

CIGMAT

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CENTER FOR INNOVATIVE GROUTING MATERIALS AND TECHNOLOGY, UNIVERSITY OF HOUSTON

NEWS AND LITERATURE REVIEW

CIGMAT CONFERENCE

A one day conference and exhibition sponsored by the Center for Innovative Grouting Materials and Technology (CIGMAT) and the Department of Civil and Environmental Engineering on 'Construction and Rehabilitation Activities in the Greater Houston Area' was held on March 10, 1995, at the University Hilton, Houston, Texas.

The slate of speakers consisted of personnel from the State of Texas, Harris County, City of Houston and Industry. The presentations also included current projects for 1995-96 in the greater Houston Area. Speakers also discussed the use of some of the state-of-the-art technologies to solve the problems in the Greater Houston area and around the country. The poster session of the conference included current research projects at the University of Houston and Rice University. Also, several companies participated in the exhibition. More than 120 people attended the conference.

C. Vipulanandan (Director, CIGMAT), in his welcoming remarks emphasized the fact that the construction and rehabilitation activities in the Houston area could be a model to rest of the country. The three keynote speakers during the first session at the conference were Milton Dietert, Chief District Engineer, Texas Department of Transportation; Terry Anderson, Chief Harris County Engineer; and Daniel Penaloza, Assistant General Manager, Engineering, Construction and Real Estate, Metropolitan Transit Authority (METRO). Other keynote speakers for the day were David Peters, Assistant Director, Facilities Engineering and Construction, City of Houston and Adil Godiwalla, Department of Aviation, City of Houston. The keynote speakers discussed some of their operational difficulties with the new environmental regulations. Several new projects planned for the Houston area were also discussed.

Industrial speakers included, Richard M. Berry, Rembco Engineering; David Magill and Dwight Pettit, Avanti International; Mike Hester, Cook Construction; Dave Gellings, Pacific International Grout Company; Sampson Bandimere, Denver Grouting Company; and Joel Venabel, ROI Inc. Richard Berry presented work on using steel plates with epoxy grouts in structural rehabilitation. The potential of soil nailing in slope construction and rehabilitation was also discussed. David Magill and

Dwight Pettit discussed their experiences in rehabilitating sewers with chemical grouts in the Houston area. Mike Hester, Dave Gellings and Joel Venabel discussed slipline grouting and some of the difficulties faced due to lack of standards and understanding of pipe material behavior. Sam Bandimere discussed the use of compaction grouting in the control of settlement in structures and pipelines. Shondeep Sarkar, S.E. Coleman Associates and Lindsey Lee, Brown and Root Environmental, were among the moderators of the sessions.

LITERATURE REVIEW

I. STRUCTURAL GROUTING

(i) Concrete repair in the future turn of the century. Any problems?; Emmons, P.H: Vaysburd, A.M: McDonald J.E., Concrete International: Design and Construction, Vol. 16, No. 3, Mar. 1994, pp. 42-49.

The deterioration of the infrastructure presents the most significant challenge facing the concrete industry as it approaches the turn of the century. Concrete repair and rehabilitation has become the industry's growth sector. The issue of durability has replaced concerns about strength as the most pressing problem. The current state-of concrete repair is described and a repair system concept is outlined. Compatibility of repair, in particular dimensional compatibility is discussed. The architect and engineer must apply the engineering principles in the design of repair projects with the same professionalism as in designing new structures.

Keywords: concrete repair, structural rehabilitation.

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New Publications and Announcements

ASCE Journal of Infrastructure Systems;
Sponsored by ASCE, NSF and CERF



(ii) *Restoration of the Rideau Canal historical locks, Narduzzo, Luig, Naudts, Alex., Concrete International: Design and Construction, Vol. 16, No. 3, Mar. 1994, pp. 42-49.*

A state-of-the-art grouting approach was used for the rehabilitation of the historical locks on the Rideau Canal, located in Ontario, Canada. Grouting reduces permeability of the structures, increases their structural integrity, and preserves their historical character.

Keywords: permeability, structural rehabilitation.

II. ANNULAR GROUTING

(i) *UK EPB Machine conquer's Bordeaux's karstic limestone; Wallis, S., Tunnels and Tunnelling, Vol. 26, No. 7, July, 1994, pp. 43-46.*

Markham through a licensing agreement it had with Okumura of Japan built and designed the 5.4 m diameter Bordeaux machine, the EPB TBM. This machine began tunnelling through karstic limestone beneath the French city of Bordeaux. The Bordeaux machine, being the right size, has proven to be effective in the challenges presented by Bordeaux's waterbearing karstic limestone and mixed face conditions.

Keywords: annular grouting, tunnelling, karstic limestone.

(ii) *Wisconsin drillers use the 'bradenhead' grout method; Riewe, T., Water Well Journal, Vol. 48, No. 2, Feb. 1994, pp. 32-35.*

Several well drillers in Wisconsin have been regularly using the 'bradenhead' method of neat cement grouting and have had success with it. This method offers some advantages over other methods, including grouting down the well annulus. A brief description of the method is offered.

Keywords: cement grouting, bradenhead grout method.

III. ENVIRONMENTAL GROUTING

(i) *Electrochemical characterization of grouted radioactive wastes; Kahanda, G.L.M.K.S., et al., Scientific Basis for Nuclear Waste Management XVII, Materials Research Society Symposium Proceedings, Vol. 333, 1994, pp. 357-362.*

We are investigating the possibility of monitoring the degree of immobilization of the low level radioactive waste by embedding an array of long lasting electrodes in grout. This work describes our ongoing attempts to understand the physics and chemistry of charge carrier in the grout under various load conditions.

Keywords: radioactive wastes, cements, leaching tests.

(ii) *Restoring water quality in the metal polluted Sorfjorden, Norway; Seip, Knut L., Ocean and Coastal Management, Vol. 22, No. 1, 1994, pp. 19-43.*

Five abatement measures to reduce the continued leakage of heavy metals from the polluted sea bed in the inner part of Sorfjorden have been studied. A multiattribute utility analysis of nine attributes expressing the objectives of the abatement operations (i.e improvements in the ecology, industry and trade,

Did you know!!!

The world's oldest road 'Neolithic Sweet Track' was laid about 6000 years ago.

Source: *New Scientist, Oct. 1988*

and neighborhood environment) showed that four of the five measures had a utility/cost ratio greater than one. Sealing the sediments (35,000 m²) with fiberpad and securing the pads on the shore with gabions had the greatest utility/cost ratio (2.0). Covering the sediments with cement based grout and the combination of ramming a sheet pile wall close to the shore and cover the remaining sediments with fiber pad and sand had both utility/cost ratios above 1.5. The most expensive measure, building a cellular coffer dam, was not utility cost effective (0.7 less than 1.0). Efforts comparable to the measures proposed have previously only been implemented in Minamata Bay in Japan. However, the cost of the present abatement efforts is much less than those used in Japan. (Cost range for the present efforts is US dollar 1.7 million to US dollar 12 million).

Keywords: water pollution control, cement grout, sealing, sediments, heavy metals, marine pollution.

IV. SOIL GROUTING

(i) *Field pile load tests in saline permafrost. I. Test procedures and results; Biggar, K.W., Segó, D.C., Canadian Geotechnical Journal, Vol. 30, No. 1, 1993, pp. 34-45.*

A pile load test program carried out in Iqaluit, Northwest Territories to provide design information for the short range radar sites is described. The program consisted of testing 10 steel pipe piles with various surface modification backfilled with clean sand and 4 Dywidag bars backfilled with Ciment fondué**T**M grout. All tests were performed in saline permafrost. This paper describes the site conditions, installation procedures and pile uplift load testing procedures, and results of the pile load tests. The beneficial effect of modifications to the pile surface and backfill material is identified. The analysis and discussions of the results are presented in a companion paper.

Keywords: pile load testing, permafrost, alumina, cement

(ii) *Field pile load tests in saline permafrost. II. Analysis of results; Biggar, K.W.; Segó, D.C., Canadian Geotechnical Journal, Vol. 30, No. 1, 1993, pp. 46-59.*

The results obtained from 14 pile load tests carried out in saline permafrost at Iqaluit, Northwest territories, are analyzed with respect to (i) development of load along the length of the piles as determined from strain gauges mounted along the embedded portion of the piles.; (ii) the time-dependent displacement of the piles under a constant load.; (iii) the performance of grout as a backfill materials.

The grout used as backfill cured adequately and provided sufficient bond strength between the anchor and the grout to cause either the anchor to yield or failure in the surrounding frozen soil. The development of load along the pile resulted in a nearly uniform stress distribution for smooth surfaced piles, but was highly nonuniform when lugs were added. Time dependent displacement of the piles without lugs can be described using a power law relationship.

Keywords: pile load testing, saline water, backfill, cement grout.

(iii) Laboratory and field performance of high alumina cement based grout for piling in permafrost; Biggar, K.W., Sego, D.C., and Noel M.M., *Canadian Geotechnical Journal of Civil Engineering*, Vol. 30, No. 1, Feb. 1993, pp. 100-106.

A grout for use in pile installation in permafrost is described. The high alumina cement (Ciment Fondue) based grout cures by rapidly evolving heat which maintains it above 0° C until it hydrates. The laboratory development program of the mix design along with the cement admixtures which allow the grout to cure at temperatures as low as -10° C and to remain workable during field use is reviewed. The development of installation procedures for the grout during construction of short range radar foundations is described along with field measurements of the compressive strength and the temperature profiles of the grout after placement in permafrost as cold as -14° C. The Ciment Fondue grout performed according to the design requirement of hardening without freezing in permafrost colder than -10° C during the installation of about 2000 piles for part of the short range radar project.

Keywords: foundations, permafrost, alumina cements grouts.

(iv) Basic properties and penetration of cement suspension grouts with different grain sizes; Yoneda, Shunichi, Nakagawa, Koji., *Proceedings of the Japan Society of Civil Engineers* No. 462, pt. 6-18, Mar. 1993, pp. 101-110.

This paper deals with basic properties of cement suspension grouts with different grain sizes and their penetration into cracks in rock masses. The main results are as follows. (1) The penetration of the grouts into dense sands or narrow cracks increased considerably with decreasing grain size. For an ultra fine grained cement grout it was excellent. (2) Dispersion admixtures increased the penetration of grouts made of ordinary grain size cements or of fine cements with a low water cement ratio. In field grouting tests in rock, the superiority of ultra fine cement to portland blast furnace slag cement was realized.

Keywords: Cement suspension grouts, grain size and shape, mechanical properties and rock mass.

V. SEWER GROUTING

(i) Trenchless pipe repair; Baxter Richard P., *Military Engineer*, Vol. 86, No. 564, June-July 1994, pp. 46-47.

It isn't in the Guinness book of world records, but perhaps it ought to be, since it is the longest single span of pipeline repaired by cured-in-place pipe technology. The world record rehabilitation of 2723 linear feet of sanitary sewer force main, which took place recently, was also unique because the host pipe ran beneath Florida's pristine Biscayne Bay to Miami Beach. The project,

which took four days to complete, allowed the City of Miami Beach to restore a vital portion of its wastewater collection system while minimizing service disruption to the affected area's residents. In addition, the noninvasive nature of the trenchless repair process left the sensitive Biscayne Bay environment untouched.

Keywords: Sewage disposal, submarine pipes, pipe repair.

V. NEWS

(i) Kodak is fined \$ 5 million for toxic chemical leaks; McKinley, James C. Jr., *The New York Times*, Oct. 8, 1994, Sec. A, p. 29, col. 5.

The EPA announced on Oct. 7, 1994, that Eastman Kodak Co had agreed to pay a \$ 5 million fine and spend tens of millions more to repair sewers and cut the use of toxic chemicals at its manufacturing plant in Rochester, NY. The company had faced a lawsuit under the Resource Conservation and Recovery Act.

(ii) EPA grout ban is a mistake; Ward, Janet, *American City and County*, Vol. 108, Issue 8, July 1993.

The EPA's proposed ban on acrylamide and N-Methyloacrylamide sewer grouts, due to the believed carcinogenic properties of the grouts, is discussed in an editorial. The National Association of Sewer Service Companies found the EPA's assessment methods of the grouts to be flawed, and the EPA should take another look at the issue.

(iii) Sewer Infrastructure; Levy, Paul F., *Oceanus*, Vol. 36, Issue 1, Spring 1993, pp. 53-60.

Maintaining sewer infrastructure is essential, but in Boston, it is also a political hot potato. The controversy surrounding the Massachusetts Water Resources Authority as it seeks to repair, rebuild and upgrade the sewer system serving the Boston metropolitan area is discussed.

(iv) Forteania; Sieveking, Paul., *New Statesman and Society*, Vol. 6, Issue 274, Oct. 15, 1993, p. 47.

Alligators in the sewer systems of New York City are discussed. Incidents where people found turtles, snakes and squirrels in their toilets and suffered embarrassing injuries should make one cautious in using the toilet.

(v) Congressional report calls for increased water infrastructure funding; Focus, HMCRI Newsletter, March 1995.

A House Public Works and Transportation report says the Federal Government is failing to meet the nation's wastewater needs. The report-the Transportation and Environmental Infrastructure Needs-was compiled from testimony given during five hearings held by the committee's Investigation and

Oversight Subcommittee. It highlights water infrastructure needs, demonstrates investment benefits, urges increased spending, and outlines alternative funding sources.

The report says public spending for water and wastewater infrastructure could improve profitability, create jobs, increase the tax base, and provide opportunities for economic development. For example, a report by the National Utilities Contractors Association (NUCA) found that a \$ 2.5 billion public investment in water and wastewater facilities pays for itself in less than a decade through additional tax revenues.

Additional federal funding is also necessary for wastewater treatment facility and combined sewer overflow and storm water controls. Appropriating money at authorized levels for the US Environmental Protection Agency's State revolving Loan Fund Program could provide additional funds for these infrastructure improvements, the report said.

The report, however, acknowledges that public investment alone is not sufficient to meet the country's infrastructure needs and recommends several policy options, such as state administered water and wastewater trust funds similar to the Federal Highway Trust Fund.

(vi) Environmental update. Cities and EPA revamp combined sewer fixes; Carr, Housley., ENR, Vol. 231, No. 22, Nov. 29 1993, pp. 46-47.

EPA is to issue its Combined Sewer Outflow Control Policy document which will indicate what is expected of the States and municipalities regarding the protection of their waters from the fouling effects of combined sewer overflows. Some indications on the contents of the document are offered

Industrial Contacts and Sponsoring Members :

Berry, R., Rembco Engineering, Knoxville, Tennessee.
Cook, D., Cook Construction, Albuquerque, New Mexico.
Fiest, G., 3M Construction, St. Paul, Minnesota.
Magill, D., Avanti International, Webster, Texas.
Odell, K., Gelco Services, Salem, Oregon.

For more information on CIGMAT or Comments on this issue of CIGMAT News And Literature Review, contact;

Dr. C. Vipulanandan, P.E.,
Director of CIGMAT,
Department of Civil and Environmental Engineering,
University of Houston,
Houston, Texas 77204-4791
Ph. No. 713-743-4278; Fax No. 713-743-4760.

Journals Reviewed

The articles for inclusion in the CIGMAT News and Literature Review are selected on the basis of their usefulness and applicability in the field of grouting technology, and are geared towards practicing professionals in the field. Recent issues of the following publications were reviewed.

1. American City and County
2. American Concrete Institute
3. Civil Engineering (ASCE)
4. Civil Engineering (London, England)
5. Concrete Construction
6. Concrete International (ACI)
7. Civil and Structural Engineering Abstracts
8. Engineering News Record
9. Environmental Geology
10. Electrical World
11. Geotechnique
12. Indian Geotechnical Journal
13. Canadian Geotechnical Journal
14. Ocean Engineering
15. Soil Dynamics and Earthquake Engineering
16. Foundation Facts
17. Geodex Retrieval System for Geotechnical Abstracts
18. Geotechnical Abstracts
19. Journal of Geotechnical Engineering (ASCE)
20. Journal of Structural Engineering (ASCE)
21. Soils and Foundations
22. Soil Technology
23. Series on Rock and Soil Mechanics
24. Public Works
25. New Scientist
26. Military Engineer
27. Oceanus
28. Pipelines and Utilities Construction
29. Pipes and Pipelines Manual
30. Pipes and Pipelines International
31. Tile and Brick International
32. Composite Materials Series
33. Mexican Society for Soil Mechanics Meeting
34. Tunnels and Tunnelling

