

US Army Corps of Engineers
Construction Engineering
Research Laboratories

Software Requirements Specifications

DrChecks - Build 1

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DrChecks is being developed as a research prototype by the U.S. Army, Corps of Engineers, Construction Engineering Research Laboratories to investigate the potential application of World Wide Web (WWW) technologies to the design review process. There are, at this time, no plans to field DrChecks systems to Corps of Engineer Offices.

This document describes the initial requirements specifications for the Design Review and Checking System (DrChecks). DrChecks will be developed using an evolutionary development mode as defined in MIL-STD-198.G.3. User needs and system requirements will be partially defined by this document and refined with each succeeding build.

MIL-STD-498 defines Build 1 as that software which establishes system and software requirements and installs software implementing a subset of those requirements at user sites. Software developed under this build shall be identified by version numbers from 0.1 up to and including 1.0.

These requirements will be used for the development and testing of DrChecks during Fiscal Year '97. The objective of this document are: (1) to identify the requirements for a web-based design review tool as envisioned by the Design Review Tools Committee, (2) to provide a guideline for prototype system developers and (3) to document development efforts for those who may ultimately develop and field a World Wide Web based design review tools.

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1 Scope

1.1 Identification

This document describes the software requirements for the DrChecks alpha prototype (Build 1). The initial prototype of DrChecks is intended as a demonstration vehicle, and contains a subset of what may ultimately be the full set of features.

Decisions regarding the fielding of DrChecks to Corps of Engineers offices have not been considered at this stage in the research process. HQUSACE Technical monitors, Mr. Justin Taylor (CEMP-ES) and Mr. Stan Green (CEMP-CE), will coordinate among appropriate organizational elements as necessary.

1.2 System Overview

The development of DrChecks follows a series of successful USACERL efforts in the domain of design review. The two design review systems previously developed at USACERL and then transferred to support agencies include the Automated Review Management System (ARMS) and the Reviewer's Assistant (RA). ARMS is currently required for design review of military program projects. RA is a complementary ARMS product that may also be used for a variety of quality assurance functions. The Construction Technology Transfer Center (CTTC) is currently developing plans to license RA for commercial distribution. Section 2.3 provides references for these developments.

DrChecks extends the expertise developed by USACERL in developing systems to support the design review process and those conducting design reviews. DrChecks takes advantage of the emerging technology of the World Wide Web to create a collaborative environment for the identification and resolution of potential deficiencies in construction plans and specifications. On-line reference materials are also available for the reviewer. Users of the DrChecks system include: private Architect/Engineer firms, members of local construction offices, project client and project occupant representatives, and design management offices.

1.3 Document Overview

The purpose of this document is to outline the capabilities that must be included within Build 1 of DrChecks. The software requirements, interfaces and qualification provisions will be described. Incremental design of this research prototype system will be conducted concurrently with and after the production of this document.

This plan was written in accordance with the U.S. Military Standard for Software Development and Documentation, MIL-STD-498 and the subsidiary Data Item Definition (DID) DI-IPSC-81433, Software Requirements Specification (SRS). This document contains no confidential information or other security risks.

1.4 Relationship to Other Plans

DrChecks development is being organized according to plans contained in the Research and Development Management Information (RDMIS) system for project AP7, "Design Reviewer's Support

Environment.” The RDMIS system contains the current outline of the research project under which this project is being conducted.

Following the approval of this document a more detailed Software Development Plan (SDP) will be created. The SDP will provide an overview of the system and the work required, and plans for software development activities. The SDP will also used as a working planning document.

2 Referenced Documents

2.1 Regulations and Specifications

U.S. Army, Corps of Engineers (1993) “Engineering and Design: Quality Management,” Engineering Regulation 1110-1-12.

2.2 Military Standards

MIL-STD-498, *Software Development and Documentation*, 5 Dec 1994

2.3 Other Documents

East, E. William, Fu, Michael Chin-Ming (1996) “Abstracting Lessons-Learned from the Design Review Process,” American Society of Civil Engineers, *Journal of Computing in Civil Engineering*,

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Kirby, Jeffrey G., Cannalte, Robert P., Hicks, Donald K., Japel Edward J. (1989) "Constructibility and Design Reviews: Analysis and Recommendations for Improvement," USACERL Technical Report P-89-15.

Kirby, Jeffrey G., Hicks, Donald K., Furry, Douglas A., Koenke, Jeffrey A. (1988) "Automated Review Management System," USACERL ADP Report P-87/08.

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3 Requirements

3.1 Required States and Modes

No states or modes are required.

3.2 CSCI Capability Requirements

3.2.1.1 Creation of Design Review Projects

The first capability of DrChecks is to create projects that may be reviewed. These projects will be created by project managers employed at the office that manages the design contract for the project.

Modification of existing project data will be limited to those who have been identified as project managers during the registration process. Projects may only be deleted by those who have been identified as system administrators during the registration process. For additional information on User Access, see section 3.2.8.1.

3.2.1.2 Project Items to Be Maintained

The only data required for DrChecks is project name and identification number. Additional data elements will be added to support a possible link between the ARMS system and DrChecks. See Section 3.3.2 for additional information the evaluation of ARMS Integration.

3.2.1.3 Project Data Input Methodology

In the demonstration system, the project manager responsible for a project shall be required to manually enter the limited set of project information into the DrChecks system. The time required to enter this data should be less than five minutes per project.

Automated sources for basic project information exist within the standard set of Corps of Engineers information management systems. These systems have not, however, provided data directly into the current set of design review tools. While the project name and other basic information may ultimately

be imported automatically from other data systems such as the Automated Management and Program Reporting System (AMPRS) or the Project Management Information System (PROMIS)

The automated creation of projects from data provided by external data sources these sources will not be considered. The cost of creating such a link would be very high when compared to the small time required to initiate a new project using DrChecks.

3.2.1.4 Project Component Identification

Data Item Descriptions for each of these items below may be found in APPENDIX A-1 "DrChecks, Build 1, Object Description Document, Section 1.1 Project Objects"

- (1) Project Identification Number. A formal definition of the project identification number has not been possible due to the variety of schemes used across Corps of Engineers District offices. Two numbers will be used to identify projects. Each project shall have a unique project key that is created when the project is first added to the database. Users will not be able to modify this project key. An additional project number will be provided for user reference.
- (2) Project Description. A number of data items may be required to adequately describe the project and allow potential integration with the ARMS system. These data items include: project description, location, and funding document.
- (3) Project Partners. A number of data items may be required to identify the participants in the project. These data items include: project management office, project manager and designer.
- (4) Project Schedule. Two data items may be required to identify the overall schedule for the project and all of the activity that is required during the lifetime of the project. These data items are the design contract award date and the construction bid date.

3.2.2.1 Creation of Design Review Phases

Once a project has been created, a review is begun to allow reviewers to identify potential design problems. Since the number of reviews and scope of each review will vary widely depending on the size and type of project under consideration, project managers will be able to create any number of design reviews.

Creation of design reviews will be limited to users who have been identified as project managers during the registration process. Reviews may only be deleted by those who have been identified as system administrators during the registration process. For additional information on User Access, see section 3.2.8.1.

3.2.2.2 Review Items to Be Maintained

The data required to manage a design review is limited to the name of the design submission that is being reviewed and the start and finish date of the review period.

3.2.2.3 Review Input Methodology

The project manager responsible for a project shall be required to manually enter the few data items required to initiate a design review into the DrChecks system. The time required to enter this data should be less than five minutes per review.

3.2.2.4 Review Component Identification

Data Item Descriptions for each of these items below may be found in APPENDIX A-2 "DrChecks, Build 1, Object Description Document, Section 1.2 Review Objects"

(1) Review Submission Identification. Each review shall have a unique project key that is created when the review is first added to the database. This key will consist of a combination of the project number and the review number. Users will not be able to modify this project key.

(2) Review Submission Description. To identify each review a textual description of the review will be provided by the project manager. A brief description of the review will be sufficient for each review since there are typically between two and four reviews per project. The specific description of the review will be determined by the project manager.

(4) Review Submission. To define the window in which review comments are accepted, the project manager will be able to assign start and end dates for the review. Under Build 1 the start and end dates of the review will not be restricted. Testing of the system will assist determining the extent to which dates will be used to restrict access to related information.

3.2.3.1 Preparation of Design Review Comments

Once a review has been created, the individuals may begin to document their evaluation of the specific set of plans and specs distributed for that review. Individuals conducting reviews may add only a few or several hundred review comments depending on the size and scope of the project, and the nature of the review being conducted. Ensuring immediate and consistent access to the comment screen is essential for DrChecks to be successful.

Creation of design review comments will be limited to users who have been identified as reviewers during the registration process. All project managers will also be identified as reviewers. Once submitted comments may not be individually modified or deleted.

Deleting projects and reviews, which may only be done by those who have been identified as system administrators during the registration process, will also delete all associated comments. For additional information on User Access, see section 3.2.8.1.

3.2.3.2 Comment Items to Be Maintained

There are four types of information required for design review comments. Project context information defines the location to which the comment applies on the plans and specifications being reviewed. Comment context information provides links to relevant indexes which will allow others (project managers, other reviewers and evaluators) to easily find the comment in the future. The comment itself is the third type of information required for each comment submitted. Finally, the identity of the author will be captured and included with each comment.

3.2.3.3 Comment Input Methodology

Typically the text of a comment will be entered manually by a reviewer. For other data elements required to completely describe a comment Graphical User Interface (GUI) tools such as drop down list boxes, check boxes and radio buttons will be provided.

In addition to manual data entry of comment text, users may paste information copied from any other data source. The ability to cut and paste comments from references or past review comments is a significant time savings for the reviewer.

3.2.3.4 Comment Component Identification

Data Item Descriptions for each of these items below may be found in APPENDIX A-3 "DrChecks, Build 1, Object Description Document, Section 1.3 Comment Objects"

(1) Project Context. Each comment shall have a number that is created when the comment is first added to the database. This key will consist of a combination of the project number, the review number and the comment number. Users will not be able to modify this project key.

(2) Comment Context. Each comment shall be identified by a set of relevant indexes, selected by the comment author that will allow the user and others to retrieve the comment in the future. This information will include specification number, drawing sheet number, room number, and design discipline. References, when appropriate, should also be cited. All data elements will conform to the ARMS data item descriptions implicitly described in the ARMS CMT file format.

(3) Comment Information. The text of the comment should be provided in two parts. In the first section the reviewer should identify the potential problem that has been addressed. The second part of the comment should indicate the recommended change.

While text-based evaluation of contract documents has been used successfully, the exchange of graphics should also be possible through DrChecks. Build 1 will contain slots to allow users to add Uniform Resource Locators (URL's) for graphical files that will be stored on the reviewer's local site.

(4) Author Identification. Every comment generated on a project must have an author that is a registered user of DrChecks. The author's name, telephone number, and e-mail address will be provided to evaluators of the comment if clarifications are needed.

3.2.4.1 Evaluation of Design Review Comments

Once comments are provided for a given design review, Architectural and Engineering firms (A/E's) and engineering or other consulting firms will evaluate those comments to determine if the issues addressed are actually problems with the current design and to explain what action, if any is to be taken to resolve the problem.

Evaluation of design review comments will be limited to users who have been identified as designers for specific projects during the registration process. Once an action has been taken to evaluate a comment that comments may not be individually modified or deleted.

Deleting projects and reviews, which may only be done by those who have been identified as system administrators during the registration process, will also delete all associated comments and evaluations. For additional information on User Access, see section 3.2.8.1.

3.2.4.2 Comment Evaluation Items to Be Maintained

There are three types of information to be maintained related to review comment evaluations. The first item is a link between the evaluation and the original comment. In Build 1, one evaluation field will be provided for a given comment. Next is the set of information that documents the designers evaluation of the comment. Finally, the name, phone number and e-mail address of the A/E firm or consultant company representative who completed the evaluation will be appended to the evaluation.

3.2.4.3 Comment Evaluation Input Methodology

The A/E or consulting firm identified as the responsible party by the comment author shall identify if the issue is to be resolved (“concur”) or if the issue is irrelevant to the current design (“non-concur”). Links between the evaluation and the author of the evaluation will be created automatically.

3.2.4.4 Comment Evaluation Component Identification

Data Item Descriptions for each of these items below may be found in APPENDIX A-4 “DrChecks, Build 1, Object Description Document, Section 1.4 Comment Evaluation Objects”

(1) Comment Evaluation Context. Blank evaluation fields will be created when a comment is created. Each comment shall have a number that is created when the comment is first added to the database. This key will consist of a combination of the project number, the review number and the comment number. Users will not be able to modify this project key.

(2) Evaluation Specifics. Radio Buttons will be used to identify if the evaluator agrees with or does not agree with the comment in question. A text field will be required for the evaluator to identify the action that is to be taken.

(3) Author Identification. The registration information from the evaluator will automatically appended to the evaluation when the evaluation is completed. Since there is a single evaluation field for each comment, the most recent evaluator’s identification will be that which is saved during an update of the database. The test of Build 1 will identify if a more sophisticated approach, to allow multiple evaluators, is needed or practical.

3.2.5.1 Past Comments Search

During the execution of a design review, comment authors frequently find issues similar to those which have appeared on previous projects. Reviewers should be able to search past review comments, created by other authors, on the current on any other project contained in the local database.

3.2.5.2 Past Comment Search Items to Be Maintained

No additional data items need to be maintained for this component.

3.2.5.3 Past Comment Search Input Methodology

The reviewer may, while creating a comment, search for related past comments by means of selecting one or more of the following indexes: specification number, plan sheet number, detail number, room number, or keyword. The reviewer will be required to manually type the information of interest into the search screen.

3.2.5.4 Past Comment Search Component Identification

During the test of Build 1 the practicality of automatically populating the search fields with valid information from past projects should be tested.

3.2.6.1 Reference Sources Search

During the execution of a design review, comment authors frequently need to access reference materials to confirm pending questions. Reviewers should be able to search available references and apply the result to the current project.

3.2.6.2 Reference Source Search Items to Be Maintained

The requirements form web-based resources will be addressed in a supplementary CSCI Document. This document will be created following the approval of this document.

3.2.6.3 Reference Source Search Input Methodology

The reviewer may, while creating a comment, search for related material contained in on-line references by means of one or more of the following indexes. Specification section, building component, building materials and key words. The reviewer may select the valid indexes from drop down list boxes. Keywords will be entered manually by the user.

3.2.6.4 Reference Source Search Component Identification

The search form used to prompt users for their needed search information will be created by searching the appropriate reference database for all valid index values. These values will be automatically placed on the search screen.

3.2.7.1 Lessons Learned

Since many review comments occur with such frequency, or are of significant impact, that they should be individually documented. This type of comment is typically referred to as "lessons learned." DrChecks will allow reviewers to identify a review comment as a potential lessons learned and forward the issue to a project manager for evaluation. Once an issue has been submitted a project manager will be responsible for the evaluation and approval or disapproval of the potential lessons learned. Approved lessons learned will be available to project partners and the general public.

3.2.7.2 Lessons Learned Items to Be Maintained

There are several additional items that must be maintained to support lessons learned. These items describe the context of the design review comment in greater detail. Also information regarding the evaluation of the potential lessons learned must be captured.

3.2.7.3 Lessons Learned Input Methodology

The majority of the information required to fully define a potential lessons learned will have been provided by the reviewer when drafting the design review comment. Additional information required will be solicited by manual input and selection of options provided using GUI tools.

Evaluations of potential lessons learned will be conducted by manual input of the disposition of the lessons learned issue.

3.2.7.4 Lessons Learned Component Identification

Data Item Descriptions for each of these items below may be found in APPENDIX A-5 "DrChecks, Build 1, Object Description Document, Section 1.5 Lessons Learned Objects"

(1) Lessons Context. Blank evaluation fields will be created when a lesson is submitted. Each comment shall have a number that is created when the comment is first added to the database. This key will consist of a combination of the project number, the review number and the comment number. Users will not be able to modify this project key.

(2) Lesson Evaluation. Radio Buttons will be used to identify if the evaluator agrees with or does not agree with the comment in question. A text field will be required for the evaluator to identify the action that is to be taken.

(3) Evaluation Author Identification. The registration information from the evaluator will automatically be appended to the evaluation when the evaluation is completed. Since there is a single evaluation field for each comment, the most recent evaluator's identification will be that which is saved during an update of the database. The test of Build 1 will identify if a more sophisticated approach, to allow multiple evaluators, is needed or practical.

3.2.8.1 User Registration

Users of DrChecks Build 1 must all self-register before using any project manager, reviewer, evaluator or lessons learned function. Following self-registration the system administrator will assign access rights for each user. During the evaluation of Build 1, various modes of user registration will be discussed.

3.2.8.2 User Registration Items to Be Maintained

Basic address information will be captured in the registration form. The registrants system CGI variables will also be captured through submission of the form.

3.2.8.3 User Registration Input Methodology

Users will manually provide registration information through an input form. The system administrator will assign one or more access rights to each user manually. Assignment of the access rights will be password protected. The IP address of the user will be automatically obtained through the use of CGI variable calls and used to validate the user identification once

3.2.8.4 User Registration Component Identification

Data Item Descriptions for each of these items below may be found in APPENDIX A-6 "DrChecks, Build 1, Object Description Document, Section 1.6 User Registration Objects"

3.2.9.1 CADD Integration

Since some users of DrChecks may be reviewing design documents in electronic formats from within Computer Aided Design and Drafting (CADD) systems, an interface between the CADD system and the DrChecks system should be included in an intermediate build of the test version of DrChecks. This capability will be further evaluated and included in DrChecks, Build 1.5.

3.2.9.2 CADD Integration Items to Be Maintained

Design element information should be captured through the DrChecks CADD Interface. This element information, as well as standard design review information, will be transmitted to a DrChecks server through the CADD Interface program.

3.2.9.3 CADD Integration Input Methodology

Native CADD system forms and input widgets will be used to develop the CADD Interface. These widgets will capture user provided and system provided data. To the extent possible, based on the underlying CADD model, the CADD Interface will capture relevant design review information and provide this information automatically to DrChecks. The user should have the opportunity to evaluate the computer selected criteria and change those criteria, if needed.

3.2.9.4 CADD Integration Component Identification

Data Item Descriptions for CADD Integration module of DrChecks have not been completed at this time. The Data Item Descriptions will be compiled and included in DrChecks, Build 1.5 documentation.

3.2.10.1 Electronic Document Transfer

Since some users will be accessing plans and specifications electronically, the ability to transmit marked-up drawings using DrChecks. In addition, field conditions identified during BCO reviews and captured using digital cameras should be included as part of a design review. This capability will be further evaluated and included in DrChecks, Build 1.5.

3.2.10.2 Electronic Document Transfer Items to Be Maintained

Electronic Documents shall be transmitted by a registered user to the DrChecks server for use and evaluation by others. Data on the file transmission date, file description, related review comment, and individual sending the file will be maintained by DrChecks.

3.2.10.3 Electronic Document Transfer Input Methodology

Additional fields will be provided on the DrChecks comment input screen. These fields will allow the user to add the file name for one file for a given comment. A description of the file may also be required as a data field separate from the comment description. Data files will be transferred to DrChecks via standard TCP/IP protocols.

3.2.10.4 Electronic Document Transfer Component Identification

Data Item Descriptions for the Electronic Document transfer module of DrChecks have not been completed at this time. The Data Item Descriptions will be compiled and included in DrChecks, Build 1.5 documentation.

3.2.11.1 Cost/Benefit Study

The costs and benefits of using DrChecks should be tracked during the test of the DrChecks system. These costs include: user connection problems, user training at their local offices, time required to register as a user, time required to access DrChecks, time required to enter comments, and other related costs. Benefits associated with the use of DrChecks include improved design quality and decreased construction and operations cost and time. This area will be further evaluated and included in DrChecks, Build 1.5.

3.2.11.2 Cost/Benefit Study Items to Be Maintained

Costs of using DrChecks cannot be effectively captured through capture of data from within the DrChecks system. Interview information, provided by users testing DrChecks should provide this data at the conclusion of the DrChecks test. Benefits data may be captured during the use of DrChecks by the addition of several data fields that can identify the benefit of including the indicated item in the finished design. Further evaluation of the data items required will be conducted and documented under DrChecks, Build 1.5 documentation.

3.2.11.3 Cost/Benefit Study Input Methodology

Additional fields will be provided on the DrChecks comment input screen. These fields will allow the user to add necessary information describing the qualitative and quantitative benefits of including the comment in the design. Additional information provided by A/E's may also corroborate the data included by the reviewer.

3.2.11.4 Cost/Benefit Study Component Identification

Data Item Descriptions for the Cost/Benefit Study module of DrChecks have not been completed at this time. The Data Item Descriptions will be compiled and included in DrChecks, Build 1.5 documentation.

3.3 CSCI External Interface Requirements

DrChecks will be designed to support integration with the ARMS and other Corps systems such as AMPRS and PROMIS. If funding is made available, an integration plan will be developed during the development phase. Specific requirements for interfaces needed may be completed under DrChecks, Build 1.5.

3.4 CSCI Internal Interface Requirements

All internal interface decisions are left until the design phase.

3.5 CSCI Internal Data Requirements

All data shall be captured and maintained in Microsoft Access™ database files. Graphics included with the system shall be stored as separate data files and linked through file name with records in the aforementioned database tables. All other internal decisions are left to the design phase.

3.6 Adaptation Requirements

There are no adaptation requirements.

3.7 Safety Requirements

This CSCI poses no particular safety risk.

3.8 Security and Privacy Requirements

3.8.1 Public Access to DrChecks

In general it is the intent to allow the general public to use the reference sources provided by DrChecks. These reference sources include sets of approved lessons learned and reference sources. Read-only access to the set of approved lessons learned and existing reference sources will not be limited during this test.

The public will not have access to the design review portion of DrChecks. During the evaluation of Build 1, alternate modes of public access will be discussed.

3.8.2 Identification of Project Participants

Project participants self register with the system at the beginning of a project. The system administrator will then identify each participant as a project manager and/or reviewer, customer or consultant. During the evaluation of Build 1, alternate modes of user registration will be discussed.

3.8.3 Access to Project, Review, Comment and Evaluation Data

Write access for all design review related data contained within DrChecks will be restricted to the group of people responsible for authoring that data. Project managers will have access only to project and review creation. Reviewers may only author new comments. Specific individuals may have both project

manager and reviewer access. Customers will have author level access. Consultants will be able to evaluate comments.

Access to these pages will be limited by checking the incoming users IP address through the CGI.Remote_Addr variable against the set of registered users. Under this scheme users must access DrChecks from the same equipment, that have fixed IP addresses, to efficiently use DrChecks. During the evaluation of Build 1, alternate modes of restricting access will be discussed.

During the evaluation of Build 1, only the system administrator will have the ability to delete projects or reviews within a project. Once a project is deleted all comments associated with that project will also be removed from the database.

3.8.5 Access to User Registration Information

The public will be able to obtain a list of persons registered to use DrChecks the system. This list will include name, company affiliation, telephone number and e-mail address.

Name, telephone number and e-mail addresses of each comment author or evaluator will be included with each review comment or review comment evaluation.

IP address information will only be provided to individual users to allow them, or their local system administrators to validate registration information.

3.9 CSCI Environment Requirements

None.

3.10 Computer Resource Requirements

This CSCI will operate in a client/server environment. See sections 3.10.1 and 3.10.3 below for additional information.

3.10.1 Computer Hardware Requirements

The server computer operating the Build 1 evaluation will be a personal computer with a Intel Pentium Processor and a 2 GB Hard Drive. During the evaluation of Build 1, alternative platforms will be discussed.

The only restriction on the computer hardware of clients is that the hardware selected by compatible with an HTML version 2.0

3.10.2 Computer Hardware Resource Utilization Requirements

None.

3.10.3 Computer Software Requirements

The server will be a personal computer operating with the Microsoft Windows™ NT version 3.51 operating system.

Client systems may use any operating system, provided that the client's have access to a HTML 2.0 compliant World Wide Web Browser. Browser programs supporting this industry standard include Netscape, version 3.0 or better, or Internet Explorer, version 3.0 or better.

3.10.4 Computer Communications Requirements

The server system must be linked to the Internet using TCP/IP protocols. The recommended connection speed for the server system will be developed through the test of Build 1.

Client systems must be lined to the Internet using TCP/IP protocols. Connection to the server will be accomplished through the World Wide Web. Based on the anecdotal experience of the authors, the minimum connection speed for clients testing Build 1 should be 9600 bps. A recommended speed of client connections to the world wide web will be identified through the test of Build 1.

3.11 Software Quality Factors

The software should be able to perform all of the functions specified in these requirements to the level of competence reasonably expected from commercial software. Software quality will be addressed in the Software Test Plan (STP), to be drafted following approval of these requirements.

3.12 Design and Implementation Constraints

There are no constraints to the design of the system.

Constraints to implementing this system are that each client must have access to the World Wide Web. Although the web is becoming ubiquitous in many settings, small A/E firms and construction offices may not have access to the program. Evaluation of Build 1 will assist in evaluating the difficulty the A/E and user community may have in obtaining Web access.

3.13 Personnel -Related Requirements

None.

3.14 Training-Related Requirements

Since testing of Build 1 will be conducted by CERL, no training requirements will be required for web server managers.

User training to develop proficiency with commercial World Wide Web browser and general computer skills may be helpful for many potential users. This training is to be conducted at the testing office.

3.15 Logistics-Related Requirements

None.

3.16 Other Requirements

None.

3.17 Packaging Requirements

Software required to operate this system was developed using a combination of commercial and CERL. Commercial software will be provided through the private sector. Software developed by CERL will be

Client software will be provided through the commercial sector. No additional requirements are necessary.

3.18 Precedence and Criticality of Requirements

All requirements have equal weight, though priorities may be assigned in conjunction with the development team as the project progresses.

4 Qualification Provisions

All qualifications will be accomplished through demonstration.

5 Requirements Traceability

This is the top level requirements document, so there is no upward traceability. The CSCI described herein is the entire system, so all requirements are traced beginning with this document.

6 Notes

6.1 Acronyms

A/E	Architect/Engineer firm
AMPRS	Automated Management and Program Reporting System
ARMS	Automated Review Management System
CMT	The ASCII file name extension for ARMS data exchange files.
CSCI	Computer System Configuration Item
GUI	Graphical User Interface
DrChecks	Design Review and Checking System
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transfer Protocol

ISP	Internet Service Provider
PROMIS	the Project Management Information System
RA	Reviewer's Assistant
RDMIS	Research and Development Management Information System
STP	System Testing Plan
URL	Uniform Resource Locators
USACERL	Construction Engineering Research Laboratories
WWW	World Wide Web

6.2 Additional Notes

None.

APPENDIX A. DrChecks Object Model

This appendix briefly describes the current status of the object model developed during the preliminary investigations into the DrChecks.¹ Readers are reminded that every software designer will develop slightly different models. There is no one correct representation for a given problem.

Figure One contains the structure for the object model developed during Build 1. Readers of this document are encouraged to provide suggestions to this model. The model has several important components which are described, in some detail, in the sections below.

APPENDIX A-1. Project Object Model

Attribute	Description	Type	Length
project_id	Unique project identification key for each project.	Integer	Long
description	A brief project description. The 18 character code used by ARMS Many need to be expanded to 30 characters for non-Corps offices.	Text	18
location	Includes Base/State/Country name. The 18 character code used by ARMS may be insufficient for database containing large geographical area.	Text	18
office	Name of the office completing the design management. The three character code, called "Design District," used by ARMS may need to be expanded for non-Corps offices.	Text	3
authorization	Number shown on 1391 or equivalent project authorization document. Will be required for future links to other integrated systems and ARMS	Text	
funding	Number found on authorizing document or provided in standard list of sources. Standard listing of funding sources is provided in ARMS	Text	
manager	Name of person initiating the project. Called "Technical Manager" in ARMS	Text	
designer	Name of registered A/E firm who will have access to the system. Called "A/E User Name" in ARMS.	Text	
Start Date	The award date for the design contract, defaults to current date. Called "project initiation date" in ARMS. Should be provided by future integrated systems.	Date	
End Date	The estimated finish date for the design project. Called "estimated RTA date" in ARMS. Should be provided from future integrated systems.	Date	

¹ Object modeling technique adapted from Rumbaugh (1991) Object-Oriented Modeling and Design, Prentice Hall

APPENDIX A-2. Review Object Model

Attribute	Description	Type	Length
project_id	Foreign key from the project object to allow inheritance	Integer	Long
review_id	Unique review identification key for each review	Integer	Long
name	Name of the review to be conducted. The 38 characters used in ARMS are adequate for describing most reviews	Text	38
submittal_date	Date that the review submittal is expected from the A/E. This date should not be prior to the design award date	Date	
review_date	Date that all comments for the review should be completed. This date should not be later than the construction award date.	Date	

APPENDIX A-3. Comment Object Model

Many of the items in the comment object may be modeled within the table as data fields or may be derived from separate reference tables. For example, the discipline codes required to be submitted with each comment are required to be three characters. A simplistic implementation of this requirement, that is used for Build 1 is to allow the data input form to translate the data from English descriptions of disciplines into the three letter codes. In the future data tables could automatically provide the data without the need to “hard-wire” the application. Testing of Build 1 should assist in the determination of the which, if any, of these external indexes should be included directly in DrChecks or obtained from the linking of additional foreign keys.

Attribute	Description	Type	Length
comment_id	Unique comment identification key for each comment	Integer	Long
project_id	Foreign key from the project object to which this comment belongs to allow inheritance	Integer	Long
review_id	Foreign key from the review object to which this comment belongs to allow inheritance	Integer	Long
author_id	Foreign key from the person object who created the comment to allow inheritance	Integer	Long
created	The date that the comment was created	Date	
discipline	Discipline of the consultant who should review the comment. The three character standard codes provided by ARMS may not be sufficient for non-Corps offices. In a reasonable user interface requires that an English list of disciplines be provided. A foreign key would be more efficient.	Text	3
sheet	Location in drawing on document to which the comment applies.	Text	5
detail	Provides exact location where comment is applicable.	Text	5
spec	Specification to which the comment applies	Text	5
customer	If customer specific, enter the customers name. This should be a foreign key from the list of offices	Text	50
location	If location specific, enter the location name. This should be a foreign key from the list of locations	Text	50

reference	If there is a citation of code or standards, the data may be placed in this field. This should be a foreign key from the list of available reference materials	Text	50
lesson	Is the item to be submitted as a potential lessons learned? If so additional processing will occur if the user selects Y	Y/N	
text	Statement of what is to be fixed to correct the potential problem		
reviewer	Name of designer who has checked this item		
reviewed	Date of the last update to the review portion of the comment record.	Date	
concur	Identification of concur or non-concur with recommendation	Y/N	
review	Text of comments provided by the evaluator	Memo	

APPENDIX A-4. Evaluation Object Model

Data Item Descriptions needed to describe the evaluation of comments are, for Build 1, contained in the list of each comments. Modeling the evaluation of a comment in the comment object restricts the contents of the evaluation attributes to be that of the last person who edited the evaluation data. Testing of Build 1 will assist in determining if this assumption is valid.

APPENDIX A-5. Reference Source Object Model

The reference source object model is provided here as a description a reference source that may be used by reviewers as they conduct reviews. This data model is not, explicitly, part of the DrChecks system since any system could provide electronic reference. The data model is provided below for documentation only.

Attribute	Description	Type	Length
kbase_id	Unique identification key for each item in the reference source	Integer	Long
component	The component to which the reference item refers	Text	
material	The material to which the reference item refers	Text	
function	The function about which the reference item occurs	Text	
query	A question posed to identify if the specific reference item is applicable for a specific project	Memo	
comment	If the question posed for this specific item is relevant for a given project, the comment explains the steps needed to consider the issue being discussed	Memo	

Attribute	Description	Type	Length
component_id	Unique identification key for the component item	Integer	Long
component	A component to be addressed in the knowledge-base	Text	

Attribute	Description	Type	Length
material_id	Unique identification key for the material item	Integer	Long
material	A material to be addressed in the knowledge-base	Text	

Attribute	Description	Type	Length
function_id	Unique identification key for the function item	Integer	Long
function	A function to be addressed in the knowledge-base	Text	

Attribute	Description	Type	Length
photo_id	Unique identification key for the photo item	Integer	Long
kbase_id	A foreign key to identify the related item	Integer	Long
photo	The name of a photo file that is related to the item	Text	

APPENDIX A-7. Lessons Learned Object Model

In Build 1 the lessons learned object model is based upon data obtained from the Headquarters USACE's Construction Evaluation Reporting System (CERS). This draft data structure will, of course, need to be modified as Build 1 is tested.

One issue that should be addressed during the testing of Build 1, for example, results from the necessary implementation of these objects within database tables. The problem occurs since indexes must be created to allow linking of related records to simulate inheritance and other object oriented properties. For example, should the client description in this table come from user input or from the list of client offices included in the user database. Similarly, should the data included in the discipline field be supplied by the user or should the discipline be verified by only allowing those values contained in a separate data table.

In Build 1 lessons are developed directly from comments. To reduce the input requirements, most of the data fields are filled with data provided from the originating comment.

Attribute	Description	Type	Length
lesson_id	A unique key for each lesson item	Integer	Long
project_id	Foreign key from the project object to which this lesson belongs	Integer	Long
comment_id	Foreign key from the comment object from which this lesson was submitted		
author_id	Foreign key from the person object who created the comment	Integer	Long
description	A brief name of the item being addressed	Text	50
catcode	Department of Defense standard category code	Text	30
location	If the item is location specific, then this data field should have data	Text	25
client	Name of the office for whom the project is being completed	Text	15
office	Name of the office who is conducting the project	Text	15
spec	The specification number for the item	Text	5
discipline	The discipline that should be responsible for correcting the issue	Text	5
code	A code contained in the CERS system, where the sample data base originated. The code identifies if the issue is related to design, construction, or operations	Text	3
url	Allows the author of the lesson to add a relevant URL to the lesson	Text	50

- - Working Draft - -

problem	A complete description of the problem that has been encountered	Memo	
solution	A complete description of the solution to the problem identified in the record	Memo	
error	Identifies if the issue being submitted is a potential design error	Y/N	
omission	Identifies if the issue being submitted is a potential design omission	Y/N	
coordination	Identifies if the issue being submitted is a potential design coordination problem	Y/N	
cost	Identifies if the issue being submitted may result in construction cost growth	Y/N	
time	Identifies if the issue being submitted could result in construction time growth	Y/N	
quality	Identifies if the issue being submitted could result in construction quality problems	Y/N	
design	Identifies if the issue being submitted results in problems that occur during the design phase	Y/N	
construction	Identifies if the issue being submitted results in problems that occur during the construction phase	Y/N	
operation	Identifies if the issue being submitted results in problems that occur during the operations phase	Y/N	
regulation	Identifies if the issue being submitted may be resolved by a change to the applicable regulations	Y/N	
guidespec	Identifies if the issue being submitted may be resolved by a change to applicable guide specifications	Y/N	
created		Text	6
act_date	The date that action was first taken on the issue	Date	
act_author	The author of the action that was taken	Text	15
act_code	The status of the item as it moves from a "P" pending to under "E" evaluation	Text	1
act_org	The organization responsible to resolve the issue	Text	25
act_office	The specific office responsible to resolve the issue	Text	19
act_officer	The action officer to which the issue has been assigned	Text	21
act_taken	The action that was taken to resolve the issue	Text	50
act_descr	Additional description of any items needed to resolve the issue.	Memo	

APPENDIX A-8. User Object Model

Users registration and access are governed by data contained in the user object model. To simplify the user model, the table below collapses the single attribute children classes of "manager," "client," "designer" and "reviewer" into the basic user object. Each of these classes is identified with a single Y/N variable that identifies the class of the user. This simplifying assumption also allows individuals to have more than one role within DrChecks.

Another simplifying assumption in the table below is that each user will have to enter their own office address information. This assumption will need to be removed with the addition of an additional Office Object, as shown in Figure 1, a future Build of DrChecks.

Attribute	Description	Type	Length
person_id	The unique key to identify each person	Integer	Long

- - Working Draft - -

title	The title of the person	Text	50
first	The first name of the person	Text	50
last	The last name of the person	Text	50
office	The name of the office to which the person belongs	Text	50
address1	The first address line for the person	Text	50
address2	The second line of address for the person	Text	50
city	The city in which the person's office is located	Text	50
state	The state in which the person's office is located	Text	50
phone	telephone number of the person	Text	50
email	Internet email address of the person	Text	50
ipaddress	The Internet Protocol (IP) address of the user's computer identified automatically during the registration process	Text	15
reviewer	Is the individual authorized as a reviewer	Y/N	
manager	Is the individual authorized as a manager	Y/N	
client	Is the individual authorized as a client	Y/N	
designer	Is the individual authorized as a designer	Y/N	
password	User provided password. This item may be used at a later time to assist in maintenance of user accounts.	Text	10