ELECTRONIC REFERENCE LIBRARY
PHASE I REPORT

CTRE Management Project 98-31

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CTRE

Center for Transportation
Research and Education

IOWA STATE UNIVERSITY

Iowa Department
of Transportation

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ABSTRACT

This report describes the first phase in a project to develop an electronic reference library (ERL) to help Iowa transportation officials efficiently access information in critical and heavily used documents. These documents include Standard Specifications for Bridge and Highway Construction (hereinafter called Standard Specifications), design manuals, standard drawings, the Construction Manual, and Material Instruction Memoranda (hereinafter called Material IMs). Additional items that could be included to enhance the ERL include phone books, letting dates, Internet links, computer programs distributed by the Iowa Department of Transportation (DOT), and local specifications, such as the Urban Standard Specifications of Public Improvements. All cross-references should be hyper linked, and a search engine should be provided. Revisions noted in the General Supplemental Specifications (hereinafter called Supplemental Specifications) should be incorporated into the text of the Standard Specifications. The Standard Specifications should refer to related sections of other documents, and there should be reciprocal hyper links in those other documents. These features would speed research on critical issues and save staff time.

In the first phase of this project, a master plan for ERL development was developed. It is recommended that the ERL be developed incrementally, beginning with two main documents: Standard Specifications and Material IMs. A new, updated ERL should be issued every six months to coincide with the issuance of Supplemental Specifications and revised Material IMs. Additional documents should be added to these updated versions of the ERL as available effort allows. At first, additional documents should be added without hyper links to expedite their inclusion. Later, as effort is available, hyper links should be provided for cross-referencing. Initially, each new version of the ERL should be sold by the Iowa DOT to individual users. Consideration should later be given to subscription plans, electronic distribution, and third-party distribution.

Also in this first phase, a pilot version of the ERL was developed. The pilot ERL includes Standard Specifications (English and metric versions), the Iowa DOT phone book, a database of members of Associated General Contractors of Iowa, and a sample Material IM. The pilot ERL is accessed using Microsoft Internet Explorer® Version 4.0. It may be accessed with other browsers, but advanced features may not be functional. The pilot ERL was alpha tested by 10 advanced computer users and then beta tested by 50 computer users with a variety of skill levels. Testers were generally pleased with the ERL. They cited the hyper links, integration of the Supplemental Specifications, and reduced space requirements as advantages. They indicated some difficulties using some of the advanced features such as the search engine, especially if they were not using Microsoft Internet Explorer®.

INTRODUCTION

This report proposes a master plan for the long-term development of the Iowa Department of Transportation (DOT) Project Development Electronic Reference Library (ERL) and describes the development of a pilot version of the ERL. Ultimately, the ERL will contain several documents that are heavily used by transportation professionals in Iowa. Possibilities include Iowa DOT Standard Specifications for Bridge and Highway Construction (hereinafter called Standard Specifications), the Construction Manual, Material Instruction Memoranda (hereinafter called Material IMs), standard road plans, standard bridge plans, the Road Design Aids Manual, the Bridge Design Manual, and phone directories. The pilot version of the ERL, copied on compact disk (CD), includes the Iowa DOT Standard Specifications, plus General Supplemental Specifications (hereinafter called Supplemental Specifications) through October 1998, in both English and metric versions. Efforts were coordinated with the Office of Materials, as its staff developed electronic files for Material IMs that will eventually be included in the ERL; a sample of Material IMs was also included in the pilot. It is expected that the ERL will be regularly updated and expanded in the future.

Iowa State University researchers conducted research and development work for the ERL with funds provided by the Specifications Section of the Office of Development Support, Iowa DOT. Dr. Charles T. Jahren, principal investigator, was assisted by graduate research assistant Chun Li and undergraduate research assistants Ross Schaefer, Brian Overbaugh, and Matt Gumm. Donna Buchwald, assistant specifications engineer, was Iowa DOT's technical monitor for the project.

PROBLEM STATEMENT

Currently Iowa DOT's reference documents are published as books, pamphlets, and three-ring binders and are updated regularly in various ways. Replacement pages are provided for three-ring binder documents. Standard Specifications, the only document provided in book form, is updated every six months with photocopied Supplemental Specifications that note corrections to the Standard Specifications; users typically mark the Standard Specifications book to refer to the corrections.

Users find several challenges as they use these documents:

1. Paging through documents to find things and to move from one area to another is time consuming.
2. Finding the many cross-references within and between documents is time consuming.
3. Each time users read the Standard Specifications, they must check the Supplemental Specifications for changes.
4. Locating subjects of interest can be difficult.

These difficulties are especially challenging for construction inspectors who often work out of small pickup trucks on job sites. In addition to a notebook computer for tracking

quantities, inspectors must carry Standard Specifications, Supplemental Specifications, and several large binders containing Material IMs, standard road plans, and the Construction Manual. They find it difficult to overcome space limitations as they try to refer to several different documents.

Combining these documents into a single electronic reference for computer access is highly desirable. Other helpful items, such as telephone directories, standard forms, and Iowa DOT computer programs, could be included. Users should be able to search by key word and to jump to specific sections by giving the section reference. Hypertext links should allow efficient cross-referencing. The ERL should be compatible with Internet web browser software so that links may be made with Internet web sites and the Iowa DOT intranet, DOTNET. The ERL can initially be published on a compact disk (CD), which will be accessible to most Iowa DOT field employees because their standard notebook computers include a CD drive. In the future, other means of distribution may be appropriate. These might include the Internet, DOTNET, or other electronic media yet to be developed. The ERL should be updated every six months.

OBJECTIVE

This research project had two objectives:

1. After receiving input from user focus groups, draft a master plan for developing the ERL.
2. Develop a pilot version of the ERL that includes current Iowa DOT Standard Specifications on CD.

The remainder of this report describes the accomplishment of each of these objectives.

MASTER PLAN

The master plan was developed after reviewing the activities of other transportation agencies, receiving input from focus groups and alpha and beta users of the pilot ERL, and gaining experience during development. This section reviews input from focus groups and other users and then provides a master plan for developing the ERL.

Focus group and user input

Two focus group meetings were held, as well as a number of interviews with potential users. The August 3, 1998, meeting was attended by Iowa DOT employees from various offices. The January 3, 1999, meeting was attended by construction and supplier trade association representatives. A list of focus group attendees and interviewees is provided in Table 1. During each interview or focus group meeting, the attendees or interviewees were provided background on the project and asked to list the attributes that they thought were important and the content that should be included in the ERL. A compilation of

desired attributes is provided in Table 2, and a compilation of desired contents is provided in Table 3.

Table 1. Interviewees and Focus Group Attendees

First Name	Last Name	Affiliation
Douglas	Virden	Boone County Assistant Engineer
William	Behrendt	Boone County CET
Steve	Ballmer	Waterloo Construction
Don	Bebee	Kings Materials, Cedar Rapids, representing Iowa Ready Mix Producers Association
Mark	Bortle	Iowa DOT Construction
Milt	Dakovitch	Aspro, Waterloo
Melissa	Hill	Iowa DOT Local Systems
Annette	Jeffers	Bridges and Structures
Larry	Jesse	Iowa DOT Local Systems
Mike	Jorgensen	Iowa DOT Maintenance
Mike	Kindischi	Black Hawk County
Bill	Knopf	Associated General Contractors of Iowa
Dave	McCallum	Kings Materials, Cedar Rapids, representing Iowa Ready Mix Producers Association
Dennis	Osipowicz	Lee County
Myron	Parizek	Benton County
Dave	Peters	Iowa DOT Waterloo Construction
Jeff	Schmitt	Iowa DOT Design
Gorden	Smith	Iowa Concrete Paving Association
Will	Stein	Iowa DOT Design
Donald	Tebben	Iowa DOT Contracts
Ricke	Welden	Associated General Contractors of Iowa
Renee	White	Asphalt Paving Association of Iowa

Table 2. Desired Attributes

user friendly	good search engine
easy to read	printable
hyper links between documents	able to open multiple windows
able to fill in and send form	able to ensure authenticity
will retrieve correct documents when letting date is input	provide technical support
electronic documents similar to paper documents	

Table 3. Desired Contents

Standard Specifications	General Supplemental Specifications
design manuals	road standards
Material IMs	Construction Manual
phone books	letting dates
Iowa DOT computer programs	trade association manuals
job site posting requirements and posters	Davis Bacon wage rates
list of who is under contract for which jobs	county IMs
bid item list	average unit prices
CFR sections that apply	Iowa Code sections that apply
forms (fill out and send electronically)	standard proposal notes
Urban Standard Specifications for Public Improvements	ASTM, AASHTO, MUTCD manuals subject to copyright restrictions
DBE information as of issuance date	equipment rental rates (subject to
links to Internet sites	copyright restrictions)

During interviews and focus group discussions, several comments were made about the desirability of incorporating the following functions in the ERL: the ability to cross-reference with hyper links; the ability to search for updates electronically, so as to make manual updates of traditional paper documents unnecessary; and the ability to easily print certain pages of documents that are specifically needed for a particular project. Concerns revolved around the ERL's ease of use, accuracy, authenticity, and access to documents in effect for jobs with various letting dates.

Priority of documents to incorporate in the ERL
The master plan was devised to facilitate the orderly development and distribution of the ERL. The ERL will be developed incrementally, beginning with a pilot version that includes the Standard Specifications, Supplemental Specifications, a sample Material IM, and the Iowa DOT phone book. A new ERL will be issued every six months when new Supplemental Specifications and revisions to the Material IMs are issued. Each new release of the ERL will provide an opportunity to incorporate additional documents. The order of document inclusion will be determined by estimating the amount of benefit a document will give users and comparing that to the estimated amount of effort required to add it to the ERL. Documents that provide the greatest benefit compared to effort should be added first.

During focus group meetings and interviews, the documents mentioned most often for inclusion in the ERL, in addition to Standard Specifications and Supplemental Specifications, were those that are issued and updated periodically and used in the design and construction of most transportation projects. They include the following:

- Material IMs
- standard road plans
- standard bridge plans

- Road Design Aids Manual
- Bridge Design Manual
- Construction Manual

It is recommended that first priority be given to adding these documents to the ERL. Many of them are already in electronic format; however, they may be in a variety of formats that may not lend themselves to conversion to html or pdf, the electronic formats selected for the pilot EML (see page 8). This is especially true of the Construction Manual; it will offer the greatest challenge for inclusion in the ERL.

The Office of Materials has converted the Material IMs to pdf. These files can be included in the ERL as soon as a navigation protocol is developed. However, some effort will be required to develop hyper links between the Material IMs and the Standard Specifications. It is recommended that the Material IMs be issued first without hyper links to expedite their inclusion in the ERL, and that hyper links be added later as effort is available. A similar approach is recommended for standard plans and design manuals.

The Construction Manual text is currently in Word Perfect® format, while the graphics, tables, and forms are in a variety of other formats. Some may exist only as hard copies. The Construction Manual also includes copies of several forms. The ERL could provide an opportunity for users to fill out forms electronically and submit them directly from the computer by email or fax or to print out hard copies. More investigation is required before determining the proper format (html or pdf) for the Construction Manual.

Most of these documents have a structure that reflects the Standard Specifications in some way. In many cases they explain in greater detail concepts first mentioned in the Standard Specifications. For example, the Material IMs give materials testing and acceptance procedures, while the Construction Manual acts as a commentary on the Standard Specifications that explains construction administration procedures. Therefore, it is recommended that each section of the Standard Specifications reference these documents when appropriate and that each section of these documents reference the proper section of the Standard Specifications.

Other documents to incorporate in the ERL
A group of local jurisdictions in central Iowa has developed the Urban Standard Specifications of Public Improvements. There is considerable overlap between potential users of the ERL and users of this document. It is likely that other local jurisdictions will adopt the urban standard specifications. Such standardization would have considerable benefit to transportation professionals in Iowa. Inclusion of urban standard specifications in the ERL would increase their convenience and would encourage their adoption by additional agencies.

Focus group participants and interviewees suggested the addition of several other items that are not part of the large group of inter-related documents discussed previously, but that would add value to the ERL; these include the following:

- phone books
    - Iowa DOT
    - local jurisdiction officials
    - contractors
    - consultants
- Davis Bacon wage rates
- historical unit prices
- design aids published by trade associations
- standard proposal notes
- applicable CFR and Iowa Code sections
- links to other Internet sites (users could link to the site directly from the CD if on line)
- requirements for job site posters and electronic version of posters that could be printed by user
- computer programs developed by the Iowa DOT for use by contractors, consultants, and Iowa DOT employees
- bid letting dates
- Iowa DOT web site

In some cases such documents or links could be added with little effort; for example, the Iowa DOT phone book was downloaded from the Iowa DOT web site and was easily included in the alpha version of the pilot ERL. The possibility of including trade association phone books was considered; however, this possibility causes some concern because directory sales are a significant revenue source for some trade associations. Interest was expressed in including documents from AASHTO, ASTM, and MUTCD. However, copyright issues must be investigated before such documents are included.

Possible link to SiteManager®

Several construction inspectors pointed out the opportunity to interface the ERL with SiteManager®, a program that will be used by inspectors to administer construction projects. SiteManager® tracks pay quantities, generates pay vouchers, tracks material acceptance activities, keeps a diary, and assists in monitoring civil rights compliance. The pay voucher generation function is based on a bid item list, and bid item numbers are based on the organization of the Standard Specifications. Materials acceptance issues must be addressed before payment is made, and materials acceptance standards are addressed in the Material IMs, whose organization also reflects Standard Specifications. Therefore, it would be desirable to link from SiteManager® directly to the ERL.

Distribution

A variety of arrangements can be developed to distribute the ERL. The Iowa DOT can sell updated ERLs on CD each time an update is issued, sell subscriptions to purchase all updated CDs issued during a certain period of time, or transfer responsibility for distribution of updated CDs to a third party. Selling subscriptions would eliminate the need to contact a list of subscribers and process payments every time an updated ERL is issued. Transferring distribution to a third party would reduce staff requirements and

administrative involvement. In any case, a vendor should be identified to press the CDs. For early versions of the ERL, it is recommended that the Iowa DOT sell CDs to individual clients each time the ERL is updated. Later, the Iowa DOT can explore alternatives.

One possible approach to third-party distribution would be to provide the ERL via two avenues: CD and the Internet. Iowa DOT would be responsible for providing the ERL to all potential users via the Internet free of charge. Users who want the documents in CD format would be referred to the third-party distributor. The third party could be a trade association that wanted to use the CD sales as a revenue source and a way to raise its profile in the industry. The third party could also offer other products for sale on the CD. Users enticed by an advertisement on the CD could purchase a product by credit card over the telephone and then receive a code to unlock the product on the CD. The Iowa DOT would have to ensure that it could obtain CDs at a reasonable price for its own use. Costs would have to be reasonable for all users, and access could not be restricted to trade association members or in any other way. There are precedents for similar activities. For example, the Scaffold Industry Association, Van Nuys, California, a trade association, publishes pertinent sections of OSHA code in its *Directory and Handbook*. Pile Buck, Inc., Palm City, Florida (http://www.pilebuck.com/), prepackages and sell several U.S. Army and Navy design manuals on CDs.

Consideration could also be given to finding advertising sponsors that would reduce the cost of CD publication. However, this would involve administrative challenges in setting advertising rates, including the advertisements on the CD, ensuring equal access to advertising space, and ensuring that advertisements are in good taste and not contrary to Iowa DOT policy. Third-party distributors might include advertising on the CD.

DEVELOPMENT OF THE PILOT ERL

ERL development commenced by selecting a user interface. The user interface was required to have the following properties:

- Be intuitive and easy to operate.
- Have an attractive appearance.
- Allow users to quickly navigate through the documents.
- Facilitate hyper-linking of cross-references.
- Be easily available to most users.
- Facilitate rapid development.

Review of existing electronic reference libraries

Researchers reviewed electronic reference libraries of other transportation agencies by reviewing CDs that were provided by the Specifications Section of the Office of Development Support, Iowa DOT, and searching the Internet. The Specifications Section provided three CDs: one from the Illinois DOT, one from the Washington DOT, and Road Trip®.

The Illinois DOT CD contains several documents, including standard drawings. All files are Adobe Acrobat portable document format (pdf) with hot links for specification cross-references. The files also contain "electronic sticky notes," which have been placed by the developer.

The Washington DOT CD is similar to the Illinois CD. It has fewer cross-reference hot links but does include electronic forms that may be filled out using a database application.

The RoadTrip® CD is a database program that includes all Iowa DOT specifications and has an excellent search engine. RoadTrip® had proposed developing such a CD specifically for the Iowa DOT; however, the project never progressed because the Iowa DOT was not certain that RoadTrip® would retain its focus on specifications in the long term.

Researchers conducted a search for electronic documents at Internet sites for all 50 state departments of transportation. Findings are summarized as follows:

- Twenty-eight states have some publications on their Internet sites.
- Eighteen have standard specifications on the Internet.
- Five have electronic reference libraries (a group of documents) on the Internet.

Documents are provided by state DOTs in a variety of ways:

- hypertext markup language (html) files (four states)
- portable document format (pdf) files for viewing on line (15 states)
- pdf download files (two states)
- word processor or CADD download files (16 states)

Details of the search results are provided in Appendix A.

Selection of document format
The research team considered the following formats for developing the pilot ERL: html, pdf, word processor, on-line viewing, download files, and CD. A discussion of each format is provided below.

Hypertext markup language format is desirable because it can be viewed with an Internet browser. Many potential users have Internet browsers on their computers and are familiar with their operation. Internet browsers aid navigation in several ways. Hyper links can be used to link cross-references. Internet browsers have "find" functions that can locate particular text strings. Third-party search engines can also be used in conjunction with a group of html files to provide advanced search capabilities. It is also possible to include graphics and link to non-html documents (including pdf documents). The viewing area can be split into frames, and one of the frames can include a navigation bar, which itself can include major section headings for the document. Users can adjust

the width of the document to fit the viewing area on the computer screen, and the browser can wrap words as necessary to accommodate column width. Because of this flexibility, the document will not necessarily look like the original. Also, considerable programming time is often necessary to format documents from their original word processor files. This is especially true if the document contains tables or any other special formatting.

Portable document format makes conversion from original electronic documents extremely easy. Any document that can be printed on a laser printer can be converted into pdf files using Adobe Acrobat®. The document can then be viewed using Adobe Acrobat Reader®, an application that may be downloaded from the Internet at no cost (Iowa DOT policy may not allow employees to install this program without assistance from computer specialists). The electronic document has the same look as the hard copy, including page numbers, headers, and footers. Graphics are easily integrated into pdf documents. Cross-references can be hyper linked, and navigation bars can give an overview of the document content. Although it is possible to copy text from a pdf file, it is very difficult to change the file. Therefore, it is easy to assure authenticity of the original.   A search function can be used for text strings; however, it can be very slow in large documents. The format of the original document cannot be changed.

If a document is saved in word processing or CADD format, no conversion or programming is necessary. However, the user must have the word processor or CADD application program to view the document. The original document can easily be copied and modified. Recent versions of popular word processors have hyper link capability. Searching is usually limited to finding text strings.

For the pilot ERL, the Standard Specifications were developed in html format. This format was selected because it facilitates the use of search engines and because most potential users have access to an Internet browser. Most other documents may be linked to the Standard Specifications, so if users find the appropriate section in the Standard Specifications, they can easily link to the appropriate section in other documents like the Supplemental Specifications. Compared to other documents that may be included in the ERL, the Standard Specifications are not voluminous and are not difficult to convert from word processor format to html format. The two major Internet browsers, Microsoft Internet Explorer and Netscape Navigator®, interpret html differently; therefore, a document that is perfectly formatted in one browser may be slightly off on another. The researchers decided to develop the ERL to work optimally with Microsoft Internet Explorer® 4.0 or later. This browser was judged to provide the most advanced features such as Java Script interpretation. Other Internet browsers such as Netscape Navigator® can still access the ERL; however, some of the more advanced features may not be fully functional.

Converting the Standard Specifications into html and formatting them required several steps. The Specifications Section of the Office of Development Support, Iowa DOT, delivered the document to the researchers in WordPerfect format. This was converted to html using the conversion utility provided with Word Perfect 8. Additional formatting was required before the html document matched the look of the Standard Specifications.

Also, it was necessary to add hyper links, navigation bars, and an opening page. This was done using Microsoft FrontPage®. Java scripts were developed to facilitate user interaction on the opening page.

The decision was made to convert the Material IMs to pdf, which is appropriate because they are more voluminous and include a greater amount of graphic content and special formatting. Since it is possible to hyper link in both directions between pdf and html documents, the Standard Specifications and Material IMs can be seamlessly linked.

Selection of pilot ERL distribution method
If a document is placed on a server that is connected to the Internet, it can be viewed on line. This can reduce distribution problems because users connect to the server via the Internet whenever they wish to view the content. However, the server must be capable of meeting traffic demands. Also, users are limited to those with an Internet connection. This would eliminate potential users, such as construction inspectors, who want to view documents while outside their offices. Recently developed Internet browsers have the capability to download, link, and retain a group of files for off-line viewing. This requires some proficiency in using the browser.

Internet sites can also provide downloads. Users click on a file link, and the file is transferred to their local hard disk. The time required to execute the download depends on the quality of the Internet connection. Often files are compressed to reduce transfer time. The user extracts the files after they arrive on the local hard disk. Some familiarity with computers is required to store the compressed file, start the extraction process, identify the location of the extracted files, and prepare the files for viewing.

If documents are placed on a CD, users can view them on any computer with a CD drive and the software required for viewing the files. The files can be stored in any format and can be viewed using any software, including Internet browsers. Hyper links can be included to Internet sites that would be available if the computer were on line.

For this project, the decision was made to initially distribute the ERL on CD to make it accessible to everyone, including users who are not on line. This accessibility is especially important for construction inspectors and contractors working in the field. In the future, the ERL can also be made available for on-line viewing, or it can be offered as a download file.

Alpha and beta testing
Researchers produced alpha and beta versions of the pilot ERL to facilitate evaluation by potential users. An alpha version of the ERL was developed, and 10 copies were provided to the Specifications Section of the Office of Development Support, Iowa DOT, for distribution to experienced computer users. The alpha version included the metric version of the Standard Specifications, the Iowa DOT Internet phone book, and a database of Associated General Contractors (AGC) of Iowa member addresses and phone numbers. After evaluation, work continued on the English version of the Standard Specifications and on the Supplemental Specifications. The changes noted in the

Supplemental Specifications were made to the full text of the original Standard Specifications, so it would not be necessary for users to refer to two documents.

A search engine was added before the beta version was released. A search engine differs from the find function in word processors and Internet browsers in that it is not necessary to match text strings exactly to obtain suggestions about where to look in the document. Search engines evaluate heading titles and the number of times similar words appear in certain parts of the document, then returns a list of possible locations with a rating on how close the area matches the input text. At the research team's request, the software vendor modified the search engine so it highlights all occurrences of the input text in the document. Users also have the option to input a particular specification section in a quick jump box, which will then transfer them directly to the proper section.

A users' guide for the beta version of the ERL is provided in Appendix B. Essential functions are described below. Refer to Appendix B for illustration.

Users begin operation by placing the CD in the drive, browsing the files using "My Computer" or "Windows Explorer," and then clicking on the "Start Here" file. When the opening page appears, users have several choices: Standard Specifications in both English and metric editions, a sample of a Material IM, an Iowa DOT phone book, and an AGC of Iowa phone book. Users must select the appropriate supplemental specification to view the Standard Specifications. After a selection is made, a window is provided with three frames. The small frame on the top reminds users of the version of the Standard Specifications they are using. The frame on the left is the navigation bar, and the larger frame on the right is for the text of the specification. At first the right window does not contain text. To read the specification text, users must click a specification section on the navigation bar. Then text opens, and the navigation bar for the text appears in the left frame. Users click on buttons at the top of the navigation bar to access the search engine and other features.

Fifty copies of the beta version were distributed by Iowa DOT to Iowa DOT employees, city and county employees, trade associations, and contractors. A survey was included, 20 of which were returned. The results of the survey analysis are summarized below. A blank copy of the survey is provided in Appendix C, and detailed tables of the analysis are provided in Appendix D.

Of the 20 respondents, nine were from the Iowa DOT, six were from counties, and five were from trade associations or contractors. Almost all have used Microsoft Office® and have browsed the World Wide Web. More than half have installed hardware and software and have performed electronic design and drafting. At least two beta testers had considerable knowledge about computers because they have performed troubleshooting for their own and colleagues' computer problems. Sixty percent use Microsoft Internet Explorer®, while 40 percent use Netscape Navigator®. Very few beta testers experienced more than minor difficulties using the ERL, except for the search function and quick-jump function. Many users who experienced difficulties with these items were using the Netscape Navigator® browser, even though the ERL was designed for use with Microsoft

Internet Explorer[®]. Beta testers were generally supportive of the development of the pilot ERL.

SUMMARY

The Iowa DOT Standard Specifications for Bridge and Highway Construction have been converted to html format for inclusion in a pilot ERL published on CD. Cross-references have been hyper linked, and changes noted in the Supplemental Specifications have been incorporated into the text of the Standard Specifications. The ERL has several features, including navigation bars, a search engine, and a quick-jump function that allows users to go directly to a particular specification section. Users can read the ERL using commonly available Internet browsers. It is expected that the CDs will be first offered to the public for the October 1999 revisions of the Supplemental Specifications and that Material IMs will be included in pdf format. Each time an updated ERL is issued, incremental improvements will be made by adding reference documents or by improving the quality of reference documents.

A master plan for the development of the ERL was devised. It is recommended that development efforts be concentrated on including Material IMs, standard plans, design manuals, and the Construction Manual. It is also recommended that documents with considerable graphical content or special formatting be provided in pdf format and other documents be provided in html format. When appropriate, each document should be cross-referenced to the proper standard specification section, and reciprocal links should be provided from the Standard Specifications. All cross-references should hyper link directly to the appropriate document. A variety of other documents such as phone books, lists of important dates, Internet links, and Iowa DOT-distributed computer programs should also be included to enhance the usefulness of the ERL.

It is recommended that the ERL initially be distributed as an individually sold CD. Eventually, the Iowa DOT should consider alternatives such as subscriptions for a set number of issues, electronic distribution via the Internet, and third-party distribution.

People who participated in the alpha and beta tests of the pilot ERL are enthusiastic about the introduction of the ERL because they anticipate several benefits: The CD requires less space than the paper documents and is much easier to revise and update. Many potential users including field personnel have computers and are familiar with the Internet browsers used to read the ERL. Hyper-linked cross-references and the search function speed research and will save staff time and reduce misunderstandings regarding these documents. Such advantages will increase the efficiency of transportation employees and allow users to obtain more value for their investment in transportation services and facilities.

PROPOSED PHASE II RESEARCH

The second phase of the ERL project should include several tasks that will expand and enhance the library and facilitate its distribution. Researchers should train Iowa DOT staff to update the general specifications to reflect changes wrought by the Supplemental Specifications. Links should be provided to and from the Material IMs. Plans should be made for integrating the road standards and the Construction Manual. Then one of these documents should be integrated into the ERL and the other incorporated as time allows. Finally, a long-term production and distribution strategy should be adopted.

Appendix A – List of State DOT Electronic References

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State Department of Transportation's Electronic Reference Library Review

State DOT	Publications		Contents				Contact information	File type
	WWW	CD	Specifications	Construction Documents (Manuals, Standard drawings)	Phone Book	Other		
Alabama DOT	yes		92,95 Construction Specification;	Bridge Standards Bridge Design Manual.				*.pdf
Alaska DOT	yes		98 Standard Spec.	98 Construction Manual		Construction forms		*.pdf
Arizona DOT	No							
Arkansas DOT	No							
California DOT	yes		92 Standard Spec.					FTP--*.doc
Colorado DOT	yes			Bridge Design Manuals; Standard Drawings				*.dwg,*.doc *.xls compressed by winzip and *.pdf
Connecticut DOT	yes EL			Bridge Standards, Standard Drawings.				Zip files
Delaware DOT	no							
Florida DOT	yes EL			Road Design				*.pdf

State DOT	Publications		Contents				Contact information	File type
	WWW	CD	Specifications	Construction Documents (Manuals, Standard drawings)	Phone Book	Other		
Georgia DOT	yes			Electronic Bidding System				Self-extracting
Hawaii DOT	no							
Idaho DOT	yes		Unavailable so far	Unavailable so far				
Illinois DOT	yes	yes	Supplement Specifications	High way standards				Self-extracting *.doc and *.pdf
Indiana DOT	yes		95 Standard Specifications with supplements	Metric Standard Drawings				*.pdf and *.dwg by zip
Iowa DOT	no							
Kansas DOT	yes					Miscellaneous publications		*.pdf
Kentucky DOT	yes			Standard Drawings				Mcrostation *.dgn
Louisiana DOT	yes					Material Sampling Manual		*.html

State DOT	Publications		Contents				Contact information	File type
	WWW	CD	Specifications	Construction Documents (Manuals, Standard drawings)	Phone Book	Other		
Maine DOT	yes EL					Environmental Assessment		*.pdf
Maryland DOT	?		Have Publication division but unavailable					
Massachusetts DOT	no							
Michigan DOT	yes EL		Publication Divisions. including Standard Spec. with supplements(96)					Zip files
Minnesota DOT	yes		95 Metric Standard Specifications	Standard Drawings				*.pdf
Nebraska DOT	no							
Nevada DOT	no		Have Publication division but unavailable					
New Jersey DOT	yes		96 Standard Specifications with 98 supplemental Spec.					*.pdf
New Mexico DOT	no							

State DOT	Publications		Contents				Contact information	File type
	WWW	CD	Specifications	Construction Documents (Manuals, Standard drawings)	Phone Book	Other		
New York State DOT	yes					Design Procedure Manual		*.pdf
North Carolina DOT	yes		Standard Specifications for roads and structures	Design Manual				*.doc and *.html
North Dakota DOT								
Ohio DOT	yes			Standard Construction Drawings				Microstation files
Oklahoma DOT	yes		Traffic Design Standards	Construction manual, Road Design Standards, bridge design Standards				Microstation *.dgn And Acad *.dwg
Oregon DOT	yes		96 Standard Spec. with Supplement,	Standard drawings				*.pdf
Pennsylvania DOT	yes		96 Standard Spec. with Supplements					*.html
Rhode Island DOT	yes		97 Standard Spec., update Standard Spec.	High Design Manual (under construction)				*.html
South Carolina DOT	yes		Supplemental Spec.	Standard Drawings for Road Construction				*.pdf

State DOT	Publications		Contents				Contact information	File type
	WWW	CD	Specifications	Construction Documents (Manuals, Standard drawings)	Phone Book	Other		
South Dakota DOT	yes			Road Design Manual				*.pdf
Tennessee DOT	yes		unorganized					Self-extracting *.doc
Texas DOT	yes		93,95 Standard Spec.					Word Perfect Files *.wp
Utah DOT	yes		94 Standard Spec. With Supplemental Spec.	Standard Drawings, Design Manual				Spec.--*.html CAD--*.dwg *.wp
Vermont DOT	?			Some AUTOCAD Drawings				
Virginia DOT	no							
Washington DOT	yes	yes	CD-Library. Standard Spec.	Construction manual, Design manual				*.pdf
West Virginia DOT	yes					Traffic Related Publications (unavailable)		

APPENDIX B – BETA VERSION USERS GUIDE FOR PILOT ERL

24

Welcome! You have been chosen as a Beta Tester for the new Iowa D.O.T. Electronic Reference Library. This library is the result of a collaboration between the Specifications Office of the D.O.T. and Iowa State University. The aim of this pilot project has been to make the Standard Specifications and General Supplemental Specifications available in a convenient-to-use electronic format. Additionally, two other references have been included- the D.O.T. phone book, and a directory of AGC of Iowa members. In the future, other documents will be incorporated, such the the Construction Manual and Instructional Memorandums.

Figure 1

Getting Started: This reference library works best with Microsoft Internet Explorer 4.0 or higher. If you do not currently have this program on your computer, you may download it for free at www.microsoft.com/windows/ie/download If Netscape Navigator 4.0 or higher is your current browser, you can continue to use it with the Electronic Reference Library. However, it may operate slowly and a few of the periferal functions may not work. After Internet Explorer has been installed, start the program, and insert the Electronic Reference Library into your CD drive. Click **File**, **Open**, {Figure 1} and then type **D:\Start_Here.htm** into the text box {Figure 2}. Click return, and the Electronic Reference Library will start up. (If your CD drive letter is something other than D, you will need to change D to your drive letter.)

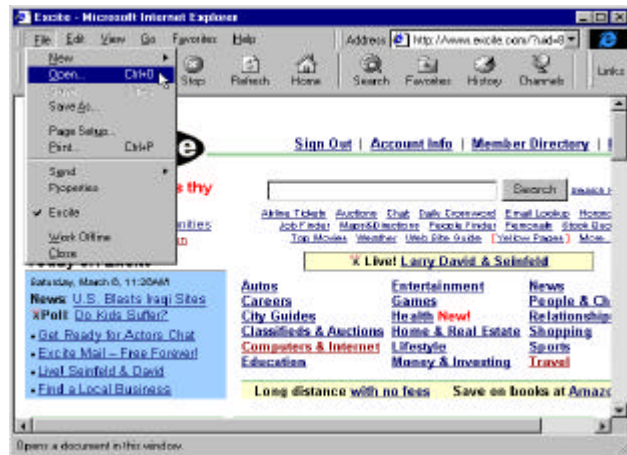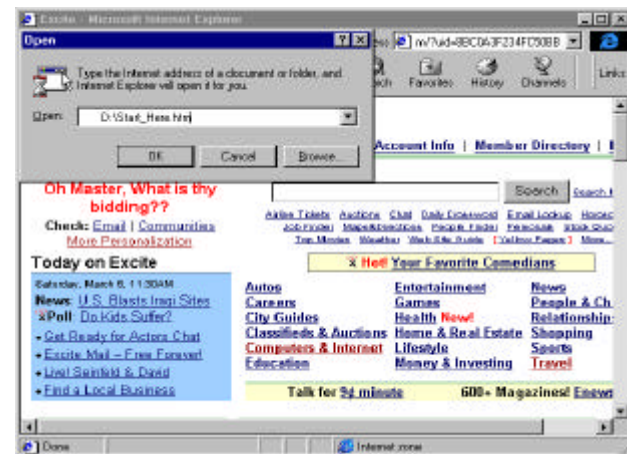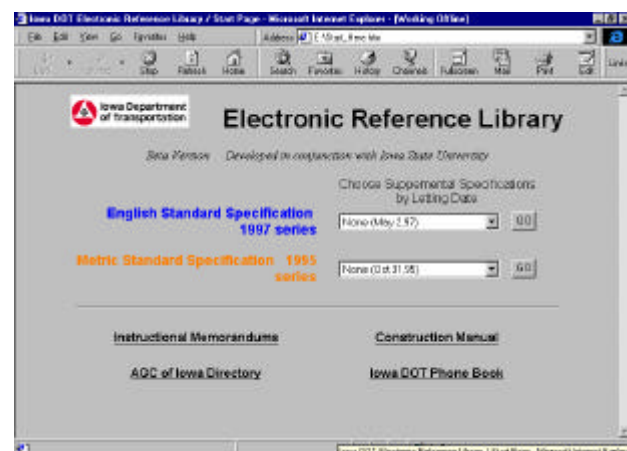The opening screen will appear {Figure 3}.

Figure 2

Figure 3

Electronic Reference Library Users Guide

Getting Around: From the opening screen, you have many options. You may view the specifications in effect for any letting date in both English and Metric, as well as view phonebooks for the D.O.T. and AGC members. There are also a few sample IM's that you may browse. <if you have Adobe Acrobat Reader 3.0 or higher installed on your computer.> To view specifications, click on the down arrow. {Figure 4} Choose a General Supplemental by picking from the list of letting dates and click the GO button {Figure 5}. The "navigation" page for those specifications will come up on your screen {Figure 6}.

Figure 4

"Navigating:" The navigation area on the left side of the screen is composed of three different parts {Figure 7}. The icons at the top allow you to go to the opening page, list of divisions (that's what you see now), search, and to go backward and forward. Below the icons is a little text box called "QuickJump!" To see a list of articles in a section, type in the section number and press return or click on Jump! To go directly to any article, enter the article number, and press return or click on Jump! Finally, at the bottom you see a list of divisions, Clicking on any of the divisions will make a list of sections and articles in that division pop up that you may choose from {Figure 7}. If you click on an article {Figure 8}, the text will appear in the right half of the screen {Figure9}.

Figure 5

Figure 6

Notes on General Supplementals: With the Electronic Reference Library, it is possible to incorporate the periodic changes in the general supplementals directly into the text. Additions to the current supplemental are in a red colored font, and deletions are in stikethrough font (they are "crossed out.") So, the changes that are new to GS-97001 are in red and strikethrough. In GS-97002, the changes in GS-97002 are in red and strikethrough. (The "old" changes from GS-97001 have been incorporated into the text: The red text has been changed to black, and the strikethroughs have been deleted.)
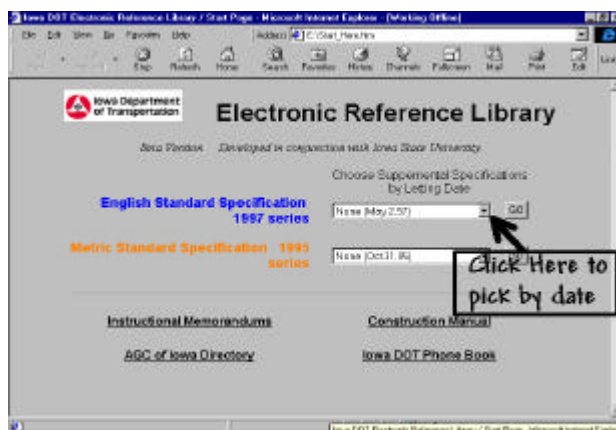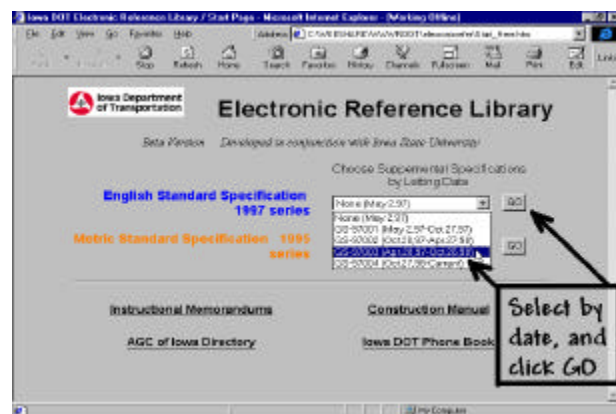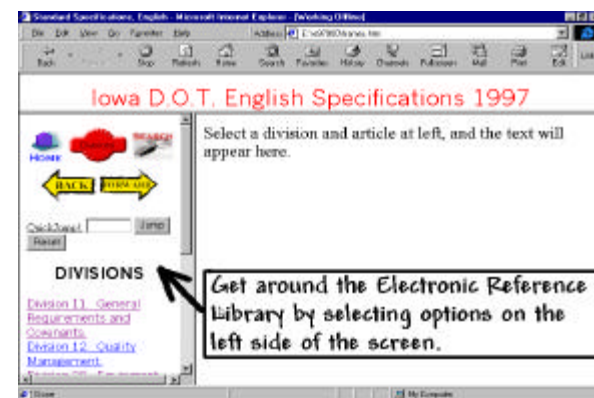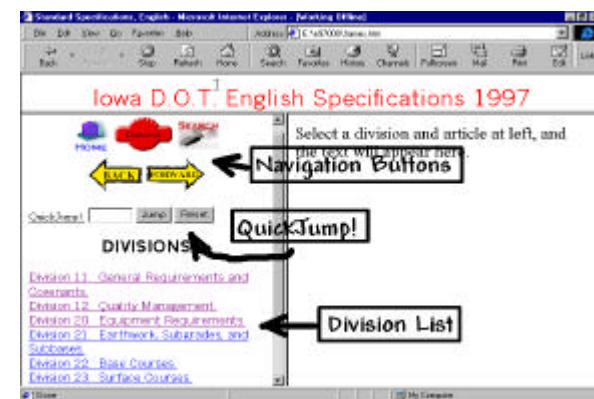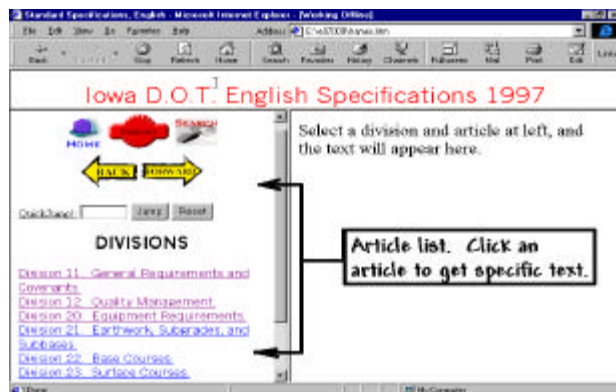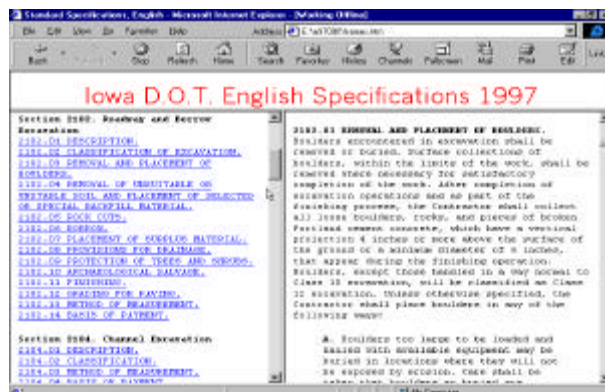

Figure 7

Figure 8

Figure 9

In this way, it is very clear to see what changes have been made to the GS you are viewing.

Figure 10

Searching: Click on the search icon in the top right corner of the left-side of the navigation bar and the search screen appears {Figure 10}. Enter a word or phrase you'd like to search for in the text box. Your search is always limited to the letting date that you chose on the opening screen. Click on the Search button or press return. By default 25 "hits" are returned {Figure 11}. Each "hit" is a specification section. If you'd like more, choose a higher number from the drop-box. Click on any section number returned ("hit") to get the specification text. Word highlighting is also on by default, so that the words or phrase you are searching for are shown in a bold, red font.
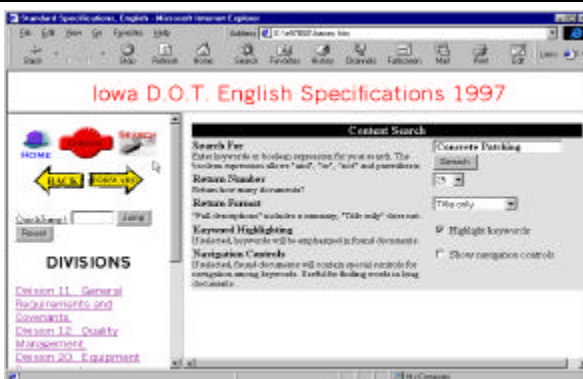

Figure 11

The search engine will look for sections containing the words you specify. It will return a list of results for you to select from. Pick one, and that section will pop up on the right-side of the screen. The search words are highlighted in red. Here, concrete pavement was the search term {Figure 12}.
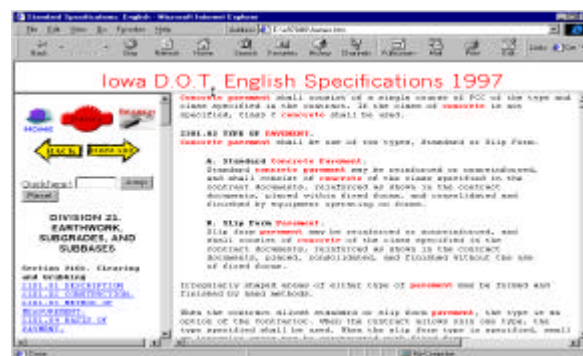

Figure 12

Phonebooks: From the opening screen, choose either the AGC of Iowa or Iowa D.O.T. phonebook. The AGC phonebook shows up all on one screen. The D.O.T. phonebook requires you to click on a letter {Figure 13}. Suppose you're looking for Donna Buchwald's phone number. Click on B, and then scroll down to Buchwald. Or, to search for her name, click **Edit**, **Find (on this page)**, type "Buchwald" into the text box, and then click **Find Next**. The name is searched for, and shows up high-lighted.
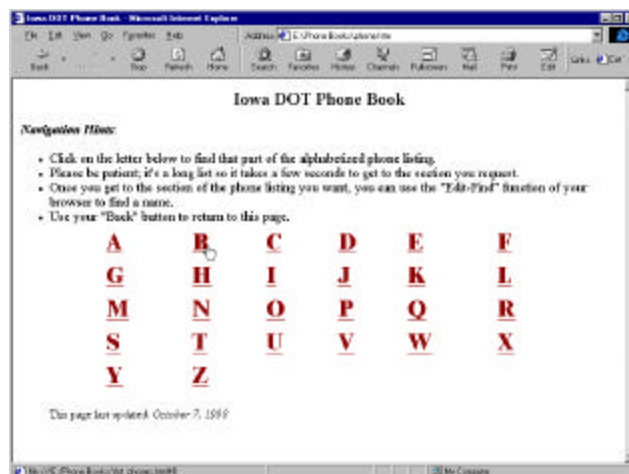

Figure 13

Instructional Memorandums:

Nine IM's have been included as a preview on this disc. If you have Adobe Acrobat Reader 3.0 or higher installed, you can browse the samples. Click on an IM number on the left side of the screen {figure 14}, and the IM will appear on the right side of the screen {Figure 15}.
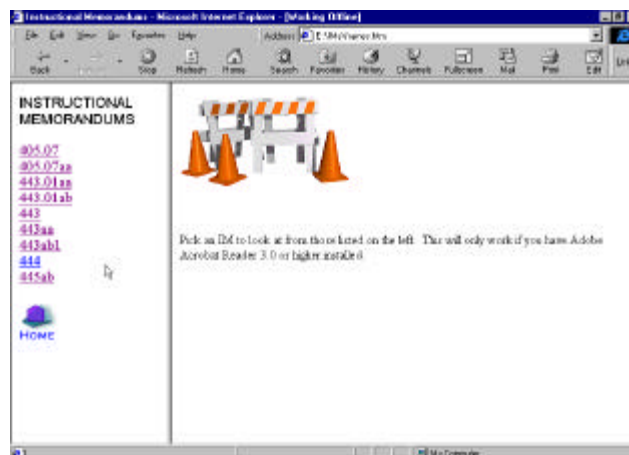
Figure 14

Reporting Problems: This is a preview version of the Electronic Reference Library, and it still has some bugs in it. We are asking you to test it so that all the problems can be identified and fixed before a general release is made. Please record any problems that you find and where they occur on the form you recieved with this disc. At the end of the beta testing period, return your form to the address specified. Your input is critical in the effort to develop an easy to use, reliable product.

Thanks for your assistance!

Figure 15

APPENDIX C – BETA USERS SURVEY

Electronic Reference Library
Users Survey Form

How may we contact you?

Your name and Title:_____

Company/Institution:_____

Address:_____

Email:_____

Phone:_____

Fax:_____

Years of Professional Experience?
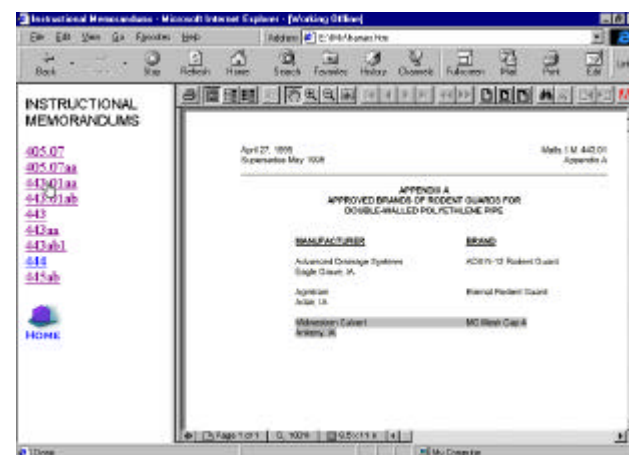   Less than 1 year   1~5 years   6~10 years   More than 10 years

What of the following have you ever done on your computer in the last six months?

Used Microsoft Office		WWW browsing		Assisted Colleges with Problems	
Electronic Design and Drafting (Auto CAD, Microstation)		Installed software		Trouble shoot network problems	
FieldBook		Installed hardware		Other_____	

What kind of computer do you use often?
   Desktop   Laptop   With CD-ROM   Without CD-ROM

What Internet browser do you use?
   Netscape Navigator, version_____   Microsoft Explorer, version_____
(To find version number, select Help menu, then click About)

How is your computer connected to the Internet?
   Office Network   Phone Modem   Other_____   Not connected

How often do you use the documents listed below?

Items	Daily	Weekly	Monthly	Less than monthly
Specifications (Metric)				
Specifications (English)				
IMs				
Construction Manual				
Road Standards				

Road Plans				
DOT Phone Book				

IOWA STATE
UNIVERSITY

Level of satisfaction with the Electronic Reference Library (ERL).
Ranks:
1. No difficulties
2. Minor Difficulties--------Resolved problems in one or two tries.
3. Moderate difficulties-- -Resolved problems in a few tries.
4. Major difficulties ------Could not resolve the problem.
5. Did not try.

Items	1	2	3	4	5
User Instructions					
Starting the CD					
Understanding Opening Screen					
Finding Specification sections					
Reading the Text					
Reading Navigator Bars					
Using Search function					
Quick Jump function					

What other documents would you like add to the Electronic Reference Library? Please specify.

_____
_____
_____
_____
_____
_____
_____
_____

What do you like about the Electronic Reference Library? Please specify.

_____
_____
_____
_____
_____

How could the Electronic Reference Library be improved? Please specify.

_____

_____

_____

_____

_____

_____

Please return to: Dr. Charles Jahren
                        454 Town Engineering Building, Iowa State Univ.   Ames, IA 50011
                        Phone: 1-515-294-3829   Fax: 1-515-294-3845

Thanks for filling out this survey!

APPENDIX D – RESULTS OF BETA USERS SURVEY

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1. Distribution of Respondents

Total Number of Respondents	20	By 23/6/99.
Number from Iowa DOT	9 (45%)	
Number from Counties	6 (30%)	*Buena vista, Davis, Decatur, Linn, Mashall, Story.*
Number from Trade Association	1 (5%)	*Asphalt Paving Association of Iowa,*
Number from Contractors	4 (20%)	*Cessford Construction Co., Manatt's Inc., Norris Asphalt Asphalt Paving Co. Snyder & Associate Inc.*

2. Level of Computer Proficiency

Used Microsoft Office	19 (95%)	WWW browsing	19(95%)	Assisted Colleges with Problems	2 (10%)
Electronic Design and Drafting (Auto CAD, Microstation)	10 (50%)	Installed software	15 (75%)	Trouble shoot network problems	6 (30%)
FieldBook	8 (40%)	Installed hardware	11 (55%)	Other (Computer Repair, Trouble shoot PC prob.)	2 (10%)

3. Internet Browser

Netscape		EXPLORE	
7+2*	40%	11+2*	60%
Version above 4.0---6+2 (35%)		Version above 4.0---9+2 (50%)	
Note: * Some users use both Netscape and Explorer.			

4. Users' Computer characteristics

Desktop		LAPTOP		WITH CD-ROM
10	50%	2	10%	100%
8			40%	

5. Responses regarding the easy use

Items	1*	2	3	4	5	Ave.
User Instructions	15(75%)	4 (20%)	1 (5%)			1.3
Starting the CD	13 (65%)	6 (30%)	1 (5%)			1.4
Understanding Opening Screen	14 (74%)	5 (26%)				1.26
Finding Specification sections	14 (70%)	5 (25%)	1 (5%)			1.35
Reading the Text	18 (90%)	1 (5%)		1 (5%)		1.2
Reading Navigator Bars	14 (78%)	3 (17%)	1 (5%)			1.28
Using Search function	9 (50%)	4 (22%)	2 (11%)	2 (11%)	1 (6%)	2
Quick Jump function	11 (58%)	5 (26%)	3 (16%)			1.58

***Note: *** *Ranks:*
1. No difficulties
2. Minor Difficulties--------Resolved problems in one or two tries.
3. Moderate difficulties-- -Resolved problems in a few tries.
4. Major difficulties ------Could not resolve the problem.
5. Did not try.