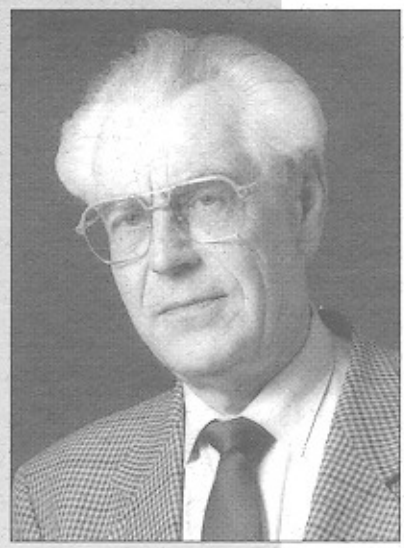
FRP
Fiber Reinforced Plastics
International
Spring, 1994 Volume II, Issue 2

Guest Author – Mr. Arie Gerritse,

Mr. Gerritse is currently a private structural consultant specializing in the use of FRP for Civil Engineering applications and assisting Dutch research organizations in developing codes and regulations in this field and other structural fields. Mr Gerritse received his engineering degree in 1950 from Rotterdam Technical College. He has accumulated extensive engineering experience working for seventeen years with the research and development group of Hollandsche Beton Group, an international contractor based in Netherlands as well as in other consulting companies since his graduation. Mr Gerritse's research work in the field of Advanced Composite Materials started in 1979 in cooperation with Mr. H. J. Schürhoff of AKZO: in 1986, they presented their work on "Prestressing with Aramid Tendons" at the 10th FIP Congress in New Delhi. Mr. Gerritse supervised the AKZO/HBG Development project on the practical use of Aramid in concrete and initiated the Brite/Euram project in the development of non-metallic tensile elements produced in 1991.



Mr. Arie Gerritse, Principal, Gerritse Consultancy, Rotterdam, The Netherlands

Mr. Gerritse emphasizes that the positive effect of using these new advanced materials to solve existing problems could possibly lead to "new", unexpected or even undesirable phenomena. Due to the fundamental differences between these new materials and steel, whose properties are well understood, attention should be given to the various design aspects especially to those related to "ductility" of concrete structures. Attention should also be given to other characteristics such as relaxation, stress rupture due to long-term tensioning, survival of fibres in alkaline environments, and bond or stress transfer phenomena.

Mr. Gerritse points out that the potential use of FRP is unlimited, as demonstrated by the use of Arapree bars to prestress over 2000 concrete panels, 35 mm thick, in the construction of fish passage structures shown in Figure A. Arapree is also used in rehabilitating masonry structures and for strength and stability. Currently there are several restoration projects for old brick work of churches and monasteries exposed to weather conditions, using non-metallic elements via prestressing in bored holes. The FRP tendons are produced by SIREG, Italy.

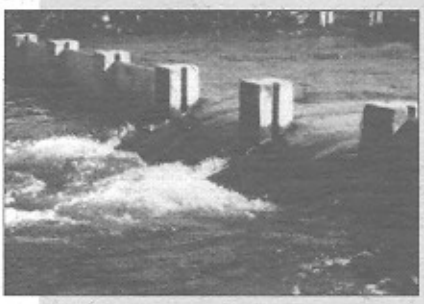


Figure A. Fish passage prestressed by Arapree bars, Netherlands.

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Composite Structures

Prestek Integrated Building System for CUA

The first major civil engineering structure constructed with the *Prestek Integrated Building System* was recently completed on the campus of the Catholic University of America. The Prestek System, developed by the Philadelphia engineering firm of E.T. Techtonics, Inc., features the use of high strength fibreglass structural members and aramid fiber tensioning cables. The system was used to construct a new composite material bi-level canopy and sunscreen over the entrance to Pangborn Hall, the home of the CUA School of Engineering (shown in Figure 1). The use of composite materials and the Prestek Integrated Building System for the new CUA canopy

Figure 1. Bi-level FRP canopy of Catholic University of America

resulted from close professional ties between the Catholic University, Creative Pultrusions, Inc., and E.T. Techtonics.

The Prestek Integrated Building System is designed to be a cost-effective solution for conventional industrial use and can also be easily adapted to many special applications such as roof canopies, shade shelters and viewing platforms for parks, and atrium enclosures for shopping malls and hotels. The Prestek System combines traditional composite advantages of corrosion resistance, non-conductivity, and ease of construction. Added benefits include long-span, adjustable load carrying capabilities, and built-in pipe hanger supports.

For further information, please contact: Prof. Larry Bank, Catholic University of America, FAX: (202) 319-4499.

Konaji Bridge

After one year of use and monitoring, the Konaji FRP cable-stayed bridge establishes that the use of HiPURR rods and CFRP cables was a success. The bridge is a 28.2 m long pedestrian cable-stayed concrete bridge in Iwafune Golf Club, 100 km north of Tokyo (as shown in Figure 2). Each stay cable consisted of seven ø 8 mm HiPURR rods developed by Arisawa Manufacturing. The characteristics of the four GFRP and two CFRP cables are:

	GFRP - ø 8	CFRP7 - ø 8
Ultimate load (Kn)	518-565	710-813
Unit weight g/m	700	560

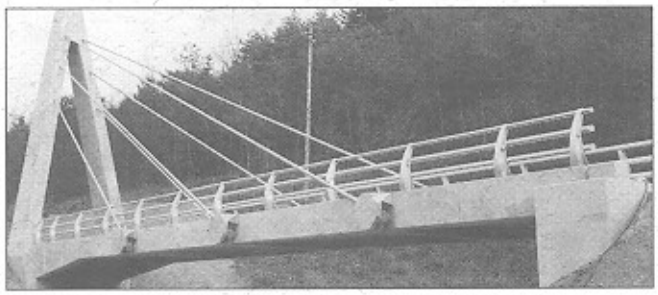

Figure 2. Konaji FRP Cable-stayed Bridge, Iwafune Golf Club, Japan

The bridge is owned by Tochikohyo Co., Ltd. and was designed and contracted by Kumagai Gumi Co., Ltd. The construction was completed in December 1992.

For further information, please contact Mr. Ben Honda, (PC Group, Technical Div.) Kumagai Gumi Co., Ltd., 2-1 Tsukudo cho, Shinjuku, Tokyo 162 Japan, FAX: 81-3-3255-8525.

Technora Rods for Flexible Drainage System

Aramid FRP Technora rods have been used in the construction of precast concrete drainage culverts constructed in the Ariake district of Saga prefecture, well-known in Japan for its soft clay soil (Figure 3).

The precast box culverts were linked by a continuous Technora cable to form a flexible structure capable of adapting to large ground movements. Aramid FRP Technora rods were selected due to their low elastic modulus, high tensile strength, and non-corrosive characteristics. The continuous cables play a major role in providing flexibility to the structure. For further information, please contact Mr. S. Kumagai, Sumitomo Company, FAX: 81-3-3353-6656.

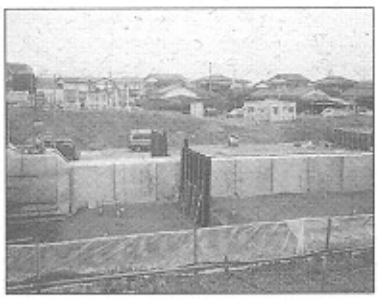

Figure 3. Flexible Box-culvert drainage system, Ariake, Japan

New Publication

The Japan Society of Civil Engineering has recently released an English version of its publication *State-of-the-Art Report on Continuous Fiber Reinforcing Materials.* Topics include:

- Characteristics of Materials
- Characteristics of Members
- Durability
- Examples of Application
- Design Concepts
- Test Methods
- Durability of Materials.

Cost of the volume is $47.00 US. To purchase, please contact the JSCE at FAX: 81-3-3355-3446.

Conferences and Meetings

2nd International FRP Symposium Call For Papers

The Second International Symposium on Non-metallic (FRP) Reinforcement for Concrete Structures (FRPRCS-2) will be held at the Universiteit Gent (University of Ghent), Belgium, 23-25 August, 1995. Topics will include; material properties, material testing and design characteristics; structural behaviour of reinforced and prestressed concrete, design and code, repair and upgrade, and sensor techniques for monitoring behaviour. Persons interested in submitting a paper should forward a 600-word abstract by 1 October 1994 to the symposium chair, Prof. Luc Taerwe, FRPRCS-2 Secretariat, Magnel Laboratory for Concrete Research, Universiteit Gent, Department of Structural Engineering, Technologiepark-Zwijnaarde 9, 9052 GENT-Zwijnaarde BELGIUM. FAX: +32-9-264-5845.

FRP Think Tank

The Ministry of Transportation of Ontario, with sponsorship from the Advanced Composite Materials in Bridges and Structures Network of Canada, Industry Canada and Public Works Canada, hosted a two-day think-tank to answer some of the most pressing questions regarding the use of FRP in infrastructure. Two dozen participants were invited from across North America, with representation from manufacturers, engineering firms, research laboratories, government agencies and the military. Five objectives were identified for discussion at the think tank. These were:

(i) To identify defence-related technologies that are now available for civil use and to develop strategies and find conditions for quick access to them;

(ii) To identify the potential uses for the fibres other than those which are already well known and being explored;

(iii) To identify the sources of funding, and means of receiving them, for the transfer of FRP technology;

(iv) To develop strategies to encourage the acceptance of the new materials by both engineers and owners of facilities; and,

(v) To develop strategies to encourage domestic industries to manufacture FRP products for civil applications.

A report of the final recommendations and discussions of the participants is being prepared for publication. For further information, please contact Ms. Cindy Lucas, Research and Development Branch, 3rd Floor Central Building, Ministry of Transportation, Tel: (416) 235-4073 FAX:(416) 235-4872.

Report on ACI Activities

On March 21, 1994, ACI Committee 440 - FRP Reinforcement met in San Francisco, California. The committee is now completing the State-of-the-Art Report on the Use of FRP Reinforcement for Concrete Structures. In mid-July, the final draft will be submitted to the membership for letter ballot. During the October committee meeting to be held in Tampa, Florida, all negative votes will be resolved. A publication date is expected for the end of 1995, after the report is reviewed and approved by the Technical Activities Committee of ACI.

Following the ACI - 440 meeting, a technical session entitled "Bond of FRP Rebars and Tendons" was held. Seven papers were presented at this session. A proceedings volume will not be published. However, copy of the 4-page papers can be obtained from Prof. M.R. Ehsani Tel: (602) 621-6589, FAX: (602) 621-2550, Email: EHSANI@VMS.CCIT.ARIZONA.EDU

For further information please contact: Prof. A. Nanni (ACI - 440 Chairman) Tel: (814) 863-2084, FAX: (814) 863-4789, Email: AXN2@PSUVM.PSU.EDU\

4th International Conference on Short and Medium Span Bridges

Halifax, Nova Scotia, Canada is the site for the prestigious 4th International Conference on Short and Medium Span Bridges (SMSB IV). The Conference will be held from 8-11 August 1994, at the Halifax Sheraton Hotel, on the Halifax waterfront.

Pre-registration figures exceed 300 delegates from: the United Kingdom, Hong Kong, Japan, Switzerland, the United States, Australia, Finland, Pakistan, India, China, West Indies and Canada. Each of these countries is also represented on the technical committee.

The 120 technical papers focus on concerns of immediate interest to practising bridge engineers: Code Developments — analysis, design and decks; Rehabilitation of Structures — construction, loading and maintenance; Advanced Composite Materials — research and development, testing & models and prestressing of FRP tendons.

The keynote topics set the Conference tone. Dr. Taketo Uomoto, University of Tokyo, Japan, will give an address on "The Use of Advanced Composite Materials in Bridges and Structures in Japan." Dr. Rodger Dorton, P.Eng., Chairman of the Canadian Highway Bridge Design Code, will speak on "Code Developments in Canada." Dr. Man-Chung Tang, DRC Consultant Inc., USA, will discuss "Construction of Bridges: Automation and Use of New Materials," and Dr. Gamil Tadros, Strait Crossing Inc., Canada will present "The Prince Edward Island Fixed Link."

The Conference Proceedings include all keynote and technical papers, plus 50 more which were unable to be included in the four-day agenda. For further information, please contact Mr. John Dow, P.Eng., Chairman, Publicity Committee FAX: (902) 420-8949 or Ms. Leigh Beauchamp Day, Publicity Committee FAX (902) 422-8380.

Composites Institute Conference a Success

The 49th Annual Composites Institute Conference and EXPO'94, which was held 7-9 February 1994 in Cincinnati, OH, focused on the rapidly growing field of structural composites for civil infrastructure applications. Over 3,500 attendees from industry, government, and academia both in the U.S. and world-wide gathered to hear the latest information about this fast growing area.

James Pirot, President of the American Society of Civil Engineers (ASCE) and Hervey Bernstein, President of the Civil Engineering Research Foundation (CERF) told a jammed session that the U.S. civil engineering community realizes that new technology is

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needed in order to improve productivity, build more reliable, low-maintenance structures and to enable continued innovation in the profession. Government experts from research and operations areas echoed the theme. Structural composites have been identified as one of the most promising materials systems for reinforcing concrete and primary structures.

The Composites Institute, ASCE, American Concrete Institute (ACI), CERF and others will be cooperating on joint initiatives to develop and demonstrate structural composites in the civil infrastructure. Promulgation of specifications and standards as well as practitioner education have also been identified as areas which will require a high level of joint cooperation. For further information, please contact Catherine A. Randazzo, Executive Director of the Composites Institute at (212) 351-5405 or Douglas S. Barno, CI's Market Development Coordinator at (614) 587-1444.

IABSE Call For Papers

The International Association for Bridge and Structural Engineering has issued a preliminary invitation and call for papers for its symposium, *Extending the Lifespan of Structures*, to take place in San Francisco, CA, USA, 23-25 August 1995. Themes to be covered in this symposium are:

Evaluation of Existing Structures Repair and Strengthening of Existing Structures Strengthening for Improved Seismic Performance Monitoring and Maintenance for Longer Life Design and Construction Issues

Participants wishing to present a contribution - paper or poster - to the above themes are invited to submit an abstract. The abstract should be typewritten in English and should not exceed 500 words. Four copies of the abstract must be delivered before June 30, 1994 to the IABSE secretariat in Zurich. Authors will be informed by October 15, 1994 about the acceptance of their proposed paper or poster. Completed papers must be submitted by January 31, 1995. For further information, please contact the IABSE Secretariat, ETH-Hönggerberg, CH-8093 Zurich, Switzerland, FAX: 41-1-371-2131.

New Products

CFCC Ground Anchors

The Research Institute of Japan Highway Public Corporation, the Zenitaka Corp, Kowa Corp., and Tokyo Rope Mfg. Co., Ltd., have jointly developed a new type of permanent ground anchor.

CFCC was used as an alternative ground tendon in place of pre-stressed steel. The end of CFCC is fixed to a stainless steel sleeve and locked with a stainless steel nut. In addition to the rust-free characteristics, the new tendons are much simpler structurally, more lightweight than the conventional ground anchors, and easier to install, with the added characteristic of re-stressing capability for future maintenance.

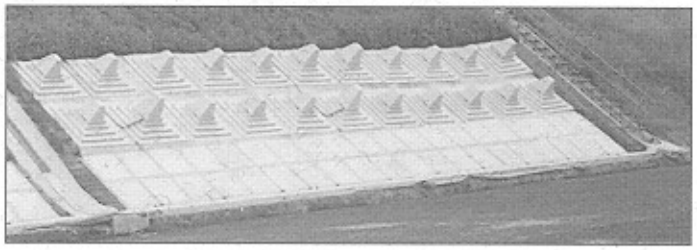

Figure 4 CFCC Ground Anchors, Abuta, Hokkaido, Japan

This new ground anchor was installed for slope stabilization for the first time in the world at Abuta, Hokkaido, Japan, in 1993 (Figure 4), and has an allowable load capacity of 50 tons. The tendon length is 20.5 m and 24.5 m, and the borehole diameter is 115 mm.

A lightweight passive pressure plate was used for the first time in place of a heavy precast concrete plate. This lightweight plate is produced by Sekisui Chemical Co., Ltd., and is made of urethane reinforced with glass fiber.

For more information, please contact Mr. Aoyagi, Civil Engineering Headquarters, Zenitaka Corp. FAX: 81-3-5210-2352.

Lightweight, Insulated Composites Hold Energy Lines

A new composite electric utility pole and cross arm system installed by a small helicopter in Las Vegas, NV, dramatically demonstrates the potential of composite structures for solving today's power industry problems.

The composite structures, manufactured by Composite Power Corporation of Las Vegas, are lighter in weight and provide better electrical insulation properties than their traditional counterparts. The lighter weight composite structures can be delivered faster and cheaper using small lightweight helicopters instead of heavy-lift sky cranes, as shown in Figure (5).

Figure 5 Helicopter installation of Composite Electric Pole

The demonstration system - a 14 m (45 ft) pole and six-phase array, fully loaded with conductors - weighs only 363 kilograms (800 pounds). The array, called a "high phase order," is a triple cross arm structure holding a double-circuit, six-phase compact energy delivery system. Southern California Edison (SCE) assisted with the configuration of the conductors for the demonstration system's array, which can be used for either distribution or transmission lines, as shown in Figure (6).

For further information, please contact Frank L. Michaels, Amoco Chemical Company, FAX: (312) 856-4151.

Figure 6 Composite Electric Pole Triple Cross-arm Cable Array

Future Projects

A 1000 Ft FRP Cable-Stayed Foot Bridge

The City of Lincoln and University of Nebraska researchers are developing a fiber reinforced plastic cable-stayed bridge that will improve pedestrian safety at one of the city's busiest intersections.

The research will investigate the feasibility of constructing a cable-stayed bridge built completely out of advanced composite material using Fiber Reinforced Plastics (FRPs). The bridge will be a full-scale, experimental structure that will serve as a test of the strength, serviceability, durability, and cost effectiveness of FRPs in large scale construction. The main span of the bridge will be approximately 150 m (500 ft) with two side spans of 75 m (250 ft) each, as shown in Figure (7). The bridge is expected to have the longest span of its kind, worldwide. The research experiment will build on knowledge gained through the 120 m (394 ft) pedestrian FRPs cable-stayed bridge completed in Scotland in the autumn of 1992 (reported in *FRP International*, Summer 1993, Vol. 1, Issue 3).

For further information, please contact Mr. Bruce Michaelson, project administrator, Tel: (402) 441-7570 or Dr. Magdi A. Khalifa, project manager, Tel: (402) 472-8771.

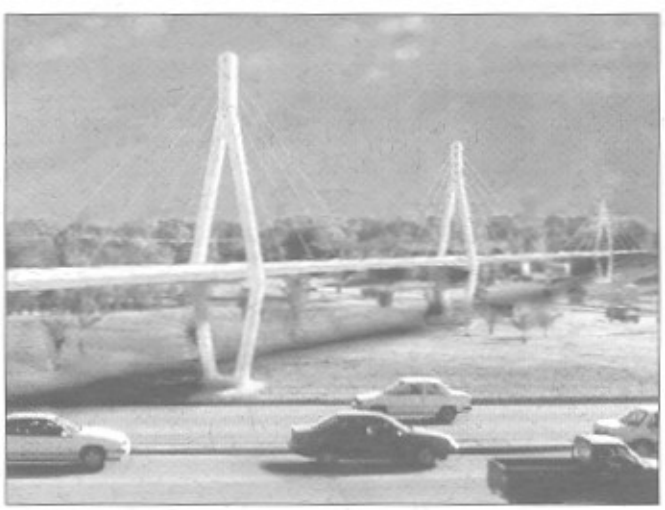

Figure 7
Computer Image of Planned FRP Foot Bridge, Lincoln, Nebraska, USA

World's First Composite Lifting Bridge

The world's first composite lifting bridge is to be built across the Stroudwater Navigation Canal in Gloucestershire, England. It replaces a former swing bridge which has to be restored as part of a plan to re-open the canal to navigation.

The bridge will have a span of 8 m, a width of 4 m, and will carry full traffic loading to an industrial estate. It is being built using the Advanced Composite Construction System (ACCS) developed by Maunsell Structural Plastics and used on the Aberfeldy Bridge in Scotland (reported in *FRP International*, Summer 1993, Vol. 1, Issue 3). The bridge will consist of a single box beam 800 mm deep, made up from ACCS units bonded together.

The box section cells that are to carry the wheel loads (up to 10 t each), similar to the configuration shown in Figure (8), will be stiffened by filling them with epoxy foam. The light weight of the units means that the bridge can be lifted by hydraulic rams to allow the passage of boats, without the need for a counterweight. The bridge is being built as part of a Department of Transport research project in association with the composites research unit at Surrey University.

For further information, please contact Mr. Peter Head, Maunsell Engineering, FAX: 44-81-663-6723.

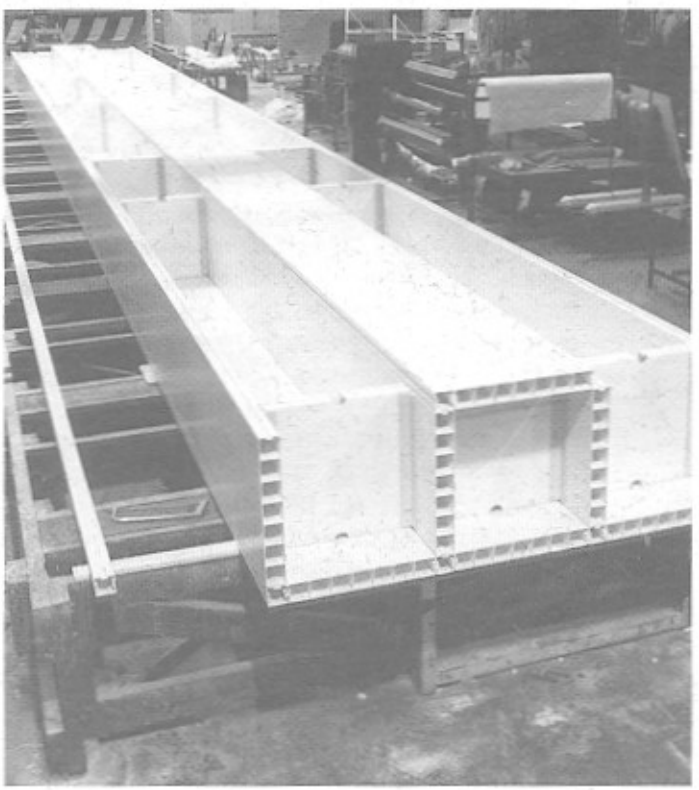

Figure 8
Box beam developed by Maunsell Structural Plastics, UK

M.Sc. Theses

HOLTE, Lars Erik. M.Sc. 1993. Anchorage of Non-Metallic Prestressing Tendons. Department of Civil and Architectural Engineering, University of Wyoming. Laramie, Wy. USA.

ZHAO, Lei. M.Sc. 1994. Behaviour of Carbon Fiber Composite Tendon Prestressed Concrete Planks Under Static and Fatigue Loading. Department of Civil and Architectural Engineering, University of Wyoming. Laramie, Wy. USA.

Research

FRP Research at L'Université de Sherbrook

Two research teams have been formed at the Université de Sherbrooke to investigate FRP for civil engineering construction. Drs. K.W. Neale and P. Labossière are researching the use of CFRP laminates to strengthen reinforced concrete columns and beams. They are also conducting experimental and analytical stress-strain studies on typical laminae and laminates to identify failure criteria for the material, and to help in optimizing their use in the foregoing applications. For this work they are preparing uniaxial coupons and cruciform specimens specially constructed for their biaxial testing apparatus.

The second research team is headed by Drs. B. Benmokrane and O. Chaallal. They are investigating the use of the GFRP bar, tradename ISOROD, produced by Pultrall Incorporated, from Thetford-Mines, Quebec, Canada. In addition to studies on the mechanical and durability properties of the ISOROD bars, flexural tests are being conducted on concrete beams reinforced for flexure and shear using these bars. Special studies are being conducted on the use of ISOROD to rehabilitate beams and slabs and on the use of a steel core for the rods. For further information, please contact: Dr. Pierre Labossière or Dr. Brahim Benmokrane, Department of Civil Engineering, Université de Sherbrooke, Sherbrooke, Québec, Canada J1K 2R1. Tel: (819) 821-7114 FAX: (819) 821-7974.

Canadian R &D Unitiative Planned

The Society of the Plastics Industry of Canada (SPI/Canada) announced that it will be forming a partnership with the Composites Institute (CI) of the SPI in the U.S. to develop a new capability in support of development of new applications for structural composites in concrete throughout North America. The two groups hope to link Canadian resources to CI's highly-successful composite market development in the U.S., combining programs where beneficial, or creating separate initiatives in each country as appropriate.

The new initiative will identify opportunities for structural fiber-reinforced polymer (FRP) composites as reinforcements for concrete including dowel bars, reinforcing rods, tendons for pre-stressing and post- tensioning, and cable-stays. The industry group will also focus on identifying and developing applications for structural composites as primary elements (beams, columns, plates, etc.). The Canadian program, which is in the process of being developed in concert with CI, is expected to be organized during March.

Through this program, the Canadian composites industry will also undertake a program of outreach to key trade & professional organizations, government, end-users/ practitioners and academia. A national symposium to unveil and initiate the program in Canada is being planned for later this year. For further information, please contact Mr. Basil Darrah, SPI/Canada in Don Mills, Ontario, Canada at Tel: (416) 449-3444.

New Interest in Thermoplastic FRP Tendons

A new generation of reinforcing rods and tendons is getting the attention of U.S. researchers. These rods feature thermoplastic matrix polymers rather than the traditional thermosetting resins (polyester, vinyl ester, epoxy, etc.). Theoretical advantages for many of the thermoplastic matrix resins include greater tensile elongation properties, superior alkali resistance, molecular orientation during processing and recyclability.

At least two U.S. firms have active thermoplastic tendon or rebar R&D programs. Thermoplastic Pultrusions, Inc. (TPI) of Bartlesville, OK and Thermoplastic Pultrusion Technologies (TPT) of Yorktown, VA are investigating this new technology. TPI recently presented a summary of its latest research at the 49th Annual Composites Institute Conference and EXPO'94 in Cincinnati. For further information, please contact Dr. Scott R. Taylor at TPI, Tel: (918) 337-0591, or Maywood L. Wilson at TPT, Tel: (804) 868-9284.

FRP Reasearch in Israel

Researchers at the Israel Institute of Technology are studying the flexural behaviour of prestressed concrete using FRP tendons from service to failure. The formulation is general and is applicable for any type of FRP and any type of high and very high (above 100 MPa) strength concrete. It considers various types of FRP tendons, like Polystal (glass fibers), Arapree and FiBRA (Kevlar fibers), CFCC (carbon fibers) and Graphite fibers.

The analysis defines the criteria for design of beams based on overall safety factors rather than partial ones and specifies the range of allowable percentage ratio of FRP area with respect to the overall area of the concrete section. The results outline the behaviour at service and at ultimate limit states (ULS).

A comparison between designs based on ordinary prestressed reinforcement and FRP was conducted on a typical Spandeck precast section. The results reveal that the design using FRP proved to be very competitive. If maintenance is included in the design considerations, it is even economical. Conclusions and recommendations for design using FRP are drawn and presented.

For further details please contact Dr. Y. Frostig, National Building Research Institute, Faculty of Civil Engineering, Technion, Israel Institute of Technology, Haifa 32000, Israel.

Polymeric Textiles For Mortars

A comprehensive study is currently in progress at the Israeli National Building Research Institute to investigate the nature of interaction between cementatious matrices and polymeric textiles for reinforcement of mortars. The object of this work is to develop the know-how required to optimize

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the properties and geometry of the fabrics in order to yield a composite with maximum strength and toughness.

The parameters evaluated are the density of the yarn in the different directions, the modulus of elasticity of the polymer and the nature of the textile in terms of the method of weaving. The mechanics of such systems are investigated to identify the role of the textile-matrix bonding. Some of the results have already been published. The group working in this are: Prof. A. Bentur, Prof. D. Yankeloevsky and Ms. A Peled.

For further information please contact Prof. A. Bentur, National Building Research Institute, Faculty of Civil Engineering, Technion, Israel Institute of Technology, Haifa 32000, Israel.

NEFMAC Barrier Walls

The concept of using a double-headed tension bar system for anchoring a cast-in-place barrier wall to a bridge deck has shown good results in preliminary testing by the Ministry of Transportation of Ontario, Canada. Testing has also confirmed that it may be feasible to reinforce the barrier wall with NEFMAC grids, which do not extend beyond the wall into the deck slab, as shown in Figure (9). NEFMAC is an FRP reinforcement fabricated into planar or three-dimensional cages and is manufactured by AUTOCON Equipment Inc. of Weston, Ontario, under a licence from NEFCOM Corporation of Japan. The NEFMAC used in the barrier wall tests was made using carbon fibers in a vinyl ester matrix. For more information please contact Mr. John Maheu, Associate Research Engineer, Structures Office, Ministry of Transportation of Ontario, Tel: (416) 235-4696, FAX: (416) 235-4872.

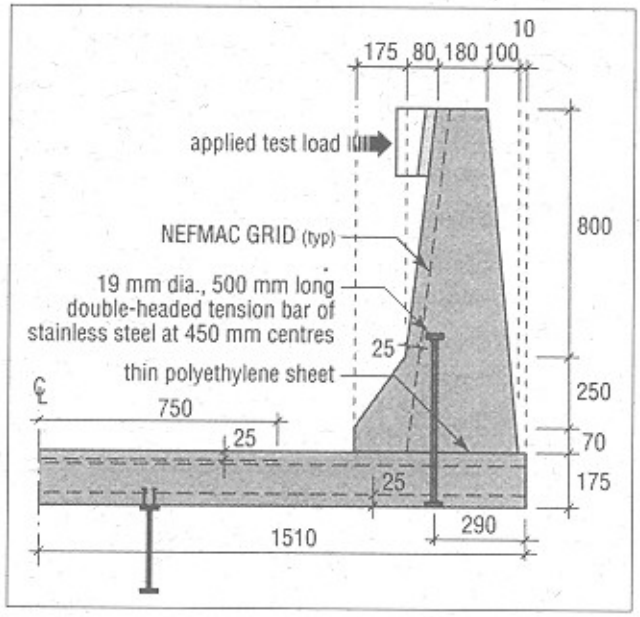

Figure 9
Half Section of test specimen of NEFMAC Barrier Walls

Workshops

Dot Engineers Bridge Workshop

Academic, Department of Transportation (DOT) Federal Highways Administration (FHWA) and consultant FRP researchers offered a Workshop to introduce the use of FRP reinforcement for concrete members to DOT bridge engineers. Sponsors of the workshop were the FHWA and the TRB Committee A2C07. Topics for the workshops consisted of the following:

- Introduction to FRP Reinforcement Materials
- Reinforced Concrete FRP Designs
- Concrete Beams and Slabs Reinforced with FRP Grids
- Non-Metallic Prestressing Tendons
- Prestressed Concrete FRP Design
- Project Material Specifications and Procurement
- Use of Fiber Reinforced Composites in California's Bridge Retrofit Program
- The Gilman Drive Bridge at U.C. San Diego
- Fiberwrap
- Florida's DOT FRP Research Program
- Application of FRP's for Highway Structures
- The Catholic University FRP Bridge Demonstration Project

A limited number of notebooks distributed at the Workshop are available through: Dr. Charles Goodspeed, HTA-20, Federal Highway Administration, 400 Seventh St. S.W., Washington, D.C., 20590.

A second workshop is being planned during TRB 1995. The theme of the workshop is FRP Designs — Research and Demonstrations. Anyone interested in contributing to the workshop please contact Dr. Goodspeed.

Awards

IABSE Outstanding Paper Award 1992
Dr. Urs Meier, EMPA, Switzerland

The 1992 Outstanding Paper Award was presented to Dr. Urs Meier, Switzerland, for his article "Carbon Fiber-Reinforced Polymers: Modern Materials in Bridge Engineering," published in *SEI* February 1992. The article discusses a variety of materials recently or soon to be employed in bridge construction. It focuses on the use of fiber composites, giving a state-of-the-art overview for these materials in order to illustrate developments that can be expected in the near future.

This award recognizes one article per year as selected by an international review committee. It was presented for the first time at the IABSE Annual Meeting in Rome, September 13-17, 1993. The presentation in Rome covered the first two years of publication of IABSE's quaterly journal, *Structural Engineering International (SEI).*

Dr. Meier is director of the Swiss Federal Laboratories for Materials Testing and Research, and was featured as Guest Author for *FRP International* inaugural issue, Vol I, Issue 1, Winter 1993. He may be reached at EMPA, Überlandstrasse 129, CH-8600, Dübendorf, Switzerland.

Technical Papers Awarded

The Composites Institute announced the winners of the prestigious BEST PAPER AWARDS, which recognize outstanding technical papers on February 9, 1994. Awards related to Structural Engineering applications of FRP are:

Best Design Paper - *Local Buckling of Pultruded FRP Beams - Analysis and Design,* L. Bank, T.R. Gentry, and M. Nadipelli, Dept. of Civil Engineering, Catholic University of America.

Best Testing Paper - *Tests on Deep I-Shape Pultruded Beams,* A. Zureick, L.F. Kahn, Georgia Institute of Technology, School of Civil Engineering, and B.J. Bandy, W.P. Moore and Associates.

Best Advanced Composites Paper - sponsored by Composites Industry Monthly - *Tension Rod End Attachments Formed via Reforming Pultruded Thermoplastic Composite Rods,* S.R. Taylor, Thermoplastic Pultrusions, Inc., and E.J. Barbero, West Virginia University.

Best Overall Paper Award - sponsored by Modern Plastics - *Local Buckling of Pultruded FRP Beams - Analysis and Design,* L.C. Bank, T. R. Gentry, M. Nadipelli, Dept. of Civil Engineering, The Catholic University of America.

All awards were presented at the Awards Luncheon on Wednesday, February 9, 1994. For further information, please contact the SPI Composites Institute, Tel: (212) 351-5410, Fax: (212) 370-1731.

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