

Concrete News

Volume 22
September 2016 - February 2017





Local Connection with International Links

■ Concrete News

Concrete News is published by ACI-Kuwait Chapter for sharing information, promoting exchange of technical knowledge amongst its membership, and enhancing the Chapter's position within Kuwait's engineering fraternity.

Volume 22 / September 2016 - February 2017

■ ACI Kuwait Chapter

The purpose of the Chapter is to help in furthering the chartered objectives of the American Concrete Institute. The American Concrete Institute (ACI), is a nonprofit international organization that promotes improved technology, technical competence, design, and construction aspects related to concrete for the benefit of society. ACI-Kuwait Chapter was established essentially

to promote education, standards of technical practice, scientific investigation and research in concrete technology. The Chapter also aims to channel efforts of its members towards a non-profit public service in collecting, correlating and disseminating information for the improvement of design, construction, manufacturing, utilisation and maintenance of concrete products and structures.

■ Functions

ACI Kuwait Chapter is approved and authorized by the Board of Directors of ACI International to provide the means of furthering the chartered objectives of the Institute in the State of Kuwait. The Chapter is managed by a local Board of Directors whose members serve as Chapter Officers. Chapter membership is open to individuals and organizations with an interest in any aspect of concrete technology. The Chapter is operated through its Committees, which are comprised up of volunteers from the membership. Programs are developed by the Committees to help achieve Chapter objectives and to meet the needs of its members. The Chapter may hold several meetings each year and engage in activities that may include:

Sponsoring educational seminars, short courses or technical workshops.
Organising or sponsoring training courses for examinations and certification.
Publishing technical information and newsletters.
Conducting awards programs for local concrete structures and related distinguished services.
Special social events.

■ Benefits

- Chapter members can attend seminars, short courses and workshops organized at reduced fees.
- Free use of ACI publications supplied by ACI International, and which are kept in the Chapter library.
- A forum for members to interact with colleagues and identifying potential sources for cooperation in addressing specific technical problems.

■ Committees

The Chapter's affairs and activities are executed through its Committees, which include:

- Technical Committee
- Membership Committee
- Publication Committee
- Social Committee
- Nomination Committee
- ACI-KC Students' Committee

■ Joining ACI Kuwait Chapter

To become a member of ACI Kuwait Chapter, please contact the Chapter Office Manager on the numbers shown below; or download an Application Form from our website. Different categories of membership are available. You will receive a copy of the Chapter Bylaws upon becoming a member. The functioning of ACI Kuwait Chapter is based on mutual interest and voluntarily effort. Its success depends upon the active participation of its members.

ACI Kuwait Chapter

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President's Message



ACI-KC President, Mr. Bader Al Salman

This is our first issue of Concrete News for the Year 2017, and the contents include a repost on our very successful 4th International Conference and Exhibition, that was held over the period 8th-10th November, 2016. Over thirty papers on the conference theme “Smart, Green and Durable Concrete Structures” were reviewed and accepted for presentation.

In noting the well-attended proceedings, I should take this opportunity to acknowledge the tremendous efforts of our Past ACI-KC President, Dr Moetaz El-Hawary, who as Conference Chairman, was greatly instrumental in making it a success.

Over the past few months the Chapter has continued with our programme of seminars, site visits and Students' Committee activities, some of which are also covered in this issue.

The next major event will be the Annual Awards Banquet, which will be held in May, 2017. This year, in addition to the Award of Excellence for a deserving project, and Award of Achievement for an individual's lifelong contribution towards advancing engineering and development in Kuwait, we are also planning on recognizing a significant infrastructure project. Further details about the Awards will be announced shortly.

As we look ahead to another eventful year, let me wish you all well and continued success in your careers.

■ ACI-KC 4th International Conference and Exhibition

Smart, Green and Durable Concrete Structures

The American Concrete Institute - Kuwait Chapter believes that open discussions and direct exchange of technical knowledge and information are among the main goals and objectives of the Chapter. Information and knowhow are the backbone of technology development and improvements in the construction industry. ACI-KC has been organizing and holding International Conferences, once every four years or so.

■ Conference Background and Theme

ACI-KC's First International Conference was held in September 2003, and was followed by two others in March, 2007 and May, 2012 respectively. In continuation of this series, ACI-KC held its 4th International Conference over the period 8-10 November, 2016. The theme for the conference was, "Smart, Green and Durable Concrete Structures". Amongst the many submitted papers, thirty scientific papers were reviewed and accepted for presentation and were included in the conference proceedings.



His Excellency, Eng. Ahmed Aljassar, Minister of Public Works and Minister of Electricity and Water



Keynote presentation by Professor Al Amoudi



His Excellency, Eng. Ahmed Aljassar, Minister of Public Works and Minister of Electricity and Water, with the current president of ACI-KC, Eng. Bader Alsaman to his right, and Conference Chairman and past ACI-KC President, Dr. Moetaz El-Hawary

The papers were related to the Conference theme with particular emphasis on the following:

- Smart buildings and structures
- Corrosion monitoring and mitigation
- Low carbon design of structures and buildings
- Design and construction of high rise buildings
- Recycling and sustainable building materials
- Management and utilization of natural resources
- Design aspects for resilience and sustainability
- Codes related to design and sustainability
- Rehabilitation and maintenance of structures
- Durability of concrete structures
- Resilience and sustainability in hot weather
- Design of resilient, safe and reliable structures
- Condition assessment of concrete structures

Authors from Kuwait, USA, UK, Egypt, Syria, Libya, UAE, Oman, India, Poland, Saudi Arabia, Pakistan and other countries had submitted papers.

■ Conference

The Conference was held under the auspices of His Excellency, Eng. Ahmed Al Jassar, Minister of Electricity and Water and Minister of Public Works. The proceedings were formally opened by the Minister, who was accompanied current President of ACI-KC, Eng. Bader Al Salman, as well as the Conference

Chairman and its proceedings editor, Dr. Moetaz El-Hawary.

Three keynote presentations were submitted by Professor Omar Al Amoudi, Dean for Academic Affairs at King Fahad University for Petroleum and Minerals in Saudi Arabia; Prof Abba Zayed of the University of South Florida, Florida, USA; and Dr. Moetaz El-Hawary of Kuwait University.

The three day event was well attended by delegates from many countries. There was general consensus that the attendees benefited from the knowledge and information presented at this Conference.

ACI-KC is planning to hold its 5th International Conference in 2020.

■ Sponsors

ACI-KC would like to acknowledge and thank all sponsors for their wholehearted support and role in the success of this Conference. The sponsors were:

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ACI-KC Board Members with the His Excellency the Minister. Presentation of Plaque of Appreciation by ACI-KC President to the Minister

■ Conference Abstracts

Abstracts of nine of the papers presented during ACI-KC's 4th International and Exhibition are reproduced here. These in brief reflect the variety of interesting technical subjects covered in the 30 papers presented at the Conference. All papers generated very involved and lively post-presentation discussions.

■ Production of Sustainable Concrete using indigenous Saudi Natural Pozzolan

Concrete structures in Saudi Arabia and the other countries along the Arabian Gulf are exposed to extreme exposure conditions. The environmental conditions in this region tend to drastically decrease the service life of concrete structures. Consequently, concrete in these regions needs to be designed for durability rather than strength alone. Several methodologies have been suggested to improve the durability of concrete in severe environments, one of which is the incorporation of supplementary cementing materials, as partial replacement or addition of cement.

Silica fume and fly ash are the most popular supplementary cementing materials used in the Kingdom. However, both of these materials are not available locally. On the other hand, large reserves of natural pozzolan have been discovered lately in the western region. However, the local natural pozzolan has a low pozzolanicity. Consequently, its performance has to be enhanced either by physical or chemical techniques.

A study has recently been conducted by the authors to develop sustainable concrete utilizing the locally available natural pozzolan by enhancing its properties either by mechanical or chemical activation. The mechanical properties and durability characteristics of the developed natural pozzolan concrete were evaluated and compared with that of OPC concrete. The experimental data indicated that there is a great potential for incorporating indigenous natural pozzolan in concrete in order to upgrade the performance of concrete, particularly its durability characteristics. Therefore, the use of locally available natural pozzolan, as a partial replacement of cement, is recommended

in order to accrue the economic, technical and environmental benefits of utilizing pozzolanic materials in concrete.

Presented by: Prof. Omar S. Baghabra Al-Amoudi

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Professor Al Amoudi with Conference Chairman, Dr. El-Hawary

■ Effect of Mineral Admixtures on Sulfate Durability and Heat of Hydration

Mineral admixtures are used today in almost all concrete mixtures to improve concrete fresh and hardened properties, as well as enhance durability. In this study, two mineral admixtures of high alumina content were investigated, Class F fly ash (FA) and granulated blast-furnace slag (BFS), together with a Type I/II portland cement. The objective of this study is to assess the effects of commonly used mineral admixtures on the durability of the cementitious system. Two durability issues were addressed; namely, the potential of the cementitious system to generate heat and sulfate attack. The properties studied here included heat of hydration (HOH) measurements using isothermal conduction calorimetry and expansion on exposure to a sodium sulfate solution. X-ray diffraction was used to characterize the as-received materials and explain failure trends.

The findings of this study indicate that incorporation of FA or BFS decreased the total heat of hydration of the system. However, BFS affected the sulfate depletion peak for the cementitious mixture. On sulfate exposure, BFS mixtures disintegrated before 180 days due to excessive ettringite formation and secondary gypsum while FA mixtures sustained better performance than the control mixture. The study indicates the importance of assessing the potential interaction of any portland cement-mineral admixture combination prior to use in applications where thermal and/or sulfate durability is of concern.

Presented by: Dr. A. Zayed

Authors:

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Jeremy Castello
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A. Zayed

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■ Methods to Control Cracking in Mass Concrete for Bridge Abutments

All concretes generate heat as the cementitious materials hydrate. Most of this heat generation occurs in the first day after placement. For thin structural elements such as beams, heat dissipates as quickly as it is generated. For thicker concrete elements such as bridge abutments (mass concrete), heat dissipates more slowly than it is generated. This mass concrete can get hot. This can cause thermal cracking if it is not controlled properly. This paper investigates the causes of cracking in bridge abutments during the construction of a highway in Oman in winter. A diagnostic study was conducted to determine the causes of the problem. Results of the investigation revealed that the cracking of the bridge abutments occurred due to thermal shock caused by the severe drop of ambient temperature and the early exposure of the concrete surface to it. The study also proposed methods to control cracking in such situations.

Presented by: Dr. K.S. Al Jabri

Authors:

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■ Behavior, Properties and Sustainability of Concrete Containing Portland Limestone Cement

Sustainable or green buildings is to design construct and maintain them in a way to use minimum of pollution and cost the minimum while increasing the comfort, health and safety of the people in them. Reducing concrete's embodied energy represents one of the major green features of buildings and an important tool to improve sustainability, save resources for coming generations and reduce greenhouse gas emissions.

Cement has high embodied energy. About 95% of the embodied energy of concrete is from the cement. Reducing cement consumption is, therefore, essential. The use of fillers is one of the methods to reduce the utilized cement in construction. With the recent trends to reduce water to cement ratio and improve compaction, there is no enough space or water for complete hydration of cement. This means that actually, a portion of mixed cement acts as expensive filler. Replacing this portion with cheaper filler that requires less energy to produce is, therefore, beneficial.

Crushed limestone is the most promising filler. This work is to investigate the effect of the amount of limestone fillers on the sustainability and the fresh and mechanical properties of the resulting concrete.

A rich mix is designed with a low water/cement ratio of 0.4. Lime is introduced as a replacement percentage of cement. Ratios of 0, 10, 20 and 30% were used. Slump, compressive strength, specific gravity and water absorption are evaluated for every mix. Sustainability is evaluated through reduction in the emitted carbon dioxide and reduction in cost. In addition, the effect of the amount of lime on the residual strength of concrete subjected to elevated temperatures is also investigated. Samples are subjected to six different temperature stations of 20, 100, 200, 300, 500 and 700oC for six hours before being cooled and subsequently tested for compressive strength and specific gravity. The paper is concluded with the properties of the concrete containing Portland limestone cement, its behavior at elevated temperatures along with its sustainability benefits.

Presented by: Mahmoud Ahmed

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Aziz Mamuji receiving Plaque of Appreciation on behalf of Gulf Consult, the Official Sponsor of the Conference

■ Flexural Strength of Improperly Moist Cured Slabs Cast Under Hot Weather Conditions

The structural system used in the construction of the floors of residential houses in Kuwait is typically two-way reinforced concrete (RC) slabs supported on beams. Floors cast during the hot summers suffer in many cases from inadequate moist curing. This research aims at studying the effects of inadequate moist curing on the flexural behavior of reinforced concrete (RC) slabs cast during severe hot weather conditions (HWC). Three RC slabs and field-cured cylinders and cubes were cast and cured under peak temperatures as high as 50 degrees C, relative humidity as low as 6%, and relatively strong winds. One of the slabs was control specimens which was cast and cured under lab conditions. The slabs were tested in a four-point loading setup to study their flexural behavior. The experimental results showed a general reduction in the properties of the concrete cast and cured outdoors, especially the concrete which did not receive adequate moist curing. The flexural strengths of the outdoor cured slabs were weaker than those of the lab-cured slabs by 25% and 29%. In addition, sharp decreases in the flexural stiffness were observed. Cores drilled from slabs cast outdoors and not cured with moisture were weaker than those from the lab-cured control slab by as much as 39%. However, considering the reduction in strengths of the drilled cores and the field-cured cylinders and cubes in the calculations did not lead to capturing the observed reductions in of the flexural strength and deformations. The calculations of the flexure theory remained conservative for all slabs. However, strain hardening in the tension reinforcement was one of the contributors to this conservatism.

Keywords: Flexure, hot weather concreting, moist curing, reinforced concrete, stiffness, strength

Presented by: Dr. K.N. Rahal

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■ Probabilistic Assessment of Existing Concrete Structures

Safety and reliability verification of existing reinforced concrete (R/C) structural components and construction of repair works in concrete structures is considered nowadays to be among the most challenging tasks in structural engineering. Damages and aging in concrete structural elements may affect not only appearance, but it may also indicate significant structural flaw and lack of durability. Decision making and selection of the most feasible and practical repairing and strengthening techniques are relatively difficult tasks, especially, when considering the variability and randomness in the strength and load parameters, cost, and expected service life for each technique.

The paper presents the practical application of probabilistic condition assessment and evaluation of existing reinforced concrete structural components. Principles of reliability updating are used in the assessment process as new information is taken into account, and combined with prior probabilistic models. Enhanced reliability models are used in drawing engineered decisions. The First-Order Reliability Method (FORM) is used in the reliability analysis to estimate the reliability index and the

partial safety factor (PSFs). Monte Carlo Simulation (MCS) techniques and the best fitting of probabilistic distribution of each basic random variable are used to convert the complicated multi-random variables capacity functions (limit-state functions) into single random variables.

Keywords: Structural reliability, First order reliability method, Monte Carlo simulation, Reinforced concrete structures, Existing buildings.

Presented by: Dr. Z. Sakka

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■ Construction and Building Materials - Program Strategy for Sustainable Solutions

The Construction and Building Materials program (CBM), has been established at Kuwait Institute for Scientific Research as a front foundation for development and implementation of research and science in composite materials and construction systems through collaborative efforts with the building industry and its establishments. The program mission is focused on providing technical support and participating in policy development to improve construction practices and promote sustainable and green alternative solutions for Kuwait and similar severe exposure environments in the region. The main aim of the program is to provide the building industry in Kuwait and the Gulf region with research studies, testing protocols, upgraded code of practices and specifications, materials characterizations and certification.

To embark upon tackling the outstanding challenges of the increased shortages and scarcity of quality raw materials to resolve the lack of confidence in the new material technologies in order to meet the demands of the building industry for the year 2020, the CBM program has identified three solution areas to deal with the national challenges facing Kuwait, which can be described as; (a) to develop, optimize and monitor the concrete and pavement construction technologies, (b) to develop and promote efficient guidelines on recycling and the applications of the recyclable materials in construction, and (c) to characterize and conduct performance assessment studies on composite and advanced materials, to maximize the life, serviceability, safety and sustainability of infrastructure and buildings.

Keywords: Sustainability, Guidelines, Green Solutions, Recycling, Characterization, Construction, Building Materials.

Author / Presented by: Dr. S. Al Bahar

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■ Skyscraper Design and Ultra-High Strength Concrete Core-wall Behavior

The use of concrete in high-rise buildings has increased significantly in the past 20 years mainly owing to improvement in all the technologies associated with these materials and methods: cementations materials, admixtures, aggregates, pumping, transportations and elevation methods...etc. these enchased possibilities are illustrated by taking 150 story high rise structural model; analyzed and designed by using the software ETABS-2013 ,further to withstand the gravity loads in addition to the lateral loads such as Wind 100mph,Exposure-C,Seismic Zone-I, soil profile type SD, Occupancy category 1.0 and Ductility factor , $R=5.5$, the type of ultra-high strength concrete cylindrical strength 107 MPa @ 28 days has been considered to bear the high load and straining action at lower portion of the core wall, Steel sections and plates are confirming to ASTM-A992-Gr:70Ksi considered for Built-up column sections and floor beams in addition Shear Studs are confirming to

ASTM-A106-Gr:1020 with composite metal deck also been considered to have a rigid diaphragm to act as a monolithic unit against the heavy lateral loads.

This paper clearly would show that the Design and constructability considerations, serviceability requirements and international codes compliances such as ACI-318, ASCE-7, IBC-2011, UBC-1997 ,further it would prove that the combination of R.C. concrete and steel composite sections could be the best solution for such tall skyscrapers.

Author / Presented by:

M. Manikandan
Sr.Structural Engineer, Gulf Consult



■ Effect of Drilling on Compressive and Tensile Strength of Drilled Concrete Cores

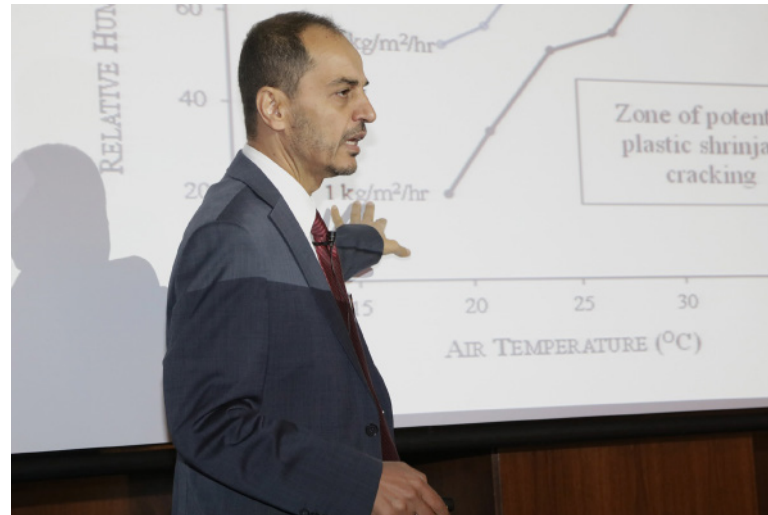
Inadequate curing of concrete during hot weather concreting (HWC) has detrimental effects on the properties of the concrete. Cores are drilled from suspect concrete to evaluate its in-situ properties. Evaluation of the results from drilled cores is difficult because of the numerous factors which affect them. The effects of these factors are not fully understood, and they are not included in the code provisions for the evaluations. This paper reports the results of an experimental study of the effects of drilling and of inadequate curing on the strength of drilled cores. It is shown that the drilling operation caused the cores to be weaker than the insert cylindrical samples by 16% to 20%. It is also shown that the inadequate curing caused a reduction of the compressive and tensile strengths of cores by as much as 30% and 25%, respectively.

Presented by: Dr. Khalad Elsayed

Author:

Dr. Khalad Elsayed
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■ Technical Activities

■ BIG5 Kuwait

ACI-KC participated as sponsors of the BIG5 Kuwait, which is the largest construction and building industry related exhibition in the Gulf. The sponsorship agreement was signed in April 2016, and the event was held from 25-27 September 2016 at the Kuwait International Fairground, and more than 600 exhibitors from 18 different countries participated. This is the fourth consecutive year in which ACI-KC have been involved in BIG5 Kuwait

The visitors showed tremendous interest in technical presentations and workshops, which were delivered and conducted by industry professionals and market experts. A presentation was delivered by Dr. Moetaz El-Hawary, ACI-KC Past President and Technical Committee Chairman on “Hot Weather Concrete: Practices and Specifications”.



■ Technical Seminar

■ International Concrete Technology Forum

The International Concrete Technology Forum was held in Dubai, UAE on November 22-23, 2016. ACI-KC was one of the official endorsers of this event. The event included a number of important presentations along and an exhibition of concrete and other building materials. The conference was attended by Dr. Moetaz El-Hawary, ACI-KC's Technical Committee Chairperson, who presented a paper entitled "Concrete Sustainability through the Use of Fillers". The event was organized by Grey Matters.



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Dr. Moetaz El-Hawary presenting his paper

■ Technical Article

This article has been reproduced from Concrete International, published by ACI International (Issue no. V.37 No.6 dated June 2015).

Modeling and Forming the Turkish American Community Center. 3-D Models facilitate the construction of a complex reinforced concrete structure

■ 3-D Modeling

Comprising a large underground parking structure, a mosque, a Turkish bath, and additional assembly spaces, the Turkish American Community Center (TACC) in Lanham, MD, posed many challenges for the Center's concrete construction team. Besides the sheer size of the project, its arched beams, large and small domes, battered walls transitioning into chorded radial walls, and crescent-shaped columns made it a clear candidate for three-dimensional (3-D) modeling. In fact, although it was not contractually required, the construction team assembled by the concrete contractor, Facchina Construction Company, started modeling the project as soon as the contract was awarded. The modeling investment paid dividends from the outset, as it:

- Facilitated mockup design and construction;
- Allowed Facchina to generate requests for information
- (RFIs) with professional detail and speed;
- Provided a visual tool for on-site meetings with the design professionals; and
- Provided field personnel with detailed views of areas with reinforcing bar congestion.

The utility of the 3-D model of the reinforced concrete structure was extended even further, as it was provided to the construction manager and formwork vendors (after signing a disclaimer) as a courtesy and to assist with their coordination efforts. Concrete construction started in January 2013 and was

substantially completed 13 months later. Largely because the 3-D model allowed detailed coordination and resolution of potential issues, no remedial work was required.

■ A Massive Project

The footprint of the TACC is dominated by its underground parking structure (Fig. 1). Because this portion of the project has a relatively conventional design, the project managers for Facchina directed that initial modeling efforts would be focused on the most complex structure above the parking level—the mosque (Fig. 2). The resulting model provided a multi-month look ahead so that formwork systems and the placement sequencing could be selected.

The remainder of the project was then modeled, including the Turkish bath (Fig. 3) and the community center (Fig. 4). The model allowed the construction team to identify, communicate, and resolve potential problems early (Fig. 5), and it facilitated the selection and implementation of the five forming systems that were ultimately required to construct the project. These formwork solutions.

Decks and platforms

Multiple platform systems were used to construct elevated beams, slabs, and domes (Fig. 6). In the

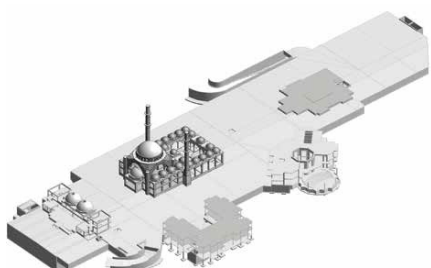


Fig. 1: The TACC facilities have a footprint of 225,000 ft² (20,900 m²). An underground parking structure provides the foundation for much of the center

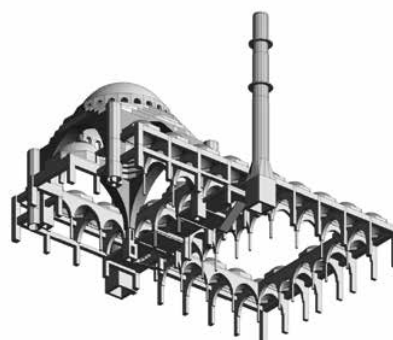


Fig. 2: The mosque, seen here in a worm's eye view of the BIM model, includes 66 arched beams, 27 small domes (radius of 6 ft 7 in. [2.00 m]), one main dome with a radius of 22 ft 1 in. (6.72 m), and two, 120 ft (36.6 m) tall minarets

Formwork Systems

Turkish bath, elevated floors were formed using MULTIPROP shoring, formwork girders, and SKYDECK panel slab formwork supplied by PERI Formwork Systems, Inc., along with HICO beams provided by Form Service, Inc. The formwork for the dome framing and domes surrounding the mosque courtyard were supported on Harsco 20K heavy-duty steel shoring. Finally, the formwork systems for the main arch platform and main dome of the mosque were supported by plywood installed on Harsco GASS® aluminum shoring and joists.

Small domes

The intermediate and small domes on the Turkish bath and the mosque were cast on expanded polystyrene (EPS) foam forms (Fig. 7). MEVA Formwork Systems, Inc., was contracted to supply these unique forms, which were fabricated by a third-party vendor.

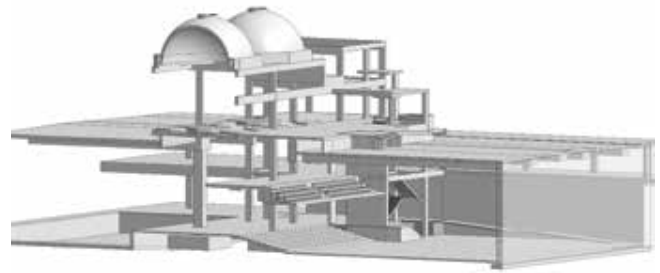


Fig. 3: The Turkish bath includes multi-story walls, a swimming pool, cast-in-place concrete seating areas, ramps, and domes

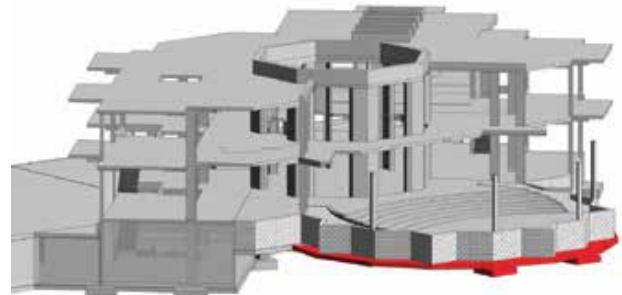


Fig. 4: The cultural center includes radial stepped slab-on-ground, C-shaped columns, and skylights

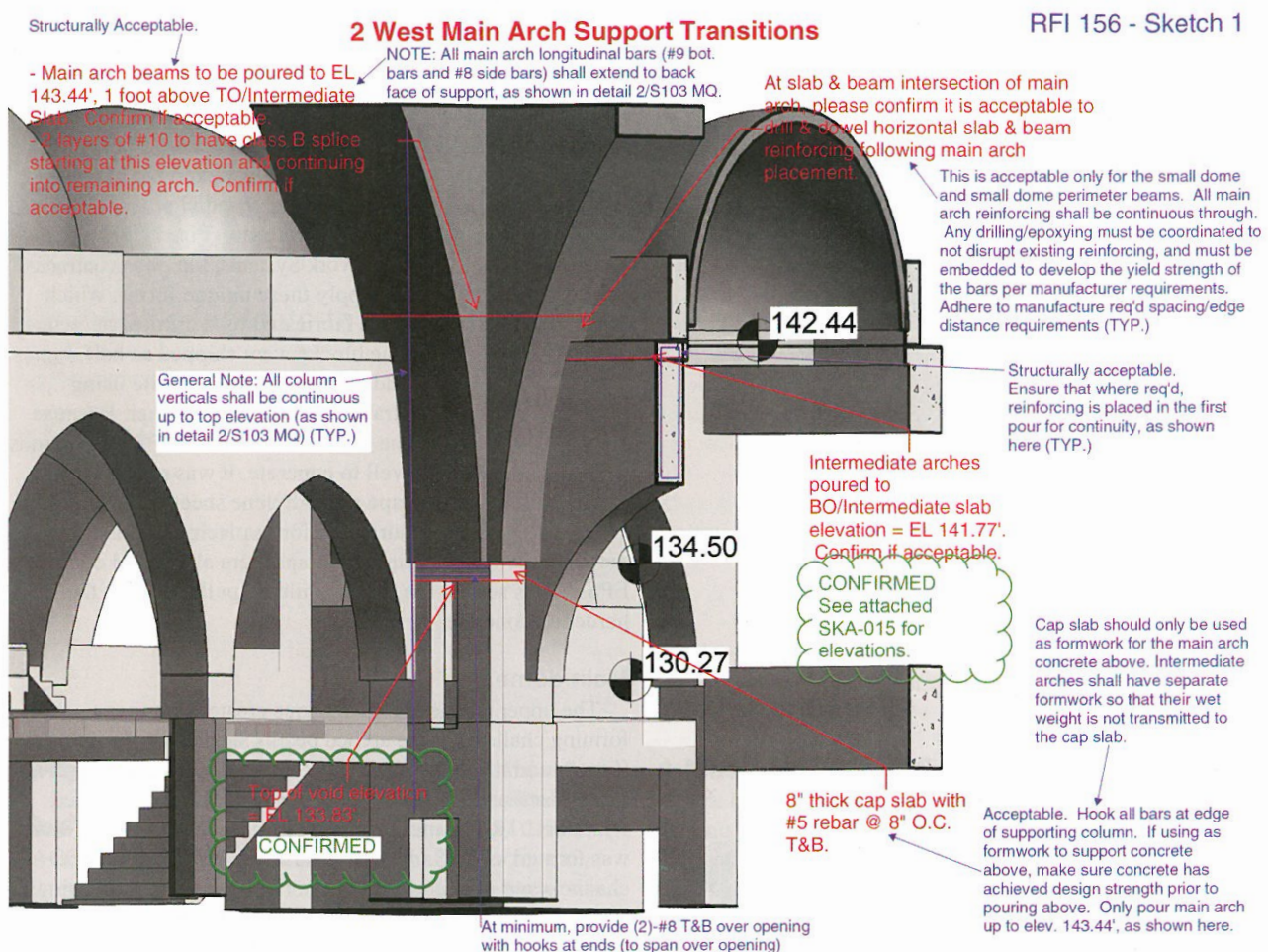


Fig. 5: The BIM model not only provided means for identifying potential constructability issues but it also served as the communication tool for the resulting RFIs

The blocks were shipped as half domes and were assembled on-site using straps to hold them together. Because the textured surface of EPS foam bonds well to concrete, it was necessary to tape polyethylene sheets to the casting surface prior to placing the reinforcement and concrete. Shipping straps were also taped over the EPS domes so that the forms could be pulled free of the hardened concrete.

Main dome

The upper reaches of the mosque created two major forming challenges: the arched beams supporting the dome (Fig. 8) and the dome itself (Fig. 9). The arched beams were constructed using laminated lumber and shoring combined with PERI TRIO panel formwork to form the sides. The dome was formed using Radius Track crimped cold-formed steel channels and plywood sheathing. The Radius Track framing and the lower portion of the sheathing were assembled on the ground and placed on the dome frame using a

tower crane. As with the smaller domes, the concrete mixture was placed with a bucket (Fig. 10). The slump ranged from 2 to 5 in. (50 to 125 mm) and the thickness was set using depth gauges.

Minarets

The TACC minarets (Fig. 11) had to transition from a square base to a polygonal tower structure. Dimension lumber and plywood sheathing were used to produce the custom formwork for the transition. Each polygonal tower was formed using a hybrid system comprising plywood and dimension lumber backed by MevaLite wall formwork.

Miscellaneous challenges

The project also required custom formwork fabricated on-site by carpenters. Stepped seating areas in the Turkish bath, for example, were formed using dimension lumber and plywood sheathing (Fig. 12).



Fig. 6: Multiple shoring and decking solutions were used for construction of the project: (a) elevated floors in the Turkish bath were formed using PERI MULTIPROP shoring, formwork girders, SKYDECK panel slab formwork supplied by PERI Formwork Systems, Inc., along with HICO beams provided by Form Service, Inc. (photo courtesy of Mostafa Fahimi, EyeConstruction, Inc.); (b) formwork for the small domes surrounding the mosque courtyard were supported on Harsco 20K steel shoring (photo courtesy of Facchina Construction Company, Inc.); and (c) support for the main dome arch formwork and the work platform below the main dome formwork were provided by Harsco GASS aluminum shoring and joists

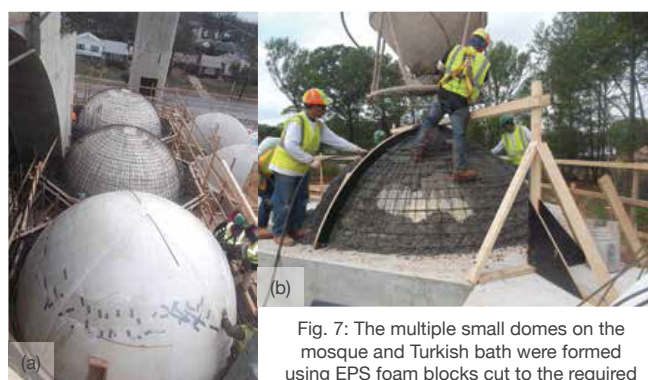


Fig. 7: The multiple small domes on the mosque and Turkish bath were formed using EPS foam blocks cut to the required

radius: (a) after the dome forms were set on a shoring and decking platform, plastic sheets and nylon straps were taped over the casting surface (to ease stripping), and a pre-assembled reinforcing cage was placed; and (b) a 2 to 5 in. (50 to 125 mm) slump concrete mixture was applied using a template and depth gauge to set the thickness



Fig. 8: The mosque structure included a platform for the main dome supported on four arched beams. The arched beams were formed using a combination of shored structural laminated timber to form the arch and PERI TRIO panel formwork to form the sides

■ Constructibility

The scope and complexity of the Turkish American Community Center created many unique challenges for the concrete construction team. The large footprint and complex structures made it essential that problems were identified and resolved well before the formwork was erected and the concrete was cast. The early creation of a 3-D model was key to minimizing

project risk and ensuring success. Finally, because very few details were repeated throughout the multiple buildings, numerous formwork systems had to be employed to complete the project on schedule. Early visualization allowed the planners to consider options and ensure that the right systems were in place at the right time.



Fig. 9: The primary dome on the mosque was too large to be formed using EPS foam, so custom formwork was fabricated from crimped cold-formed steel shapes and plywood sheathing: (a) the Radius Track cold-formed shapes were assembled at the ground level; (b) the partially completed assembly was installed using a tower crane; and (c) the remainder of the dome formwork sheathing was fastened to the framing and the window formwork was installed

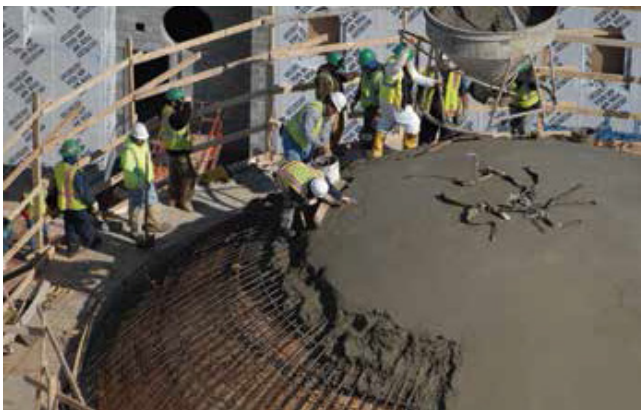


Fig. 10: Workers place concrete on the main dome of the mosque. The final depth and shape of the dome were achieved using a depthgauge and a curved screed



Fig. 12: Seating areas in the Turkish bath were formed using dimension lumber and plywood sheathing



Fig. 11: The minarets comprise rectangular bases and polygonal towers: (a) the transition between base and tower was formed using dimension lumber and plywood sheathing; and (b) the tower was formed using a hybrid system comprising MevaLite wall formwork, dimension lumber, and plywood sheathing lifted into place using the site's tower crane

Project Credits

Owner, Turkish American Community Center

Architect, Fentress Architects

Structural Engineer, SK & A Structural Engineers, PLLC

Construction Manager, Balfour Beatty Construction

Concrete Contractor, Facchina Construction Company, Inc.

Concrete Supplier, Aggregate Industries

Reinforcing Bar and Post, Tensioning System Installer, R&R Reinforcing

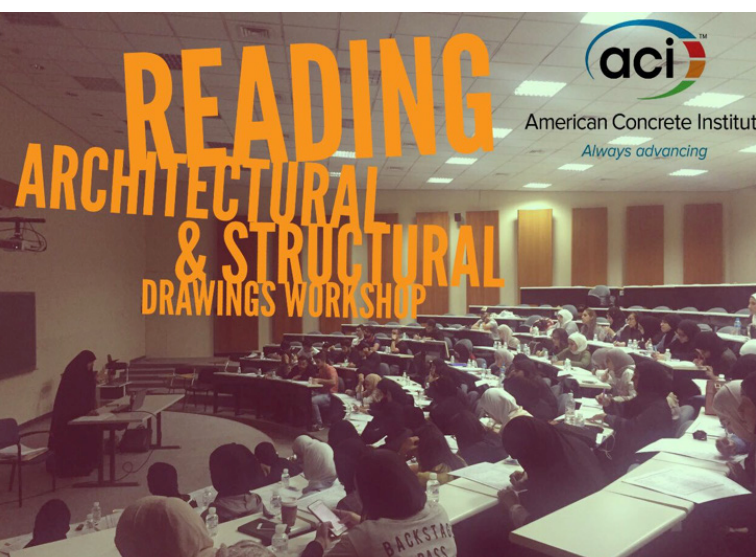
■ ACI-KC Students' Committee

ACI-KC Students' Committee continues to be active. Operating within the Civil Engineering Department of Kuwait University, the Committee has over the past few years organised many technical activities, concrete and engineering related seminars, and a variety of social events aimed at promoting better engineering practices and general awareness.

■ Activities

The activities carried out by the enthusiastic students over the past 6 months included the following:

- ACI-KC started the semester by providing laboratory coats to be used by the Civil Engineering students.
- ACI-KC participated in the 50th anniversary "Golden Jubilee" celebration of Kuwait University. This was held on December 5th, 2016 by the College of Engineering and Petroleum.
- ACI-KC arranged a competition between the Civil Engineering Department and Mechanical Engineering Department at KU. Each team challenged the other with information about physics, calculus and general knowledge.
- Taking part in developing the student's academic skills, ACI-KC organised an Excel workshop, which was conducted by Eng. Bashaier AlTuraif. It comprised a walkthrough of program basics and an introductory discussion on common techniques used in laboratory reports.
- ACI-KC organised a workshop, that conducted by Eng. Anwaar AlSuraij. It comprised a lecture to Civil Engineering students on how to read engineering and architectural drawings.
- The students conducted a one week local membership registration drive in 9KH corridor at KU. Many students showed interest.
- As a representative of the Civil Engineering Department, ACI-KC participated in the College of Engineering "admission exhibition". This was directed towards high school seniors, giving them a brief idea about majoring in Civil Engineering.
- ACI-KC established a "Best Student of the Week Award" for the special students of civil engineering. The awards were to be distributed by Professors in their respective classes as an encouragement.



■ Board Members:

*The Students' Committee activities are currently managed and organized by an enthusiastic Board.
The Board Members are:*

Hanouf Alessa
Osama Mohamad
Joury Almunier
Amal Alenezi
Mahmoud Zaidan

Instagram: ACIQ8
Twitter: ACIQ8
E-mail: ACIQ82016@gmail.com

The activities of the Committee are supervised by Dr. Moetaz El-Hawary, Past ACI-KC President and Chairperson of its Technical Committee.



■ Site Visit

The Social Committee of ACI-Kuwait Chapter organized a visit to BituGulf Factory, manufacturers of waterproofing membranes. The visit took place on Saturday, 18th February, 2017.

■ BituGulf Factory

Bitugulf International Insulation Company is a waterproofing membrane factory manufacturer and supplier of a full range of bituminous waterproofing membranes and protection boards. The Company was established in 2005 and started production in 2014. The factory has been built to very high standards by Nardini, an Italian company. Operations are technologically advanced and all machinery is fully computerized.

Mr. Salah Elborno, General Manager, and his team received and welcomed the ACI-KC members. The visit started with a presentation about the factory by



Mr. Salah Elborno, and was followed by an informative tour of the factory. During the visit, members were given the chance to ask questions regarding the different products and equipment being used in the manufacturing process.

The visit was very knowledgeable, and all members enjoyed the walk through the factory. They were

impressed by the high production standards, and were satisfied with responses they received to their technical queries.

The ACI-KC Social Committee thanked BituGulf team for their efforts making the event successful.



■ Annual Dinner Report

Farewell Function for Mr. Muhammed Harb

ACI-KC's Annual Dinner for its members was held on 10th January, 2017. The function also served as a farewell dinner for Mr. Mohammed Harb, founder member of ACI-Kuwait Chapter and current Board Member.

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Ms. Dana Drobiaova Social Committee Chairperson



Dr. Saud Al Otaibi



Aziz Mamuji conducting a game



Mr. Harb receiving a Plaque of Appreciation from ACI-KC Presedent, Mr. Bader Al Salman

The evening commenced with Social Committee Chairperson, Ms. Dana Drobiova, welcoming the guests and outlining the programme for the evening. She then invited Mr. Bader Al Salman, ACI-KC President, to address the gathering. Mr. Al Salman welcomed everyone and then gave a tribute to Mr. Mohammed Harb for his longstanding and commendable services to ACI-Kuwait Chapter and to the engineering profession in Kuwait.

The evening's entertainment comprised a beautiful rendition in Arabic by Dr. Saud Al Otaibi. He sang in praise of Mr. Harb and wished him well for the future. Mr. Aziz Mamuji, ACI-KC Vice President, thereafter conducted a lively game of Bingo. Four lucky guests won prizes. And in a raffle draw, six other guests went home with gift vouchers.

An enjoyable evening ended with a vote of thanks by the Social Committee Chairperson, and this was followed by a grand dinner.



■ Press Coverage

The 4th ACI-KC International Conference received extensive coverage in media. The article below is reproduced from the February 2017 issue of ACI International's magazine, *Concrete International*. On the opposite page are excerpts from local national newspapers

Chapter Reports

CIB New York Chapter – ACI Hosts 55th Annual Roger H. Corbetta Awards

The Concrete Industry Board (CIB) New York City Chapter – ACI held its annual awards program on November 16, 2016, at the Marina del Rey in the Bronx, NY. Winning projects included:

- Annual Award—10 Hudson Yards Tower, New York, NY;
- Award of Merit with Special Recognition for Design—56 Leonard Street, New York, NY;
- Award of Merit for Technical Innovation—JFK International Airport, Runway 4L-22R RSA Compliance/Runway Reconstruction;
- Award of Merit for Public Works—Spring Street Salt Shed, 553 Canal Street, New York, NY;
- Award of Merit for a Private Residence—Oceanfront Residence in Southampton, NY;
- Awards of Merit—The American Copper Buildings, 626 1st Avenue, New York, NY; 45 East 22nd Street, New York, NY; 50 West, New York, NY; and 100 East 53rd Street, New York, NY;
- Award of Merit (Out of Area)—Faena Forum, Miami Beach, FL; and
- Award of Merit (Out of Country)—Building 1 Honeycomb, New Providence, the Bahamas.

For more information, visit www.cibofnyc.org.

Kuwait Chapter – ACI International Conference and Exhibition

The Kuwait Chapter – ACI believes that open discussions and direct exchange of knowledge and information are among the main goals and objectives of the chapter. The chapter has been organizing and holding an international conference about every 4 years. The Fourth International Conference was held November 8-10, 2016, with a theme of “Smart, Green, and

Durable Concrete Structures.” Thirty scientific papers were accepted for presentation and are included in the conference proceedings. Authors are from Egypt, India, Kuwait, Libya, Oman, Pakistan, Poland, Saudi Arabia, Syria, United Arab Emirates, United Kingdom, United States, and others.

The conference was opened by Ahmed Al Jassar, Kuwait Minister of Electricity and Water and Minister of Public Works; Bader Al Salman, Kuwait Chapter – ACI President; and Moetaz El-Hawary, Conference Chair and Proceedings Editor. Keynote presentations were also made by Omar Al Amoudi, Dean for Academic Affairs, King Fahad University for Petroleum and Minerals, Dhahran, Saudi Arabia; and Abba Zayed, University of South Florida, Tampa, FL. The Kuwait Chapter – ACI is planning the Fifth International Conference for 2020.



Kuwait Chapter – ACI Board Members with Ahmed Al Jassar, Kuwait Minister of Electricity and Water and Minister of Public Works



2016 Roger H. Corbetta award winners with their project display boards



Omar Al Amoudi, Dean for Academic Affairs, King Fahad University for Petroleum and Minerals, presented a keynote address at the Fourth International Conference of the Kuwait Chapter – ACI



لجنة جامعية لأعضاء المجلس الأمريكي للخرسانة في الكويت خلال تسليم تكريما من وزير الكهرباء والماء، م. أحمد الجبار (أحمد علي)



بدر السلمان



وزير الكهرباء والماء، م. أحمد الجبار

على هامش افتتاح المؤتمر الدولي الرابع للمعهد الأمريكي للخرسانة - فرع الكويت تحت رعاية وزير الكهرباء والماء وبتنظيم من «نوف إكسبو» الجسار: صناعة الخرسانة الأكبر في الكويت بعد النفط

إنشاء هيئة مستقلة لمراقبة صناعة الخرسانة

قال بدر السلمان إن هناك ضرورة لإنشاء هيئة مستقلة لمراقبة أعمال الخرسانة في الكويت، وأوضح أن تلك الهيئة دورها ينحصر في مراقبة الخلطات التي تقوم بإعدادها المصانع وذلك للتأكد من مطابقتها للمواصفات العالمية. وشدد على ضرورة أن تتكاتف وزارات الدولة من البلدية والأشغال ومعهد الأبحاث ومعهد الخرسانة بالكويت لتأسيس هيئة مستقلة للمراقبة على الخرسانة في الكويت في أقرب وقت، نظرا لخطورة حجم أعمال البناء والتشييد بالكويت.

الخرسانة أكثر المواد المصنعة استعمالاً في العالم ونعمل على تطويرها محلياً



تكرم فوزير أحمد الجبار و بدر السلمان

حصة الفرد من الخرسانة طن سنوياً لأعمال البناء والتشييد

صناعة الخرسانة.. إحدى ثروات الدولة الحديثة والعصب الأساسي للإنشاء والمعمار

السلام: صناعة الخرسانة ضرورة واجبة لتلبية احتياجات النمو الاقتصادي

محمود فاروق
قال وزير الأشغال العامة ووزير الكهرباء والماء، م. أحمد الجبار إن كمية الخرسانة المستخدمة عالمياً تقدر بنحو طن لكل إنسان، مبيّناً أن كمية استخدام الخرسانة تزيد بالكويت، نظراً لخطورة حجم صناعة البناء في البلاد حيث تعد أكبر صناعة في الكويت بعد النفط. جاء ذلك على هامش افتتاح المؤتمر الرابع للمعهد الأمريكي للخرسانة - فرع الكويت تحت رعاية وزير الأشغال العامة ووزير الكهرباء والماء وبتنظيم من «نوف إكسبو»، وتستمر أنشطة لوبيين بحضور قيادات شركات صناعة البناء والتشييد في المنطقة. وأضاف الجبار أن مادة الخرسانة لها أهمية قصوى، حيث تعد أكثر استخدام في العالم بعد الحديد، مشيراً إلى أن الخرسانة باتت لها تطبيقاتها المختلفة لتغير عملاً رئيسياً مهماً في مختلف المجالات، فهي الشريك الأساسي في البنى التحتية التي تعد أحد ثروات الدولة الحديثة، كما أنها العصب الأساسي للناحية الإنشائية والمعمارية

تنظيم أعمال الخرسانة ومواصفاتها وشروطها وأيضاً يضع لوائحها. وأوضح أن الخرسانة تعتبر منذ ظهورها في العالم هي المعنصر الأساسي في بناء أي منشأة سواء كانت تحت الأرض أو فوقها. وتربط الخرسانة ارتباطاً وثيقاً بالتطور العلمي، حيث تعدّ أنواع الخرسانة من الخرسانة العادية والخرسانة المسلحة والخرسانة المزججة الخرسانة الأخرى. وهناك أيضاً الخرسانة الخضراء وهي الصديقة للبيئة.

سواء، مؤكداً أن الخرسانة بتطبيقاتها المتعددة المختلفة تلعب دوراً رئيساً لمعظم البنى التحتية بما فيها البنى التحتية التجارية والصناعية والجسور ومحطات الطاقة وسبل المواصلات المختلفة وغيرها. وأشار السلمان إلى أن الخرسانة هي أكثر المواد المستخدمة استعمالاً في العالم، مضيفاً أنه ومن هذا المنطلق كان اهتمام العالم بمؤسساته ومطوري الخرسانة، ومن هذه المؤسسات المعهد الأمريكي

وإبحاث تتناسب مع حجم جهدهم المبذول والخروج بتوصيات تعود بالنفع على الكويت. **النمو الاقتصادي** من جانبه قال رئيس المعهد الأمريكي للخرسانة فرع الكويت بدر السلمان إن أهمية تكنولوجيا الخرسانة وصانعتها تنجلي في حقيقة تنمية البنى التحتية في العالم وصانعتها لها ضرورة واجبة لتلبية احتياجات النمو الاقتصادي وتحسين مستوى جودة الحياة في الدول النامية والصناعية على حد

الخلافة العلمية، مسترشداً بكلماته على تبيان ذلك من أن الله قد جابنا بخرنه وأفاء علينا بفضلته الوجب، علمنا شكره فولا وعملنا واستثمر موارثنا فيما يعود بالنفع على أبنائنا هذا الوطن بالخير والرفاء حاضرنا ومستقبلنا. وأكد أنه حرصاً على تطبيق هذا التوجيه السامي إلى واقع، فقد جعلت الوزارة في الوصايا الفنية العامة، وأشار إلى أنه في إطار الاهتمام بالعلم، فقد حرص حضرة صاحب السمو أمير البلاد على إعلاء شأن المعرفة والبحث العلمي وتشجيع

الجلسة الأولى

تطوير «الخرسانة» الكويتية وتوافقها مع المعايير العالمية



د. عمر العمودي



د. محمد الواري



د. خليفة الجابري

استعرضت أعمال الجلسة الأولى للمؤتمر الدولي الرابع للمعهد الأمريكي للخرسانة التطورات التي أحدثتها بصناعة الخرسانة مؤخراً وأهم المواد الكيميائية التي تمت إضافتها لها لتجعل منها خلطة مقاومة لجميع الضغوط البيئية التي قد تتعرض لها. وتحدث خلال الجلسة الأولى التي ادارها رئيس قسم الهندسة المدنية جامعة الكويت وبمشاركة د. عمر بن سعيد العمودي من جامعة الملك فهد للبترول والمعادن، ود. خليفة بن سيف الجابري من جامعة السلطان قابوس، **التجربة السويدية**

وقال د. عمر العمودي إن مادة البوزولون الطبيعي «مادة طبيعية خاضعة لمعالجة» أصبحت متاحة استخدامها في تحسين مادة الخرسانة والاستفادة من خواصها الطبيعية التي تزيد خلطة الخرسانة قوة ومتانة وتجعلها مقاومة لجميع الضغوط البيئية التي من شأنها إلحاق الضرر بالمعدن المستخدمة في الخرسانة

د. خليفة الجابري في عمليات التخليق الخرساني وكيفية إعداد خلطة خرسانية مميزة تتنوع بخواص ميكانيكية قوية. وأوصى العمودي بضرورة إضافة مادة السيليكا مع مادة البوزولون والاستعانة بتكوين مادة ثلاثية لاستطوع مقاومة أي ظروف طارئة لتصبح في النهاية مادة خالية من الصمغية وضد صدأ الحديد الذي يطرا على الخرسانة لتعرضها للمحلول الجوية **سلطنة عمان** من جانبه استعرض

شركة العاصمة العقارية ش.م.ك.
Al Asima Real Estate Company K.S.C.

(إعلان تذكيري)

يسر مجلس إدارة شركة العاصمة العقارية ش.م.ك. دعوة السادة المساهمين الكرام لحضور اجتماع الجمعية العامة غير العادية للساحس وذلك في تمام الساعة الحادية عشرة من صباح يوم الأربعاء الموافق 2016/11/16 بجميع الصالحيات التجارية المدخل الرئيسي ميزانين 2.

وعلى السادة المساهمين الراغبين بالحضور مراجعة مكتب الشركة الخلية رقم 105 لحفظ الأوراق المالية لإصدار البيانات الخاصة بالاجتماع (الشرق شارع ميركات الكبير نهاية زيد الكاظمي الدور 6/5).

والله ولي التوفيق ...
رئيس مجلس الإدارة

افتتح المؤتمر الرابع لمعهد الخرسانة الأمريكي الجسار: البناء في الكويت الصناعة الكبرى بعد النفط

الخبرة وإفاء علينا بفضلته، فوجب علينا شكره قولاً وعملاً، وأن نستثمر موارثنا في ما يعود على أبنائنا هذا الوطن بالخير والرفاء حاضراً ومستقبلاً».

وأردف «حرصاً على تطبيق هذا التوجيه إلى واقع، فقد جعلنا هذه الكلمات هي الوقود التي تبرز بخلطاتها المختلفة النواحي التجميعية فيها». وتابع «منذ إنشاء معهد الخرسانة الأمريكي - فرع الكويت جعل جل اهتمامه في تطوير هذه الصناعة وإمدادها بالإبحاث العلمية والمؤتمرات المتعلقة بالتكنولوجيا في هذا المجال وطرح الرؤى الجديدة في التصميم والإنتاج والتخزين تزامناً مع التطور العمراني ومواكبة التحديثات في المواصفات الفنية» و«وفي الختام، شكر الجسار كل من أسهم في إقامة هذا المؤتمر وكل من شارك في فعالياته، معتبراً إياه لبنة في تقدم الوطن».

الأساسي في البنى التحتية التي تعد إحدى ثروات الدولة الحديثة، والعصب الأساسي للناحية الإنشائية والمعمارية التي تبرز بخلطاتها المختلفة النواحي التجميعية فيها». وتابع «منذ إنشاء معهد الخرسانة الأمريكي - فرع الكويت جعل جل اهتمامه في تطوير هذه الصناعة وإمدادها بالإبحاث العلمية والمؤتمرات المتعلقة بالتكنولوجيا في هذا المجال وطرح الرؤى الجديدة في التصميم والإنتاج والتخزين تزامناً مع التطور العمراني ومواكبة التحديثات في المواصفات الفنية» و«وفي الختام، شكر الجسار كل من أسهم في إقامة هذا المؤتمر وكل من شارك في فعالياته، معتبراً إياه لبنة في تقدم الوطن».

أساً، د. معزز الهواري فيستعرض أعمال المعهد الأمريكي للخرسانة في الكويت، كما أنه يعمل على تطوير صناعة الخرسانة وتطوير مستوى مهنتيها، وأضاف أن معهد الخرسانة الأمريكي يعتبر من أقدم المؤسسات التي تعنى في مجال الخرسانة. وذكر أن المعرض شارك فيه أكثر من 300 عالماً من عدة دول منها أميركا وبولندا وإكسبون والهند والسعودية والكويت.

Sponsors

ACI-KC appreciate the support of various Organizations, Consultants and Companies in Kuwait



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دار الكويت
للإستشارات الفنية
kuwait technical
consulting bureau

Arab Building
Industrial
Resources Co.

National Insulation Company

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First Name

Middle Name

Surname

اللقب

الاسم الثاني

الاسم الأول

Photo

Employer/Organization:.....

Position:.....

Address:.....

Telephone:..... Mobile:..... Email:.....

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Please check the category of membership you are applying for and submit the Form with appropriate dues as noted below:

- ☐ Organization: KD 100/year ... (Firm, Corporation, Government Agency, Society or Institute, etc.)
- ☐ Individual: KD 15/year ... (Individual who is a member of ACI International)
- ☐ Affiliate: KD 15/year ... (A person who is not a member of ACI International)
- ☐ Student: KD 5/year ... (Full time student at an approved Educational Institution)

Member Profile Information (Please check only one box in each column)

- | | | |
|---|---|---|
| ☐ Top Management | ☐ Engineering Services | ☐ Testing Laboratory |
| ☐ Administrative, Operating Management | ☐ Contracting Services | ☐ Quality Control |
| ☐ Plant, Production & construction | ☐ Architectural Services | ☐ Research Services |
| ☐ Design/Engineering Management | ☐ Management | ☐ Concrete Products |
| ☐ Architectural & Engineering Services | ☐ Design Engineer | ☐ Educator |
| ☐ Chemicals and Allied Products | ☐ Materials Engineer | ☐ Student |
| ☐ Construction Machinery & Equipment | ☐ Plant Engineer | ☐ Utility |
| ☐ Concrete Blocks & Bricks | ☐ Research Engineer | ☐ Architect |
| ☐ Ready-Mixed Concrete | ☐ Sale & Marketing | ☐ Government |
| ☐ Educational Institutions | ☐ Technical Specialist | ☐ Other (Please specify) |

Are you interested to join any ACI Chapter Committee?

() Yes

() No

Payment Method

Membership fees may be paid as follows:

- ☐ Cash..... ☐ Cheque (Payable to ACI-Kuwait Chapter)

Receipt No.

Cheque No.

- ☐ Money Transfer (Payable to ACI-Kuwait Chapter, Account No. 06655310 with Gulf Bank)

Transaction No.



Detailed Information Please Contact
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Kuwait Chapter

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