

# *MyConcrete:*

*The Bulletin of the American Concrete  
Institute – Malaysia Chapter*



**American Concrete Institute  
Malaysia Chapter**

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## American Concrete Institute – Malaysia Chapter

*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.*

### Our Objectives

- ✓ **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.**

## ***Join Us Today!***

### **Benefits such as:**

- Individuals, professionals, corporate, students can interact and widen their networking.
- A one-stop centre where educators & members can contribute their areas of expertise by sharing and presenting topics related to concrete technology at seminars organized by ACI on a monthly basis.
- ACI can assist members to resolve technical issues, seek professional assistance and even development of solution to their existing problems.
- Individual or corporate members can send their employees to attend seminars organized by ACI to learn and re-learn any topics that relate to concrete technology and to improve their technical knowledge which will assist in their work to reduce and avoid any reworks and repairs.
- Participate in seminars and networkings at an affordable price.
- Our institution will organize hands-on trainings which will benefit any intellectuals or fresh graduates and prepare them for work in the real work environment.
- An institution where members can contribute to our bulletins to keep our members informed of what is new in the concrete industry and the latest developments and innovations around the world. Our website will keep you informed and updated on what is coming along the concrete technology pipelines.
- Corporate members will enjoy the benefits of being able to pick and recruit fresh graduates from the large pool of student members.
- ACI Library where members can source information on articles published, gain access to technical literatures and related topics pertaining to the concrete industry.

## **Register now. . .**

*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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# Strengthening Concrete Structures Using Ultra High Performance Concrete (UHPC)

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## ABSTRACT

Various UHPC strengthening interventions were conducted in this study to investigate the behaviour of composite reinforced concrete (RC) slabs strengthened with UHPC. The aim of the research is to explore UHPC as patch material for repairing deteriorated concrete structures. The results showed that UHPC safeguard against diagonal cracking compare to conventional RC slab. The UHPC exhibited excellent energy absorption with extensive deflection hardening and ductility during the post cracking range.

## INTRODUCTION

Ultra-high performance concrete (UHPC) is an advancement in concrete technology. It is a mix of reactive powder concrete (RPC) with steel fibres, which was firstly developed by Richard and Cheyrezy [1]. Typically, UHPC offers excellent mechanical characteristics with high compressive strength of from 150 to 200 MPa without heat curing [2]. Because of its superior properties, UHPC is often used in protective structures, as non-penetrable coverings and in elements that must be durable against aggressive environments and severe loadings such as earthquakes, impacts or blasts.

Many researchers have investigated the structural responses of UHPC members. For instance, Graybeal [3] conducted full-scale tests of UHPC bridge girders with different overall spans and shear spans. On the other hand, Voo et al. [4] studied the shear strength of UHPC beams without stirrups. Their results showed that UHPC significantly enhances strength and improves ductile behaviour. Furthermore, Yang et al. [5] and Yoo et al. [6] reported how the longitudinal steel ratio

affects UHPC beams. Their studies demonstrated that the rebar and steel fibres effectively control crack width and ductility.

Recently, UHPC has been considered as a potential material for retrofitting and strengthening concrete structures. Concepts for using UHPC to strengthen parts of structures where the outstanding properties of UHPC could be fully exploited have been proposed by Brühwiler and Denarie [7], as illustrated in Figure 1. To validate the concepts, four unique full-scale site applications were discussed. Their findings were very encouraging. The use of UHPC has shown great potential and UHPC development is mature for use in either cast in-situ or precast applications using conventional standard concreting equipment.

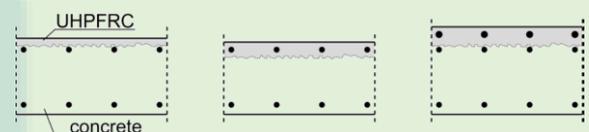


Figure 1: Composite structural elements combining UHPFRC and normal concrete [7]

Oesterlee [8], Habel et al. [9] and Noshirvani and Brühwiler [10] evaluated the behaviour of RC members strengthened with UHPC overlays under bending. Their results indicated that UHPC overlays enhance the structural performance in terms of ultimate loads, stiffness and cracking behaviour. Zohrevand et al. [11] reported the use of UHPC within critical punching shear area of the RC slabs. It shown that the partial use of UHPC improves the shear capacity and significantly influences cracking patterns in punching shear area compared to the reference RC slab.

Study on the composite UHPC-concrete section are still in its infancy. This article is intended to share summary of the experimental studies carried out by the author on the composite UHPC-concrete slabs. For full extent of the work can be obtained from its original paper [12].

### EXPERIMENTAL INVESTIGATION ON UHPC STRENGTHENING INTERVENTION

To investigate the effectiveness of UHPC strengthening intervention, five rectangular concrete slabs were carried out in this experimental programme. All slabs are 1600 mm long with a clear span of 1200 mm. They were tested under three-point load condition, as shown in Figure 2. Details of cross-sectional dimensions and reinforcement of each slabs are shown in Figure 3. All slabs were reinforced with five T12 mm diameter high tensile steel bars (5T12) at top and bottom. No transverse shear reinforcement was provided, but to avoid anchorage failure at the end supports, three R6 mm diameter mild steel links were installed.

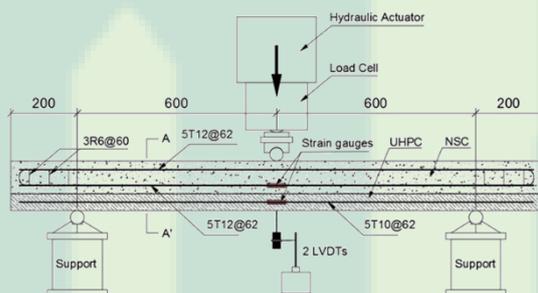


Figure 2: Experimental setup

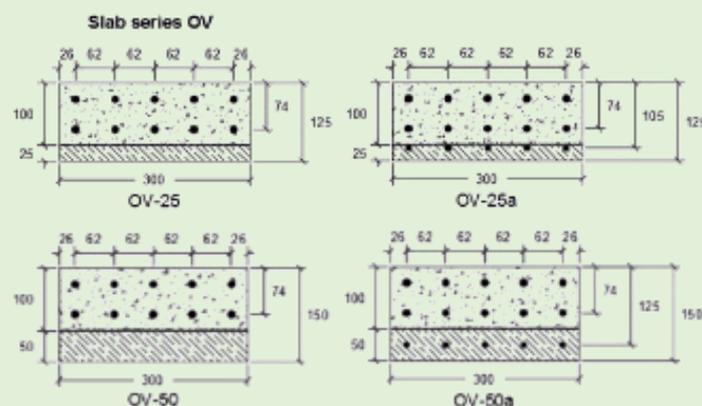


Figure 3: Details of strengthening configuration, sectional dimensions and reinforcement

Five slabs were manufactured, one control and four strengthened specimens, as showed in Figure 3. The strengthening intervention is provided by means of UHPC overlay at the tension zone. Two thicknesses of UHPC overlays were considered, namely 25 mm and 50 mm. Two slab specimens of each overlay thickness were prepared. One without reinforcement and another had five T10 mm diameter high tensile steel bars as longitudinal reinforcement (5T10).

The average cylinder compressive strength of the normal strength concrete at 28 days was 23 MPa. On the other hand for UHPC was 153 MPa. The full mix proportion and constituents used in this study can be found in [12]. The type of steel fiber used in the UHPC is a straight fiber with 13 mm long and 0.2 mm diameter (aspect ratio = 65) with average tensile strength of 2300 MPa. After several attempts on different percentages of steel fibers, it was found that 3% of steel fibers achieved the best performance and was therefore chosen for this study.

### DISCUSSION OF RESULTS

Figure 4 shows the final crack patterns and modes of failure exhibited for each slab in the OV series. Regardless of UHPC overlay thickness, all the strengthened slabs failed in shear in the normal strength concrete section. Through all loading stages, there were no apparent signs of distress or extensive cracking in the slabs. The UHPC overlay actually helped delay the development of diagonal shear cracks. Once a diagonal shear

crack formed, ultimate failure prevailed. In some cases, the composite interface between the UHPC and NSC suffered debonding failure, as clearly indicated in Figure 4.

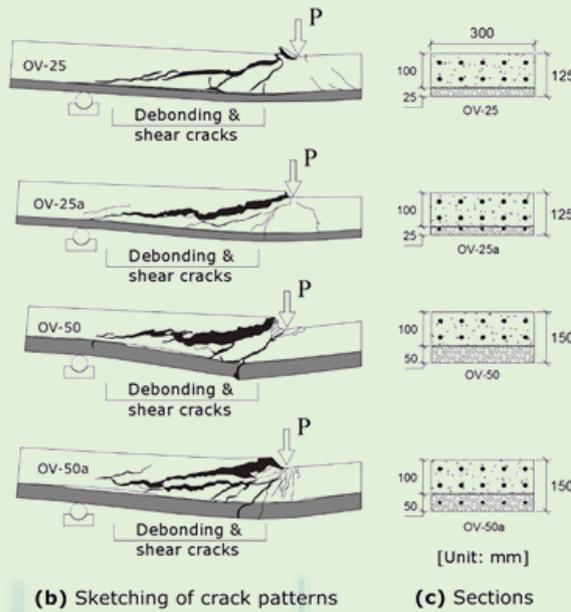


Figure 4: Failure modes and crack patterns

Table 1: Test results

Specimens	Ultimate Failure Load, $P_u$ [kN]	Modes of Failure
RE-0	61.08	Shear
OV-25	73.47	Shear
OV-25a	77.97	Shear
OV-50	77.97	Shear
OV-50a	95.06	Shear

The ultimate failure loads are summarised in Table 1. Based on our observations, the thickness of the UHPC overlay did not significantly influence the ultimate strength and failure modes underwent. Slabs OV-25 and OV-50 both failed in comparatively similar ways at ultimate loads of 73.57 kN and 77.97 kN, respectively, only a 6% marginal difference. This is mainly because ultimate failure in both slabs was controlled by debonding failure at the composite interface. Despite that failure, the ultimate strengths of both slabs were about 24% higher than that of RE-0. It must also be noted that the tendency for fracture failure in the UHPC layer was higher with thicker overlays, as found in slabs OV-50 and OV-50a.

Experimental results also showed that presence of longitudinal steel bars within the UHPC layer increased the ultimate strength of the slab as long as sufficient cover was provided for effective bond development. As shown in slab OV-50a achieved an ultimate load of 95.06 kN, an increase of 22% over that of slab OV-50. On the other hand, the strength of slab OV-25a was only 6% greater than that of OV-25. This is in agreement with the findings of Habel et al. [13], the minimum thickness of the UHPC layer is limited by the size of the reinforcing bars and the UHPC cover over them, so that effective force transfer between the reinforcing bars and UHPC can be developed.

The load versus mid-span deflection curves of the slabs in OV series are shown in Figure 5. From the figure, it indicated that with UHPC overlays at the tension zone, the overall stiffness of the strengthened slabs improved significantly compared with reference slab RE-0. Extensive deflection hardening and ductility during the post cracking phase was seen in all strengthened slabs as well. Also the thickness of the UHPC overlay greatly influence the stiffness of the slabs. It was found that thicker UHPC layers lead to increase stiffness, as clearly observed in slabs OV-25 and OV-50. Slab OV-50a with reinforced UHPC layer did not seem to differ from slab OV-50 in initial stiffness. But the reinforcing bars in the UHPC layer helped to extend the ultimate resistance capacity of the slab and lead to lesser deflection.

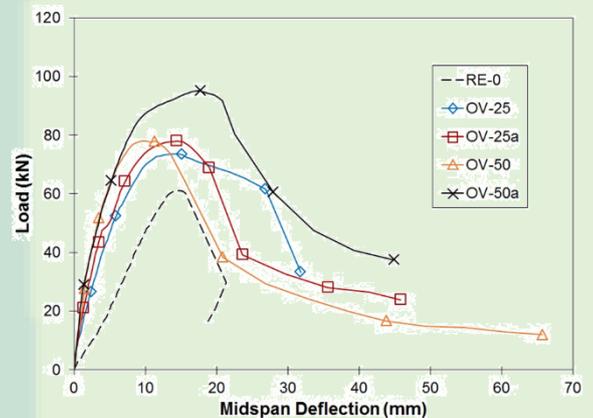


Figure 5: Load versus mid-span deflection curves

## CONCLUSION

The results from this preliminary studies showed very promising. It demonstrated the potential of UHPC as an excellent and effective strengthening material for structural application. More research are still needed, especially to develop further understanding on the composite bond interface between UHPC and normal concrete.

The test results indicated that slabs strengthened with UHPC overlays at tension zone failed in shear. It showed diagonal shear cracks in the normal strength concrete section followed by debonding at the UHPC-concrete interface. The results indicated that the UHPC overlay improves the overall stiffness of the slabs and delays the development of shear cracks. With addition of reinforcing rebar in the UHPC layer, further enhancement could be observed in the ultimate strength. However, sufficient concrete cover is required to ensure effective full bond development.

## REFERENCES

- [1] P. Richard and M. Cheyrezy, "Composition of reactive powder concretes", *Cement and concrete research*, vol. 25, pp. 1501-1511, 1995.
- [2] K. Wille, A. E. Naaman, and G. J. Parra-Montesinos, "Ultra-high performance concrete with compressive strength exceeding 150 MPa (22 ksi): a simpler way", *ACI Materials Journal*, vol. 108, 2011.
- [3] B. A. Graybeal, "Characterization of the behavior of ultra-high performance concrete", PhD Thesis, University of Maryland, USA, 2005.
- [4] Y. L. Voo, W. K. Poon, and S. J. Foster, "Shear strength of steel fiber-reinforced ultrahigh-performance concrete beams without stirrups", *Journal of structural engineering*, Vol. 136, 2010, pp. 1393-1400.
- [5] I. H. Yang, C. Joh, and B.-S. Kim, "Structural behavior of ultra high performance concrete beams subjected to bending", *Engineering Structures*, Vol. 32, 2010, pp. 3478-3487.
- [6] D.-Y. Yoo, N. Banthia, S.-W. Kim, and Y.-S. Yoon, "Response of ultra-high-performance fiber-reinforced concrete beams with continuous steel reinforcement subjected to low-velocity impact loading", *Composite Structures*, Vol. 126, 2015, pp. 233-245.
- [7] E. Brühwiler and E. Denarie, "Rehabilitation of concrete structures using ultra-high performance fibre reinforced concrete", *UHPC-2008: 2nd International Symposium on Ultra High Performance Concrete*, 2008, pp. 05-07.
- [8] C. Oesterlee, "Structural response of reinforced UHPFRC and RC composite members", PhD Thesis, École Polytechnique Fédérale de Lausanne, Switzerland, 2010.
- [9] K. Habel, E. Denarié, and E. Brühwiler, "Experimental investigation of composite ultra-high-performance fiber-reinforced concrete and conventional concrete members," *ACI Structural Journal*, Vol. 104, 2007.
- [10] T. Noshiravani and E. Brühwiler, "Experimental investigation on reinforced ultra-high-performance fiber-reinforced concrete composite beams subjected to combined bending and shear," *ACI Structural Journal*, Vol. 110, 2013, pp. 251-261.
- [11] P. Zohrevand, X. Yang, X. Jiao, A. Mirmiran, "Punching shear enhancement of flat slabs with partial use of ultrahigh-performance concrete", *ASCE Journal of Materials in Civil Engineering*, Vol. 27, Issue 9, Sept 2014.
- [12] H. Yin, W. Teo, and K. Shirai, "Experimental investigation on the behaviour of reinforced concrete slabs strengthened with ultra-high performance concrete", *Construction and Building Materials*, Vol. 155, 2017, pp. 463-474.
- [13] K. Habel, E. Denarié, and E. Brühwiler, "Structural response of elements combining ultrahigh-performance fiber-reinforced concretes and reinforced concrete," *Journal of Structural Engineering*, Vol. 132, No. 11, 2006, pp. 1793-1800.

# Thermal Properties of Concrete

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## ABSTRACT

Thermal properties of building materials has a vital role on the amount of heat transfer in buildings. Thermal properties of concrete as the most consumed material in building sector affecting on the amount of energy consumption. Thermal conductivity ( $k$ -value) of concrete indicates its ability on heat transfer through conduction. Specific heat capacity ( $c$ -value) of concrete specifies the capability of concrete in heat storage. Thermal diffusivity of concrete as a function of its thermal conductivity and heat capacity indicates the rate of heat transfer in transient condition. Generally, concrete with low  $k$ -value and high  $c$ -value is desirable in building sectors to reduce energy consumption.

## INTRODUCTION

More than ten billion tons of concrete is produced every year which as a common material is generally used in buildings, bridges, industrial pavements and other structures [1]. Investigators have been considering the engineering properties of concrete due to its widespread usage [2]. Thermal properties of concrete have a vital role in the amount of heat transfer and thermal stress which are directly related to the energy saving in buildings and damage in structure, respectively. The key thermo-physical properties of concrete are: thermal conductivity, specific heat capacity and thermal diffusivity. It should be noted that around 30 % of greenhouse gas emission and one third of total energy consumption are attributed to the buildings sectors [3, 4]. Energy efficiency in buildings usually define as minimizing the energy usage in the form of heating and cooling. This is why using concrete with worthy thermo-physical properties can lead to the reduction in heat transfer and consequently energy consumption in building sectors.

## THERMAL CONDUCTIVITY

Different types of heat transfer in buildings are categorized as conduction, convection and radiation (Fig. 1)

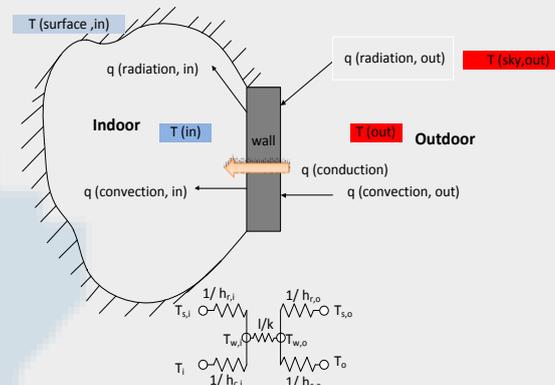


Figure 1: Principle of heat transfer in buildings

In conduction heat transfer in solids like as concrete is a mixture of vibrations of the molecules and energy transport by free electrons [5]. Steady heat conduction is occurred when the temperature does not change with time and transient heat conduction is when it does. However, the heat transfer in buildings in real conditions is under transient conditions, but in some cases the heat transfer is considered in steady conditions because of easier analysis.

However, it is not possible to determine accurate heat transfer but we can achieve answer of our question to design HVAC system in critical conditions. The heat equation for a wall in steady state and transient conditions are:

$$\frac{d^2T}{dx^2} = 0 \text{ (Steady) (1)}$$

$$\frac{\partial^2 T}{\partial x^2} = \frac{1}{\alpha} \frac{\partial T}{\partial t} \text{ (Transient) (2)}$$

Therefore, thermal conductivity (k-value) is a property of material, which demonstrated its capability in heat conduction [6, 7]. Further, the thermal conductivity value of materials, they are classified in different groups to use in different fields. The energy consumption in buildings extremely depends on the thermal conductivity value of the building materials [8]. The use of materials with low k-value is required to reduce energy usage in buildings.

The k-value of concrete in saturated conditions is higher than in dry conditions due to higher k-value of water compared to the air. Moreover, the measured k-value of concrete shows a declining trend with growing temperature. Using lightweight concrete is a valuable technique of reducing energy consumption due to the lower k-value of lightweight concretes (LWCs) compared to normal weight concrete (NWC). the application of structural lightweight aggregate concrete (SLWAC) in buildings located in European countries reduce 15% of heating energy compared to normal weight concrete (NWC) [9]. The relation between oven dry density and the k-value of concrete can be calculated using following equation [10]:

$$k = 0.0625e^{0.0015p} \quad (R^2 = 0.81) \text{ (3)}$$

### SPECIFIC HEAT

Heat capacity of concrete shows its ability in the heat storage capability. However, specific heat states the heat storage capability of concrete per unit mass (J/kg oK). Specific heat is described as the amount of energy required to raise a unit of mass by one degree of temperature. Concrete with high specific heat is valuable for improving the temperature

stability of buildings. On the other hand concrete with high specific heat is more stable against changing temperature. The specific heat of concrete is related to the c-value of each components. Therefore, using cementitious and aggregate with higher c-value can increase the c-value of concrete. Also, incorporating the phase change material with concrete can be consider as another alternative to increase the specific heat through heat absorption and release during changing phase.

### THERMAL DIFFUSIVITY

The transient conduction is related to the k-value, c-value and density of material. These parameters are related each other based on thermal diffusivity as follow:

$$\alpha = \frac{K}{\rho C} \quad (4)$$

In fact  $\alpha$  (m<sup>2</sup>/s) indicates the rate of heat spread through concrete. Therefore, concrete with low k-value and high c-value can be considered as a proper material for energy saving in building. The laser flash method is the most famous method of measuring thermal diffusivity. However, measuring k-value, c-value and density and calculation the thermal diffusivity according Eqn 4 is an acceptable method.

### CONCLUSIONS

Thermal properties of concrete are changing based on using different types of raw materials. According to the available literature the thermal conductivity of concrete is in the range of 0.2 w/m.°K to 3.8 w/m.°K. The specific heat is in the range of 0.741 J/g oK to 1.00 J/kg oK. The thermal diffusivity of concrete has been reported in the range of 0.62 mm<sup>2</sup>/s to 1.17 mm<sup>2</sup>/s. The general conclusion of this study can summarized as below:

a. The thermal conductivity of concrete is a function of its aggregate's type, temperature and humidity, type of cementitious and density.

b. The thermal conductivity of concrete has a declining trend with rising

temperature. Also, the k-value increased in saturated conditions due to higher k-value of water compared to the air. Lightweight concrete has the lower thermal conductivity compared to the normal weight concrete.

c. Using materials with high specific heat capacity as aggregate and/or cementitious material can increase the heat capacity of concrete.

d. Incorporation phase change material in concrete can increase the latent heat of concrete and its capability in heat storage.

e. Using concrete with low k-value and high c- value in structural and non-structural part of building can reduce the amount of heat transfer in buildings and save the energy.

## REFERENCES

- [1] Meyer C, The greening of the concrete industry. *Cement and concrete composites*, 2009. 31(8): p. 601-605.
- [2] Hassanpour M, Shafigh P, Mahmud H B, Lightweight aggregate concrete fiber reinforcement – A review. *Construction and Building Materials*, 2012. 37: p. 452-461.
- [3] Zhang D, Li Z, Zhou J, Wu K, Development of thermal energy storage concrete. *Cement and concrete research*, 2004. 34(6): p. 927-934.
- [4] Martínez-Molina A, Tort-Ausina I, Cho S, Vivancos J-L, Energy efficiency and thermal comfort in historic buildings: A review. *Renewable and Sustainable Energy Reviews*, 2016. 61: p. 70-85.
- [5] Bhattacharjee B, Krishnamoorthy S, Permeable porosity and thermal conductivity of construction materials. *Journal of Materials in civil Engineering*, 2004. 16(4): p. 322-330.
- [6] Tong X C, Characterization Methodologies of Thermal Management Materials, in *Advanced Materials for Thermal Management of Electronic Packaging*. 2011, Springer. p. 59-129.
- [7] Zhang W, Min H, Gu X, Xi Y, Xing Y, Mesoscale model for thermal conductivity of concrete. *Construction and Building Materials*, 2015. 98: p. 8-16.
- [8] Budaiwi I, Abdou A, Al-Homoud M, Variations of thermal conductivity of insulation materials under different operating temperatures: Impact on envelope-induced cooling load. *Journal of Architectural Engineering*, 2002. 8(4): p. 125-132.
- [9] Real S, Gomes M G, Rodrigues A M, Bogas J A, Contribution of structural lightweight aggregate concrete to the reduction of thermal bridging effect in buildings. *Construction and Building Materials*, 2016. 121: p. 460-470.
- [10] Asadi I, Shafigh P, Hassan Z F B A, Mahyuddin N B, Thermal conductivity of concrete-A review. *Journal of Building Engineering*, 2018.

# Past Events

## 2018 ACI-Malaysia Seminar on Concrete and Concrete Structure, 25 September 2018

We had great sharing by the experts at the 2018 ACI-Malaysia Seminar on Concrete and Concrete Structures, on 25 September 2018.

- Session 1 - Self-Consolidating Concrete (SCC): Design and Field Applications, by Mr. Jean Michel Laye
- Session 2 - Concrete Quality Control at Site, by My. Yeo Shih Horng
- Session 3 - Defects in Concrete and Repair Measures, by Ir. Steven Ng
- Session 4 - Strengthening Systems for Concrete Structures, by Assoc. Prof. Dr. Teo Wee

**INTRODUCTION**

American Concrete Institute - Malaysia Chapter (ACI - Malaysia) is a nonprofit technical and educational society representing the American Concrete Institute (ACI) in Malaysia, which is one of the world's leading authorities on concrete technology. The ACI - Malaysia Chapter (formerly known as the American Concrete Institute, Kuala Lumpur Chapter) was founded in 1997 and is currently based in Petaling Jaya, Malaysia. The objective of this Chapter is to further the education of the members of ACI from enrollment, among them to further the education and technical practice, scientific investigation, research, and disseminating information for the improvement of design, construction, maintenance, use and maintenance of concrete products and structures. This seminar is organized to enable the participants with the knowledge related to latest progress in concrete construction, materials and systems. It has with the objectives of the Chapter. The information is provided to engineers, architects, contractors, students, construction managers, builders, as well as to anyone with the interest in concrete and concrete technology.

**SPEAKERS**

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## 2018 ACI-Malaysia Networking Dinner, 25 September 2018

It was a full house at ACI-Malaysia's Networking Dinner held at Armada Hotel, Petaling Jaya on Tuesday, 25 September 2018. We had a great sharing session by Mr. Hanson Foong of Mapei Malaysia Sdn. Bhd., the Main Sponsor of the event, on "PURTOP - A high performance waterproofing and protection solution for Roof, Deck, Tank and Underground Structures". Members and participants from the Malaysian concrete construction industry had a productive fellowship and networking session.

We would like to thank our sponsors, Mapei Malaysia Sdn. Bhd. (Main Sponsor) and Sika Kimia (M) Sdn. Bhd. (Sponsor) for their support in the event.





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