

Issues in Construction Research

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This year many are reflecting on the closing Millennium, and a few are even venturing predictions about the future. Some of the predictions concerning construction, which actually are simply obvious observations, include:

1. in the new millennium the labor shortage of skilled craftsmen will be tremendous,
2. environmental concerns will not go away, and will probably become more intense,
3. innovative contracting practices such as design-build, performance specifications and warranties will change how contractors do business,
4. advanced technologies such as lasers will be used for faster, and more accurate control,
5. the use of modular construction systems will expand to reduce cost and speed construction, and
6. advanced project management and scheduling software will be offered as a means to minimize construction time and improve process control.

All six of the statements are easy to support based on what is happening today. Contractor organizations, equipment manufacturers and material suppliers are all seeking solutions to these challenges of the future. Both of the major contractor organizations are pushing craft training. A visit to CONEXPO this year makes it clear equipment manufactures are building machine controls that mimic how kids play Nintendo. Future machines will embrace the operators of the future.

It is the last prediction that should give constructors pause. While the computer has freed us from the slide rule, log tables, the French curve and ammonia reeking blueprints it presents a new set of challenges. The example of the problems the Corps of Engineers experienced with their construction projects at Ft. Bragg a few years back is a good illustration of the hazard the computer brings to construction. The building, road, or bridge is the reality, not what the computer report says. From reading the news reports, it seems that at Ft. Bragg the construction managers tended to completely rely on computer generated reports in evaluating the quality of the work when a quick walking tour of the project would have made many of the problems obvious.

The cliché “garbage in, garbage out” might be applied but the real issue is not the computer but the constructor. A good superintendent once said watch for the “Indian signs.” What it means is that if you *observe the work* there are usually warnings before things become serious problems. He did not say observe the computer monitor.

- **Issue Number 1 is how we structure and present construction education.** One of the truly critical issues of the millennium will be insuring that constructors do not lose their *practiced eyes* and the ability to think. As constructors are overwhelmed by a tidal wave of superficial information the human capacity to concentrate can easily be forfeited. It is important that young constructors be given opportunities to actually observe the work in progress and that they be mentored not only in the mechanics of the latest software but more importantly in the field. It is people who build the work not the computers, and the next generation of constructors must understand how to physically put the pieces of the erector set together.

- **Issue Number 2 is the labor shortage of skilled craftsmen.** Can we as researchers move away from the comfort of our computers and attack the field issues of how we build. This is both a materials engineering and process issue and it will require that we join forces with other disciplines. Modular construction with advanced materials used for structures, and peripherals will be expanded to reduce cost and minimize disruption through the rapid assembly of lighter and more durable components.
- **Issue Number 3 is the development of advanced technologies for faster, and more accurate control.** Construction automation, equipment, and techniques must be employed to perform the equivalent work with fewer workers. This automation will likely prove more reliably, efficient, and cost-effective. Construction equipment and robots or automated/preprogrammed machinery will incorporate advanced technologies for guiding, monitoring, and coordinating. These technologies were developed for the purposes of aeronautic navigation, mobile robot navigation, geodesy, etc. They can be classified as inertial navigation systems (INS), active beacon navigation systems (ABNS), and radio frequency identification systems (RFID) or tagging, tracking, and locating systems (TT&L).
- **Issue Number 4 is environmental concerns.** Environmental concerns and worker safety will probably become more intense. Construction contractors will be called upon to use innovative construction techniques that require less hazardous materials in order to provide safer working conditions and less environmental impact.
- **Issue Number 5 is innovative contracting practices such as design-build, performance specifications and warranties.** Further research is needed to provide basic material knowledge that will allow owners to establish performance based on measurements taken during the construction process.
- **Issue Number 6 is the use of modular construction systems.** The most significant benefit of this concept is the shorter construction time but additionally, quality can be improved and cost can be reduced when components are built in a factory setting rather than a field setting. Advanced materials that can not be adequately controlled in the field can be used or fabricated under controlled factory conditions. After partial curing or fabrication the material or modules can be transported to the field for final assembly, installation, or curing.

Construction research has tended to focus on those things that it is easy for us in academia to do, build some type of computer model in our offices. But the promises of the benefits from such research should be regarded with a bit of skepticism. We should have the courage to focus on all of the issues facing construction.

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Visiting Associate Professor, Department of Civil Engineering, Virginia Polytechnic Institute and State University, Blacksburg, Virginia. August 1993 - August 1994.

EDUCATION

Ph.D., Purdue University (Construction Engineering and Management) 1980

M.S.C.E., Georgia Institute of Technology (Construction) 1972

B.S.C.E., Georgia Institute of Technology, 1967

AREA OF TEACHING AND RESEARCH

Construction Engineering, Construction Equipment and Techniques, Heavy Construction Estimating, Construction Estimating, Environmental Construction, and Geotechnical Engineering.

INDUSTRIAL EXPERIENCE

June 1988 - August 1993, Chief Engineer, Nello L. Teer Company, Durham, North Carolina.

Officer of the Corporation and of Sloan Construction Company, Inc. (a wholly owned subsidiary company).
Qualifying party for North Carolina Contractors License, unclassified. Direct line responsibility for the coordination and supervision of both the estimating and construction of major Heavy/Highway and Environmental projects.

August 1986 - May 1988, Engineer, Granite Construction Company, Grapevine, Texas.

June 1983 - July 1986, Engineer, T. L. James Company, Inc., Ruston, Louisiana.

REFEREED ARCHIVAL JOURNAL PAPERS

Schexnayder, Cliff J., "Dealing with Nighttime Construction Nuisances," *Practice Periodical on Structural Design & Construction*, ASCE, accepted, October 1998.

Shapira, Aviad and **Schexnayder, Clifford J.**, "Selection of mobile cranes for building construction projects," *Construction Management & Economics*, (UK), accepted February 1998.

Schexnayder, Cliff, Weber, Sandra L., and Brooks, Brentwood T., "Effect of Truck Payload Weight on Production," *Journal of Construction Engineering and Management*, ASCE, Vol. 125, No. 1, Jan./Feb. 1999.

Gwen Flora, James J. Ernzen and **Schexnayder, Cliff**, "Field-level Management's Perspective of Design-Build," *Practice Periodical on Structural Design & Construction*, ASCE, Vol. 3, No. 4, Nov. 1998.

Ohrn, L. Greg and **Schexnayder, Cliff**, "Performance-Related Specifications for Highway Construction," *Journal of Construction Engineering and Management*, ASCE, Vol. 124, No. 1, Feb. 1998.

Schexnayder, Cliff and Ohrn, L. Greg, "Highway Specifications - Quality vs. Pay," *Journal of Construction Engineering and Management*, ASCE, Vol. 123, No. 4, Dec. 1997.

Walker, Kenneth K., **Schexnayder, Cliff**, Mayo, Richard E., and Walsh, Kenneth D., "Methods and Procedural Considerations in Demolishing Tall Concrete," *Journal of Construction Engineering and Management*, ASCE, Vol. 122, No. 3, Sept. 1996.

REFEREED ARCHIVAL JOURNAL PAPER DISCUSSIONS

Schexnayder, Cliff, discussion of "Rational Equipment Selection Method Based on Soil Conditions," by Ali Touran, Thomas C. Sheahan, and Emre Ozcan, *Journal of Construction Engineering and Management*, ASCE, Vol. 124, No. 6, Nov./Dec. 1998.

Schexnayder, Cliff, discussion of "Optimizing Haul Unit Size and Number Based on Loading Facility Characteristics," by Douglas D. Gransberg, *Journal of Construction Engineering and Management*, ASCE, Vol. 124, No. 2, Mar./Apr. 1998.

Schexnayder, Cliff, discussion of "Analysis of Earth-Moving Systems Using Discrete-Event Simulation," by S. D. Smith, J. R. Osborne, and M. C. Forde, *Journal of Construction Engineering and Management*, ASCE, Vol. 123, No. 2, June 1997, p. 199.

INTERNATIONAL CONFERENCE PROCEEDING (REVIEWED PAPERS AND ABSTRACTS)

Schexnayder, Cliff J., Wiesel, Avi, and Ruwanpura, J. Y. "Using the Internet to Transfer Knowledge," 1999 Annual Conference of the Canadian Society for Civil Engineering (CSCE), Canadian Society for Civil Engineering, Regina, Saskatchewan, Canada, June 1999.

Cristiano Maio, and **Schexnayder, Cliff**, "Simulation Model Probability Distribution Functions – Relationships between Input Data and Good-of-fit Tests," 16th IAARC/IFAC/IEEE, *Symposium on Automation and Robotics in Construction*, International Association for Automation and Robotics in Construction, Madrid, Spain, Sept. 1999. accepted

Schexnayder, Cliff, "Mitigation of Construction Nuisances," *The Millennium Conference, Cities and Sustainability*, Sri Lanka, Feb. 2000, accepted, Dec. 1998.

Schexnayder, Cliff J. and Wiesel, Avi, "The Use of the Internet as a Tool to Transfer Knowledge," *Etkin Seminar, National Building Research Institute, Technion, Haifa, Israel*, May 1998.

NATIONAL CONFERENCE PROCEEDINGS (REVIEWED PAPERS AND ABSTRACTS)

Schexnayder, Cliff J., "Compaction Specifications for Low Hydraulic Conductivity Clay Embankments," *Transportation Research Record, No. 1462*, Transportation Research Board, National Research Council, December 1994. (73rd Annual Meeting, Transportation Research Board, Washington, D. C., January 1994)

Schexnayder, Cliff and Lukas, Robert G., "The Use of Dynamic Compaction to Consolidate Nuclear Waste," *Grouting, Soil Improvement and Geosynthetics*, Geotechnical Special Publication No. 30, ASCE, February 1992.

Lukas, Robert G. and **Schexnayder, Cliff**, "Dynamic Compaction of Nuclear Waste Deposits," *Stabilization and Solidification of Hazardous Radioactive and Mixed Wastes*, ASTM STP1123, 2nd Vol., January 1992.

Steward, Rita F. and **Schexnayder, Cliff J.**, "Construction Techniques for Roller-Compacted Concrete," *Roller-Compacted Concrete Pavements and Construction*, Transportation Research Record 1062, Transportation Research Board, National Research Council, 1986.

BOOKS AUTHORED

Peurifoy, Robert L., Ledbetter, William B., and **Schexnayder, Cliff J.**, *Construction Planning, Equipment & Methods*, Fifth Edition, McGraw-Hill, Inc., November 1995.

PROFESSIONAL COMMITTEE SERVICE

American Society of Civil Engineers, Fellow (1967-present).

Technical Activities Committee, member (1998-present)

Management Group E, member (1994-1997).

Construction Division Executive Committee (1986-1992), chairman (1991).

Committee on Construction Equipment and Techniques (1978-1988), chairman (1982-1986).

Committee on Environmental Geotechnics, member (1993-1997).

Construction Research Council, member (1981-present).

Transportation Research Board

Group 2 – Design and Construction of Transportation Facilities, Council, (Feb 1997-present)

Section A2F00, Construction, Chair (Feb 1997-present)

Committee on Construction Equipment (A2F06) (1982-present), Chairman (1994-1997).

Committee on Transportation Earthworks, (A2K02), member (1991-present).