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History of ACI Committee 548: The Past Thirty Years

by J. T. Dikeou

Synopsis: The paper reviews the historical development of polymers in concrete, and the history of ACI Committee 548, and it's sister organization, the International Congresses on Polymers in Concrete. Polymer concretes and polymer modified concretes have been studied and used since the1940's and 1950's; polymer impregnated concretes have been studied starting in the mid 1960s.

Three categories of concrete that contain polymers are: (1) polymer concrete (PC), (2) polymer modified concrete (PMC), and (3) polymer-impregnated concrete (PIC). Committee 548 was started in 1971, and from the start has been one of the most active and productive committees in ACI. The committee has produced seven documents, most of which have required committee action to reaffirm or revise over the years. The committee has also organized and conducted nine technical sessions at ACI Conventions, which have produced Special Publications (SP), and has organized two National ACI Seminars.

Keywords: ACI Committee 548; historical development; international congresses; properties of polymers in concrete

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INTRODUCTION

Before reviewing the history of ACI Committee 548, I'd like to first discuss a little about the historical use of polymers in concrete.

HISTORICAL DEVELOPMENT

Improvement of the properties of hardened concrete by the addition of polymers is now into its sixth decade. In the 1940's and 1950's, both polymer concrete and polymer-modified concrete were studied and used. Polymer concrete was being used in the mid 1950's in the production of prefabricated wall panels and floor tile (figure 1). Polymers used included both methyl methacrylate and polyester styrene based systems. The products were successful and continue to be used up to the present time.

Polymer concrete using polyester resins was also being considered in the 1950's for use in road and bridge overlays, pothole repairs, and airfield runway repairs. However, early formulations of polymer concrete for highway work, although relatively easy to mix and place, were found to be porous and not resistant to chloride deicing salt penetration, which permits corrosion of reinforcing steel to occur. The early products therefore did not have wide acceptance in the highway industry.

Polymer modified concrete that was developed in the 1950's was actually a mortar rather than a concrete. It was found that by introducing the polymer in the form of a latex, it could be made compatible with portland cement in the fresh mortar. Polymer modified mortars were initially used as overlays for industrial floors and later were used in the construction of prefabricated wall panels and as an admixture for shotcrete. Their use also expanded into the highway field in the production of bridge overlays. However, refining of the materials remained necessary, both in terms of the polymeric component and in terms of modification of the mixture from a mortar to a concrete.

In 1966, U.S. Government sponsored research was initiated to develop methods for impregnating hardened portland cement concrete with liquid monomers, which are subsequently polymerized in place to form the polymer impregnated concrete composite. Initial tests showed that the structural and durability properties of this new composite could be quite remarkable, prompting the U.S. Government to spend several millions of dollars over the next few years to identify suitable monomers for impregnation, develop impregnation processes, evaluate structural and durability properties of polymer impregnated concrete, and study and develop applications for polymer impregnated concrete.

However, because of the complexity and cost of the treatment process commercial applications for fully impregnated polymer impregnated concrete have not emerged. Nevertheless, the high level of worldwide interest in polymer impregnated concrete stimulated accelerated interest in polymer concrete and polymer modified concrete development, and it was from this point in time that worldwide studies and applications of these composite materials started to rapidly evolve.

ACI COMMITTEE 548, POLYMERS IN CONCRETE

Following approval by the ACI Technical Activities Committee, ACI Committee 548, Polymers in Concrete, held it's organizational meeting at the spring 1971 ACI Meeting in Denver, Colorado. The first Chairman of Committee 548 was George B. Wallace, then Head of the Polymer Concrete Group at the Bureau of Reclamation's Engineering and Research Center in Denver (figure 2). George was a wonderful visionary and organizer who set the Committee on the course which it still follows 30 years later. One of the more interesting procedures that George initiated was that, following the Committee's business session, George went "around the table" and invited all attendees to present a brief discussion of the particular work with polymers in concrete that they were involved in. This procedure has been and is still followed today. Another procedure George initiated and is still followed today is that document preparation is accomplished in Task Groups and Subcommittees, and presented to the Committee for letter ballot or at Conventions for final action. So, time is not wasted at Committee meetings with boring time consuming activities such as crossing T's and dotting I's on Committee documents, as is done at so many other committee meetings.

The first undertaking of the Committee was to prepare a State-of-the-Art Report on Polymers in Concrete. The Committee membership was assigned to one of five task groups, and work was begun. Through George's initial push, the report was approved and published in some sort of record time for an ACI document.

At the same time that work was started on the State-of-the-Art Report, work was

started on organizing Technical Sessions on Polymers in Concrete for the Fall ACI Convention in 1972 in Hollywood, Florida, and for the Spring 1973 Session in Atlantic City, New Jersey. Both sessions were quite successful.

Because of a change in employment and professional interests, George Wallace gave up the Chairmanship of Committee 548 at the end of his first 2-year appointment, and I became Chairman at the spring 1973 ACI Meeting, continuing as Chairman until Spring 1979. I was followed by David Fowler, who was Chairman from spring 1979 through spring 1985. The next Chairman was Jack Fontana who served from spring 1985 until Spring 1991, and Jack was succeeded by D. Gerry Walters who was Chairman from Spring 1991 until Fall 1996. And this brings us to our current Chairman Albert O. Kaeding who started his term at the fall 1996 ACI Convention (figure 3).

In my mind, Committee 548 has continued it's initial impetus of busy activities started in 1971. Over all the years, it has consistently had one of the largest memberships of all ACI Committees, including voting, associate and consulting members from around the world. I can just about guarantee you that no other ACI Committee has been more productive. Let me back this up with the following data regarding published documents, sponsorship of Technical Sessions at ACI Conventions, and organization of ACI Seminars.

PUBLICATIONS

Published Committee Reports

ACI 548	Polymers in Concrete, State-of-the-Art Report
ACI 548.1R	Guide for the Use of Polymers in Concrete
ACI 548.2R	Guide for Mixing and Placing Sulfur Concrete in Construction
ACI 548.3R	State-of-the-Art Report on Polymer Modified Concrete
ACI 548.4	Standard Specification for Latex Modified Concrete (LMC) Overlays
ACI 548.5R	Guide for Polymer Concrete Overlays
ACI 548.6R	Polymer Concrete Structural Applications - State-of-the-Art Report

Along with other Committee work, numerous updates and revisions have been made, approved, and incorporated in the above documents.

SPONSORSHIP OF TECHNICAL SESSIONS AND PUBLICATION OF ACI SP'S

Committee 548 has regularly sponsored Technical Sessions at ACI Conventions,

and has published proceedings of such sessions as ACI SP's. Following is a listing of the proceedings:

ACI SP-40	Polymers in Concrete	1973
ACI SP-58	Polymers in Concrete	1978
ACI SP-69	Applications of Polymer Concrete	1981
ACI SP-89	Polymer Concrete - Uses, Materials, and Properties	1985
ACI SP-99	Polymer Modified Concrete	1987
ACI SP-116	Polymers in Concrete: Advances and Applications	1989
ACI SP-137	Polymer Concrete	1993
ACI SP-166	Properties and Uses of Polymers in Concrete	1996
ACI SP-169	In-Place Performance of Polymer Concrete Overlays	1997

ACI SEMINARS

At the request of ACI Local Chapters and the ACI Education Department, Committee 548 organized and conducted two ACI Seminars on Polymers in Concrete. The first was held in Denver, Colorado in 1973, in cooperation with the ACI Rocky Mountain Chapter, and the second was held in Albany, New York in 1978, in cooperation with the ACI New York Chapter. Both involved speakers from the Committee 548 membership, and were received with much enthusiasm.

ICPIC ACTIVITIES

I'd like also to say a few words about an offspring of Committee 548, which is the International Congresses on Polymers in Concrete (ICPIC). The first international meeting on polymers in concrete was held in 1975 in London. About 300 persons from over 30 countries attended the First Congress. This Congress proved to be extremely useful. For the first time representatives from around the world gathered to present and exchange information on incorporation of these relatively new synthetic polymer materials into concrete. Much new information was presented on research and development of materials, processes, and properties of a variety of polymer-concrete composites. In addition, the latest information on the technological and economic feasibility of numerous applications was presented and explored. It became apparent that these materials could be used advantageously for many applications.

Following the success of the First Congress, it was decided that such meetings should be held at regular intervals, and I, as current Chairman of Committee 548 was asked if I could find a home for ICPIC-II in the United States. Following the

Second ICPIC Congress, Committee 548 gave its endorsement of this activity, and the ICPIC Organization became a reality.

The meetings, with dates and locations for ICPIC Congresses, are as follows. Ten Congresses have now been held, as shown below (figures 4, 5, and 6):

	DATE	LOCATION	ORGANIZED BY
ICPIC-I	May 1975	London, England	The Concrete Society
ICPIC-II	Oct 1978	Austin, USA	University of Texas
ICPIC-III	May 1981	Koriyama, Japan	Nihon University
ICPIC-IV	Sept 1984	Darmstadt, Germany	Technische Hochschule Da
ICPIC-V	Sept 1987	Brighton, England	Brighton Polytechnic
ICPIC-VI	Sept 1990	Shanghai, China	Tongji University
N.A. Workshop	Sept 1991	San Fransisco, USA	American Concrete Institut
ICPIC-VII	Sept 1992	Moscow, Russia	Research Institute of Concr Reinforced Concrete
IBRACON Workshop	Oct 1993	Salvador City, Brazil	Instituto Brasileiro do Con
ICPIC-VIII	July 1995	Oostende, Belgium	Katholieke Universiteit Le
Central European Workshop	Sept 1996	Bled, Slovenia	Institute for Research-Mate Applications
ICPIC-IX	Sept 1998	Bologna, Italy	Universita di Bologna
ICPIC-X	May 2001	Honolulu, USA	ICPIC

CONCLUSIONS

From the time that Committee 548 was formed in 1971 (30 years ago) to the present, many advances have been made in the commercial and practical applications of polymers in concrete. Many refinements have emerged, as a result of efforts of both researchers and commercial producers, which have converted laboratory processes into commercially and economically feasible products. From a review of what has happened to date, it is evident that much future progress will be made with these "new construction materials." Time will tell where the economics will balance with the increased costs. But, it is very exciting to view the progress in improvement in properties that are possible.

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13. Polymers in Concrete, Proceedings of the Fourth International Congress on Polymers in Concrete, Darmstadt, Germany, September 1984.
14. Polymers in Concrete, Proceedings of the Fifth International Congress on Polymers in Concrete, Brighton, England, September 1987.

15. Polymers in Concrete, Proceedings of the Sixth International Congress on Polymers in Concrete, Shanghai, China, September 1990.
16. Polymer Conference, American Concrete Institute SBM –1, 1991.
17. Polymers in Concrete, Proceedings of the Seventh International Congress on Polymers in Concrete, Moscow, Russia, September 1992.
18. Polymers in Concrete, Proceedings of the IBRACON Workshop, Salvador City, Brazil, October 1993.
19. Polymers in Concrete, Proceedings of the Eighth International Congress on Polymers in Concrete, Oostende, Belgium, July 1995.
20. Polymers in Concrete, Proceedings of the Central European Workshop, Bled, Slovenia, September 1996.
21. Polymers in Concrete, Proceedings of the Ninth International Congress on Polymers in Concrete, Bologna, Italy, September 1998.

Figure 1: Precast Wall Panels (courtesy of Prusinski).

Figure 2: George B. Wallace.

Dikeou

Walters

Fontana

Fowler

Kaeding

Figure 3: Committee Chairmen.

Figure 4: The Third International Congress.

Figure 5: The Sixth International Congress.