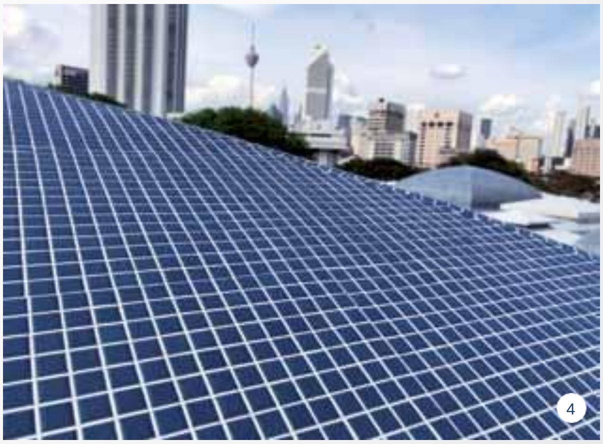

PHOTO 1. The frames embedded between the pyramids and the cupolas were first cleaned by hydroblasting. **PHOTO 2.** The substrates of the cupolas were waterproofed with PURTOP 1000. **PHOTO 3.** To provide further protection, the frames were treated with MAPECOAT PU 15 finish. **PHOTO 4.** The mosaic tiles were bonded to the cupolas with KERAPOXY and joints were grouted with KERACOLOR FF + FUGOLASTIC

are characterised by their high chemical resistance to alkalis and diluted acids, exceptional flexibility and tear strength, and make the surfaces immediately waterproof after application.

KERAPOXY improved, slip resistant, reaction resin adhesive was chosen to install the mosaic tiles (blue tiles for the cupolas and grey tiles for the pyramids which, from above, form a coloured chess-board effect), while for the joints the preference was for KERACOLOR FF polymer-modified, water-repel- lent, cement-based grout mixed with FUGOLASTIC polymer admixture to im- prove its resistance to abrasion and re- duce its porosity and water absorption rate.

On the roof there are also frames embed- ded between the pyramids and cupolas that needed to be waterproofed because they were causing damp on the ceil- ing below. In this case, too, work com- menced by using hydro-blasting equip- ment to remove the old waterproofing treatment and any deteriorated areas of the roof. The deteriorated areas were then reintegrated with PLANITOP G40 SP polymer-modified mortar (which is distributed in Malaysia by Mapei Malay- sia Sdn Bhd). The next step was to apply a coat of PRIMER SN with a roller and to broadcast the surface of the primer while still wet with QUARTZ 30/60 (distributed in Malaysia by Mapei Malaysia Sdn Bhd), followed by the application of a 2 mm thick coat of PURTOP 1000 by spray. Work was completed by applying a coat of MAPECOAT PU 15 two-component, aliphatic, solvent-based polyurethane finish, which resistant to wear and ultra- violet rays.

TECHNICAL DATA

National Mosque, Kuala Lumpur (Malaysia)
Design: Howard Ashley, Hisham Albakri, Baharuddin Kassim
Period of construction: 1963-1965
Period of the intervention: 2016-2018
Intervention by Mapei: supplying products for waterproofing and protecting the roofs, installing mosaic tiles and grouting joints on the domes
Design: M. Azahari Architect
Client: Wilayah Persekutuan Islamic Religious Council
Installation company: Structural Repairs (M) Sdn Bhd
Mapei coordinator: Dino Vasquez (Mapei SpA, Italy), Hanson Foong, Lim Kean Meng, Simon Yap (Mapei Malaysia Sdn Bhd, Malaysia)

*These products are distributed in Malaysia by Mapei Malaysia Sdn Bhd

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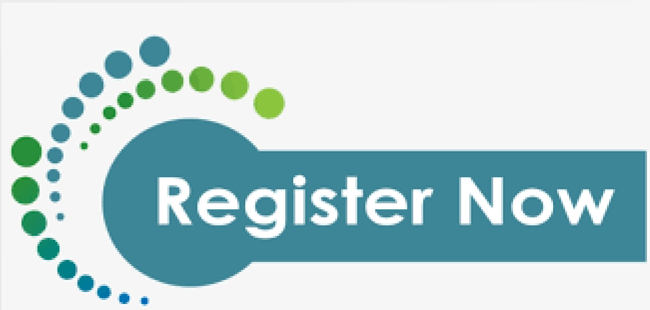

We look forward to your kind support and, more importantly, to your participation and registration as a member of ACI-Malaysia Chapter. It is our firm belief your involvement and together with your commitments will go a long way in our quest to uphold all our objectives to mutually benefits for all members.

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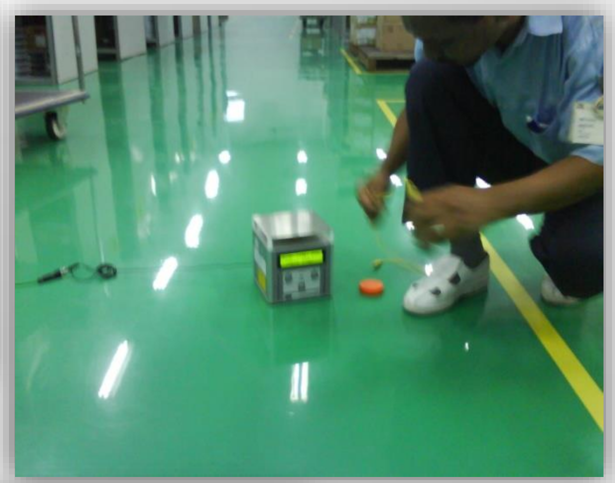


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