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UFC 1-300-01
28 February 2006
Change 2, July 2009

ENTERED

UNIFIED FACILITIES CRITERIA (UFC)

CRITERIA FORMAT STANDARD

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

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UNIFIED FACILITIES CRITERIA (UFC)

CRITERIA FORMAT STANDARD

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U.S. ARMY CORPS OF ENGINEERS

NAVAL FACILITIES ENGINEERING COMMAND (Preparing Activity)

AIR FORCE CIVIL ENGINEER SUPPORT AGENCY

Record of Changes (changes are indicated by **1**\ ... /**1**/)

Change No.	**Date**	**Location**
1	June 2007	Throughout Chapter 1.
2	July 2009	Revised Paragraph 2-1.2.2, deleted Paragraphs 2-1.2.2.1, 2-1.2.2.2, and 2-5.2.1, revised links in Appendix A, and updated Appendix B

This UFC supersedes UFC 1-300-01, dated November 2002.

FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with USD(AT&L) Memorandum dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the more stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Civil Engineer Support Agency (AFCESA) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: Criteria Change Request (CCR). The form is also accessible from the Internet sites listed below.

UFC are effective upon issuance and are distributed only in electronic media from the following source:

- Whole Building Design Guide web site http://dod.wbdg.org/.

Hard copies of UFC printed from electronic media should be checked against the current electronic version prior to use to ensure that they are current.

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UNIFIED FACILITIES CRITERIA (UFC)
REVISION SUMMARY SHEET

Description of Changes: This update to UFC 1-300-01 incorporates new metric criteria to comply with DoD standards, the addition of the new document or change summary sheet, a clarification of contract language use in UFC and a reorganization of the reference appendix.

Reasons for Changes:

- DoD published SD-10, clarifying DoD metric policy.
- Design-Build processes may require UFC to contain contract language to indicate contract requirements.
- A revision summary sheet or a new document summary sheet will expedite the UFC approval process and will help UFC users to better understand the changes from the previous version.
- User feedback indicated that the previous method for listing references made it difficult to find the references indicated. The new organization mimics that used in non-government standards.

Impact: There are negligible cost impacts. However, the following benefits should be realized.

- By ensuring that all UFC conform to DoD metric policy, confusion regarding metric policy should be lessened and project communication enhanced.
- The inclusion of contract language when warranted should strengthen UFC requirements in design-build, and possibly other projects.
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CHAPTER 1 INTRODUCTION

1-1 PURPOSE AND SCOPE.

\1\ This UFC provides standards for the preparation, general appearance, and content of Unified Facilities Criteria (UFC). UFC are published by the Military Services under the auspices of the tri-service Engineering Senior Executive Panel (ESEP), comprised of:

- Director, Installations Requirements and Management, Office of the Deputy Under Secretary of Defense for Installations and Environment (ODUSD(I&E)),;
- Chief, Engineering and Construction Division, Headquarters U.S. Army Corps of Engineers (HQUSACE),;
- Chief Engineer, Naval Facilities Engineering Command (NAVFAC)
- Deputy Civil Engineer, Headquarters U.S. Air Force (A7). /1/

UFC are prepared by DOD committees called discipline working groups.

UFC are published in electronic media only. The *Memorandum of Agreement for the Whole Building Design Guide* establishes the Whole Building Design Guide (http://www.wbdg.org/) as the sole distribution method for internet access to UFC. UFC are also available in electronic format via the Construction Criteria Base system disk sets.

1-2 APPLICABILITY.

This UFC applies to all service elements and contractors preparing UFC.

1-3 REFERENCES.

Appendix A contains a list of references used in this UFC and illustrates the format for listing references.

1-4 CONTENT AND FORMAT.

\1\ UFC are used to rapidly provide technical information to plan, design, construct, operate, and maintain shore facilities, and are essential communications between policy- and standards-making elements and execution elements. The UFC content and format is designed to facilitate ease of preparation and use. A template of this guidance document in Microsoft® Word format is available from the Whole Building Design Guide (http://www.wbdg.org/.) /1/

1-4.1 **Content Guidance**.

\1\ Each DOD discipline working group is responsible for the technical content and overall quality of its UFC in accordance with the following guidelines:

- Provide technical information in a well-written, straightforward manner.
- Reference non-Government standards wherever appropriate, and avoid repeating commercially available criteria.
- State unique government requirements and exceptions to commercially available criteria clearly and succinctly. Each exception over and above industry standards should be verifiable as to the functional need and to assure it promotes the lowest life cycle cost.
- Maximize functionality while addressing all life, safety, and health requirements. Using lessons learned and innovative technology, develop the criteria to promote lowest life-cycle cost, maximum environmental responsiveness, energy efficiency, quality of life, and productivity.
- Focus on performance criteria. Exclude textbook information, charts and figures, and other information that is available in commercial and industry references. Design UFC are not intended to be training manuals or compilations of reference material as were design and technical manuals.
- Write criteria to the level of the experienced engineer and architect. In some cases (such as operations and maintenance UFC), criteria will be written in procedural language and at the level of the experienced field personnel.
- Generally larger documents containing multiple topics should be broken into separate UFC to facilitate updating. However, document size and content must also address the following:
    - user/usage;
    - use in design and construction contracts, types and number of projects affected;
    - other criteria and documents that reference or work with the UFC; and
    - ease to maintain the UFC. /1/

1-4.2 **Electronic Format**.

UFC will be distributed in Adobe® Portable Document Format (PDF) according to paragraph 2-7.

1-4.3 **Variations in Format**.

The format prescribed herein is intended to provide uniformity and will apply to most UFC. Deviations from the prescribed format may be necessary to effectively communicate a message. Examples include design guides that contain numerous graphics, field handbooks in non-standard sizes, and service existing documents reissued with a UFC cover to expedite dissemination of critical subject matter within the UFC system.

1-4.3.1 Coordinate variations from the prescribed format with the appropriate service office: HQUSACE (CECW-E) for the Army, the NAVFAC EICO for the Navy, or HQ AFCESA/CES for the Air Force.

1-4.3.2 When a UFC is published in non-standard format, include the following statement below the supersedure information on the title page: "The format of this document does not conform to UFC 1-300-01." If the UFC will be reformatted at a later date, include "; however, it will be reformatted at the next revision."

1-5 **COPYRIGHT RELEASES**.

If copyrighted material is used in a UFC, obtain written permission from the copyright holder. Identify the material properly in the UFC according to the requirements of the copyright holder.

1-6 **PUBLICATION DATE**.

The publication date is the date of the last ESEP signature. To expedite dissemination of new criteria for multiple-discipline UFC, the preparing activity may publish a basic UFC, which later may include additional chapters or appendixes. These later chapters or appendixes, when approved, will be published as changes. These changes will bear the same publication date in the header as the basic UFC but will be identified at the top of the first page with the change number and date of the change. Issue dates for these chapters and appendices will be identified by the publication change dates documented on the UFC title page. (Refer to paragraph 2-5.)

CHAPTER 2 REQUIREMENTS

2-1 CONTENT.

2-1.1 Organization.

Use one of the following two outlines. Longer UFC should follow the chapter format.

Without Chapters:

Front Matter
- *Cover*
- *Title/change page*
- *Foreword*
- *Summary Sheet*
- *Table of Contents*

Main Text (Requirements)
- *Introduction*
  - *Background*
  - *Purpose*
  - *Scope*
- *References**
- *Technical requirements*
- *Glossary*

Appendixes
- *Appendix A - References**
- *Appendix B – Best Practices*
- *Supporting technical guidance*

Index

OR

With Chapters:

Front Matter
- *Cover*
- *Title/change page*
- *Foreword*
- *Summary Sheet*
- *Table of Contents*

Main Text (Requirements)
- *Chapter 1 – Introduction*
  - *Background*
  - *Purpose*
  - *Scope*
  - *References**
- *Chapter 2 (and following)*
  - *Technical requirements and guidance*

Glossary

Appendixes
- *Appendix A - References**
- *Appendix B – Best Practices*
- *Supporting technical guidance*

Index

*Refer to paragraphs 2-1.3.2 and 2-1.5.1.

2-1.2 Front Matter.

2-1.2.1 **Cover, Title Page, and Foreword**. These pages are mandatory. Prepare them according to the example provided by this UFC.

2-1.2.1.1 The cover page will include distribution statement A or C in accordance with DOD Directive 5230.24 (at http://www.dtic.mil/whs/directives/corres/html/523024.htm), as follows:

> DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

DISTRIBUTION STATEMENT C. Distribution authorized to U.S. Government Agencies and their contractors (fill in reason) (date of determination). Other requests for this document shall be referred to the preparing activity.

2-1.2.1.2 Most unclassified UFC will require Distribution Statement A. UFC determined to be classified or for official use only (FOUO), such as those dealing with Anti-Terrorism/Force Protection, will require Distribution Statement C. For these documents, the reason will be for “administrative” or “operational” use, the date will be the date determination was established (not necessarily the UFC publication date). Requests for these documents using the Freedom of Information Act (FOIA) will be coordinated with the preparing activity in accordance with DOD Directive 5230.24.

2-1.2.1.3 **Cover Sheet-Document Title**. The first line of the document title will contain only the description of the system, engineering discipline or facility type. It will be assumed that the document contains design requirements and may contain planning, operations and maintenance requirements. Provide a second line modifier to the title such as handbook, maintenance manual, best practices, or inspection procedures, only if the document does not contain the design requirements.

2-1.2.1.4 Identify the preparing activity on the title page parenthetically. The foreword is identical for all UFC.

2-1.2.2 **Summary Sheet**. Provide a summary sheet for new UFC and revisions to existing UFC. The summary briefly addresses the subject of the UFC, or the changes made to the UFC, whichever is appropriate. Maintain the summary to less than a single page, using bullets to organize the information. \2\ The Summary Sheet briefly addresses the following:

Subject:
Cancels: if applicable
Document Description and Need for new UFC or Description of Changes for revised UFC

- Purpose
- Application
- Need
- Reasons for Change of revised UFC

Impact: The following direct benefits, both positive and negative, will result from publication of UFC X-XXX-XX or the revision of the UFC

- Initial costs
- Life cycle cost
- Maintenance
- Safety
- Efficiency
- Force protection

Non-Unification Issues:

- Listing in bullet format of all differences between the agencies in the UFC along with justification of each difference/2/

2-1.2.3 **Table of Contents**. A table of contents is not required for UFC with fewer than 30 pages (including front matter and appendixes). As a minimum, the table of contents should list titles of main paragraphs and, if used, titles of first level subparagraphs. Format the table of contents according to the example in this UFC. For multiple-discipline UFC (e.g., UFC Series 4 – Multi-disciplinary and Facility-specific Design), each chapter and appendix may have a table of contents that lists titles of main paragraphs and first-level subparagraphs within the chapter or appendix. The main document table of contents then lists only chapter and appendix titles. Do not list the front matter or the index in the table of contents.

The table of contents may also list figures and tables included in the UFC. If so, format these listings similarly to the rest of the table of contents under the separate headings of "Figures", "Tables" or "Figures and Tables."

UFC may be formatted to facilitate the automatic generation of the table of contents in Microsoft Word. The format of a table of contents that has been generated automatically will differ from the example in this UFC (1-300-01); after it is generated, format the table of contents to resemble the example as closely as possible.

2-1.3 **Main Text**.

2-1.3.1 **Introduction**. As a minimum, this paragraph presents the purpose and scope of the UFC. Background information is not mandatory, but include it when such supplementary information helps the user better understand how to use the UFC.

2-1.3.2 **References**. List all publications cited in the UFC, including appendixes, and any additional publications needed to use the UFC. If the list is longer than one page, refer the user instead to Appendix A and list all references there (refer to paragraph 2-1.5.1).

2-1.3.3 **Technical Requirements**. Minimize content in this section by focusing on requirements only and referencing non government standards. Include all unique government requirements and exceptions to industry criteria. Follow the controlling industry standard or code format where applicable. Supporting information and guidance will be located in Appendix B, Best Practices. Appendix B shall not contain any additional requirements.

2-1.4 **Glossary**.

The glossary lists and defines acronyms, abbreviations, and uncommon terms used in the UFC. A glossary is not mandatory but should be used when the main text would be complicated if it included a large number of definitions, or when it contains a large number of acronyms or abbreviations (20 or more). Format the glossary into two sections—the first for acronyms and abbreviations, the second for terms—each organized alphabetically.

2-1.5 **Appendices**.

2-1.5.1 **General Guidelines**. Appendixes containing technical guidance should be written in the same style as the main text (refer to paragraph 2-3). Exception: Previously published material should retain the original format.

2-1.5.2 **Appendix A**. Use Appendix A to list references in alphabetical order. Generally, include a standard designation, title, publishing date and publisher. Specific information for different reference types, and the order to present this information, is provided in the paragraphs below.

If the appendix is several pages, consider breaking the references into categories. For example, a UFC may use the categories "Government" and "Non-government"; or it may categorize the references by military agencies: "Air Force," "Army" and "Navy." Choose categories that break the references into manageable lists that are logical for the user.

2-1.5.2.1 **Publisher Information to Include**. Provide the user with the necessary publisher information to obtain the reference. For the purposes of this UFC, "publisher" is defined as the entity with control and authority over distribution. In cases where more that one entity wields such control and authority, list the lead or authoring entity as publisher.

If the reference can only be obtained from a single source, include the address, telephone number or web site. If this information is not listed, it will be assumed that the reference may be obtained through the many normal means of obtaining any book or magazine.

If a reference is difficult to obtain, do not use it as a reference and do not cite it in the main text of the UFC. If warranted, the source may be included in a separate appendix titled "Supplemental Resources" (see paragraph 2-1.5.2.6.)

2-1.5.2.2 **Government Standards**. List government standards (UFC, Military or Federal Standards, or other government standards or specifications) using the appropriate standard designation (UFC 1-200-01, MIL-STD-3007), followed by the title in italics, publication date, publishing agency, agency address, telephone number and web site if applicable. See Figure 2-2.

2-1.5.2.3 **Non-government Standards**. List non-government standards (e.g. ASTM Standards, ASME Standards) in alphabetical order using the appropriate standard designation (ASTM A 38) followed by the title in italics, publication date, publishing organization, organization address, telephone number and web site, if applicable. See Figure 2-2.

2-1.5.2.4 **Books and Periodicals**. If the reference is a book or a complete journal, list these documents in alphabetical order by title in italics, followed by the date of publication, author or editor's name, publisher, publisher's address, telephone and web site, if applicable. See Figure 2-2.

If the reference is a distinct portion of a book or journal (an article or a chapter,) list in alphabetical order by title in quotation, followed by the title of the document of which it is part in italics, followed by the date of publication, the author's name, publisher, publisher's address, telephone number and web site, if applicable. See Figure 2-2.

2-1.5.2.5 **Web Sites**. If the reference is a web site, list in alphabetical order by the name of the web site in all upper case, followed by the uniform reference locator (URL) in parenthesis, the name of the organization or person that maintains the web site, address, and telephone number if applicable. See Figure 2-2.

2-1.5.2.6 **Supplemental Resources**. It may be warranted to include additional sources of information about the UFC subject, such as web sites or journals that publish new findings about a subject on a regular basis. In such cases, include these resources in a separate appendix titled "Supplemental Resources," and list in the same manner as for References. Limit supplemental resources to a single page.

2-1.5.3 **Appendix B**. Use Appendix B to contain the Best Practice information. The information is considered to be guidance and not requirements. Its main purpose is to communicate proven facility solutions, systems, and lessons learned, but may not be the only solution to the design, operation, or maintenance requirement. It is not intended to be a textbook or to repeat information from industry standards and other non-government references. Appendix B may contain chapters but is not intended to parallel the chapter organization and numbering of the technical requirements section of the main text

2-1.6 **Index**.

An index is not required for a UFC unless the UFC is long and complex. Indexes are difficult to develop and maintain and should be used only when absolutely necessary. Electronic formats allow search and find routines to locate occurrences of words and phrases.

2-2 **FORMAT**.

2-2.1 **Page Layout**.

Prepare final electronic drafts using an 8.5- by 11-inch page size. Foldout sheets should be avoided.

2-2.1.1 **Margins**. Use 1-inch margins left and right, 0.75-inch margins top and bottom. Position marginal copy (headers and page numbers) one-half inch from the edge of the page. All text is left-aligned at the margin, including paragraph numbers, except as noted for headers and page numbers.

2-2.1.2 **Font**. Use a 12-point sans serif font. Helvetica, Arial, and Universal are acceptable examples. Ensure color fonts appear legible when printed black and white.

2-2.1.3 **Paragraphs**.

2-2.1.3.1 **Numbering**. Number all main text and appendix text paragraphs. In main text, number paragraphs and subparagraphs consecutively from beginning to end, using a period to separate the numbers representing each breakdown. Limit subparagraphs to four numbers separated by periods. (Label subparagraphs according to the following example.) Where a UFC is divided into chapters, number each paragraph consecutively within the chapter, beginning each paragraph number with the applicable chapter number followed by a dash. Number chapters and paragraphs consecutively within each appendix, beginning each paragraph number with the letter designation of the appendix followed by a dash (e.g., A-1, A-1.1). Figures and tables located in the Appendices will be numbered consecutively beginning each with the letter designation of the appendix followed by a dash and the chapter number if used. Use this UFC as a guide.

Use no more than two unnumbered paragraphs beneath any numbered paragraph. Indent the first line of unnumbered paragraphs 10 character spaces from the left margin. Place all other lines flush with the left margin. Leave a blank line between paragraphs.

Example:

2 CHAPTER
2-1 MAJOR PARAGRAPH
2-1.1 First level subparagraph
2-1.2 First level subparagraph
2-1.2.1 Second level subparagraph
2-1.2.1.1 Third level subparagraph
2-1.2.1.2 Third level subparagraph
2-1.2.2 Second level subparagraph

2-2.1.3.2 **Titles**. Each major paragraph must have a paragraph title in bold uppercase. Titles are optional for subparagraphs, but should be applied consistently; i.e., if any subparagraphs of a particular paragraph have titles, all subparagraphs in the same sequence at that level must have titles. Present titles of subparagraphs in bold with initial capital letters only. Indent paragraph title 10 character spaces from the left margin. If text follows the title, end the title with a period and begin the paragraph text on the same line. Place all other lines flush with the left margin.

Exception: If you use Microsoft Word's style function to generate a table of contents automatically, lines with paragraph titles cannot contain additional text. Consequently, for all numbered and titled paragraphs, place the paragraph text flush with the left margin on the line below the paragraph title. For consistency, follow this rule even for numbered and titled paragraphs that will not appear in the table of contents.

2-2.1.4 **Headers**. Each page of a UFC, including the cover and the title page, will bear the UFC designation and publication number (short title) and the publication date as marginal copy, right-justified, one-half inch from the top of the page. The short title occupies the first line; the publication date (refer to paragraph 1-6) appears directly beneath the short title.

2-2.1.5 **Page Numbers**. Center page numbers horizontally in the footer (bottom marginal copy area) of each page.

2-2.1.5.1 **Front Matter**. Page numbers will not appear on the cover, title page, and foreword. Beginning with the first page of the table of contents, number pages consecutively with lowercase roman numerals.

2-2.1.5.2 **Main text**. Beginning with the first page of main text and continuing through the last page of the document (including glossary, appendixes, and index), number pages consecutively with Arabic numerals. Do not include chapter numbers in the page numbers.

2-2.2 **Tables**.

Position each table after the paragraph which first references it. If this causes the table to break between two pages, the entire table may be placed on the next page. Number tables consecutively, starting with Table 1. If a UFC has chapters, number tables consecutively within each chapter, using the chapter number first, followed by a dash (Example: for Chapter 2, Tables 2-1, 2-2, 2-3). Format tables according to the following example. Font size may be reduced to a minimum 10-point to enhance the presentation of data within a table.

Table 2-1 Example Table

Nomenclature	T.O. 35E8-2-10-4 Illustration	Part Number	National Stock Number	Units per Trailer	CAGE Code
Coupling, female, Series 56	19-17	5601-6-6S	4730-00-939-5533	1	01276
Washer, flat	19-18	495-060-A3		1	51506
Dust cap	19-20	5657-6	5340-00-071-3829	1	01276
Dust cap	19-21	5659-6	5340-00-071-3830	1	01276
Coupling, male, Series 56	19-39	5602-6-6S	4730-01-063-9285	1	01276
Wacker HPU	19-1	52D9014-101	4940-01-356-3478	2	21439
Hose assembly	30-7	52C8620-1	4720-01-254-0957	2	21439

2-2.3 **Figures**.

Figures may be drawings or photographs. Figures may be color or black and white. Ensure color fonts appear legible when printed black and white. Position each figure after the paragraph which first references it. If the figure is too large for the remaining

space on the page, allow text to fill the remainder of the page and place the figure at the top of the next page. If figures are so numerous they disrupt the flow of text, group them at the end of the chapter. If more than one chapter is affected, group all figures in an appendix. To conserve disk space, provide figures in JPG, GIF, or WMF format; BMP is also acceptable. Embed (do not link) figures within the document file. Minimum font size for labels and callouts within figures is 8-point. Number figures similar to tables.

Figure 2-1 Example Figure

2-2.4 **References in Text**.

Identify documents referenced in UFC text by publication number only. Document titles normally will not be cited in the text; locate full titles of references according to paragraph 2-1.3.2. When references are issued without number identifiers, include their titles in the text in italics according to the examples in this UFC. Do not use UFC to republish material available from another source. Information extracted from other publications for inclusion in a UFC must not exceed one page in length. Present such extracted material in quotation marks, indented one-half inch from both right and left margins, and provide appropriate references.

2-2.5 **Footnotes**.

Use a footnote to give credit for a legal citation, copyrighted, or quoted material. Identify the footnote with an Arabic superscript number or asterisk. Number footnotes consecutively throughout the UFC. If the UFC is divided into chapters, number the first footnote in each chapter as "1." Then number the other footnotes consecutively throughout the chapter. Place footnotes at the bottom of the same page containing the referenced text, separating them from the main text by a hairline rule.

2-2.6 **Bullet Styles**.

In addition to the bullet style shown in Figures 2-3 and 2-4, bullets can be alphabetical or numerical. Choose a bullet style that is appropriate to the context of the material being presented; e.g., use alphabetical or numerical bullets when listing steps that must be followed in order.

2-3 **WRITING STYLE**.

Write in a direct, active voice with simple, concise sentences as much as possible. Use language appropriate for the user with the experience level required by the subject matter. Avoid ambiguous, indefinite terms such as "too short" or "relatively simple." Quantify whenever possible. Define what applies before using "applicable." Do not use "and/or"; do not use the virgule (/) to substitute for "and" or "or." Do not use "etc."; use "e.g.," "for instance," or "such as." For more guidance, see *Principles of Clear Writing* at http://www.archives.gov/federal_register/drafting_legal_documents/clear_writing.html.

2-3.1 **Mood, Tense, and Voice**.

Use the imperative mood (e.g., install equipment) of “shall” and “must” to prescribe mandatory requirements, actions and procedures. In documents that are likely to become part of legal contracts such as Design-Build Templates, the term “shall” is preferred. Use "will" for future action that is not mandatory. Use "can" and "may" to permit choice and identify guidance. Use "should" to indicate desirable procedures that are advisory in nature. Use of the first and second person pronouns "we" and "you" is acceptable. The third person singular pronouns "he" or "she" must meet neutral language requirements. Often, rewriting a sentence eliminates the need for repetitive "he or she"; e.g., "Information managers complete their training" rather than "the information manager completes his or her training." For more guidance, see *Principles of Clear Writing* at http://www.archives.gov/federal_register/drafting_legal_documents/clear_writing.html.

2-3.2 **Abbreviations and Acronyms**.

If the UFC contains more than 20 different abbreviations and acronyms, list and define in an appendix titled "Glossary".

2-3.2.1 **Abbreviations**. Follow guidance in the *United States Government Printing Office Style Manual* regarding abbreviations, terms of measure, and use of signs and symbols. Use abbreviations consistently throughout a UFC. Spell out proper names on first use, and present the abbreviation immediately following in parentheses; use the abbreviation thereafter. Do not use symbols in the text; e.g., use the word "inches," not the symbol (''). Use of % is acceptable. Spell out degrees; do not use the symbol (º). Greek symbols are acceptable. Symbols may be used in figures and tables.

2-3.3.2 **Acronyms**. When use of an acronym will improve reader understanding of the text, provide the complete term the first time it appears, followed by the acronym in parentheses. Then, use the acronym consistently throughout the remainder of the UFC.

2-3.4 **Metric System of Measurement**.

The following requirements are consistent with the provisions of DOD (AT&L) Standardization Directory - 10, *Guide for Identification and Development of Metric Standards*, December 2003. In new or revised publications, provide dimensions in

English inch-pound units with metric dimensions in parentheses. Calculate metric dimensions to the same level of significance as the English inch-pound units. Use dual units in tables and figures. Refer to IEEE/ASTM SI 10 - 2002 for metric practices.

2-3.5 **Miscellaneous**.

Follow the example of this UFC and guidance in *United States Government Printing Office Style Manual* for rules of capitalization, punctuation, grammar, and syntax.

2-4 **FORMS**.

Forms may be developed for specific data collection tasks required within a UFC. To make photocopying easier, each form should occupy a separate page.

2-5 **CHANGES AND REVISIONS**.

Changes and revisions to UFC must be coordinated with and approved by the responsible tri-service discipline working group.

2-5.1 **Changes**.

A change is appropriate when less than 40 percent of the total number of UFC pages will contain new material. Changes may include the addition of entire chapters or appendixes. The preparing activity issues a new electronic file that incorporates all changes and retains the date of publication prior to the changes.

2-5.1.1 **Marking Text**.

2-5.1.1.1 **Preparing Activity**. The preparing activity lists each change on the title page under the record of changes, and marks the start of changed text with the number of the change enclosed with right slant virgule symbols (\X\) and the end of changed text with left slant virgule symbols (*/X/*) in bold type. Respectively, the letter *"X"* represents the number of the change (see Figure 2-3). These change markings are not used for complete chapter replacements; instead, complete chapter replacements must have the change number and date identified at the top of the first page of the chapter (see Figure 2-4).

2-5.1.1.2 **Other Proponents**.

On multiple-proponent UFC, proponents other than the preparing activity mark text changes with the letter "X" enclosed with virgule symbols at the start and end of changed text. Proponents other than the preparing activity will not assign change numbers or record changes on title pages. As part of creating the new electronic file, the preparing activity will replace the letter "X" with the appropriate change number and update the title page accordingly.

2-5.2 **Revisions**.

Accomplish a complete revision when more than 40 percent of a UFC contains changes. The preparing activity issues a new electronic file, incorporating all changes. Previously recorded changes are removed from the title page, and all change markings are deleted from text. The revision will bear the new publication date according to paragraph 1-6.

2-6 ASSIGNING PUBLICATION NUMBERS.

The technical working group that prepares the UFC will recommend the most appropriate numerical series based on Appendix B (e.g., UFC 4-010-XX). The preparing activity will forward the recommendation to will.rinaman@tyndall.af.mil for assignment of the last two digits based on a master index.

2-7 ELECTRONIC FORMAT AND MEDIA.

Use MS Word® or an equivalent software application that can easily and accurately convert UFC source files to Adobe® PDF. Drafts and final manuscripts must incorporate figures and tables in proper position within the electronic source files so that UFC printed from the files will accurately represent the UFC viewed electronically. Upon approval of the UFC, the preparing activity provides the electronic files (MS Word® and PDF) to the other service offices (refer to the Foreword) by e-mail or file transfer protocol (FTP), or on 3½-inch disk, zip disk, or compact disc. The preparing activity must ensure that NIBS gets the PDF file for publication on CCB and WBDG. Additionally, the services may request that the preparing activity bookmark the Adobe® PDF file to allow prompt navigation through the UFC.

2-8 **INDEX OF UFC**.

Upon approval of a UFC, each service will update its own master list of UFC.

2-9 **ARCHIVE OF CURRENT AND SUPERSEDED UFC**.

Each service is responsible for maintaining records of current and superseded UFC, including changes and revisions, for each UFC for which they are the preparing activity.

2-10 **FINAL UFC APPROVAL**.

Each UFC should be reviewed by cognizant technical personnel for technical accuracy prior to submission to the UDGCP for final approval. Extend the opportunity for review to major commands, facility users, and private industry as applicable.

Figure 2-2 Example Reference Appendix A

APPENDIX A REFERENCES

"Chapter 4, Editing Text," *Editing Technical Writing*, 1993, Donald C. Samson, Jr., Oxford University Press, Inc.

IEEE/ASTM SI-10, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*, 30 December 2002; Revised 1997, The Institute of Electrical and Electronics Engineers, Inc, 3 Park Ave., New York, NY 10016-5997, http://www.ieee.org/.

MIL-STD-3007B, *Department of Defense Standard Practice: Standard Practice for Unified Facilities Criteria and Unified Facilities Guide Specifications*, 1 April 2002, Defense Standardization Program, http://www.dsp.dla.mil/.

United States Government Printing Office Style Manual, 2000, United States Government Printing Office, The Public Printer, Stop SSOP, Washington, DC, 20402-0001, (202)512-1800, http://www.bookstore.gpo.gov/.

UFC 1-200-01, *Design: General Building Requirements*, June 2002, Tri-Service Engineering Senior Executive Panel, http://dod.wbdg.org/.

WHOLE BUILDING DESIGN GUIDE, (http://www.wbdg.org/), National Institute of Building Sciences, 1090 Vermont Ave, NW, Suite 700, Washington, DC 20005, (202)289-7800.

Figure 2-3 Example Change to UFC

CHAPTER 2 PRELIMINARY DESIGN DATA

2-1 **GENERAL**. **\1**The need for subsurface drainage and frost protection must be identified during the design stage to enable incorporation of appropriate features into the pavement design.**/1/** Verification of design assumptions is important to obtain reliable designs. If during construction any of the site conditions were found different than those assumed in the design, the design may have to be modified. Some site-related factors affect the need for frost protection and the need for subsurface drainage. In this section, investigation of those site factors is discussed.

2-2 **INVESTIGATION FOR FROST DESIGN**. The key factors that determine the need for frost protection include type and gradation of subgrade, climate, and depth of groundwater table. Frost heaving will occur only if the following three conditions exist:

- Presence of frost-susceptible material.
- Penetration of freezing temperatures into the susceptible material.
- Available supply of water.

\1The investigation for frost design involves evaluating site conditions for the determination of the presence of these conditions.**/1/**

2-2.1 **Subsoil Investigations**. Frost action is detrimental if it results in differential heaving, which is caused by variations in subsurface conditions. Variability of subsurface conditions, therefore, is an important consideration for frost design. Subsoil investigation should include assessment of horizontal and vertical variations in subgrade soil type, natural moisture content, and water table elevations. In various situations, variable pavement sections may be needed for different parts of the project to accommodate the differences in subsurface conditions along the project. These conditions must be identified during the subsoil investigation. Consider removing isolated pockets or sections of frost-susceptible soil to eliminate abrupt changes in subgrade conditions.

2-2.2 **Classification of Soils for Frost Susceptibility**. Frost susceptibility of a soil is the potential for the formation of ice lenses in the soil under freezing conditions. Because the water needed for formation and growth of ice lenses is supplied through capillary action, severe frost heave occurs in soils with a high capillary rate. As the freezing temperatures penetrate deeper into the ground, a heavy formation of ice lenses takes place at each successive level, resulting in severe frost heave. All inorganic soils that contain more than 3% by weight of particles finer than 0.02 mm in diameter are generally frost-susceptible.

Figure 2-4 Example Chapter Replacement

Change 1
15 June 2000

CHAPTER 2 FROST PROTECTION DESIGN

2-1 **NEED FOR FROST PROTECTION**. Differential frost heaving can cause pavement cracking, significant roughness, and a drastic reduction in pavement service life. If prevented from free movement, frost heaving can exert enormous forces on pavements, structures, or utilities. The forces involved are so great that any attempt to accommodate frost heaving by providing a more substantial pavement structure is not practical. The only practical solution is prevention. Even if frost action does not result in significant heaving, the excess free water during thaw periods, and consequent softening of the subgrade and base material, can also be detrimental to pavement performance. If the investigation for frost design (refer to Section 2) reveals that frost action is possible at the project site, frost protection design must be considered. In general, the following combination of conditions denotes a potential for frost action and the need for frost protection:

- Presence of frost-susceptible soil.
- Groundwater level within 5 ft (1.5 m) of the proposed subgrade elevation.
- Frost penetration depth greater than the planned overall thickness of the pavement structure (typically, design freezing index greater than 150 degrees F (83.3 degrees C)).

2-2 **DESIGN APPROACH**. There are two basic approaches to frost protection: (a) complete prevention of subgrade freezing and (b) limiting frost penetration into the subgrade. The first method involves providing a sufficient cover over the frost-susceptible material to prevent penetration of freezing temperatures into the subgrade. This may require removing and replacing a certain thickness of frost-susceptible material or providing a layer of non-susceptible fill, if the combined thickness of the pavement structure and any fills needed for geometric requirements are not sufficient to provide adequate cover. The second approach allows limited frost penetration into the subgrade. The applicability and details of each of these design approaches are discussed in the following.

APPENDIX A REFERENCES

DOD Directive 5230.24, *Distribution Statements on Technical Documents,* 18 March 1987*,* Department of Defense, Washington Headquarters Service, Executive Services and Communication Directorate, Directives and Records Division*,* http://www.dtic.mil/whs/directives/

IEEE/ASTM SI 10-2002, *Standard for Use of the International System of Units (SI): the Modern Metric System,* 2002, Institute of Electrical and Electronics Engineers Inc. (IEEE) 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, http://www.ieee.org/

Memorandum of Agreement for the Whole Building Design Guide, 8 October 2003, National Institute of Building Sciences (NIBS), 1090 Vermont Ave, NW, Suite 700, Washington, DC, 20005, http://www.wbdg.org/

PRINCIPLES OF CLEAR WRITING, available at \2\ http://www.archives.gov/federal-register/write/legal-docs/clear-writing.html /2/, Office of the Federal Register, National Archives and Records Administration, http://www.archives.gov/.

SD-10, *Guide for Identification and Development of Metric Standards*, December 2003, Document automation and Production Service, Building 4/D, 700 Robbins Ave, Philadelphia, PA, 19111-5094, \2\ http://assist.daps.dla.mil/ /2/

United States Government Printing Office Style Manual, 2000, United States Government Printing Office, The Public Printer, Stop SSOP, Washington, DC, 20402-0001, (202)512-1800, \2\ http://www.gpoaccess.gov/stylemanual/index.html /2/

APPENDIX B NUMBERING OF UNIFIED FACILITIES CRITERIA

UFC SERIES 1 -- POLICY, PROCEDURES, AND GUIDANCE

1-100 Series -- General
1-200 Series -- Policy
1-300 Series -- Procedures and Guidance
1-400 Series -- Reserved
1-500 Series -- Reserved
1-600 Series – Fire Safety
1-700 Series -- Reserved
1-800 Series -- Reserved
1-900 Series – Miscellaneous

UFC SERIES 2 -- MASTER PLANNING

2-100 Series -- Comprehensive Master Planning
2-200 Series -- Land Use Planning
2-300 Series -- Utility System Planning
2-400 Series -- Transportation System Planning
2-500 Series -- Spatial Data Systems
2-600 Series -- Installation Design Guides
2-700 Series -- Outdoor Recreation Planning
2-800 Series -- Planning in the Noise Environment
2-900 Series -- Reserved

UFC SERIES 3 -- DISCIPLINE-SPECIFIC CRITERIA

3-100 Series – Architecture and Interior Design
- 3-101 General
- 3-110 Architectural Design
- 3-120 Interior Design
- 3-130 Arctic and Subarctic Construction
- 3-140 Reserved
- 3-150 Reserved
- 3-160 Reserved
- 3-170 Reserved
- 3-180 Reserved
- 3-190 Miscellaneous

3-200 Series – Civil / Geotechnical / Landscape Architecture
- 3-201 General
- 3-210 Site Planning and Design
- 3-220 Geotechnical
- 3-230 Water
- 3-240 Sanitary
- 3-250 Vehicle Roadway Design
- 3-260 Airfield Pavements
- 3-270 O&M for Airfield Pavements
- 3-280 Environmental Remediation
- 3-290 Miscellaneous

3-300 Series – Structural and Seismic Design
- 3-301 General
- 3-310 Structural Design Criteria
- 3-320 Structural Design Guidance

3-330 Structural Design Commentary
3-340 Hardened Structures – Conventional Weapons Effects
3-350 Hardened Structures – Nuclear Weapons Effects
3-360 Reserved
3-370 Reserved
3-380 Reserved
3-390 Miscellaneous

3-400 Series -- Mechanical

3-401 General
3-410 HVAC
3-420 Plumbing Systems
3-430 Central Plants and Energy Distribution Systems
3-440 Renewable Energy Systems
3-450 Acoustics and Vibration Control
3-460 Fuel Storage and Distribution Systems
3-470 Reserved
3-480 Reserved
3-490 Miscellaneous

3-500 Series -- Electrical

3-501 General
3-510 Foreign Voltages
3-520 Interior Electrical Systems
3-530 Lighting Design and Controls
3-535 Airfield Lighting Systems
3-540 Electric Power Generation
3-550 Electric Power Supply and Distribution
3-555 400Hz Power Systems
3-560 Electrical Safety
3-570 O&M: Cathodic Protection
3-575 Lightning Protection
3-580 Telecommunications
3-590 Miscellaneous

3-600 Series -- Fire Protection

3-601 General
3-610 Hangar Fire Protection Systems
3-620 Reserved
3-630 Reserved
3-640 Reserved
3-650 Reserved
3-660 Reserved
3-670 Reserved
3-680 Reserved
3-690 Miscellaneous

3-700 Series -- Cost Engineering

3-700 General
3-701 Pricing Guides
3-710 Code 3 Design with Parametric Estimating
3-720 Economic Analysis Guides
3-730 Programming and Budget Cost Estimating
3-740 Construction Cost Estimating
3-750 Reserved
3-760 Reserved
3-770 Reserved
3-780 Reserved

3-790 Miscellaneous
3-800 Series -- Environmental
3-900 Series -- Reserved

UFC SERIES 4 – MULTI-DISCIPLINARY & FACILITY-SPECIFIC DESIGN

(Series numbering based on DOD Uniform Real Property Category Codes per DODI 4165.14)

4-000 Series – Multi-Disciplinary Requirements
4-000 General
4-010 Force Protection
4-020 Security Engineering
4-021 Electrical Engineering
4-022 Civil Engineering
4-023 Structural Engineering
4-024 Chemical, Biological, Radiological, Nuclear (CBRN)
4-025 Waterfront
4-026 Threats
4-027 Expeditionary/Contingency
4-030 Sustainable Development
4-100 Series -- Operational and Training Facilities
4-120 Liquid Fuel Dispensing Facilities
4-121 Aircraft Dispensing
4-130 Communications, Navigational Aids and Airfield Lighting
4-133 Navigation and Traffic Aids - Buildings
4-134 Navigation and Traffic Aids - Other than Buildings
4-140 Land Operational Facilities
4-141 Operational - Buildings
4-150 Waterfront Operational Facilities
4-152 Wharfs
4-159 Other Waterfront Operational
4-160 Harbor and Coastal Operational
4-170 Training Facilities
4-171 Training Buildings
4-179 Training Facilities - Other Than Buildings
4-200 Series -- Maintenance and Production Facilities
4-200 General
4-210 Maintenance
4-211 Maintenance - Aircraft
4-213 Maintenance - Ships, Spares
4-214 Maintenance - Tank, Automotive
4-215 Maintenance – Weapons, Spares
4-216 Maintenance - Ammunition, Explosives, Toxics
4-218 Maintenance - Facilities for Miscellaneous Procured Items and Equipment
4-220 Production
4-229 Production - DOD Maintenance, Repair and Operation of Installations
4-300 Series -- Research, Development, Test, and Evaluation Facilities
4-310 Science Laboratories
4-390 Other Than Buildings
4-400 Series -- Supply Facilities
4-400 General
4-420 Ammunition Storage
4-440 Storage - Covered
4-442 Storage - Covered - Installation and Organizational

4-450 Storage - Open
4-451 Storage - Open - Depot

4-500 Series -- Hospital and Medical Facilities

4-500 General
4-510 Medical Center / Hospital

4-600 Series -- Administrative Facilities

4-610 Administrative Buildings

4-700 Series -- Housing and Community Facilities

4-700 General
4-710 Family Housing
4-711 Family Housing - Dwellings
4-720 Unaccompanied Personnel Housing
4-721 Unaccompanied Personnel Housing - Enlisted Personnel
4-722 Unaccompanied Personnel Housing - Mess Facilities
4-724 Unaccompanied Personnel housing - Officers Quarters
4-730 Community Facilities - Personnel Support and Service
4-740 Community Facilities - Morale, Welfare and Recreation - Interior
4-750 Community Facilities - Morale, Welfare and Recreation - Exterior

4-800 Series -- Utilities and Ground Improvements

4-800 General
4-820 Heat and Refrigeration (Air Conditioning)
4-826 Refrigeration (Air Conditioning) - Source
4-830 Sewage and Waste
4-832 Sewage and Industrial Waste - Collection
4-860 Railroad Tracks

4-900 Series -- Real Estate

4-900 General
4-910 Land
4-911 Land Purchase, Condemnation, Donation or Transfer
4-920 Other Rights

UFC SERIES 5 -- SOFTWARE AND TOOLS *(including Planning and O&M software and tools)*