256

National Cooperative Highway Research Program

NCHRP Synthesis 256

Submittal of Bid Proposals in Electronic Format

A Synthesis of Highway Practice

Transportation Research Board
National Research Council

National Cooperative Highway Research Program

Synthesis of Highway Practice 256

Submittal of Bid Proposals in Electronic Format

DONN E. HANCHER, P.E., Ph.D.
Department of Civil Engineering,
University of Kentucky

Topic Panel

ROGER E. BIERBAUM, *Iowa Department of Transportation*
CLARETTA DUREN, *Federal Highway Administration*
MICHAEL D. FRANCOIS, *Digex, Inc.*
C. FRANK GEE, *Virginia Department of Transportation*
REX GRATHWOL, *New York Department of Transportation*
FREDERICK D. HEJL, *Transportation Research Board*
MICHAEL KISTLER, *Pennsylvania Department of Transportation*
JIM MICHAL, *Washington Department of Transportation*
GARY R. SMITH, *Pennsylvania State University*
LISA UNNASCH, *Texas Department of Transportation*
GERALD YAKOWENKO, *Federal Highway Administration*

Transportation Research Board
National Research Council

Research Sponsored by the American Association of State Highway and Transportation Officials in Cooperation with the Federal Highway Administration

NATIONAL ACADEMY PRESS
Washington, D.C. 1998

Subject Areas
Planning and Administration

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communication and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

NOTE: The Transportation Research Board, the National Research Council, the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the individual states participating in the National Cooperative Highway Research Program do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

NCHRP SYNTHESIS 256

Project 20-5 FY 1996 (Topic 28-07)
ISSN 0547-5570
ISBN 0-309-06113-X

Price $15.00

NOTICE

The project that is the subject of this report was a part of the National Cooperative Highway Research Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the program concerned is of national importance and appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical committee according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

The National Research Council was established by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and of advising the Federal Government. The Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in the conduct of their services to the government, the public, and the scientific and engineering communities. It is administered jointly by both Academies and the Institute of Medicine. The National Academy of Engineering and the Institute of Medicine were established in 1964 and 1970, respectively, under the charter of the National Academy of Sciences.

The Transportation Research Board evolved in 1974 from the Highway Research Board, which was established in 1920. The TRB incorporates all former HRB activities and also performs additional functions under a broader scope involving all modes of transportation and the interactions of transportation with society.

Published reports of the

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

are available from:

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

and can be ordered through the Internet at:

http://www.nas.edu/trb/index.html

Printed in the United States of America

PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis will be of interest to state department of transportation (DOT) contract officers, program managers, and construction engineers. It will also be of interest to computer specialists and construction contractors interfacing with the state DOTs using electronic media processes. It describes the current state of the practice for submittal of bid proposals in electronic format.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

This report of the Transportation Research Board presents a brief introduction to the history of electronic data interchange (EDI), its relation to electronic bidding, and current applications in the transportation construction industry. The results of a literature review, surveys of DOTs and highway contractors, and interviews with industry experts and government agencies on the use of electronic bidding for highway projects are presented. Potential benefits and concerns, plus other issues related to the full implementation of electronic bidding in DOTs, are also presented. In addition, reported common

plans for near future implementation of EDI technology to electronic bidding system processes for transportation construction projects are included.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the research in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

CONTENTS

ACKNOWLEDGMENTS

Donn E. Hancher, P.E., Ph.D., Chairman & Terrell-McDowell Chair Professor of Construction Engineering and Management, Department of Civil Engineering, University of Kentucky was responsible for collection of the data and preparation of the report.

Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of Roger E. Bierbaum, Office of Contracts, Iowa Department of Transportation; Claretta Duren, Federal Highway Administration; Michael D. Francois, Network Planner & Architect, Digex, Inc.; C. Frank Gee, Construction Engineer, Virginia Department of Transportation; Rex Grathwol, Director, Contract Management Bureau, New York Department of Transportation; Frederick D. Hejl, Engineer of Materials and Construction, Transportation Research Board; Michael Kistler, Program Manager, Bureau of Planning & Research, Pennsylvania Department of Transportation; Jim Michal, Washington Department of Transportation; Gary R. Smith, Associate Professor of Civil Engineering, Pennsylvania State University; Lisa Unnasch, Systems Analyst, Construction & Maintenance Division, Texas Department of Transportation; Gerald Yakowenko, Contract Administration Group, Federal Highway Administration.

This study was managed by Stephen F. Maher, P.E., Senior Program Officer, who worked with the consultant, the Topic Panel, and the Project 20-5 Committee in the development and review of the report. Assistance in Topic Panel selection and project scope development was provided by Sally D. Liff, Senior Program Officer. Linda S. Mason was responsible for editing and production.

Crawford F. Jencks, Manager, National Cooperative Highway Research Program, assisted the NCHRP 20-5 staff and the Topic Panel.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

SUBMITTAL OF BID PROPOSALS IN ELECTRONIC FORMAT

SUMMARY

Bid proposals in the transportation construction industry have been received in basically the same way for several decades. However, in the coming decade it is very likely that the industry will undergo a major change to electronic bidding. With the advancement of computer technology and enhanced uses of the Internet, new ways of processing bid information can be beneficial for both transportation agencies and highway contractors.

Electronic bidding is not a new concept, but an attempt to adapt existing technology successful in other types of businesses to the construction industry. The objective of electronic bidding is to transmit all the project information in an electronic format. This information consists of bid announcements, project plans and specifications, bid proposals, bid submittals, and reports of bid results. This report focuses on the bidding process, especially the receipt of bids electronically.

This synthesis describes the technology currently available and summarizes the practices followed to use electronic media to support the bidding process for transportation construction projects. The report gives a brief introduction to the history of Electronic Data Interchange (EDI), its relation to electronic bidding, and current applications in the transportation construction industry. The results of surveys of departments of transportation (DOTs) and highway contractors, plus interviews with industry experts and government agencies, on the use of electronic bidding for highway projects are presented. Potential benefits and concerns, and other issues related to the implementation of electronic bidding in DOTs, are also presented.

Forty-two departments of transportation responded to the synthesis survey (36 state DOTs, the District of Columbia and 5 Canadian DOTs). Of the agencies responding, 25 state agencies and two Canadian agencies currently use some type of EDI activity in their bidding process. Seven state DOTs and one Canadian DOT are planning or reviewing the use of EDI to enhance their current practices.

Twenty-four of the 25 state DOTs using EDI in their bidding process use some type of EDI for bid announcements, while only 4 do so for listing their bid specifications. Fourteen of the users receive contractor bids in electronic format at this time; however, none actually receives bids fully electronically. All the users accept bids on diskettes, and they require contractors to also submit a hard copy of the bid with all signatures required. Systems in place range from simple electronic bulletin boards where contractors can obtain project information and prepared bid item sheets, to the comprehensive American Association of State Highway and Transportation Officials (AASHTO) computer systems for electronic project administration. Use is classified by medium—bulletin board system, e-mail, World Wide Web, and diskette. Web pages appear to be the system of choice for the future.

Electronic bidding systems have the potential to provide substantial savings in time and cost to both agencies and highway contractors. As the evolution of electronic media progresses, especially the Internet, it appears that the electronic submittal of DOT bid advertisements, bid documents, and contractors' bids will become increasingly prevalent in the future. This raises many questions related to the adequacy, reliability, and security of existing electronic media technology, plus several questions concerning the actual bidding

process to be followed if electronic media are used. These questions are addressed in this study.

The technology to support electronic bidding systems in the transportation industry already exists and has been proven in other business segments. EDI has been developed extensively for purchasing activities in both the public and private sectors. However, there are bidding process management issues that must be addressed in the transportation industry that currently limit the development of electronic bidding systems. Some of the major concerns are legal approval to receive bids electronically, the validation of the bid information from contractors, the ability of contractors to change bid items submitted before the required bid time, the ability of DOTs to look at submitted bids before the required bid time, and the ability of small highway contractors to adapt to the new technology.

It does not seem that requiring electronic bidding will cause undue hardship to small contractors. The hardware requirements of a personal computer with a modem and a telephone connection to the Internet or a dedicated computer system specified by the DOT do not seem unreasonable. The cost of the computer and the monthly access for connection to the system should be attainable for most firms. However, special arrangements may be necessary by DOTs to provide access to computer hook-ups in public offices for small contractors to use.

Finally, it appears that any state DOT desiring to adopt electronic bidding procedures may benefit from considering AASHTO's Expedite, and other Trns-port modules. Work continues to further develop these products, and companion products are being developed by software vendors. The annual fees for using these AASHTO products, plus current policy restricting access to the AASHTO Trns-port DSS module to members only, may prohibit their use by non-state agencies. However, small agencies can use several simple and inexpensive existing systems for improving their bidding process until more advanced software systems are developed at more feasible prices.

CHAPTER ONE

INTRODUCTION

PROBLEM STATEMENT

Several state departments of transportation (DOTs) are using electronic media for the posting of project bid information and, in some cases, the receipt of contractors' bids. Such systems promise potential savings in time and cost to both agencies and contractors. With the progressive evolution of electronic mail and the Internet, it appears likely that electronic submittal of bids will become increasingly prevalent.

Electronic data interchange (EDI) is the electronic exchange of information between computers. It allows for rapid transfer of data without the need to re-key the information, which eliminates the errors associated with the re-keying process. Use of EDI is prevalent in all businesses today and will increase in the future. This is also true in the transportation industry where large amounts of data are exchanged annually, especially for construction projects. DOTs are seeking to adapt EDI practices to all phases of their contracting process for projects:

- Bid proposals (announcements, plans, specifications, instructions, bid item sheets),
- Bid submittals (receipt of bids, analysis of bids, award of contract), and
- Posting of bid results.

The use of EDI techniques for purchasing is a common practice in many industries today. Such purchases involve some of the same problems that confront DOTs in their project bidding process, such as validity of data received, protection of client cost data, efficiency of the process, and reliability of the electronic system. However, the transportation industry has a much more complicated purchasing system related to its competitive sealed-bid requirements. Contractors must submit responsive bids to the DOTs by a designated date and time. DOTs must hold all received information in strict confidence until a public opening of the bids, with the award going to the contractor with the lowest bid price. This bidding process, a labor-intensive one, has been developed over many years of practice.

Changing to an electronic process presents many issues that must be addressed for successful implementation. Some of the major issues are

- Existing and available systems for electronic handling of bid information,
- Reliability of systems (transmission error, computer breakdown, on-line access),
- Validation of bid responsiveness (electronic signature, timeliness, prequalification, bonds or security deposits, completed bid forms),
- Security issues (confidentiality and theft of bid information),
- Contractor access to bid files prior to deadline (withdraw or modification),
- DOT access to bid files prior to deadline,
- Public opening of bids,
- Legislative restrictions to electronic bidding,
- Potential benefits to and concerns of contractors,
- Potential benefits to and concerns of DOTs, and
- Equity issues for small contractors.

This synthesis of current practices addresses the issues and reports on common plans for implementation of EDI technology to electronic bidding system processes for transportation construction projects. The study emphasizes the interface between the contractor and the DOT for bidding purposes up to the contract award, with major emphasis on the potential for fully electronic submittal of bids.

OBJECTIVES

- To summarize the current technology available and the practices being followed in transportation agencies for using electronic media in the bidding process for transportation construction projects,
- To identify the benefits and concerns of DOTs and contractors regarding use of electronic media in the bidding process, and
- To address the implementation issues related to electronic bidding processes.

PROCEDURES

A literature review was conducted to identify current practices of EDI in business organizations, including transportation agencies. Most of the useful literature was found on the Internet and in applications for other industries. Surveys were conducted of state DOTs to identify applications of electronic media in their current operations, especially in their contract bidding process, and to ascertain their perceptions of potential benefits and concerns related to implementing an electronic bidding process. Telephone interviews were held with several of the responding agencies to further discuss their current practices and suggestions. The U.S. Army Corps of Engineers, the major contracting agency for military construction projects, was contacted for input on their Electronic Bid Sets program. Selected highway contractors were surveyed to identify their perceived benefits and concerns with electronic bidding. Input was received from AASHTO and computer experts and software vendors provided information related to EDI and its applications to the transportation industry.

ORGANIZATION OF THE SYNTHESIS

Chapter 2 presents a brief history and introduction to the field of EDI. The findings of the surveys (found in appendixes A and B), contacts with DOTs and other industry participants, and existing software systems available for electronic bidding systems, with special emphasis on AASHTO's electronic exchange system for transportation construction projects, are presented in chapter 3. Chapter 4 presents the opinions of DOTs and contractors on the potential benefits and concerns related to adopting electronic bidding practices. Chapter 5 discusses information on issues related to the implementation of electronic bidding systems by DOTs. The findings of the study and recommendations for further action are provided in chapter 6. A list of companies mentioned in this report follows the reference section.

CHAPTER TWO

ELECTRONIC DATA INTERCHANGE

INTRODUCTION

This chapter gives a brief introduction of the history and current practices related to EDI in business today. This will set the stage for later discussions of the application of such practices in DOTs for establishing an electronic bidding system for their construction projects.

In its simplest form, EDI is the electronic exchange of information between two computers in a specific predetermined format. In current practice, EDI allows for rapid, hands-off transfer of information, eliminating the need to re-key the information and the errors associated with the re-keying process. According to the EDI Group (*1*), the reduction in cycle time averages 40 percent.

The exchange occurs in basic units called messages, or transaction sets, which typically relate to standard business documents, such as purchase orders and customer invoices. Over time, the business community has arrived at series of standardized transaction formats to cover a wide range of business communication needs.

The traditional form of sending information using EDI is more rigid and standardized than sending electronic mail messages or sharing files through a network, a modem, or a bulletin board. The straight transfer of computer files requires that the computer applications of both the sender and receiver (referred to as "trading partners") agree on the format of the document. The sender must use an application that creates a file format identical to the receiver's computer application. In Figure 1, major reasons for adopting EDI in the business industry are presented.

EVOLUTION OF EDI

It is believed that EDI has been under development in the United States in one form or another since the mid 1960s. EDI started in 1968 with a group of railroad companies concerned with the quality of intercompany exchanges of transportation data. Formation of the Transportation Data Coordinating Committee (TDCC) resulted. At about the same time, individual companies such as General Motors, Super Valu, Sears, and K-Mart were also addressing the inefficiencies of intercorporate document movement by using their own electronic (but proprietary) systems with their major trading partners. EDI developed in the grocery industry as well, which initially recognized the need for industry standards because of the amount of information it had to deal with. TDCC members believed that, between available levels of technology and the extent of their particular needs, a universal standard was impractical and unnecessary (*2*).

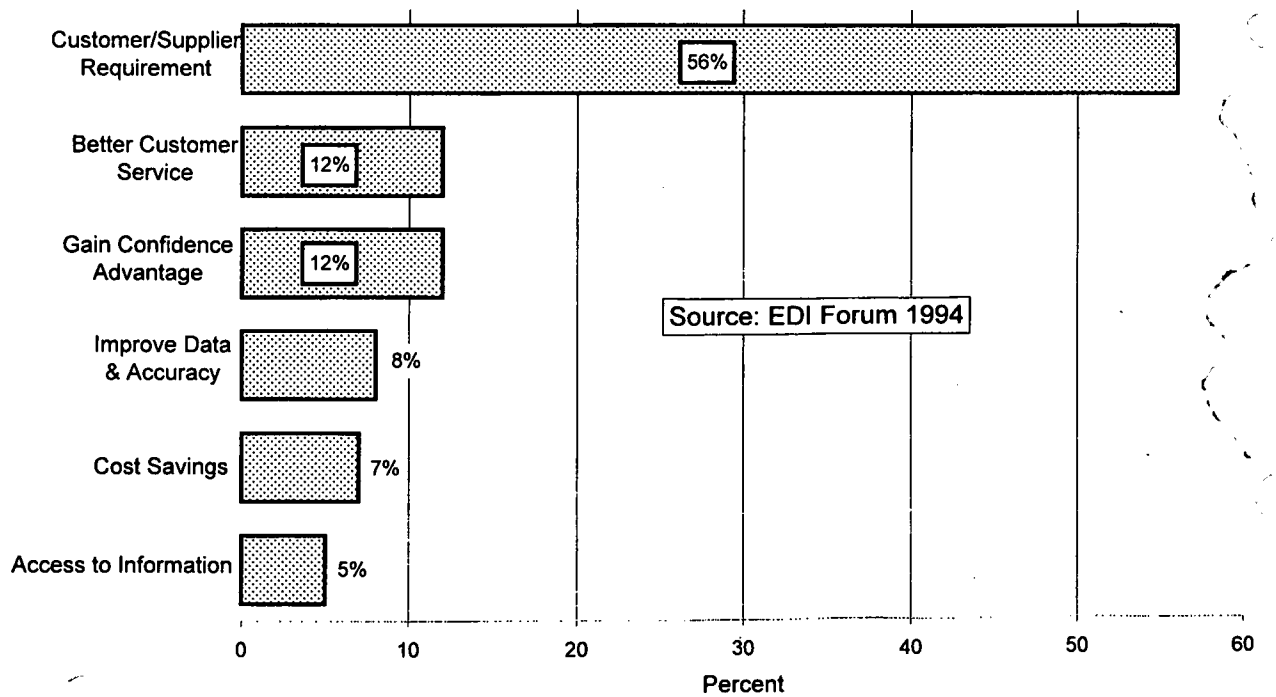

FIGURE 1 Reasons to adopt EDI.

In 1973, the TDCC decided to develop a set of standards for EDI between companies and to invent a so-called "living standard" which, in 1975, resulted in the first interindustry EDI standard covering air, motor, ocean, rail, and some banking applications. What evolved included generic formats for general businesses: ANSI X12, first published in 1981; WINS format for the warehouse industry; UCS format for the food and drug industry; and TDCC. European development of EDI systems became active around 1984. In 1985, work started on EDIFACT (EDI for Administration, Commerce & Transport), an international standard through the auspices of the United Nations (*2*).

In the current decade, EDI has spread quickly across American and international business. According to annual surveys conducted by the EDI Group, Ltd., and published in the *EDI Forum* (*1*):

> The use of EDI in the U.S. has grown steadily. Nearly one-quarter of those surveyed in 1993 anticipated implementing EDI within two years and 20% were already using EDI. The number of companies with no EDI plans fell dramatically. By 1993, EDI was the second most common means of exchanging business documents in the U.S. [the other methods being paper, voice, and fax]. Paper remained number one, but had fallen by nearly 50% since 1988. [In 1993, the ratio was 40% done on paper; 28% using EDI and the rest by fax and voice].

TOOLS NECESSARY FOR EDI

The most basic elements of an EDI program consist of a PC, a modem, X12 translation software, and an electronic mailbox on a Value Added Network (VAN). The cost to an end user for the above elements is about $4,500 (*3*). The other cost associated with EDI is the VAN cost, which is dependent on the type of VAN used. According to the same source, the VAN cost to send and receive a typical purchase order is about $0.15 to $0.20 per order. The Internet will most likely be used more extensively in the future.

For the host company maintaining the system, the investment in EDI is not inexpensive. The average cumulative investment ranges from $45,000 to over $1 million or an annual investment of $200,000 given an average hub age of 5 years (*1*).

A VAN is a network service usually provided by the telephone companies or large computer suppliers to serve as a post box (electronic mailbox) between EDI users. A company that wishes to send EDI messages dials up the VAN and deposits packages of messages via computer transmission into its post box, each package of which includes the electronic address of the recipient. The VAN takes the data from the post box and sorts it into the recipients' mail boxes ready for those users to collect when they each dial in next.

The use of the VANs in EDI provides a way to link types of computers that could not otherwise link directly. By tracking messages through the network, VANs record whether and when messages arrive, are transferred, and picked up. So if there is a fault at any point along the end-to-end link or if there is a dispute between the users, evidence can be produced to show what really happened.

TRANSMISSION OF INFORMATION

In EDI, there are two basic ways of processing the information: 1) the traditional EDI where information is processed using VANs, and 2) the new method using Internet technology to transfer information. The second method offers more flexibility and applicability to users, and it requires only an Internet browser and a modem to transmit files.

Using the Internet as the transmission medium for EDI reduces the number of processes necessary to complete a transaction. This method, however, is relatively new and is being tested in pilot programs. The traditional form is still the most widely used method for EDI.

SECURITY AND CONFIDENTIALITY IN EDI

One of the major concerns in EDI is whether or not there is sufficient legal framework to operate confidently in a paperless environment. Premenos (*4*) considers the following questions regarding security:

- How can a sender be sure that a message goes only to the intended recipient?
- How can a recipient be sure that a message has not been altered or tampered with?
- How can a recipient be sure that the message received has been duly authorized and is binding on the purported sender?
- How can the parties be sure that no other person can gain access to the message and misuse the information therein?

To deal with these issues, solutions are being developed by software companies that account for the particular aspects of the paperless environment. Cryptography is used to name the array of software programs that were developed for these purposes. It comprises the following elements: encryption, decryption, and authentication.

Encryption—transforms the data into an unreadable form to ensure privacy. The amount of privacy attained depends on the level of encryption used to encode the data. The encryption is limited by U.S. government regulations concerned about illegal uses of encryption in crimes, terrorism, and national security. For domestic uses, the allowed level is 128-bit encryption (used by Internet browsers). 40-bit encryption is breakable today within 6 hours. Every additional bit of encryption used doubles the time to break a code. 128 bits means that in 50 years (assuming a constant yearly tripling of processing power), it will take a year to break a 128-bit code (*5*).

Decryption—is the reverse of encryption; it transforms the encrypted data back into the original, intelligible form.

Authentication—identifies an entity such as an individual, a machine on a network, or an organization. Authentication is obtained by the use of digital signatures and digital time stamps.

Digital Signatures—bind the document to a possessor using public and private keys to encode and decode the messages. To "digitally sign" the data, it is necessary to use both the sender's private key and the recipient's public key to encode the data. This ensures that only the intended recipient will be able to decode the message. If a signature verification fails, however, it will generally be difficult to determine whether there was an attempted forgery or simply a transmission error. Pretty Good Privacy (PGP) (available from the MIT distribution site) is one of the softwares used to provide digital signatures.

Digital Time Stamp—binds a document to its creation at a particular time. Once a document has been time stamped, it is not possible to modify it or change its creation date. Surety Technologies currently develops a software solution for creating digital time stamps.

Encryption software can be found in common internet browsers, such as Netscape and Internet Explorer, which offer up to 128-bit encryption codes. These programs are mainly used for online ordering through the Internet using credit card information. For company use of security, the leading manufacturer for all of the above concerns is RSA Data Security, Inc.

TRENDS IN EDI

Loren Data Corporation is introducing World Wide EDI, which does all translation and mapping of the complex forms using the Internet instead of VANs as the interface. This promises ease of use, a much higher degree of security, and wider availability and accessibility. Requiring only a web browser that supports encryption (Netscape, Microsoft Explorer), the expected cost is a fixed fee of $50 per month, with no annual fees.

EDI today spans nearly every type of transaction-based business. The potential market for EDI, however, remains largely untapped. While 90 percent of the Fortune 500 companies are equipped with EDI, of the remaining 10 million U.S. companies, only six percent are EDI capable. The worldwide EDI market is poised to more than triple to $3.2 billion by the year 2001 from $1 billion in 1995 (*6*).

CHAPTER THREE

CURRENT EDI PRACTICES IN THE DOT BIDDING PROCESS

INTRODUCTION

The terms electronic data interchange (EDI) and electronic bidding systems (EBS) are widely used in the transportation construction industry and may lead to confusion in the scope of their definitions. EBS covers preparing bid proposals, availing the bid information and bid submittal sheets to contractors, receiving the final bids electronically, analyzing the bids, awarding the contract, and the final tabulation and reporting of the bid results.

EDI in the construction industry covers any type of exchange of information by electronic media, including EBS. Some construction organizations in North America and Europe have already implemented some kind of EDI, but only to a limited extent. Current uses of EDI allow for transmission of project information, but do not allow for the receipt of bid proposals electronically. This is limited basically because of security, authenticity, new management practices, and computer system reliability issues involving the transmission of information to a remote recipient.

The implementation of EDI, including EBS, can provide a variety of benefits to owners and contractors. Currently, the driving force is owners who seek automation of the bidding process to reduce DOT personnel requirements, to reduce errors, and to save costs and time, among other benefits. To the contractors, benefits include the availability of project information 24 hours a day, the convenience of submitting bids from their office without the risk of last minute delay situations, and the ability to resubmit their bids in case major errors are detected before the bid submittal deadline.

Contractors bidding on a project can submit their bids in electronic format in several different ways: sending e-mail, filling out a form on a bulletin board system, filling out a secure form on the Internet, and on a diskette. Once the bids are received in a consistent, preformatted manner, they can be analyzed with contract management software for a variety of purposes by the owner. All this is done in a systematic, paperless manner requiring minimal effort.

On the project level, electronic exchange can be used to exchange standard types of information usually done in a time-consuming fashion. Some types of information include addenda, change orders, progress payments, updated drawings, etc. The level of detail and amount of information to be exchanged depend on the project size and importance to the owner. Along with all the promises of electronic bidding come some issues of major concern with its implementation:

- Security of the transmissions on the Internet,
- Authenticity of the information received,
- Reliability of the system,
- The extent to which it can be applied by contractors, and
- A broad range of other issues related to the need for changing the existing bidding process management systems to accommodate electronic bidding.

LITERATURE REVIEW

The main sources of information were gathered from the Internet, as it is the most current and up-to-date source available. Several organizations in the United States are promoting the use of EDI, while others exist to monitor its progress, such as the EDI Group. Little information was available on the construction industry. A first survey (Appendix A) was prepared and sent to all 50 state DOTs, the District of Columbia, Puerto Rico, and 12 Canadian agencies to learn more about EDI usage among transportation agencies. A second survey (Appendix B) was sent to several selected highway contractors to obtain information on possible benefits and concerns with the implementation of EDI processes by the transportation agencies for contract bidding.

DOT SURVEY RESULTS

Forty-two departments of transportation responded to the synthesis survey (36 state DOTs, the District of Columbia, and 5 Canadian DOTs). Table 1 classifies the respondents according to their interest in electronic bidding. The survey results show a clear willingness by many DOTs to use EDI and implement EBS in their construction programs within the next few years. Any numbers quoted on the survey results refer only to the 36 state and 6 non-state DOTs that responded to the survey.

Twenty-five state agencies and two Canadian agencies currently use some type of EDI activity in their bidding process. Seven state DOTs and one Canadian DOT are planning or reviewing the use of EDI to enhance their current practices.

Computer Use in Transportation Agencies

A summary of the survey responses about the computer usage by DOTs is shown in Figure 2 with several applications listed. The use of computers in DOTs shows a high level of importance given to contract bidding and to project administration. The multiple uses of computers explains why the percentages do not total to 100 percent.

Types of Information Exchanged

Table 2 depicts the current activities of the 25 state DOTs responding affirmative to using EDI in their bidding process.

TABLE 1
RESPONDENTS TO SURVEY OF DOTs

DOTs Currently Using EDI in the Bidding Process				
Alberta*	Georgia	Maryland	NW Territories*	Virginia
Alaska	Illinois	Missouri	Ohio	Wisconsin
Arkansas	Indiana	Montana	Oregon	Wyoming
California	Iowa	Nebraska	South Carolina	
Colorado	Kentucky	New York	Texas	
Florida	Maine	North Carolina	Utah	
DOTs Planning To Use EDI in the Bidding Process				
Delaware	New Jersey	Rhode Island		
Mississippi	Newfoundland*	Vermont		
DOTs Reviewing EDI Use in the Bidding Process				
Arizona	Nevada			
DOTs Not Planning To Use EDI in the Bidding Process				
Connecticut	New Mexico	Washington. D.C.*		
Minnesota	North Dakota			
New Brunswick*	Saskatchewan*			

*Not U.S. state DOTs

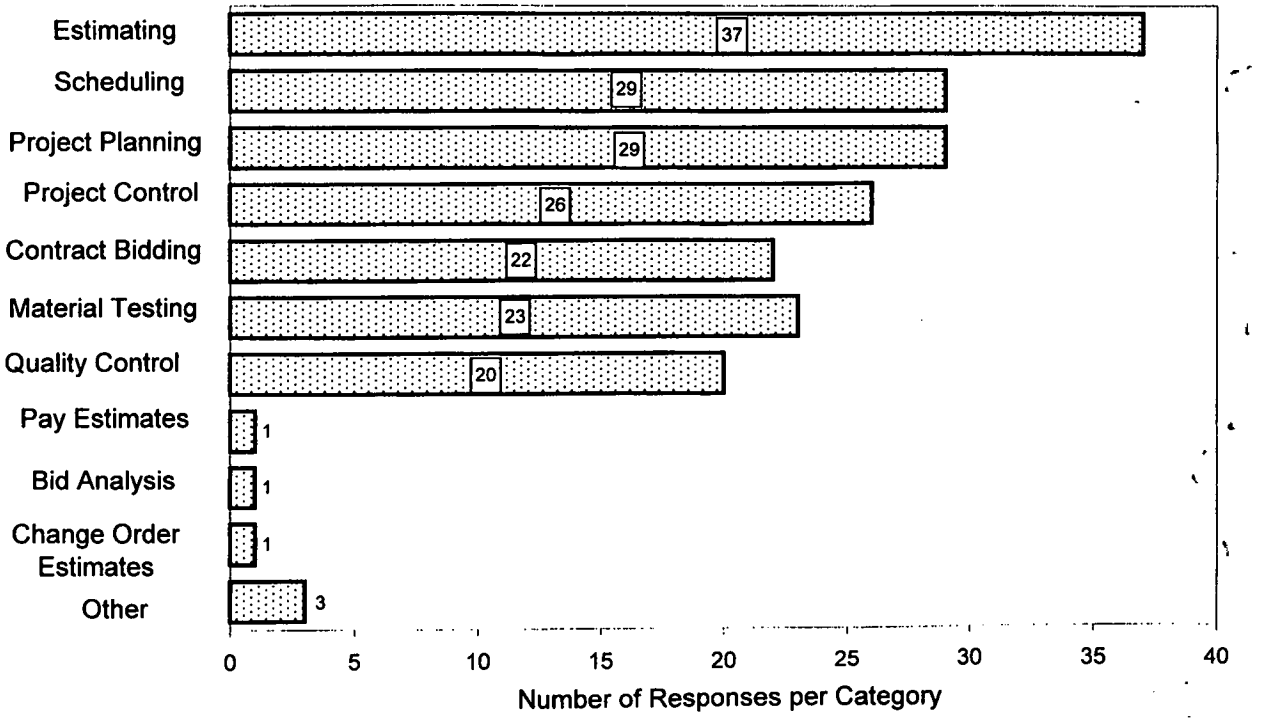

FIGURE 2 Use of computers in DOTs.

Use is classified by the medium used, Bulletin Board System (B), E-Mail (E), WorldWide Web (W) and Diskette (D).

Twenty-four of these 25 are using some type of EDI for bid announcements, while only 4 are using EDI for listing their bid specifications. Fourteen of the users receive contractor bids in electronic format at this time, by diskette only along with a signed hard copy of the bid. Many other types of bid-related information are also being provided. (Note: The Federal Highway Administration discourages the publication of plan holders lists and bid tabs from previously bid projects to avoid the potential use of such information for bid collusion.)

Of the 25 state DOTs that are current EDI users, 11 are using AASHTO's Trns-port modules, 13 are using AASHTO's Expedite software, and 8 are using systems developed in-house or commercial software for EDI.

Regarding the resources available to transportation agencies, 90 percent of the agencies have e-mail capabilities and 80 percent have an Internet connection. This makes a less-costly

TABLE 2

CURRRENT DOT USE OF EDI IN THE BIDDING PROCESS

State DOT	Bid Announcement	Project Plans	Project Specifications	Receipt of Bids (Diskette Only)	Other: Plan Holder List	Bid Tabs	Average Bid Tabs	As-Read Bids	List, Award Sheets, Sched. of Pay Items, Dbe Directory	Ex = Expedite T = Trns-Port I = In-House	A = All Projects S = Selected Projects T = Trial Projects
Alaska	W					W			W	I	T
Arkansas	W			D					W	Ex, T	A
California	W					W			W		
Colorado	B			D		B			B	Ex, T	A
Florida	B			D					B	I	A
Georgia	B,W			D	B,W	B,W			B,W	Ex,T	A
Illinois	D,W					W			W	I	A
Indiana	E			D					D	Ex,T	A
Iowa	W		W	D		W		W	W	Ex,T	A
Kentucky	W				W				W		
Maine	W									T	
Maryland	B					B	B	B	B		
Missouri	E					B			B	I	A
Montana	W			D	W	W	W	W	W	Ex	A
Nebraska	B			D					B	Ex,T	A
New York	B			D					B,I,W	I	S
North Carolina	W			D						I	A
Ohio	W		W	D						Ex,T	A
Oregon	E,B,W					B,W				Ex,T	A
South Carolina				D						Ex, I	A
Texas	B,W		B,W		B,W		B,W		B,W	Ex	S
Utah	E,W		E,W		E,W	E,W	E,W	E,W	E,W	I	A
Virginia	B				B	B			B		
Wisconsin	E,W			D						Ex,T	A
Wyoming	W			D						Ex,T	A

B–BBS, E–E-Mail, W–WWW, D–Diskette, Ex–Expedite, T–Trns-Port, I–In-House.

startup possible for the implementation of EBS by the transportation agencies.

INTERVIEWS WITH INDUSTRY PARTICIPANTS

Personal interviews were conducted with several professionals during the study to ascertain the current technology for implementing electronic bidding in the transportation industry and the current stage of development in the DOTs. Interviews were conducted with computer science professionals; personnel from software vendors, notably with the Info Tech Corporation, which developed AASHTO's Trns-port systems, and RSA Data Security, Inc.; representatives of the Associated General Contractors of America (AGC) and the American Road and Transportation Builders Association (ARTBA); and personnel of the Department of Defense's Electronic Commerce Resource Center; the U.S. Army Corps of Engineers, and several DOTs.

Computer Software Vendors

Discussions were held with several computer experts familiar with the use of EDI software for communication and purchasing activities, plus the many complicated issues related to security, authentication, and confidentiality in doing business. Several commercial software systems are available to handle these problems; therefore, technology is not a barrier. For example, RSA Data Security, Inc. has security software for every type of EDI transmission system, which are discussed in the following section on existing software solutions. However, it will take a computer expert considerable time to develop a specific application, such as an electronic bidding system for transportation projects, to meet the specific requirements of the user's desired system. In order to do this, the user must first define a management process to be followed for their system. It is difficult to estimate the exact amount of effort required without knowing the details of the system desired; however, the technology exists to accomplish the task.

Several discussions were held with representatives of the Info Tech Company, developers of AASHTO's project management computer system, Trns-port. Expedite, formerly known as Electronic Bid System, and Bid Express were developed by Info Tech specifically to handle electronic bidding. (These systems are discussed in more detail in the section following on AASHTO's Electronic Exchange System.) It is the opinion of those interviewed that the problem of setting up true electronic bidding in transportation agencies is not a technology issue, but a management issue. DOTs must establish a management process for conducting bidding electronically that is satisfactory to both the agency and the contracting firms working with them before total electronic bidding will occur. It took years to develop the current sealed-bid system and it will take time to change the system. The legal approval to accept electronic signatures will also be required and Florida, which has this authority, may be the first DOT to implement a full-scale electronic bidding system.

Highway Contractors

Several highway contracting companies and industry associations were contacted for their views on using an electronic bidding process for highway projects. All were members of either AGC or ARTBA. Discussions were also held with highway contractors in Kentucky. The consensus of the industry members is that electronic bidding will come in the near future and that it offers many benefits to them, mostly in the convenience of obtaining project bid information, preparing bids, and less complicated and less costly procedures for submitting bids. At the present time, they are quite comfortable with the submission of bids on diskette. However, until a good working process is in place, the contractors are very concerned about the security of their bid information and the reliability of a fully electronic system to work when they need to access it at bid time. If developed carefully and fairly by the DOTs, these contractors are not against the implementation of electronic bidding systems.

United States Army Corps of Engineers

The U.S. Army Corps of Engineers handles the bidding of millions of dollars of construction contracts each year for the Army, Navy, and Air Force. This involves spending millions of dollars to print and distribute contract solicitation documents. In 1995 and 1996, the Corps of Engineers developed the Electronic Bid Sets (EBS) system to produce and distribute these contract documents in an electronic format. Initial pilot projects were highly successful in providing contractors the documents, free of charge, either on CD-ROM or by downloading from the Internet. Thousands of dollars were saved in printing and handling costs. The Corps is now training all of its personnel on use of the system and will begin using it for all of its projects. The system is very user friendly for contractors. The EBS does not include provisions for the electronic receipt of contractors' bids. Because of the security issues involved, the Corps has decided to continue using the sealed-bid in envelope system until full electronic bidding is better defined. More information on the Corps' EBS system can be obtained by contacting the Engineering Management Branch at Washington Headquarters.

Departments of Transportation

The following summaries were developed from telephone interviews with personnel of the listed transportation agency about electronic bidding activities in their agency. These are presented as typical activities in DOTs related to implementation of electronic bidding.

Alberta (Canada) Transportation Agency

In 1994, this agency decided to set up a bulletin board system to allow contractors to obtain tender documents for construction projects electronically. They initially looked at several commercial services: Open Bidding System, a Canadian Government initiative; CompuServe, a large public BBS used by several American DOTs; America Online; and Sierra Online, a Colorado service specializing in construction tenders. Because of excessive costs or other deficiencies, they decided to set up their own system using Oracle Database and Powerbase Database Manager, giving them an inexpensive and easy-to-use system.

Contractors with a PC and a modem can get an account to access the bulletin board. They pay $25.00 to download a set of tender documents in WordPerfect, which includes courier costs to deliver a set of reduced-size plans (11 by 17 in.). For $45.00 they can have courier delivery of a full-size set of plans. Bids are submitted by hard copy only, but diskettes are also encouraged. Many contractors currently use the bulletin board. In the summer of 1997, a committee was established to work on a system for receiving bids electronically.

Georgia Department of Transportation

The DOT is actively involved in using EDI in its project bidding process. It announces its bid information on the Internet and via CompuServe. It also provides earthwork end area files, bidding results, award announcements, bidders lists, bid tabulations, item mean prices, and pay item lists on the same systems. The Department uses AASHTO's Trns-port modules and uses the bidding module, Expedite, for its bidding process.

Contractors can currently submit bids on diskette with hard copy required. Diskettes are stored and protected by Contract Administration personnel until the bid reading begins, then select CA personnel load the data to a PC and upload to the VAX. Changes must be made on the paper copy or the contractor can withdraw their bid and resubmit a new bid on diskette; however, most make changes on the paper submittal. Beginning in October 1997, all contracts over $500,000 are to be submitted on diskette.

The Georgia legislature has approved electronic signature for business transactions; however, the DOT is not ready to go to full electronic bidding at this time until further study is made of the system required to assure security and reliability in the process.

New York Department of Transportation

The NYSDOT started accepting submittal of bids by diskette in 1994. Rather than adopt AASHTO's EBS or devise its own software, they asked vendors of bid development software to modify their systems to read and write bid data according to state specifications. Software vendors such as The Construction Link; Heavy Construction System Specialists; LEJ Software; Bid Tech; and Hard Dollar complied as a service to their customers, the contractors. Bidders may also modify their in-house systems to support electronic bidding. In any case, electronic bidding becomes a seamless part of their existing software. This allowed rapid implementation at no cost to the state. Its simplicity also supported the Department's custom letting and award systems, which were incompatible with AASHTO's EBS program.

Contractors can receive bid data by dialing in to a PC-based BBS. Data compression allows bidders to download the data for all contracts for a given bid date in just a few minutes. Two telephone lines support the entire state at no cost to the bidder. NYSDOT still sells plans and specifications as hard copy through offices located throughout the state. Bidders return a computer diskette along with a signed hard copy of their bid documents. These documents back up the diskette and always prevail in case of discrepancy. The system supports handwritten changes up to the last minute. While electronic bid participation is voluntary, more than 50 percent of the bids are currently received in that format. NYSDOT suspends the BBS privileges of firms that routinely download data without returning a diskette with their bid. An Internet web page provides downloadable summaries of bid results and schedules.

While the NYSDOT approach has significant limits, it shows that an early stage of electronic bidding is possible at this time in spite of numerous complications and a large construction program. The agency will alter or replace this simple approach and support full electronic bidding to a secure mailbox once state law permits it and the department embraces it as an overall improvement to the present process.

South Carolina Department of Transportation

SC DOT uses AASHTO's Trns-port and Expedite computer software for electronic bid information on diskette for all projects. A hard copy bid with signature is still legally required along with a diskette. Contractors can access bid proposals and browse plans, but must buy sets of prints, which include a diskette for bidding. They still accept bids from contractors by paper only and hope to implement full electronic bidding in the future. They will soon have an Internet web page on line for advertising bids.

Wyoming Department of Transportation

WYDOT uses AASHTO's Trns-port and Expedite computer software for electronic bid information on diskette for all projects. A hard copy bid with signature is still legally required along with the diskette. The agency has a web page on the Internet using Compuserv software to list bid proposals and bid item spreadsheets for contractors. They allow contractors to change their bids up to the official bid time as long as they sign a form specifying the change. WYDOT plans to eventually have authority to go to fully electronic bidding with electronic signature. Together with Colorado, Iowa, Montana, Nebraska, Oregon, and Texas, WYDOT has hired Info Tech to modify the AASHTO Expedite software for

enhanced electronic bidding. The major objective is to enhance Expedite so that a contractor's bid can be evaluated for errors and omissions before submitting their final bid to the DOT. The consortium plans to donate the enhanced Expedite to AASHTO after development.

EXISTING SOFTWARE SOLUTIONS

Many private software companies in the United States are currently developing applications to fill the needs of EDI in the construction industry. Some transportation agencies started using EDI in 1992 (according to the survey responses). The earliest implementations allowed for publishing of bid listings and general project information. Some of the many software service companies available to assist DOTs have been mentioned in previous sections of the report, such as The Construction Link; Heavy Construction System Specialists; and Info Tech. Most of these companies have developed software to download bid information from the DOT files and offer a spreadsheet compatible with the DOT's required format for submitting bids on diskette and hard copy. Other companies have developed software to provide the required attributes of an EBS, such as security of data, electronic signature and time, authentication, and others. RSA Data Security, Inc. provides a wide variety of software for different EDI modes of transmission.

DOTs are seeking to adopt EDI practices to all phases of their contract bidding process for projects, all of which may be included in an EBS:

- Bid proposals (announcements, plans, specifications, instructions, bid item sheets),
- Bid submittals (receipt of bids, analysis of bids, award of contract), and
- Posting of bid results.

There are four basic EDI modes that a DOT can use to enhance communication for any or all of the different phases of its contract bidding process: diskette and/or CDROM, E-mail, Bulletin Board System (BBS), and WorldWide Web (WWW).

All of these modes can be beneficial to both DOTs and contractors. Diskettes and CDROMs are not fully electronic methods, but do enhance computer operations and save large quantities of paper and labor. E-mail and BBS are both text-based systems and cannot be used efficiently for graphics. E-mail is primarily run on the Internet (which operates on dedicated telephone lines). BBSs are run on modem-phone hookups with charges for calls. With the advancements of the WWW, it is believed that BBSs will gradually fall out of favor for the more popular WWW. The Web is very flexible, offering both text and graphic transmissions of high quality with basic service to external users costing about $20 per month. A web site (or web page) can be set up for an organization by a computer service company, such as CompuServe or America On Line, by renting memory (space) on their computer server. The rate depends on the size of the memory required.

The latter three modes offer the ability for full electronic exchange of data between the DOT and contractors. They have been widely used for the first and third phases of the bidding process, bid proposals and posting bid results. However, no DOT is currently using them for receipt of bids for two basic reasons. First, most states must obtain legal approval from the legislature to receive bids electronically. States such as Florida, Georgia, Utah, and Washington have such authority, but still only accept bids on diskette along with a hard copy. Second, there is a need for each DOT to revise its current contract bidding process to address problems related to EDI activities. This process should be done with input from the contracting industry. Once this is done, an EBS can be developed using a variety of EDI modes to streamline the DOT's bidding process. An expensive part of the process will be obtaining security software (requiring annual fees of thousands of dollars) and having this software programmed into the EBS by the DOT or a consultant. Most DOTs have computer personnel who can handle this task. Another alternative would be to contract with a computer service company to handle the total project bidding activities for the DOT.

AASHTO'S ELECTRONIC EXCHANGE SYSTEMS

These electronic exchange systems were developed in 1982 by Info Tech under a consulting contract with AASHTO under the name of Bid Analysis Management Software (BAMS) and Electronic Bid System (EBS). In June 1996, the system was purchased by AASHTO for licensing to all member DOTs interested in enhancing information exchange and management. Upon acquisition, AASHTO changed the BAMS name to Trns-port and the EBS name to Expedite.

A workshop on the Trns-port, Expedite, and Bid Express software put on by personnel from Info Tech for the Kentucky Transportation Cabinet was attended by the researcher. This state-of-the-art software is customized for transportation agencies and the entire package is constantly reviewed and updated by AASHTO committees working with Info Tech. A brief summary of the available software is given in the report; full details can be obtained by contacting AASHTO's Project Director.

Trns-port Modules

Five Trns-port modules are available to meet state highway construction contract administration needs. Each module addresses the needs of the highway agency at a particular milestone in the highway construction contracting cycle.

- CES (Cost Estimation System): a job and program cost-estimating and planning tool that provides a highly productive environment for preparation of parametric, cost-based and bid-based job cost estimates. It provides a full range of cost estimating and scheduling support capabilities, from preliminary estimates needed for program planning to the final engineer's estimate required for award approval.

- PES (Proposal and Estimates System): addressing the needs of the design and funding departments in the pre-letting phase of the construction process, PES allows the engineer to prepare detailed estimates for highway construction projects, combine projects into proposals, and select a group of proposals for a bid letting package.
- LAS (Letting and Award System): designed specifically to assist highway agency personnel in advertising bids, processing bid information, evaluating bids, and making award decisions, LAS provides on-line and batch data entry with full edit checking and verification for vendor bids, produces the bid tabulation report, and performs analysis on received bids. Additionally, it maintains the Planholders List, produces mailing lists, and maintains information for invoicing vendors for proposals and plans purchased.
- CAS (Construction Administration System): from award to final payment, CAS manages contract information and contractor payments, offering a complete set of management information reports detailing construction progress. It addresses the construction offices's needs regarding contractor payments (progress or final), subcontract approval and tracking, and modifications to original contract specifications (change orders and supplemental agreements). Also included is the ability to track DBE/WBE subcontractor and supplier information and payments.
- DSS (Decision Support System): provides a complete historical database of construction contract information specifically designed to provide decision support in bid review and evaluation, collusion detection, vendor (contractor) analysis, item price estimation, and planning and budgeting processes.

It should be noted that these modules were developed to work together for a complete construction contract management system and are not all stand-alone systems. CES and CAS can be used independently; however, PES and LAS were designed to work together. DSS appears to be a valuable data base with many benefits; it comes with Trns-port, which is useful for analyzing and reviewing bids. The annual fees for licensing these modules from AASHTO includes considerable consulting assistance: the 1997–98 fee schedule is:

Base Fee:		*$31,700 (always charged)*
Modules:	*CES*	*$15,800*
	PES	*$15,800*
	LAS	*$15,800*
	CAS	*$15,800*
	DSS	*$15,800*

Expedite

Expedite (formerly the Electronic Bid System, EBS) is a PC-based collection of programs designed to work with Trns-port PES and LAS or any similar proposal preparation and bid letting management system to allow bidders to receive proposal item schedules and submit item bids in a secure machine-readable form. (Expedite does not have to be used with the other Trns-port modules). It supports proposals with alternate sections and alternate items, lump-sum and fixed-price items, marking proposals as information only or with serial numbers and distribution of amendments in electronic form.

Expedite consists of several components, some intended to be run by the state highway agency and others to be run by bidders. A flow diagram of this process is shown in Figure 3 for the Trns-port/Expedite package; however, it can be used with software other than Trns-port. The first component will convert a file of proposal item information, taken from PES or a similar system (Step 1), into an electronic proposal or amendment file for distribution to prospective bidders (Step 2). The second component allows contractors to prepare bid prices and complete the bid proposal, which is then sent back

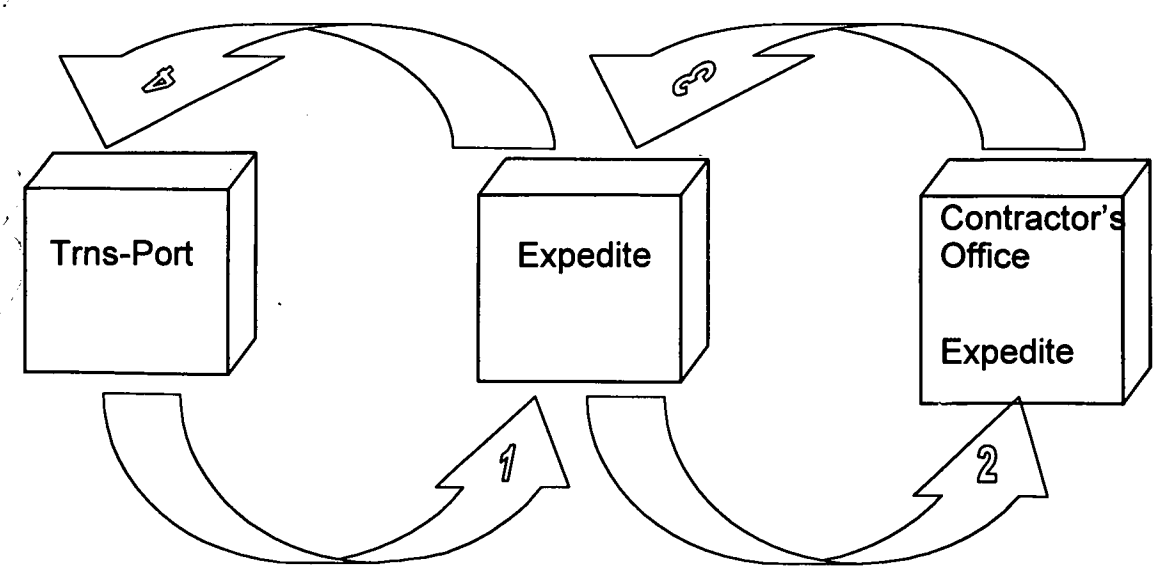

FIGURE 3 Trns-Port—Expedite Flow of Information.

to Expedite (Step 3). The third component, run by the state highway agency, checks the electronic bid for validity and data errors, prints information for comparison of the electronic bid to the paper bid, and converts the bid proposal to a file suitable for loading into LAS or a similar system (Step 4). The final component allows the state highway agency to enter bid data from proposals submitted manually in a PC-based program for loading into LAS or a similar system.

As indicated, a DOT could use Expedite without using any of the other AASHTO Trns-port modules. If they are using any of the modules already, then Expedite is available at no additional charge. If not, an annual fee of $10,000 is charged for the Expedite module, plus the agency will have to purchase other supporting software for proposal preparation and bid letting management.

BID EXPRESS

Bid Express is a new software developed by Info-Tech that could serve as an interface between the bid management systems, Trns-Port, and Expedite modules to transfer the information between the transportation agency and the bidders. It is an example of the type of bidding service software that could be contracted for by DOTs to handle their bidding process. It was originally designed for the Wisconsin DOT and was piloted in 1996 and put in production in 1997. More than one hundred contractors in Wisconsin are using this service and many more are expected to join in. Florida DOT is currently considering using the same service.

The information from the Trns-port modules is converted into HTML files and published in a secure web site for downloading by the contractors. In order to provide a secure web site for the DOT and contractors, Info Tech is using IBM Advantis, a secure Internet Protocol system. The contractors can access the information using login and passwords and download project information along with the Expedite-format proposals. Bid Express has been developed as a secure, totally electronic bid system, but has not yet been fully implemented because of liability issues concerned with handling contractors' bids. At this time, contractors still submit their bids on a diskette, along with a hard copy, to the DOT for analysis. Also, the existing legislation in most states does not yet allow the use of electronic transmission for contract bidding.

Bid Express offers the convenience to use any bid software analysis program (not only Trns-Port) in conjunction with Expedite. This is convenient for DOTs that are not currently using the Trns-port modules, but want to streamline their bidding process. It may be possible for city governments and other local transportation agencies to use Bid Express.

Essentially, the DOT hires Info Tech to advertise its contract RFP information and manage the bid submittal process, thus reducing the DOT's cost for personnel to administer the EDI system. The cost to the bidders (contractors) is a flat fee of $25 a month and the required equipment is a computer with a modem. Local network connect time is charged at $8.00 per hour and 800-number access is charged at $16.00 per hour. Info-Tech requires a minimum of 100 bidders to start the program and provision of the following information by the DOT to Info-Tech: Contract advertisements, schedule of bid items, and timely updates for changes. The DOT is not charged by Info Tech for operating this service once it is developed.

CHAPTER FOUR

REPORTED BENEFITS AND CONCERNS

BENEFITS AND CONCERNS REPORTED BY DOTs

A request of emphasis in the questionnaire (Appendix A) sent to all DOTs was to list their perceived benefits and concerns with using electronic data interchange methods in the bidding process for highway projects. Graphical summaries of the responses received are shown in Figures 4 and 5.

The major benefits noted were time savings, increased accuracy, and increased convenience in the bidding process. The major concerns noted were security of the bids and reliability of the bidding system.

There is a tremendous potential for savings in reduced personnel costs to prepare and distribute bid proposals, and to collect, record, and analyze bids when EDI methods are used by DOTs. There is also a tremendous potential for savings in printing costs for plans and specifications, as the Corps of Engineers has proven with its EBS efforts. At a meeting of the AASHTO Construction Subcommittee's Computer Task Force in Branson, Missouri in August, 1997, it was noted that excellent savings can be realized in the bidding system even if DOTs do not go with full electronic bid transmission. Some members questioned whether the marginal benefit of going fully electronic would offset the problems and costs associated with the security requirements necessary for the full electronic process to function.

BENEFITS AND CONCERNS REPORTED BY HIGHWAY CONTRACTORS

The questionnaire shown in Appendix B was sent to more than 50 major highway contractors recommended by the Contractor Division Staff Contacts for American Road and Transportation Builders Association and the Associated General Contractors of America. As can be seen, this questionnaire was much simpler than that sent to the DOTs and primarily asked for input on the perceived benefits and concerns of using electronic data interchange methods in the bidding process, and for opinions on access to the contractor's formal bid submittal before the final bid letting deadline. Summaries of the responses received from highway contractors on EBS benefits and concerns are shown in Figures 6 and 7, including responses from Kentucky contractors, a total of 39 responses were received.

The primary potential benefits of electronic bidding were believed to be the ease of obtaining project bid information, a more efficient process for preparing a bid, and the increased

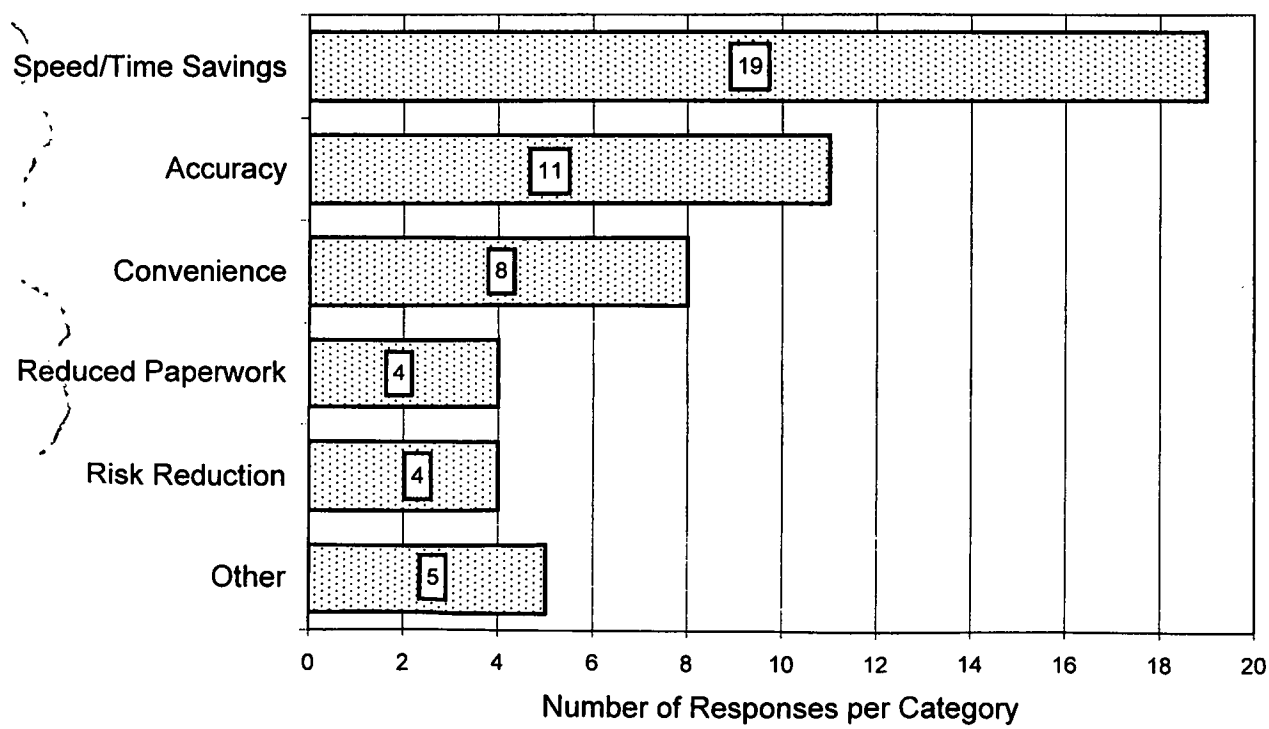

FIGURE 4 EDI benefits reported by DOTs.

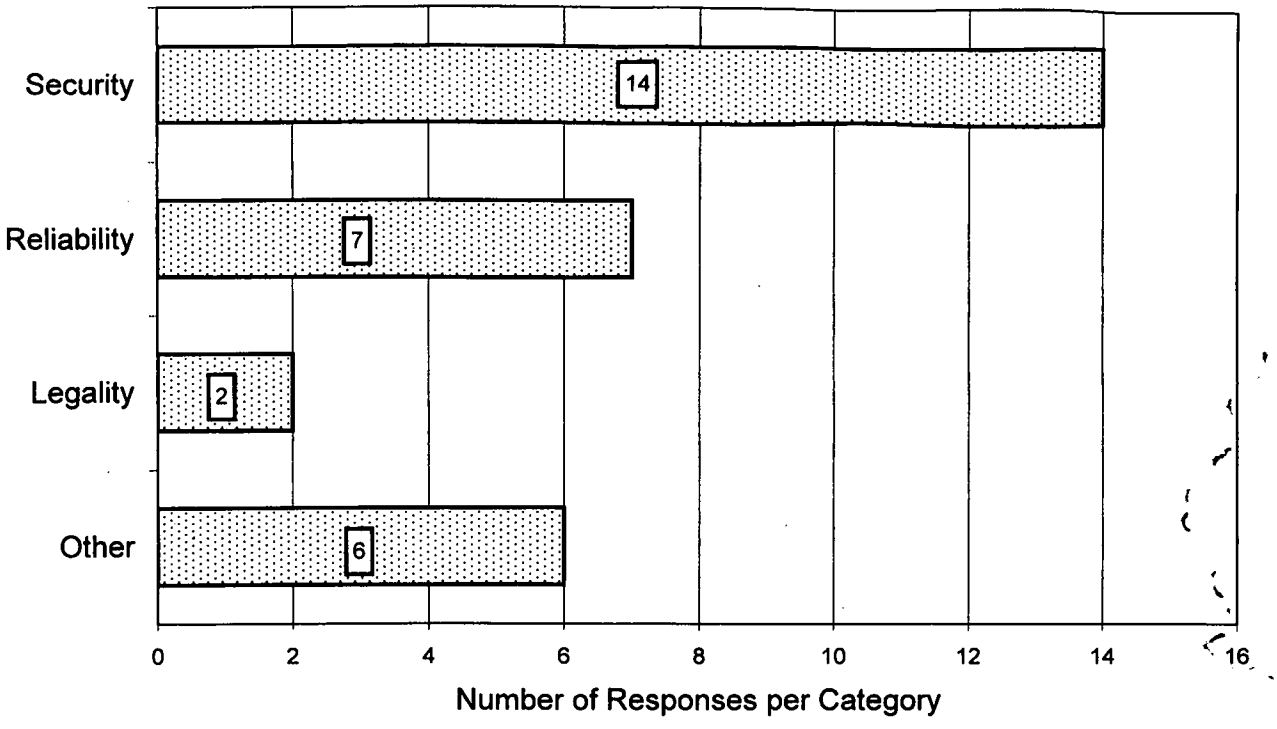

FIGURE 5 EDI concerns reported by DOTs.

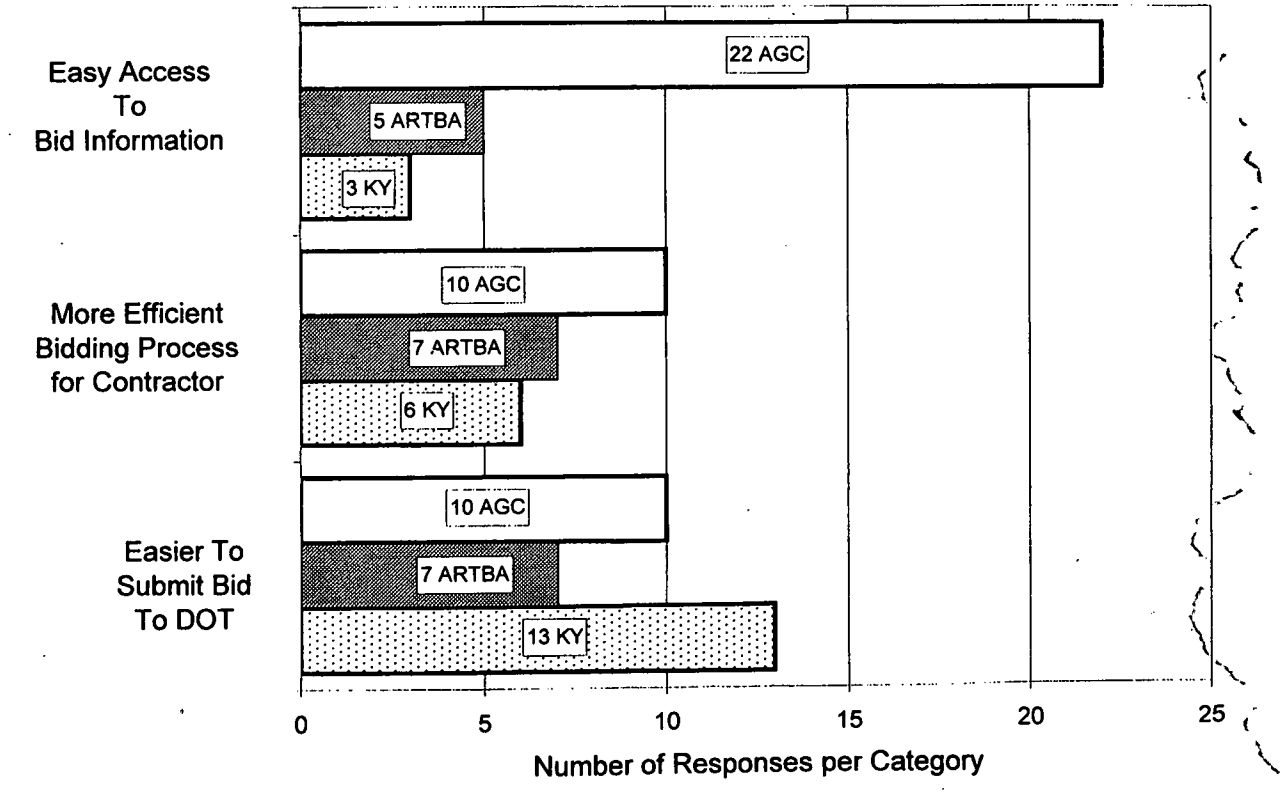

FIGURE 6 Potential benefits of EBS reported by contractors.

ease of submitting bids to the DOT (with associated savings of cost and time). The major concern, almost unanimously, was the security and confidentiality of the contractor's bid information. They are very concerned with tampering of their bids by others prior to the official bid deadline and public opening. They were also concerned with access to the DOT

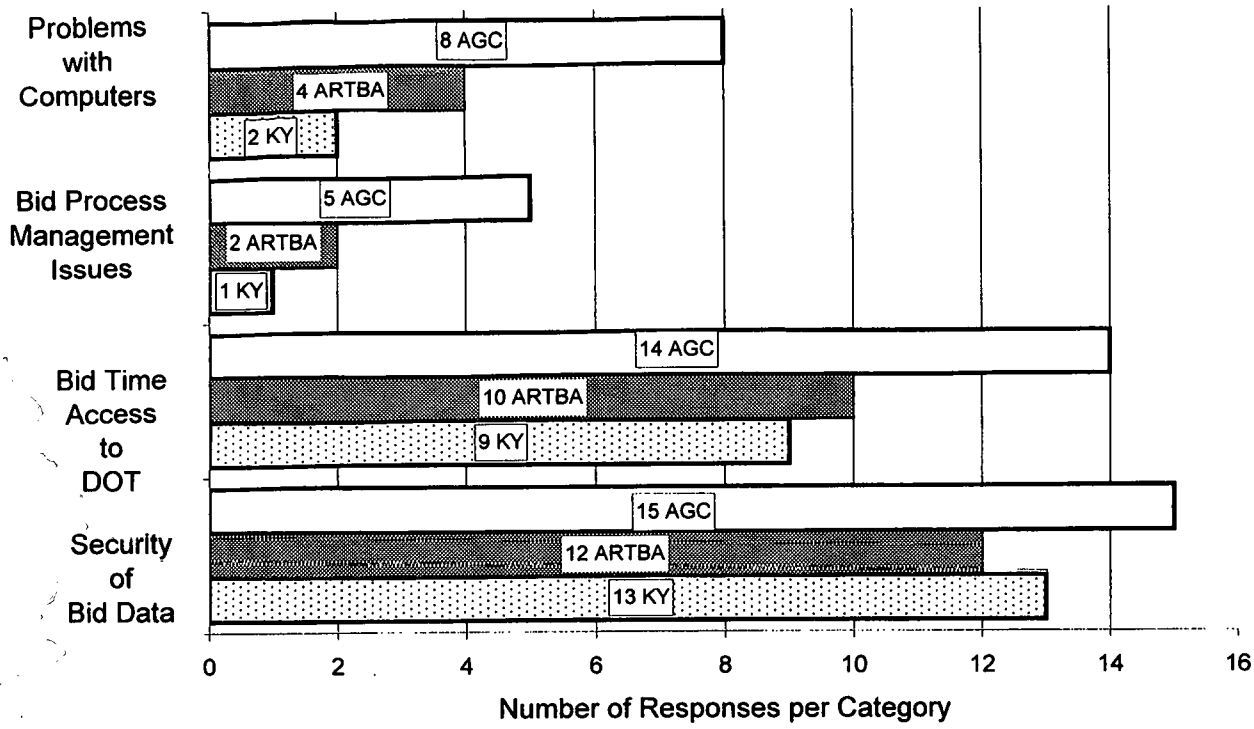

FIGURE 7 Major concerns of EBS reported by contractors.

TABLE 3

CONTRACTOR RESPONSE TO ACCESS TO BID DATE PRIOR TO DEADLINE

If electronic bidding is implemented for all highway projects,

a) Should the contractor be able to modify submitted bids before the final deadline?

	Yes	No	Total
AGC	16	3	19
ARTBA	7	1	8
KY	11	1	12
Total	34	5	39

b) Should the DOT have access to submitted bids before the deadline/bid opening?

	Yes	No	Total
AGC	0	19	19
ARTBA	0	8	8
KY	0	12	12
Total	0	39	39

computers on bid day and problems with their own computers when time to submit bids. Finally, there was some concern with the management of the new bidding process.

The contractors were also asked specific questions about access to their submitted bids before the final bid deadline. The responses are summarized in Table 3, classified by contractor group. Responding contractors strongly agreed that they should be able to access their bids and make modifications prior to the deadline, but unanimously agreed that the DOT should not have access to their bid information before the public bid opening.

CHAPTER FIVE

IMPLEMENTATION OF DOT ELECTRONIC BIDDING SYSTEM

ISSUES IN IMPLEMENTING ELECTRONIC BIDDING IN A DOT

Several DOTs have initiated EDI activities to facilitate the bidding process for their construction projects. However, none has implemented a true electronic bidding system where bids are transmitted electronically via computer from a contractor to the agency. The technology exists and is being used in other sectors of business; however, the specific nature of the competitive bidding process for DOT projects requires that several issues be addressed before any implementation. Some of the key issues are identified and discussed below.

Reliability

This concerns the availability of the system to the users and the probability of system failures. The critical point occurs close to the bid date with a situation of high network traffic. This could result in frustration and underrating of the system by users not able to send their bids. Some external factors should be considered in the reliability of the system also. Currently, the reliability of the Internet is not guaranteed by any organization, although it is unlikely that all servers in an area will turn inoperable simultaneously (e.g., a major electricity blackout). In this matter, the traditional form of EDI (using dedicated telephone service lines from a vendor such as AT&T) offers more reliability than using Internet access.

Security

Security is probably the most serious concern, but it is not necessarily the most difficult to address. The security of the information is critical to bidders who may not feel comfortable sending their proposal through an electronic connection. Encryption is currently the best solution to address the security issue. The current level of security attained with 128-bit encryption offers far more security than is needed for bidding purposes. Companies such as RSA Data Security have proven security software available for any EDI mode used for EBS systems. Of concern would be the integrity of DOT personnel with access to review a contractor's bid price prior to the bid letting time. However, this concern exists for more traditional current practice as well, and is not new.

Authentication

Authenticating processes ensure that a message from a particular bidder can have originated from that bidder only. This can be handled by digital signature software that is already available.

Validation

Validation of files is closely related to the issue of authentication and concerns whether transmitted data have been altered. This can be handled with digital signature and digital time software on the market.

Start-up Costs

The initial costs to the transportation agency will depend on the additional software, hardware, and personnel needed to implement the electronic system. The potential for offsetting savings is very high.

Compatibility

Compatibility addresses the differences in computer software and operating systems. This issue is much less critical when EBS is used over the Internet instead of a VAN. With all of the methods and software available for EDI operations on basic PCs, compatibility should not be a major problem to address when setting up an EBS.

Government Regulations

The legislation in most states currently does not allow for electronic signatures of documents on the Internet; until this changes full electronic submission of bids is prohibited. Also, electronic data interchange currently being done is voluntary and bids are still accepted by paper only. If full electronic bidding is approved for DOTs, paper bids may still be received, especially from small contractors.

Equity For Small Contractors

There is concern that small contractors may have problems submitting bids on an electronic system. DOTs may have to provide access to computers and training to allow such contractors to participate. It is probable that many small contractors will have the computer equipment to access an EBS in the future.

Electronic Transfer of Funds

The ability to prove bonding or for a deposit to be submitted electronically with a bid requires electronic transfer of

funds. A bonding company could easily provide an electronic message verifying that a bond has been obtained. As for a deposit, the technology exists now for financial credit to be securely transferred from the account of a bidder to the account of a DOT, although the costs are much higher than bonding verification.

EBS Management Process

Several issues need to be addressed in the management process to be followed for a DOT's electronic bidding system. Some of the issues are: contractor and DOT access to the contractor bid files before the deadline; public opening of bids; impact of computer problems by DOT or contractor on bid day; addenda to original bid information. Jointly developed agreements are needed, and perhaps enabling legislation, involving the DOT and the contractors in a given state, to identify the process to be followed for an EBS and the legal responsibilities of the parties involved. This is a very important task and should be done before developing the EBS. As noted, this management process should address operating procedures to be followed for all phases of the bidding process:

- Bid proposals (announcements, plans, specifications, instructions, bid item sheets),
- Bid submittals (receipt of bids, analysis of bids, award of contract), and
- Posting of bid results.

DEVELOPMENT OF A CUSTOMIZED ELECTRONIC BIDDING PROCESS

It appears that the software currently available from AASHTO is fully capable of handling the electronic bidding process in DOTs. Other software is currently being developed to complement the AASHTO Trns-port modules to make the process even more efficient. It would seem logical for a state transportation agency to proceed in this direction.

Development of a customized electronic bidding process that does not use the AASHTO software could require considerable time and expense. The DOT would have to put together a computer system that would support the full process of advertising, receiving bids, and awarding contracts electronically. It may also be possible to purchase a commercial system or hire a service company to provide the service. However, some DOTs may decide to develop their own customized system. A computer consultant could be hired to set up this system, although the computer personnel in most DOTs should have the capability to do this, since most software vendors will help them implement their software packages. The cost to develop a system depends on the complexity desired of the system.

Developing a customized EDI process would seem more appropriate when publishing bid information only, thus not involving the transmission of legal and financial documents by electronic media. This is already being done by several DOTs using readily available and inexpensive software, with very satisfactory results. Such systems are still used on a voluntary basis and are not required of all bidders. All aspects of an EBS up to the actual electronic submission of the bid, plus the publishing of final bid results, can easily be done with a Web page setup. The bids could be received by diskette. There are now computer service companies willing to provide this service for a DOT, thus eliminating the need for the DOT to develop a system to receive bids.

OBTAINING NECESSARY HARDWARE AND SOFTWARE

The hardware needed for electronic bidding is not special and is readily available now. The DOT will need a dedicated computer and supporting equipment to advertise projects, and to receive and evaluate bids. A detailed analysis of the specific equipment needed would depend on the characteristics desired in the system. A contractor should need no more than a PC with a modem and a telephone connection to the Internet or a dedicated computer system specified by the DOT. Obtaining the necessary hardware should not be a problem for either party.

The software requirements depend on whether the DOT chooses to set up its system using the AASHTO software or to develop a customized system. If following the latter path, it is highly recommended to use existing software. The contractor should not require any special software, except for possibly a spreadsheet program.

TRAINING OF PERSONNEL

Personnel training will almost certainly be required by both the DOT and the contractors if optimum use of the electronic bidding process is to be attained. Most likely, the DOT will have to provide such training or arrange for it to be provided. It is not anticipated that the training will be very difficult and will be mostly informational on the use of the electronic system and the process to follow. AASHTO and several computer service companies provide training as part of the annual service agreements for their products.

OPERATION AND CONTROL

Operation and control of any electronic bidding system will be the responsibility of the DOT or its specified agent. Once again, a detailed management process for an EBS should be established by a DOT, with industry input, prior to developing or implementing electronic bidding for its construction contracts. Several of the issues to consider were discussed in the previous section on issues in implementing electronic bidding in a DOT. Periodic input should be sought from both DOT personnel and the local contracting industry to be sure the system is working smoothly and to identify possible improvements in the system.

CHAPTER SIX

CONCLUSIONS

This synthesis summarizes the current technology available to support the bidding process for transportation construction projects using electronic media processes and describes practices being followed. The report gave a brief introduction to the history of electronic data interchange (EDI), its relation to electronic bidding, and current applications in the transportation construction industry. The results of surveys of departments of transportation and highway contractors, plus interviews with industry experts and government agencies, on the use of electronic bidding for highway projects were presented. Potential benefits and concerns, plus other issues related to the implementation of electronic bidding in DOTs, are also presented.

The findings of the study and conclusions drawn from survey responses are summarized below.

Several state departments of transportation (DOTs) are now using electronic media to post project bid information and in some cases to show receipt of contractors' bids. However, none actually receives bids electronically, but many accept bids on diskettes. In addition, they all require contractors to also submit a hard copy of the bid proposal with all signatures required. Systems in place range from simple electronic bulletin boards where contractors can obtain project information and download bid item forms, to the comprehensive AASHTO computer systems for electronic project administration. Most agencies have plans to implement new, or enhance their existing, electronic systems in the future.

Electronic bidding systems (EBS) have the potential to provide substantial savings in time and costs to both agencies and highway contractors. Due to the progressive evolution of electronic media, especially the Internet, it appears that the electronic submittal of DOT bid advertisements, bid documents, and contractors' bids will become increasingly prevalent in the future. This raises many questions related to the adequacy, reliability, and security of existing electronic media technology, as well as questions concerning the actual bidding process to be followed if electronic media are used.

The technology to support electronic bidding systems in the transportation industry already exists and has been proven in other business segments. EDI has been developed extensively for purchasing activities in both the public and private sectors. However, there are bidding process management issues that must be addressed in the transportation industry that currently limit the development and implementation of EBS. Some of the major concerns are legal approval to receive bids electronically, the validation of the bid information from contractors, the ability of contractors to change bid items submitted before the required bid time, the ability of DOTs to look at submitted bids before the required bid time, and the ability of small highway contractors to adapt to the new technology.

It does not seem that requiring electronic bidding will cause undue hardship to small contractors. The hardware requirements of a personal computer with a modem and a telephone connection to the Internet or a dedicated computer system specified by the DOT do not seem unreasonable. The cost of the computer and the monthly access for connection to the system should be attainable for most firms. However, special arrangements may be necessary by DOTs to provide access to computer hook-ups in public offices for small contractors to use.

Finally, it appears that any state DOT desiring to adopt electronic bidding may benefit from considering AASHTO's Expedite, and other Trns-port modules. Efforts continue to further develop and enhance these products, and companion products are being developed by software vendors. The annual fees for using these AASHTO products, plus current policy restricting access to the AASHTO Trns-port DSS module to members only, may prohibit their use by non-state agencies. However, small agencies can use several simple and inexpensive existing systems for improving their bidding process until more advanced software systems are developed at more feasible prices.

Based on the findings and conclusions, some recommendations are presented for consideration.

It is very likely that DOTs would benefit from continuing to pursue the implementation of EBS for highway construction projects. This could start with electronic announcements of bid proposals and develop over time to a complete system from announcements of new proposals to final announcement of the winning bids.

State DOTs may want to consider using the AASHTO Trns-port software modules and other supporting software for their EBS. They are specifically designed for transportation agencies and have on-going support and development.

DOTs will probably need to develop training programs for contractors as part of their implementation program if they adopt full electronic bidding.

DOTs may want to consider forming working groups with members of their organizations and members of the highway contractors in their state to develop a total process for electronic bidding that is fair and beneficial to all participants.

DOTs may need to set up special programs in the initial implementation stages of an EBS to ensure that small contractors are not penalized for the lack of resources to comply with the new process.

Further research is needed to identify the key elements of an effective management system for operating an EBS in a DOT and to identify the benefits and costs associated with its implementation.

REFERENCES

1. Mason, D.J. "The Real Facts about U.S. EDI in 1994," *EDI Forum,* EDI Publications, Inc., Oak Park, Illinois, Vol. 7, No. 4 (1995).
2. Computer Advocacy, "Terminology," (December 1996). http://edi.road.com/terms.htm
3. Federal Supply Service, General Services Administration, "More About Electronic Data Interchange (EDI)" (March 1996). http://www.fss.gsa.gov./edi_mae.html
4. Premenos Corporation, "EDI Some Legal Aspects," (March 1996).
5. Lightning Instrumentation, S.A., "White Paper on Encryption," (November 1996). http://www.lightning.ch/products/software/encryption/details. html
6. Premenos Corporation, White Paper "The Future of Electronic Commerce." http://www.premenos.com/edi/papers /edicom95/ 002.html.

BIBLIOGRAPHY

Aviation Research, "Electronic Data Interchange Service (EDI)"(January 1996). http://www.arinc.com/Products Services/PROXY/edi.html

European Workgroup for Open Systems, "Electronic Data Interchange" (November 1996). Http://www.ewos.be/edi/gtop. html

General Electronic Information Systems, "Introduction to EDI-A Primer" (September 1996). http://www.geis.com/geis/edi/edifaq2.html

Fahley, M., "The Challenge of Electronic Commerce" (June 1996). http://www.guide.org/fsecom.html

Netscape Corporation, "On Security." http://home.netscape.com.fo/security-doc.html#C13

RSA Data Security Inc., "RSA Labs FAQ#5" (May 1996). http://www.rsa.com/rsalabs/newfaq/q5.html

Rodriguez, J. E., MSCE Report, "Electronic Bidding in the Transportation Construction Industry," Department of Civil Engineering, University of Kentucky, Louisville (May 1997).

San Antonio Electronic Commerce Resource Center, "The Fundamentals of EDI, Legal Concerns" (April 1997). http://www.saecrc.org/dodedi/edifun07.html

San Antonio Electronic Commerce Resource Center, "The History, Growth and Benefits of EDI" (April 1997). http://www.saecrc.org/dodedi/edifun02.html

The Computer Network, News, "For E-Commerce All Systems Go" (December 1996). http://www.news.com/News/Item/0,4,6553,00.html

REFERENCED COMPANIES

1. MIT Distribution Site for PGP, http://web.mit.edu/network/pgp.html
2. Surety Technologies, http://www. surety.com
3. RSA Data Security, Redwood City, California http:// www.rsa.com
4. Loren Data Corporation, Marina del Rey, California http://www.id.com
5. Info Tech, Gainesville, Florida Email: infotech@ cloverleaf.net
6. The Construction Link, Geneva, New York
7. Heavy Construction System Specialists, Houston, Texas

APPENDIX A

Questionnaire Sent to Transportation Agencies

NCHRP Project 20-5, Synthesis Topic 28-07

SUBMITTAL OF BID PROPOSALS IN ELECTRONIC FORMAT

QUESTIONNAIRE

PURPOSE OF THIS SURVEY

Several state departments of transportation (DOTs) are now using electronic data interchange (EDI) for the posting and in some cases receipt of bid proposals. Such systems promise potential savings in time and cost to both the agency and contractors. Due to the progressive evolution of electronic mail and the Internet, it appears that the electronic interchange of DOT bid advertisements, bid documents and bid proposals will become increasingly prevalent in the future. This raises many questions related to the adequacy, reliability and security of existing electronic media technology, plus several questions concerning the actual bidding process to be followed if electronic media are used. This synthesis will emphasize the interface between the contractor and the DOT for bidding purposes up to the contract award. It will address the potential benefits and possible concerns of utilizing electronic media in the bidding process, plus it will also address the issues related to the implementation of such a process in a DOT.

Please complete the following request for information to aid the processing of this survey:

Agency: _____

Address: _____

_____

_____

City: _____ State: _____ ZIP: _____

Questionnaire Completed By: _____

Position/Title: _____ Date: _____

Telephone: _____ FAX: _____

Email : _____

PLEASE RETURN QUESTIONNAIRE AND SUPPORTING INFORMATION BY: **March 7, 1997**

TO: Dr. Donn E. Hancher
Civil Engineering Department
University of Kentucky
Lexington, KY 40506-0281

TEL: 606-257-4857
FAX: 606-257-4404
email: **hancher@engr.uky.edu**

THANK YOU FOR YOUR VALUABLE ASSISTANCE ON THIS PROJECT!!
PLEASE WRITE ON THE BACK OF ANY PAGES IF YOU NEED MORE SPACE FOR YOUR RESPONSES.

SECTION 1 CURRENT USE OF ELECTRONIC BIDDING SYSTEMS BY DOT's

1. What is the current use of computers by your DOT in the construction process?

   (Please check all the applicable systems where computers are used):

Estimating	Contract Bidding
Scheduling	Material Testing
Project Planning	Quality Control
Project Control	

   Other, please specify: _____

   _____

   _____

2. Do your DOT personnel have access to the following?

   a. E-mail:

   No Yes. Restrictions? _____

   b. Internet:

   No Yes. Restrictions? _____

3. Does your DOT have its own home page on the World-Wide-Web (WWW)?

   a. ____ NO
   b. ____ YES (Address: _____)

4. Are you currently using any type of electronic data interchange (EDI) for your construction projects?

   a. ____ NO (If NO please go to question No. 11)
   c. ____ YES. Started ____/____/____(if YES please go to question #5)

SECTION 2 CURRENT USERS OF ELECTRONIC BIDDING SYSTEMS IN DOT's

5. Please check the types of information exchanged and the media used.

Bid announcements	E-mail	WWW	Diskette
Project Plans	E-mail	WWW	Diskette
Project specifications	E-mail	WWW	Diskette
Receipt of bid proposals	E-mail	WWW	Diskette

(Indicate if: Required or Optional)

Other, please specify:

_____

_____

6. Indicate the electronic data interchange system(s) currently in use in your bidding process:

EXPEDITE (By AASHTO, formally EBS) TRNS-PORT (By AASHTO, formally BAMS)

An in-house developed system: (Please explain)

_____

_____

_____

A commercially available system: (Please identify supplier)

_____

_____

7. Do you use your electronic data system(s) for bidding process on:

a. ____ All projects

b. ____ Selected projects: (Please explain)

_____

_____

c. ____ Trial basis only:. (Please explain)

_____

_____

8. Authentication and Security.

a) Please specify how you handle authentication of electronic information received

_____

_____

_____

b) Please specify how you handle privacy of electronic information received

_____

_____

_____

9. Based on your experience with electronic data interchange, please list the major benefits and concerns, whether attained or expected:

a. Major Benefits:

1.

2.

3.

b. Major Concerns:

1.

2.

3.

10. Please note any future enhancements planned for your electronic data interchange system in the bidding process.

_____

_____

_____

_____

_____

***** **Please go to Question 13** *****

SECTION 3 CURRENT NON-USERS OF ELECTRONIC BIDDING IN DOT's

11. Are you planning to implement any electronic data interchange systems in the near future?
    a. ___ NO
    b. ___ YES If YES, please indicate uses and the system(s) to implement:

Possible uses of electronic data interchange information systems and methods of transmission.

Bid announcements	E-mail	WWW	Diskette
Project Plans	E-mail	WWW	Diskette
Project specifications	E-mail	WWW	Diskette
Receipt of bid proposals	E-mail	WWW	Diskette

Other, please specify:

_____

_____

Possible Software solutions:
(1) ___ EXPEDITE (By AASHTO, formally EBS):
(2) ___ TRNS-PORT (By AASHTO, formally BAMS)
(3) ___ An in-house developed system: (Please explain)

_____

_____

_____

(4) ___ A commercially available system: (Please identify supplier)

_____

_____

_____

12. What, in your opinion, are the major benefits and concerns of using electronic data interchange systems?

a. Major Benefits:
1.
2.
3.

b. Major Concerns:
1.
2.
3.

SECTION 4 REQUEST FOR FURTHER COOPERATION WITH SYNTHESIS

13. Are you willing to discuss further issues related to electronic data interchange systems in the bidding process with the researcher?

14.
    a. ___ YES
    b. ___ NO

14. If YES, please specify the person(s) in your organization to contact:

Name: _____

Position/Title: _____

Address: _____

_____

_____

City: _____ State: _____ ZIP: _____

Telephone: (_____)_____ FAX: (_____)_____

E-mail Address: _____

Thank you for your cooperation. Please return this questionnaire by February 21, 1997 to:

Dr. Donn E. Hancher
Civil Engineering Department
University of Kentucky
Lexington, KY 40506-0281

TEL: 606-257-4857
FAX: 606-257-4404
email: hancher@engr.uky.edu

APPENDIX B

Questionnaire Sent to Highway Contractors

NCHRP Project 20-5, Synthesis Topic 28-07
ELECTRONIC BIDDING SYSTEMS
HIGHWAY CONTRACTOR QUESTIONNAIRE

PURPOSE OF THIS SURVEY

Several state departments of transportation (DOTs) are now using electronic data interchange (EDI) for the posting and in some cases receipt of bid proposals. Such systems promise potential savings in time and cost to both the contractor and the state agency. Due to the progressive evolution of electronic mail and the Internet, it appears that the electronic interchange of DOT bid advertisements, bid documents and bid proposals will become increasingly prevalent in the future. This raises many questions related to the applicability, adequacy, reliability and security of existing electronic media technology, plus several questions concerning the impact on the users, whether big or small contractor firms. This synthesis will emphasize the interface between the contractor and the DOT for bidding purposes up to the contract award. It will address the potential benefits and possible concerns of utilizing electronic media in the bidding process, plus it will also address the issues related to the implementation of such a process.

Please complete the following request for information to aid the processing of this survey:

Company:_____

Address:_____

City:_____ State:_____ ZIP:_____

Questionnaire Completed By:_____

Position/Title:_____ Date:_____

Telephone:_____ FAX:_____Email:_____

1. What is the current use of computers by your company in the construction process?
(Please check all the applicable systems where computers are used):

Estimating — Project Planning

Scheduling — Project Control

Other, please specify: _____

2. Does your company have an Internet connection?

a. ____YES

b. ____NO (Are you planning to use Internet in the near future? ___, please go to question No. 4

3. What are the most primary uses of the Internet in your company

Marketing

Looking up information

Communication (e-mail, etc)

Other, please specify _____

4. If the Department of Transportation used Electronic Data Interchange methods for project bid proposals, bid submittals, and bid reviews, what would be the major benefits and concerns to your company?

Major Benefits:

1.
2.
3.
4.

Major Concerns:

1.
2.
3.
4.

5. If electronic bidding is implemented for all highway projects,

a) Should contractors be able to modify submitted bids before the final deadline?

YES _____ NO _____

b) Should the DOT have access to submitted bids before the deadline/bid opening?

YES _____ NO _____

6. Please indicate any other comments related to the implementation of Electronic Bidding Systems:

PLEASE RETURN QUESTIONNAIRE AND SUPPORTING INFORMATION BY: June 6, 1997

TO: Dr. Donn E. Hancher
Civil Engineering Department
University of Kentucky
Lexington, KY 40506-0281

TEL: 606-257-4857
FAX: 606-257-4404
email: hancher@engr.uky.edu

THE TRANSPORTATION RESEARCH BOARD is a unit of the National Research Council, a private, nonprofit institution that provides independent advice on scientific and technical issues under a congressional charter. The Research Council is the principal operating arm of the National Academy of Sciences and the National Academy of Engineering.

The mission of the Transportation Research Board is to promote innovation and progress in transportation by stimulating and conducting research, facilitating the dissemination of information, and encouraging the implementation of research findings. The Board's varied activities annually draw on approximately 4,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

The National Academy of Sciences is a nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce Alberts is president of the National Academy of Sciences.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encouraging education and research, and recognizes the superior achievements of engineers. Dr. William A.Wulf is president of the National Academy of Engineering.

The Institute of Medicine was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences, by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Kenneth I. Shine is president of the Institute of Medicine.

The National Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Bruce Alberts and Dr. William A. Wulf are chairman and vice chairman, respectively, of the National Research Council.

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

ADDRESS CORRECTION REQUESTED