

Concrete News

- **Technical Activities**
- **Ready Mixed Concrete**
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- **Site Visit**

Volume 19
January - May, 2015



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 19 / January - May, 2015

■ 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 of 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.

■ Joining ACI Kuwait Chapter

To become a member of ACI Kuwait Chapter, complete the membership application form printed on the last page of this publication. 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.

■ 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

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■ President's Message



ACI-KC President, Eng. Mousa Al-Sarraf

The release of the first of the two yearly issues of the Newsletter is always an exciting event, particularly as the publication of this issue will be closely followed by the Chapter's Annual Awards function. This year's awards ceremony will be held on 12th May, 2015, and it promises to be a grand event. The Chapter's 2014 Award of Excellence and Award of Achievement shall be respectively presented to a commendable project and a deserving candidate.

The Chapter has indeed been quite active over the past few months, and it is especially pleasing to note the enthusiasm and commitment of the Students Committee. They organize many activities, and it is my hope that they will continue to generate new ideas for their events, and to participate in these with full commitment.

This Newsletter also includes reports on the technical seminars conducted recently, the visit to the construction site of the new Headquarters for Ministry of Education, as

well as our annual members' dinner. A number of informative technical articles have also been presented, together with a very interesting interview. The free ACI Webinars are proving to be a very valuable source for information on a wide range of aspects related to concrete, and I strongly encourage more members to avail themselves of this service.

Finally, I do hope that everyone concerned with the Chapter will help publicise our activities and encourage their colleagues to join us. The Chapter has a lot to offer, but it can only thrive and achieve more if we have sustained growth in membership members.

I should also like to take the opportunity to wish all our Members well for the future.

■ Technical Activities

■ Fly Ash

In a well-attended technical seminar sponsored by ASH TECH, Mr. Robin De Beer gave a presentation entitled 'Fly Ash: A Solution for Concrete in Harsh Environments'. The seminar was conducted on 3rd December, 2014 at the premises of Gulf Consult in Shuwaikh.

Mr. De Beer has been involved in the concrete industry for about 34 years, firstly in South Africa and for the last 16 years in the Middle East. His presentation covered the following subjects: What is Fly Ash?; Classification Process; Fly Ash Standards and Compliance; Impact of Physical and Chemical Properties; and benefits of fly ash in concrete for chloride resistance, sulphate resistance and heat of hydration.

The informative presentation was greatly appreciated by a large audience comprising ACI-KC members and other interested engineers.



■ Corrosion of Concrete

On 14th April, 2015, Mr. Ken Howes, Technical Manager of Cementaid UK Limited, conducted a technical seminar on 'The 11 Mechanisms of Corrosion/Destruction of Concrete'. Cementaid UK, an international company founded in 1954, specializes in the manufacture of advanced admixtures for concrete.

In his presentation, Mr. Howes expounded on the wide range of chemical and physical processes involved in the different mechanisms of concrete deterioration. He noted that all mechanisms shared a 'common denominator' which is the route cause of premature corrosion or degradation of concrete. He also presented a simple hypothesis that if we can reliably produce concrete that does not allow water ingress and which will remain inherently 'dry' during its service life, none of these mechanisms can occur. A lively question and answer session followed the presentation.



The seminar was held at the premises of Gulf Consult in Shuwaikh, and many ACI-KC members attended.

■ Webinars

The Webinar programme being offered by ACI International continues with its wide range of interesting technical papers, seminars and case-studies being offered on-line to ACI members worldwide. Between December 2014 and April 2015, eleven Webinars were presented.

■ ACI-KC Students' Committee

Kuwait Chapter's Students Committee have as usual been very active over the past few months. Included amongst the many events and activities organized recently are the following:

■ Refurbishment

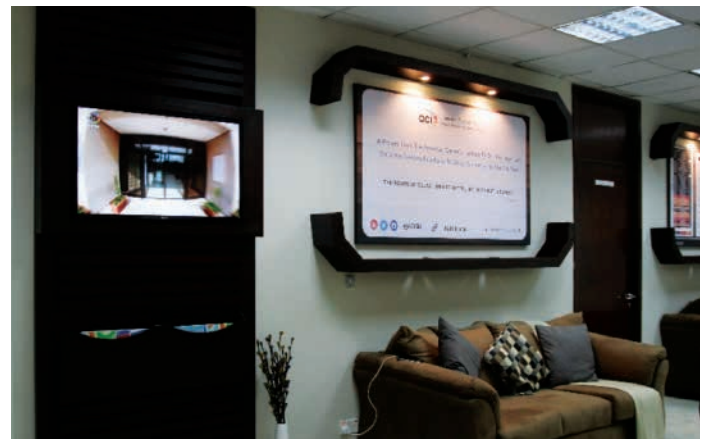
Under the sponsorship of KOC and Inshaa, the premises of the Civil Engineering Department of Kuwait University's College of Engineering and Petroleum, was renewed and refurbished.

■ Infinity and Beyond

Students organized and participated in a well attended open day, the theme of which was entitled "Infinity and Beyond". The theme was inspired by the appreciation and experience of outer space.

■ Field Trip

Dr. Ammar Ben-Nakhi kindly agreed to accompany students on a field trip to Kuwait University's new Sabah Al Salem University City campus at Shadadiya. Students were enlightened on in-situ technical aspects of civil engineering, particularly in concrete structures.



■ Campus Guide

An informal video on the location of civil engineering laboratories and their respective engineers within the campus was produced to help students locate these facilities.

■ Competition

A cardboard boat competition was organized to challenge students' abilities in constructing structure to withstand increasingly heavier weights.

■ Box Challenge

A "Secret Box Challenge" was conducted whereby participants had to guess a code that opened the box to collect the prize within.



Healthy Lifestyle

In order to promote healthier lifestyles, the Committee organized a seminar by Dr. Ali Alhaddad on healthy food choices. Also, arrangements were made for providing free testing for diabetes and blood pressure to coincide with International Day for Diabetes.

Environmental Awareness

In order to manifest their concern for environmental awareness, students participated in a campaign to collect plastic bottle caps. This commendable effort was organized by the “Cuz I’m Kuwaiti” team.

ACI themed folders and notebooks were distributed for student and faculty use.



■ Ready Mixed Concrete

Ready Mixed Concrete in Kuwait - A Brief History

Abdul Jaleel M. Redha, General Manager, Kuwait Canadian Ready Mix Co.

Abdul Wahab Rumani, Commercial Manager, Kuwait British Ready Mix Co.

Ready mixed concrete is more than a century old and traces its origins to Germany. It was first patented in 1903 in Germany, but the means of transporting it had not been developed sufficiently to enable the concept to be exploited for another couple of decades. In essence, the term ready mixed concrete is used for concrete mixed in a mixer and supplied fresh at the site of consumption. Ready Mixed Concrete is thus not only a product but also a service, as timely delivery with the right workability and temperature are critical aspects.

■ Historical Background

The first delivery of ready mixed concrete was made in Baltimore, USA, in 1913, but it took another 13 years before the first transit mixer was commissioned in 1926. The invention of the transit mixer acted as a catalyst for the growth of this industry.

The advantages of scale, efficiency of mechanical mixing, and improved control opened the way for the ready mixed concrete industry. The fact that most in-situ concrete is now supplied ready-mixed, is a measure of how successful this industry has been in terms of addressing and meeting the demand for quality and efficient services.

■ In Kuwait

In Kuwait the history of concrete dates back to early 1960s. In the very early days in Kuwait cement was available in bags. Gravel was manually extracted from the natural deposits in the wadis in north Kuwait, and sand was collected from the sea. These materials were then manually batched by volume and mixed at the work site in a portable mixer to produce concrete.

It was not until late 1970s that concrete was delivered ready-mixed in Kuwait. With growing demand for concrete during early 1970s, dry mix concrete batch plants came



Early transit mixer models

into operation. Truck mixers of about 5-6 m³, and concrete pumps of 21-28 m boom lengths were available for concrete delivery and placement. Raw material suppliers then began importing cement in bulk, and a cement milling plant was also established. Stone crushers were installed near to the gravel deposits in north Kuwait to ease the supply of crushed gravel in various sizes. Also, Kuwait Government identified and allocated suitable desert sand quarries where suppliers installed screening and simple screw type sand washing plants to enhance quality. During this period all major contractors had a concrete batch plant and a fleet of truck mixers and pumps dedicated to the project they were involved in. Equipment companies were established for hiring truck mixers, pumps and cranes.

The housing sector was growing rapidly during this period, but as mostly small contractors dominated this sector, they were using what was commonly referred to as "Irani Concrete", which was manually volume batched and mixed in a small portable mixer at site. It was around this time that one project contractor, 'Messers. Ruwaibe Shaam', is said to have sighted the commercial opportunity offered by the fast growing housing sector and began supplying concrete from their project plant as an alternative to 'Irani Concrete'. This company could therefore be credited for becoming a major catalyst in initiating the ready mixed concrete industry in Kuwait. Establishing of Ready Mix Concrete Companies in Kuwait.

■ Ready Mix Concrete Kuwait

In late 1970s and early 1980s, seeing the opportunity presented by this fledging industry, several local and foreign ready-mixed concrete companies came into existence. Almost all were established on government allocated land in Sulaibiya Industrial Area. Amongst the companies that were the first to set up their ready mix operations were NIC, IBC, KBRC, Khalifa Daeej Al Dabbous, Qatami, Behbehani, Khalifa Al-Jassem, and Arabic Center.

As the number of companies entering the sector increased the ready mixed concrete business soon grew to become an industry in itself, with its own environment and sustainability issues. As is the inevitable consequence of fast growth, complications and new dimensions were faced by the business. In order to address these concerns

and to overcome uncertainties and stabilize this business environment, a need for control regulations was felt. Unfortunately, before the control regulations and technical standards could be fully established, the 1990 Iraqi invasion of Kuwait crippled the country's economy.

Following Kuwait's liberation in February 1991, and as environmental considerations gained prominence, the ready mixed concrete industry was relocated to an isolated undeveloped new area in Kab'd. The allocated area was without any kind of basic infrastructure for the industry. Again for environmental concerns, in 1995 the Government closed the aggregate quarries in north Kuwait, and consequently aggregate imports from UAE began. The high cost of aggregate import thus significantly impacted concrete unit rates and the construction industry in general.



Advance sand washing plant

■ Post Invasion Facilities

On the positive side the post-invasion construction industry of Kuwait, possibly influenced by construction practices in Dubai, became more quality conscious. Major consulting offices were beginning to introduce durability requirements; and in late 1990 cement replacement material like GGBS (ground granulated blast-furnace slag) was specified for the first time in The Scientific Center project by Gulf Consult. Ironically, however, the material was at that time imported from UK for the project, but today local cement companies are grinding GGBS for domestic consumption. In due course a facility for producing cement clinkers was also developed.

As the industry evolved, the use of fly ash became popular for thick raft foundations for high rise buildings. Also, microsilica use became frequent for high strengths and for achieving durability parameters.

By early 2000, the persistent quality awareness campaigns by government bodies such as Kuwait Institute for Scientific Research (KISR), Kuwait Municipality, ACI-Kuwait Chapter and local consulting offices, resulted in the phasing out of traditional 'Irani concrete'. However dry mix concrete production, though unacceptable, was still in practice and it was not until the rise in demand for high strength concrete and the requirement of wet mix as specified by Gulf Consult, that the supply of dry mix concrete was significantly reduced. Regrettably it is yet to be totally eliminated.



Al Hamra Tower

■ High Strength Concrete

From 2005 onwards the demand for high strength concrete accelerated, which created a need for higher quality sand. This in turn forced sand suppliers to upgrade their sand washing technology to achieve better quality. In tune with the need, they adopted modern ways of washing sand; and today the major sand suppliers have the most advanced washing systems to produce highest quality of sand.

After over 40 years since inception, the industry today has grown in size and relatively improved in quality. There are currently over fifty ready mix concrete companies in Kuwait, and batch plants are now fully computerized with automatic operating systems, moisture control and the highest levels of batching accuracy.

Chilled water and ice plants are used for concrete temperature control. Transit mixers of 9-10 m³ capacities have become standard sizes, and mobile pump boom lengths have reached up to 63 metres. Static pipelines with placing booms are commonly used for high rise buildings now.

Concrete has even been pumped up to a record height of 412 meters for Kuwait's well-known Al Hamra Tower, the second tallest concrete structure in the world. On the other hand, concrete was also pumped 50 meters below the ground level for the Egaila Pump Station, - the deepest pump station in the Middle East. Large volumes of self-compacting concrete and high grade concrete mixes such as K 600-K 800 are produced consistently and are no longer considered high risk mixes.

■ Infrastructure

In spite of these advances the industry remains neglected. The ready mixed concrete industrial area lacks basic infrastructural facilities, a state of affairs that is symbolic of this apathy. A proper concrete waste disposal system does not exist. And more critically, an independent regulatory body with relevant technical standards is yet to be established. ACI-Kuwait Chapter could play a role in helping the industry in this area.

■ Interview

George Abi-Hanna

Resident Director, SSH, Kuwait



George Abi-Hanna was born and raised in Australia. Fate brought his immigrant family back to Lebanon, but the start of the civil war there disrupted life again; and accepting his Uncle's invitation to come to Kuwait was therefore an obvious choice.

■ Kuwait

George's Uncle, Mr. Sabah Abi-Hanna, was a partner in the consulting firm of Salem Al Marzouk and Sabah Abi-Hanna, better known as SSH. And from then onwards George's life, career and personal development were very much linked with his Uncle, and the growth and progress of his consulting firm.

After completing schooling in Kuwait, and with the Lebanese civil war still raging, he returned to Australia where in 1983 he graduated with a degree in Electrical Engineering, specialising in communication systems. Australia at that time was in recession, and the offer to join SSH in Kuwait was a welcome opportunity. His intention was to work for a while and then pursue further education, but little did George realise that a 31-year career with the firm had beckoned. The Operations Centre for National Bank of Kuwait was his first project, but he soon became involved in the Bayan Palace complex which was being constructed through a fast-track process for the 1987 Islamic Conference. The project was obviously an important and formative career step for George; and its successful completion clearly highlighted the value of prompt decision making, and the advantages of removing bureaucratic obstacles and rigid regulatory controls. He cannot help but bemoan the comparatively more constrained conditions under which consultants and contractors operate today.

■ SSH

By the late 1980s, under the guidance of its founding pillars, Sabah Abi-Hanna, Salem Al Marzouk and Charles Bosel, SSH had become one of Kuwait's largest consultancy practices. Further growth, however, was interrupted by the Iraqi invasion, and George returned to Australia. But within 4 months after the Liberation, as Kuwait embarked on a major reconstruction programme, he was called back to rejoin SSH as a Project Manager. This second coming was in effect his initiation into management and to progressively more involvement in the firm's strategic development.

In the mid nineties, George felt the need to enhance his

management skills and a four year distance learning MBA course with an Australian University, majoring in Technology Management, honed his management skills in aspects such as finance, law, economics, human resources and professional practice.

With the three SSH partners nearing retirement, the need for a graceful change of leadership became inevitable. As the firm prepared for the transition, George, together with Omran Hayat, was promoted into higher management in 1995. By 2003, however, a complete change was contemplated when Omran Hayat expressed interest in purchasing the company. This he ultimately did, with Sadoun Al Essa and Salem Al Marzouk partnering him as joint licence holders. The latter eventually stepped down.

■ Transition and Growth

Effecting the transition was indeed a major learning experience for George, as with the effective re-birth of the firm, it was his responsibility to carefully straddle the old legacy and future direction. This generational change also ushered in a different strategy for SSH, and with the young owners seeking more aggressive growth, George became instrumental in executing and consolidating this new era. The design office was strengthened, and the search for new markets was launched with Oman, in 2007, becoming SSH's first full-fledged regional office.

It was soon felt that Kuwait "was too small for the size and ability of the firm", and SSH decided to implement another major evolutionary change. A paradigm shift in direction was planned, and Mr. Bob Hope, who had expanded Atkins International in the northern gulf region, was hired to spearhead this challenge. Bob brought with him a leadership team and they formed the nucleus around which the firm's regional growth and a 5-year expansion plan was structured. George was ear-marked to manage the Kuwait operation; and come 2012, the firm's regional expansion was manifested with offices in Bahrain, Abu Dhabi, Qatar, Erbil, South Africa and London. The firm today has a staff of 950, with a projected increase to 1200-1500 in the near future.

■ Engineering Profession

In commenting on the engineering profession in Kuwait, George regrets what he perceives as a regression. Other countries in the region have obviously done better and moved faster, perhaps aided by the effectiveness of their institutions which govern the engineering profession, while Kuwait's institutions seem to have suffered as a result of political tensions.

There should be hope and optimism though. The amazing talents of young Kuwaiti architects and engineers can help in developing an extremely vibrant, competitive and progressive consulting environment. But they need a champion to guide them, and that is where the government can play an important role. It needs to encourage this talent and good initiatives need to be supported, as "there is nothing worse than having talent that you cannot take advantage of" he says. This valuable asset has to be carefully nurtured.

■ Design-Build Projects

George believes that the current trend of delivering large scale state projects through a design-build approach is not always achieving the essential objectives of saving time and cost. Design-build is traditionally more suited to projects defined in terms of process and performance requirements,

Academic/Professional Background

- University of New South Wales, Australia.
- Deakin University, Australia
- Bachelor of Engineering in Electrical Engineering, 1983
- Master of Business Administration (Technology Management), 1999
- Kuwait Society of Engineers
Registered Consultant (Electrical Engineer)
- MEW Licensed Electrical Engineer;
- Institution of Engineers, Australia (Chartered Professional Engineer).

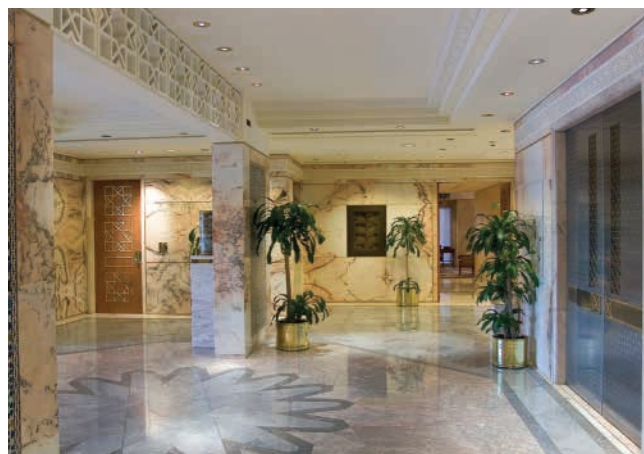
such as waste water treatment plants or power stations. In respect of buildings, where success is largely measured using non-tangible criteria like aesthetics, planning efficiency, conformance to statutory regulations and quality and cost, this approach is not necessarily appropriate. The inflexibility of our regulations and permitting process is not helpful, and public-sector decision making is often too rigid to facilitate expedited implementation. Consequently, without proper monitoring, most design-build projects do ultimately get delayed, and can incur compromises in quality, and cost. The objective is thus not always being achieved, and George strongly feels that the conventional 'design, tender and build' method is generally more appropriate for large and complex building projects.

Kuwait's Union of Consulting Engineering Offices is currently discussing various design and construction related aspects with concerned authorities. There is definitively room for improvement in the manner in which projects are procured, designed, permitted and implemented, and the Union's on-going consultations will hopefully streamline the processes that impact development here. As George aptly stated, "The profession knows the situation and it has the solutions. We just need a receptive audience".

■ Sustainability

Innovation, environmental issues and sustainable design are vital parameters which deserve committed consideration. While Kuwait has been somewhat slow in addressing these issues, there is now more awareness within the consulting fraternity and amongst concerned authorities. Although this is a positive development, a policy initiative backed-up by strong state leadership is essential for ensuring more serious attention to such issues.

Building Information Modeling (BIM) is another of today's realities that has to be pursued more vigorously by consultants, state institutions, builders and developers. The advantages are obvious and widely acknowledged, and the benefits encompass design phases, the construction period and ultimately future facility management. Total adoption of BIM will require 10-15 years, and it can succeed only if the government courageously takes the lead and makes the transition mandatory.



Bayan Palace



Bayan Palace

Commenting on how quality of design work can be improved, George highlighted the tendency to select consultants purely on price, rather than on relevant experience and technical capabilities. Fees constitute a very small percentage of total project costs, and he urged clients to apply more objective value judgements when evaluating consultants. Also, technical reviewers within and outside government agencies should be done by adequately qualified staff; and finally, the contribution that good project management firms can make in complex multi-packaged projects, should be appreciated.

■ Aspirations and Interests

As an interesting and wide-ranging interview neared its end, it was time to briefly dwell on George's aspirations, interests and hobbies. Firstly, he hopes that SSH can continue doing good work, and in the process meaningfully shoulder its corporate social responsibility by promoting Kuwaitisation and proactively contributing towards positive change in our honourable profession. He strongly believes in a healthy lifestyle and passionately pursues an active sporting and fitness regime. He is very interested in current affairs, and is a committed student of modern history, particularly that of our region. We are, he observes, beset with political turmoil, religious strife and cultural diversity, and understanding the past is the only way to try to explain the present. And there should always be hope for a better future.

George certainly came across as a committed and compassionate professional. I enjoyed talking to him.

Mr. George Abi-Hanna was interviewed by Aziz Mamuji

■ Technical Article

Synthetic Macro Fibres in Marine Applications

Gerard Attree MICT, Sales Leader, Grace Construction Products.

Blackpool sea defences in the UK have been constructed to protect 1,500 properties and the seafront tramway from flooding. The new sea wall constructed is the first of its kind to include synthetic macro fibres namely STRUX 90/40 instead of steel. Khalifa Port in Abu Dhabi, UAE selected this technology for it's inherent benefits to eliminate the risk of chloride induced corrosion and enhanced durability. This article explains the concrete reinforcement solution that is making inroads in the field of sustainable marine construction.

■ Blackpool Sea Defences

The complete £62m reconstruction of the seafront was always destined to be an impressive feat of maritime civil engineering. The new sea defences constructed along 3.2km of Blackpool's shoreline are rapidly becoming a benchmark for the rest of the world. Grace Construction Products was called upon to supply its innovative Strux 90/40 synthetic macro fibre technology to reinforce much of the concrete that is being installed along the length of Blackpool's promenade. It is the first time in the world that this technology has been employed for major reinforced concrete elements in marine coastal defences.



Artist's Impression: Blackpool Sea Defences

■ The Project

The project began in September 2005 and took approximately four years to complete and is designed to prevent shoreline erosion. Blackpool's Central Area Coast Protection Scheme is a major part of Blackpool Council's ambitious regeneration master plan, which stretches from the Sandcastle Waterworld, near Blackpool's South Pier, to beyond the North Pier.

Grace's synthetic macro fibre reinforcement was used in two main areas of the Blackpool project. Firstly, the cast in-situ concrete to create a 3.2km-long toe beam, which held 10,000 steel sheet piles firmly in place and act as a "stop" to the sea



The old sea wall during a major storm

defence steps, or revetment units, which rise from the toe beam to the promenade. It was also used in the revetment units, produced off site by SLP Precast Limited, at a purpose-built factory near Blackpool.

The Blackpool project was funded by the Department for Environment, Food and Rural Affairs. Rigorous testing evaluated the use of STRUX 90/40 and the decision made to use Grace's synthetic macro fibre to provide the reinforcement, following some innovative problem-solving by SLP Precast Limited.

■ Trials

Following research and laboratory-based proving trials, full-scale production trials were initiated. In addition to steel reinforcement being replaced by the Strux 90/40 technology,



Vacuum machine lowering precast unit

other constituents were included in the concrete mix. These were:

- Grace's Adva Flow 410, a superplasticising admixture, which is added to reduce both the water demand and hence the water/cement (w/c) ration of the concrete.
- Concrete "Fylde Buff" colour, added so that the exposed surfaces of the precast concrete closely match the colour of the beach sand.
- Polypropylene micro fibres, which are added to control the bleeding of water while the concrete is in the plastic state.

The addition of these four components, alongside CEM I, ground-granulated blastfurnace slag (ggbs) cement replacement, limestone-based aggregates and water, presented the concrete supplier with a challenge in repeatedly producing and supplying a consistent quality of ready-mixed concrete to SLP Precast from a dry batch concrete plant. Nevertheless, the initial trials paid dividends towards achieving a remarkable level of consistency early in the programme.

■ Project Challenges

The use of synthetic macro fibres presented a fundamental challenge for SLP Precast in the production of the revetment units. With the absence of a steel cage, there were no lifting eyes present to enable the straightforward demoulding and lifting of each 20-tonne revetment unit. Therefore, the concrete revetment units were lifted out of the mould by suction. A Dutch firm was commissioned to build bespoke vacuum lifting machines, capable of lifting the units from the mould, turning them 180° for storage while curing and then re-lifting and lowering them onto lorries for transportation to the construction site. A vacuum seal could still be achieved when the concrete surface had been shot-blasted to provide a non-slip surface.

These machines, which have a 20-minute failsafe lock in the event of a vacuum failure, had been used on site as well to lift the steps and lower them into position. The revetment units sit four or five deep behind the toe beam, acting as both a seating area for holiday makers and a barrier to the sea – where each step gradually dissipates the force of the incoming waves. Each unit contains 8m³ of fibre-reinforced concrete. In total, approximately 2900 step units had been cast, equating to about 23,000m³ of concrete. SLP Precast producing five revetment units per day.

With regard to the in-situ concrete pours, the fibre-reinforced concrete is poured into steel formwork on site to create the 3.2km toe beam. One of the main concerns for the main contractor was to ensure maximum efficiency was achieved in view of the restrictive tidal windows. The omission of steel reinforcement cages proved to be a significant benefit. Working times varied considerably according to the height of tides and level of the beach, giving an average working window of only eight hours per day. The main contractor noted they poured about 15 linear metres per day of the toe beam, compared with about 10m per day on previous jobs where steel had been used.

Using Strux 90/40 also removed the logistical problems of transporting and storing tonnes of steel fabric on site. Pouring the concrete into precast moulds off site, without the problems surrounding the placement of steel cages, also speeded up that side of the operation.

Inaugurated in December 2012, the state of the art \$390 million Khalifa Port is designed to handle all of Abu Dhabi's container traffic and is a key part of the Abu Dhabi economic vision 2030 mega project; with the neighbouring Kizad it is the largest infrastructure project ever undertaken in the Abu Dhabi Emirate. The main concrete slab at the container terminal required a 100 year design life and to achieve this in the challenging, high chloride conditions both a high durable concrete and non corroding reinforcement were required. Speed of construction was equally important. Based on these challenges and the design requirements Grace's macro fibre, STRUX 90/40 was specified and used throughout the 1 million squared metres of pavement area, the largest area of synthetic macro fibre laid to date in the Middle East region.



Khalifa Port

Concluding Remarks

The design life of the new sea defences at Blackpool and Khalifa Port are 100 years and because STRUX 90/40 has none of the potentially corrosive qualities of steel, which could have been a problem in these aggressive marine environments, the project teams utilised innovative admixture, fibre technologies and technical expertise from the manufacturers to deliver successful projects to meet these onerous requirements.



Revetment unit being vacuum-lifted out of the mould



Load testing of the revetment units



Some of the first revetment units in place

■ Social Activities

■ Site Visit: Ministry of Education Headquarters

On 17th January, 2015 Members of ACI-KC visited the site of the new Headquarters of Kuwait's Ministry of Education, which is currently under construction. The project is located in South Surra and is being managed by the Ministry of Public Works.

The visit was organized by the Chapter's Social Committee and commenced with a welcome note by the Resident Engineer, Mr. Jonathan Sagherian. This was followed by a presentation by Mr. Jay Stoughtenger, who outlined the architectural background to the project and explained the salient features of the building's design. The structural aspects, and especially the inclined column-wall system, was explained by Mr. Sanjeev Takkar, Structural Engineer.

Videos were shown to explain how the ETFE membrane was being assembled. (ETFE - Ethylene Tetra Fluoroethylene - is a transparent polymer that transmits light. It also is a very good insulator and is often called a miracle construction material for tensile architecture.) Pictures of the project highlighting different construction stages, were also shown.



Ministry of Education Headquarters

■ MOE Headquarters

Members were thereafter taken on a tour of the project's construction site.

ACI-KC would like to thank everyone who helped in organizing the visit.

Project Data

Client	:	Ministry of Public Works
User	:	Ministry of Education
Consultants	:	Cambridge Seven Associates, Inc., (C7A), USA Gulf Consult, Kuwait
Site Area	:	40,000 m ²
Building Area	:	142,300 m ²
Basements	:	104,500 m ² (3 Basements)
occupancies	:	3,800 Employees
Floors	:	Ground Floor + 11 floors
Parking	:	1,640 cars



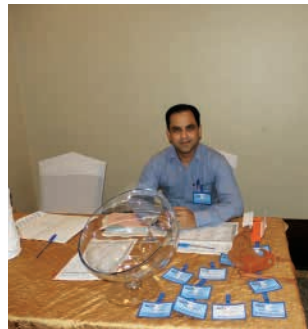
Ministry of Education Headquarters Site Visit

■ Annual Dinner

On 9th December, 2014 the Social Committee hosted ACI-KC's Annual Dinner for members and their families and friends at the Holiday Inn Hotel, Salmiya. The function commenced with a welcoming address by Ms. Dana Drobiova, Chairperson of the Social Committee.

This year the Committee chose to introduce some new games which called for all attendees to become involved. The first game was a variation of the classic 'Scrabble' word-game, whereby each table was given 8 randomly selected letters. The table forming the fastest long word won. The second game was Sudoku, and everyone present was given the same puzzle to solve. The fastest correct solution won the game. Both games generated a lot of excitement and keen competition, and it was obvious that everyone enjoyed themselves. A raffle draw was then conducted to give a chance to those who did not win the games! All winners received gift vouchers from Al-Shaya Company.

The evening concluded with Ms. Drobiova wishing everyone well for the New Year; and, of course, a great buffet dinner.



Annual Dinner at Holiday Inn Hotel, Salmiya

■ ACI-KC News

■ Annual Awards

ACI-Kuwait Chapter's Annual Awards Banquet will be held on 12th May, 2015, at the Jumeirah Messilah Beach Hotel. The grand function will focus on the presentation of the Award of Excellence for a commendable project; and the Award of Achievement for a candidate who has made a lifelong contribution to the development of the engineering profession in Kuwait.

The occasion will be graced by many dignitaries, ACI-Kuwait Chapter members and guests; and there is always a sense of anticipation with all attendees excitedly waiting for names of the awardees to be announced!

■ The CRSI Local and Distance Learning Programs

Concrete Reinforcing Steel Institute (CRSI) has announced an expanded "Blended Learning" library with the launch of several new continuing education programs available on multiple desktop, mobile, and local platforms for design and construction professionals. These new resources include:

- Interactive Webinars
- CRSI Webinar Archive- recorded webinars, including Q&A exchanges, are available for extended viewing. CRSI's first two courses will remain available for a minimum of 1 year;
- Online Courses: Self-paced learning on a wide range of topics including reinforced concrete basics and best practices. Seven new courses will launch in the spring; and
- Regional Seminars: Delivered by CRSI Region Professionals.

In addition, CRSI's new Online Detailer Training Course provides, as a member-exclusive benefit, reinforcing fabricators with more than 40 hours of job-specific detailer training as a reliable foundation for this important role in the reinforcing steel industry. The Detailer Training Program teaches participants about key people, project requirements,

and deliverables; provides an introduction to industry terminology and standards; and prepares trainees for a successful detailing career. CRSI's Detailer Training Program is designed to train and retain efficient reinforcing steel detailers in member's fabrication shops. Membership with Fabricator classification in CRSI is required; contact CRSI for details.

Information on webinars and continuing education courses can be found at www.crsi.org.

■ ACI-KC 4th International Conference and Exhibition

The ACI-Kuwait Chapter invites you to attend its fourth international conference and exhibition that will be held in Kuwait over the period 2830- March 2016.

The theme for the conference is "**Smart, Green and Durable Concrete Structures**". The Organizing Committee invites authors to submit papers related to the theme with particular emphasis on the following areas or any other area related to the theme of the conference:

- 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 of resilience 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

The official language of the conference will be English. However, papers may be also submitted and presented in Arabic.

All those who are interested in submitting paper(s) are requested to submit an abstract in 200300- words. The abstract may be submitted in either English or Arabic and should be accompanied by the name(s) of the author(s),

affiliations, mailing address and e-mail address. The following dates should be noted:

Abstract Submission	:	September 4, 2015
Abstract Acceptance	:	October 25, 2015
Draft Manuscript	:	December 13, 2015
Final Manuscript	:	January 24, 2015

Registration

- Registration is free for presenting authors and ACI-KC paid members
- Registration Fee for non-authors, including banquet attendance, is KD 250
- Authors and registered non-authors will receive a full set of documents and proceedings.

Contacts

Please send scientific papers and abstracts to:
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Other inquiries:

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Membership Applications

Engineering professionals interested in joining ACI-Kuwait Chapter may collect membership application form from the ACI-KC office located in Kuwait society of Engineers Premises in Bneid Al Gar . The Chapter Contact Numbers are:

2449071, 2448974 (Ext. 312)

Press Coverage

The Annual Awards function held in May, 2015 was an unqualified success and received considerable coverage in local newspapers. Excerpts from various newspapers are reproduced here.




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