



**International  
Concrete Repair  
Institute**

# **ICRI Style Manual 2007**

Prepared by the  
**Technical Activities Committee**

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## FOREWORD

This manual has been prepared by the Technical Activities Committee to provide guidance on the preparation of ICRI technical documents. The 2007 *Style Manual* is a reference tool created to promote concise, unambiguous, well-written ICRI technical documents.

Uniformity of expression throughout all ICRI technical documents contributes to the credibility and professionalism of our published works. The style and grammar rules in this manual have been approved by the ICRI Technical Activities Committee (TAC) as acceptable for ICRI technical documents. TAC encourages suggestion for improvement of the manual and suggestions received will be considered and incorporated where appropriate.

The *Style Manual* is a companion document to the *ICRI Technical Committee Manual (TCM)*. Technical committee documents must be developed following the procedures given in the *TCM*. When preparation is complete, the final draft is submitted to ICRI Headquarters for TAC review.

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## SECTION 1 - ICRI STYLE

### **1.1 Document structure**

All technical committee documents should follow the same basic structure. Below is an outline of the parts of a committee document and a brief description of each.

#### **Document number**

Staff assigns all document numbers.

#### **Title**

The title of the document should appear prominently on the first page of the manuscript.

#### **Roster**

The committee roster should appear directly under the title of the document. The roster of the committee that voted on the final letter ballot on the document before submission to TAC is the roster that should appear on the document, regardless of when the document is published. Only voting members are listed in the roster. If a committee is seeking reapproval of a document, the originating committee roster is retained, and the roster of the current committee is not shown. If a subcommittee prepared the document, acknowledge the subcommittee chair and members with asterisks and appropriate footnotes.

Individual committee members often take responsibility for writing the first draft of portions of a committee document. The final committee document reflects the opinion of the committee. If the document was prepared by individual members, then an asterisk may be printed next to their names, and an appropriate noted added, to indicate an increased level of participation. If individuals other than committee members contributed to the document and should receive recognition, the acknowledgment should appear below the roster on the first page of the document.

The TAC roster should also appear on the first page of the document. TAC members at the time the document was approved for publication is the roster that should appear on the document.

#### **Synopsis**

A one- or two-paragraph synopsis must be provided for the document. Synopses of documents are also printed in the *Concrete Repair Bulletin*. The synopsis should state the scope and purpose of the document, without going into too much detail. When writing a synopsis, bear in mind that it must make sense when read independently of the document - it should inform and spark interest.

#### **Keywords**

Keywords contain items discussed in the document and aid users in retrieving material. The title, synopsis, and table of contents of the document are good sources for keywords. Keep the number of keywords listed to about 10. The keywords chosen for a document should be defined in the ICRI *Concrete Repair Terminology* unless there is a technical reason for using a different term. Such terms must be defined in Section 2 of the document text. The keywords should reflect the subject matter of the document without being too general. For example, listing “concrete” or “repair” should be avoided. Do not use multiple forms of the same word as keywords. List keywords in alphabetical order and separate them with semicolons.

#### **Table of contents**

All documents are required to have a table of contents that lists primary and secondary headings in all sections. Headings are often revised from one draft to another, and the table of contents must be updated accordingly (see Section 1.2.2 for numbering convention). The table of contents should always be

proofread against the section headings of the final draft for accuracy. Do not include page numbers; page numbers are assigned by staff after final formatting of the document.

### **Body text**

The document text should be organized in sections (see Section 1.2.2 for numbering convention). Section 1 should be an introduction that includes the purpose, scope, and historical background related to the document. Section 2 should include definitions for appropriate terminology and notations used within the document. Organization of the remaining body text is up to the committee. The document must maintain a logical flow, keeping like ideas and related information centralized, so a reader does not have to flip to other sections to clarify information presented. Use references within the document as needed rather than repeat information.

### **Reference section**

All documents should supply reference citations and a reference section. See Section 2.

### **Appendices**

Use appendices to present alternative requirements for special cases, long derivations, research data, or sample calculations in a document. Use a separate appendix for each main purpose, numbered consecutively. If the document contains appendices, these should follow the reference section. Remember to include appendices in the table of contents. References that appear in an appendix should be presented in a list following the appendix and should be in the author-date format.

### **Figures/tables**

All figures and photographs should be legible when reduced to 3.5 in. (90 mm) wide. Avoid using fill patterns in figures; these do not reproduce well. Use sans-serif fonts, such as Arial or Helvetica, for labels in drawings and graphs. Avoid using fine lines and small lettering that can be lost in reduction for publication. Original high-contrast photographs result in the highest quality printed image. If photographs cannot be reproduced with suitable quality and contrast, staff will eliminate the image and revise the text accordingly. For up-to-date information on formatting of electronic images, such as resolution requirements, please contact ICRI staff.

If retrieving artwork from a previous printed version of the document or from another committee document, indicate from where it can be retrieved. Also indicate its original number and its new number.

Refer to Section 1.2.2 for figure and table numbering conventions. All figures and tables should have a caption or subject title. Figure captions are placed below the figure; table captions are placed above the table.

Place all figures and tables in a separate file or at the end of the text. Including figures within the text results in files that are difficult to format and edit. Suggested locations for figures can be identified by embedding “[Place Fig. XX here]” within the narrative.

### **Disclaimer/copyright information**

Do not include any kind of disclaimer or copyright information on the draft. This information is added to the document by staff, once the document is ready to be printed. The document will automatically receive the latest version of the ICRI disclaimers, and the copyright information will be dated accordingly.

## **1.2 Document formatting**

### **1.2.1 Aesthetics**

**Staff responsibility: final format**

Final formatting is performed by staff before publication. Therefore, it is unnecessary for a committee to take the time and energy to make the document “look like” the finished product; however, the amount of staff effort required to prepare the document for publication can be reduced if the committee adopts the proper working format during draft preparation.

**Committee responsibility: working format**

To facilitate review by staff and TAC, files should be one column, double-spaced, with 1 in. (25 mm) margins on all sides and line and page numbering. Number each page of the draft consecutively with page numbers centered on the bottom of the page. This includes title page, table of contents, text, figures, charts, and graphs. Also, each line on each page shall be numbered consecutively, starting with “1” on each page. Use a 12 point font, preferably Times New Roman. In-text styling such as bold, italic, underline and super/subscript is welcome. The use of “table” features for constructing tables is also recommended. Do not use spaces or tabs to center or format text; use center justification. Avoid using unnecessary automatic features of a word processing program that involve layout - such as headers and footers, columns, automatic footnote, endnote, and comment features. It may be useful to use a header to indicate the draft number and revision date where multiple drafts are involved. Do not use automatic hyphenation. Use the word processor's equation editor to insert equations.

Make the format consistent. If indenting paragraphs, be sure each one is indented the same way. If leaving spaces between paragraphs, make sure spaces are all uniform. Make headings of equal level appear the same. An example of suggested formatting for section headings is:

**SECTION 1 – INTRODUCTION**

**1.1 – Background**

Begin text here.

**1.2.2 *Numbering section headings, tables, figures, and equations***

Sections should have titles. Subsections may or may not be titled, but should be numbered consecutively following the decimal designation system:

**Section 1**

**1.1 – 1<sup>st</sup> section in Section 1**

**1.1.1 – 1<sup>st</sup> subsection of 1.1**

**1.1.2 – 2<sup>nd</sup> subsection of 1.1**

**1.1.2.1 – 1<sup>st</sup> subsection of 1.1.2**

**1.2 – 2<sup>nd</sup> section in Section 1**

and so on.

Use “Fig.,” “Table,” or “Eq.” for figure, table, and equation, respectively, and give numerical designations beginning in each section. For example, Fig. 3.11 is the eleventh figure in Section 3, Table 4.2 is the second table in Section 4, and Eq. (2-2) is the second equation in Section 2 (note that equation numbers are separated by a hyphen instead of a period.) Write out “Figure” and “Equation” when used to begin a sentence.

**1.2.3 *Indicating revisions***

Committee chairs should contact staff for an electronic version of the most recently published version of the existing document and work from that version.

Revisions made to an existing document must be indicated. The preferred method of showing revisions is to indicate added text with underlining and deleted text with ~~strikeout~~. Most word processing programs,

including MS Word and WordPerfect, can track changes automatically. If unable to use these conventions for some reason, such as a limitation of the software being used, contact staff to discuss an alternative method. The revised file returned to ICRI must reflect all changes to the original file.

If completely rewriting an entire document or sections therein, submit a statement that explains why the committee feels the rewrite was necessary and summarizes the major differences between the new and existing text. Using strikeout and underline is not necessary in such a case.

### **1.3 Consistency**

Consistency of language in technical writing is of the utmost importance. Technical writing must be precise and convey one meaning only. Using multiple terms when referring to a single item or idea creates confusion and can lead to misinterpretation of information. Avoid words or phrases that have more than one meaning that can be applicable to the context of the document. Do not use slang expressions. If there is any doubt that a specific phrase or term may be confused with another, and it must be used in the manuscript, define the exact intended meaning in Section 2. Use ICRI *Concrete Repair Terminology*, unless there is a technical reason for using a different term.

### **1.4 Language**

#### **1.4.1 Mandatory and nonmandatory language**

Mandatory language is used when providing requirements that must be followed exactly as written or referenced, as in codes or specifications. The words “shall” and “must” are mandatory terms. Terse, imperative sentences are also recommended in mandatory language documents (See examples in Section 1.4.2.). Also, see Cendrowska and Schultz (1999) for a good reference on the use of mandatory language. (Cited references are included in Appendix A)

Guidelines or recommendations should not be presented in mandatory language. Reports and guides should use nonmandatory language. Words such as “can,” “may,” or “should” are appropriate for use in nonmandatory-language documents.

#### **1.4.2 Clarity of expression**

##### **Hedging:**

ICRI technical document language should not hedge or convey any uncertainty. This causes the document to lose credibility to the reader. Avoid beginning sentences with phrases such as “It is recommended that” or “It is suggested that.” It is understood that the document presents recommendations.

##### **Example:**

*Poor construction:* It is recommended that measurements are taken in advance.

*Better:* Measurements should be taken in advance. (In nonmandatory-language documents)

*Better:* Measurements shall be taken in advance. (In mandatory-language documents)

*Best:* Take measurements in advance. (In mandatory-language documents)

Avoid using the phrase “It has been observed that” or “research has shown that.” This leaves the reader wondering, Who observed? What research? In these instances, identify the source or cite a reference.

##### **Example:**

*Avoid:* Experience has shown that shotcrete is an effective repair method.

*Use:* Shotcrete is an effective placing method (Warner 1995).

Avoid using vague expressions that are not truly informative and may cause the reader to make an

incorrect judgment call. Words like “very,” “all,” “every,” “never,” “excessive,” “slightly,” or “significant” are not useful.

Example:

*Avoid:* Allow for slight expansion.

*Correct:* Allow for expansion between 0.2 and 0.5 in. (5 and 13 mm).

*Avoid:* This can increase drying shrinkage significantly.

*Correct:* This can increase drying shrinkage by 20%.

**Active versus passive voice**

When possible, write in the active voice. This means that the subject of the sentence performs the verb of the sentence, which makes for more forceful and direct writing.

Example:

*Active voice (preferred):* This manual provides helpful hints for writing technical papers.

The passive voice usually employs a form of the verb “to be.” When using the passive voice, the subject of the sentence receives the action of the verb.

Example:

*Passive voice (avoid):* Helpful hints for writing technical papers are provided in this manual.

Both of the example sentences are grammatically correct, but the active voice is less convoluted. Technical writing should be easy to understand and succinct. The active voice is usually the best choice for technical writing.

**Run-on sentences**

In addition to writing in the active voice, avoid long, convoluted sentences that attempt to convey too many ideas in one place. Run-on sentences are easily misinterpreted and can skew the idea being presented.

**Referencing sections within the same document**

Avoid using constructions such as “the following” and “the above.” If it is necessary to refer to specific information in another part of the document, referencing a section number is more useful to the reader than a generalization like “as discussed above.”

Example:

*Avoid:* The above discussion addresses this problem.

*Correct:* Section 8.1.3 addresses this problem.

*Avoid:* These situations are given in the following list.

*Correct:* These situations are:

**1.4.3 Spelling**

Always run a spell-check program. ICRI style is to use U.S. English rather than British English spelling; for example, “mold” not “mould,” and “behavior” not “behaviour.”

**1.4.4 Numbers**

Within the body of text, always spell out numbers less than 10 unless accompanied by units of measurement or a decimal place. Use numerals for numbers 10 and higher. Refer to section 1.6.2 for fraction usage.

Example:

*Use numerals:* “3 in. (76 mm)” and “5 min”

*Use numerals:* The average family has 2.3 children.

*Use words:* “eight construction projects” and “repeat three times”

Use commas to separate numbers greater than 9999.

Example:

*Correct:* “A compressive strength of 12,500 psi...”

*Correct:* “The repair was loaded more than 1000 times.”

Numerals should not be used to begin a sentence. When a sentence cannot be restructured to move the numeral elsewhere in the sentence, spell out the number.

Example:

*Correct:* Fourteen inches (355 mm) is sufficient length. (Note that “inches” is also spelled out in this case. See Section 3 for information on units of measurement.)

#### **1.4.5 Abbreviations and acronyms**

When using abbreviations or acronyms, define the term at its first mention in the body of the document and then consistently use the abbreviation or acronym from that point forward. Be consistent with the use of capitalization or periods in abbreviations and acronyms throughout the document. See Section 3.2 for abbreviations of units of measurement. See ACI 104R (1997) for notations consistent with industry standards.

#### **1.4.6 Gender-specific language**

Avoid using gender-specific terms, such as “he,” “she,” or “man” when possible. Most often such terms can be replaced by “operator” or “person.”

Example:

*Incorrect:* Cleanup for this project is a three-man job.

*Correct:* Cleanup for this project is a three-person job.

### **1.5 Lists**

Technical documents tend to contain lists of various items. Whether discussing procedures, materials, characteristics, or precautions, pulling out text from the body of the document and presenting it in a list is sometimes the most direct way of conveying a lot of information in a little space.

#### **1.5.1 List phraseology**

When listing items, always make the phrases parallel.

Examples:

A correct list of the responsibilities of a job supervisor might be:

- Proportioning the mixture;
- Cleaning the forms;
- Monitoring the batch procedures;
- Inspecting the finished product.

These items are all parallel in that if you were to begin each phrase with the same words, such as “The supervisor is responsible for,” each would be a complete sentence.

An *incorrect* list would be:

- Proportion the mixture;
- Forms are cleaned;
- Monitoring the application procedures;
- Inspection of finished repair.

### 1.5.2 List styles

ICRI technical documents follow three styles for lists, depending on the content of the list, and sometimes, on the text to follow.

#### **Style 1: bulleted lists**

Separate the items of a general list with bullets. Each line of the list should end with a semicolon and the final item of the list should end with a period. Use bullets for any list that does not indicate a progression of activity. If it is necessary to refer back to specific items on a lengthy list later in the text, do not use bullets. (See Style 3: listing items by lowercase letters).

#### **Example:**

These items should be considered when scheduling a project:

- Weather conditions;
- Availability of materials, equipment, and qualified personnel;
- Quality-control system development and implementation;
- Geographical conditions; and
- Number of required personnel.

#### **Style 2: numbered lists**

Numbering items on a list is a style used for items that are part of a sequence. If the items on a list are the steps of a procedure, and are to be performed in a specific order; these items should be numbered sequentially.

#### **Example:**

Consider this list. Each item is a specific part of a sequence and is essential to the next item:

1. Identify existing problem;
2. Consider possible options;
3. Design a viable solution;
4. Make provisions for any consequences of solution; and
5. Correct problem.

#### **Style 3: listing items by lowercase letters**

When referring to specific items on the list later in the text, it is simpler for a reader to refer to item “p” on the list rather than count down to the sixteenth bulleted item of the preceding list.

#### **Example:**

The total water content of concrete may be reduced by:

- (a) Maintaining proper slump;
- (b) Reducing as-mixed temperature of the concrete;
- (c) Avoiding delays in placement that requires large quantities of retempering water;
- (d) Increasing the maximum size of coarse aggregate, as well as using coarser sand;
- (e) Reducing sand content; and
- (g) Using a high-range water-reducing admixture.

This would be an acceptable style if followed by text such as:

“Item (b) may be accomplished by.....; whereas (d) and (e) require.....”

## **1.6 Punctuation and notation**

(See also Section 3.1.)

### **1.6.1 Capitalization**

#### **When to capitalize:**

Always capitalize any mention of a specific figure, table, or equation (see Section 1.4.5 for details about abbreviations).

#### **Example:**

This is shown schematically in Fig. 12. The value can be determined using Eq. (2-3). A quick-reference list is provided in Table 4.6.

Specific types, classes, or categories are capitalized.

#### **Example:**

Type I, Type II, and Type III cements  
Class C or Class F fly ash

#### **When not to capitalize:**

The term “portland cement” is not capitalized.

Do not capitalize words for emphasis. When emphasis of a particular word is essential to the meaning of a sentence, italicize the word.

### **1.6.2 Hyphenation**

For consistency of style, ICRI has adopted specific rules of hyphenation.

#### **When to hyphenate:**

Three or more compound adjectives should be punctuated with hyphens or commas. Two compound adjectives may be hyphenated, if appropriate. Avoid globally inserting hyphens in such phrases, as the same phrases can also appear as nouns, in which case the hyphen is not used.

#### **Example:**

The production of *high-strength* concrete does not always require special materials. (compound adjective)  
*Drying-shrinkage* cracks result from loss of moisture. (compound adjective)  
Adequate moisture can prevent *drying shrinkage*. (noun)

Hyphens are used between whole numbers and fractions that precede a unit abbreviation.

#### **Example:**

*Correct:* “a 3-1/2-in. pipe” or “a 5-1/4-ft space between forms”

#### **When not to hyphenate:**

Do not use a hyphen after an adverb that ends in “ly.”

#### **Example:**

*Correct:* That was a poorly executed plan.

Most often prefixes and suffixes should not be separated from a word by a hyphen. Most words beginning

with “pre,” “non,” “un,” “de,” “multi,” “co,” “re,” “post,” “over,” “under,” “micro,” and “macro” do not use a hyphen. Likewise, most words ending with “less” or “proof” do not require a hyphen.

EXCEPTIONS: Hyphenate prefixes that must be distinguished from existing words, for example, “re-cover” and “re-create.”

### 1.6.3 *Serial comma*

The serial comma is used in ICRI technical writing. Therefore, when listing three or more items that are separated by commas, a comma should precede the word “and” or “or” before the last item.

Example:

Proportion the cement, water, and aggregates in accordance with the project specifications.

### 1.6.4 *Footnotes*

Footnotes should be used to cite unpublished references (see Section 2.2.3.2). Most other information should be incorporated into the main text by either placing it in parentheses in the place where a footnote call-out would appear or by making it part of the paragraph.

### 1.6.5 *Parentheses and brackets*

(See also Section B.1.4) When it is necessary to set off text that is already within parentheses, brackets are used. In text, brackets are used inside parentheses.

Example:

Allow for an appropriate gap (no more than 1 in. [25 mm]).

In mathematical expressions, the reverse is true. Parentheses appear inside of brackets.

Example:  $32 \times [25(3.4 + Y/2)]$

Parentheses around a figure, equation, or table number are not switched to brackets when used in a parenthetical expression, however.

Example:

*Correct:* “...in which case, the compressive strength is adequate (see Table 2 (a)).

### 1.6.6 *Equation variables*

Equation variables are always italic. Always define each variable with units or provide a reference to where an explanation can be found. See Section 1.2.2 for numbering of equations. See ACI 104R (1997) for equation variable names and notations.

Example:

$$F=ma \quad (3-1)$$

where:

$F$  = force, N

$m$  = mass, kg

$a$  = acceleration,  $m/s^2$

Equations should be generated using standard word processing equation editors, such as Microsoft Equation Editor or Mathtype.

## SECTION 2 - REFERENCES

ICRI has adopted the following styles for references in the text of a document and for the reference section listing the details for each reference. See section 1.4.1 of this *Style Manual* and Chapter 3 of the *Technical Committee Manual* for an explanation of the various types of ICRI documents and whether they use mandatory or nonmandatory language.

### 2.1 Mandatory-language documents

Mandatory-language documents may only cite other mandatory-language documents as references, and must reference a specific edition. When referencing technical documents of standards-producing organizations, such as ACI or ASTM, in the text of a document, titles are omitted and only serial designations appear.

Example:

*Correct:* ...as specified in ACI 301.

*Correct:* Follow the procedure in ASTM C 39 to measure compressive strength.

The referenced documents are listed with full titles and year designations in a reference section at the end of the document titled, "Referenced Standards and Reports."

Example:

**Referenced Standards and Reports**

*American Concrete Institute*

301-05 Specifications for Structural Concrete

318-05 Building Code Requirements for Structural Concrete

*ASTM*

C 150-04 Specification for Portland Cement

C 94-04 Specification for Ready-Mixed Concrete

This list is followed by the addresses of all sponsoring organizations cited.

### 2.2 Nonmandatory-language documents

#### 2.2.1 Documents of standards-producing organizations

When referencing technical documents of standards-producing organizations, such as SSPC or ASTM, in the text of a document, titles are omitted and only serial designations appear, without a year designation unless the content requires a specific year designation (See 2.2.3.1 for this exception).

Example:

*Correct:* For further details on concrete surface preparation, refer to SP 13/NACE 6.

*Correct:* The procedure given in ASTM C 39 to measure compressive strength should be followed.

#### 2.2.2 Cited references

Cited references are individually authored references, such as journal papers, books, or magazine articles. The two acceptable methods of citing individually authored references are: author-date format in parentheses in the text and an alphabetical list of references by author; or superscripts in the text and a numbered list of references. Superscripts and a numbered list are often used in periodicals such as the *Concrete Repair Bulletin* because they use less space in the text. The author-date format should be used

for guidelines and other documents that require updating. Listing by authors' names and dates provides the reader with information in the text, permits additions to and deletions from reference lists without renumbering, and allows the list to be used as an authors' index. Do not include references that are not cited in the text.

When citing publications by author and date in parentheses in the text, do not place a comma between the last author's name and the year of publication.

Use these formats in the text:

(Smith 2005) .....one author

(Smith and Jones 2005).....two authors

(Smith et al. 2005).....three or more authors

(Smith 2005; Jones and Johnson 2005).. ....separate works by different authors with a semicolon

(Smith 2002, 2004; Jones et al. 2006).....separate works by same author with a comma,

(Smith et al. 2004a, b; Jones 2005).... .....if the same author or group of authors have two works with the same year, designate them "a" and "b" (and "c" and "d" and so on as necessary)

### **2.2.3 Reference section format**

The reference section of a nonmandatory-language technical document (a commentary that accompanies a mandatory-language document falls into this category as well) should have two sections, "Referenced Standards and Reports" and "Cited References," each with its own format. The reference section should be placed at the end of the document.

#### **2.2.3.1 Referenced standards and reports**

Documents of standards-producing organizations are listed under the heading "Referenced Standards and Reports" and year designations are not listed. These references are generally updated periodically, and reference to the most recent edition of any referenced standard or report should be indicated; see the example in Section 2.2.3.3. This list is followed by the addresses of all sponsoring organizations cited.

EXCEPTION: If a reference to a specific edition of a standard or report is made for historical purposes that are essential to the discussion being presented, these references may be cited with their year designations under the heading "Cited References."

#### **2.2.3.2 Cited references**

When listing Cited References, place the titles of articles inside quotation marks and the titles of books or periodicals in italics. For articles from technical journals, provide the volume (V.) and number (No.) of the journal issue, month (spelled out), year of publication, and page numbers for the article. The more information that can be provided for a listed reference, the better. Remember, the object is to enable the reader to locate the listed reference if desired.

Do not list unpublished (unavailable to the public) work in the reference list. If an unpublished reference is referred to in the text, a footnote should appear to provide all publication information available to date. References that are not cited in the body of the text should not be listed. This means that documents should not include categories such as "Additional References" or "Suggested References."

When listing references with more than two authors, separate the authors with semicolons.

### 2.2.3.2.1 Web site references

Whenever possible, printed publications should be referenced. However, for original content available only from electronic sources, include as much information as possible: author, title of page, title or owner of Website, URL, and date Website was accessed.

Example:

McDonald, J. E., *An Evaluation of Materials for Repair of Erosion Damage in Hydraulic Structures*, High-Performance Materials and Systems Research Program, U.S. Army Engineer Research and Development Center, [http://www.wes.army.mil/SL/HPMS/HPMS\\_art-1.pdf](http://www.wes.army.mil/SL/HPMS/HPMS_art-1.pdf) (accessed March 27, 2007).

If there is no author, the owner of the site may stand in for the author.

Example:

International Concrete Repair Institute, *Concrete Repair Terminology*, ICRI, <http://www.icri.org/onlineresources/ConcreteRepairTerminology.pdf> (accessed March 27, 2007).

For electronic journals, follow the same format for paper journals, and add the URL.

### 2.2.3.3 Sample reference chapter for a nonmandatory-language document

The example given in the following is representative of a document that uses the author-date format for citing references in the text; therefore it is alphabetical by first author's last name.

## SECTION 10 - REFERENCES

### 10.1 - Referenced standards and reports

The standards and reports listed below were the latest editions at the time this document was prepared. Because these documents are revised frequently, the reader is advised to contact the proper sponsoring group if it is desired to refer to the latest version.

*International Concrete Repair Institute*

03733 Guide for Selecting and Specifying Materials for Repair of Concrete Surfaces  
03743 Guide for Repair of Unbonded Post-Tensioned Concrete Structures

*American Concrete Institute*

228.2R Nondestructive Test Methods for Evaluation of Concrete in Structures  
364.1R Guide for Evaluation of Concrete Structures Prior to Rehabilitation

*ASTM*

C 881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete  
C 928 Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs

These publications may be obtained from these organizations:

International Concrete Repair Institute 3166 S. River Road, Suite 132 Des Plaines, IL 60018 <a href="http://www.icri.org">www.icri.org</a>	American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48331 <a href="http://www.concrete.org">www.concrete.org</a>	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428 <a href="http://www.astm.org">www.astm.org</a>
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## 10.2 - Cited references

ACI Committee 548, 1998, *Guide for Polymer Concrete Overlays (ACI 548.5R-98)*, American Concrete Institute, Farmington Hills, MI, 26 pp.

Emmons, P. H., and Sordyl, D. J., 2006, "The State of the Concrete Repair Industry, and a Vision for its Future," *Concrete Repair Bulletin*, V. 19, No. 4, pp. 7-14.

Flood, W., 2006, "Minimizing the Shrinkage of Concrete Mixtures: a Low-Cost Approach," Master's thesis, University of Colorado, 83 pp.

Kosmatka, S. H., Kerkhoff, B., and Panarese, W. C., 2002, *Design and Control of Concrete Mixtures*, EB001, 14th Edition, Portland Cement Association, Skokie, IL, 358 pp.

McDonald, J. E., and Vaysburd, A. M., 2001, "Evaluation of Procedures for In Situ Tensile Bond Testing of Concrete Repairs," *Recent Advances in Concrete Technology: Proceedings of the Fifth CANMET/ACI International Conference*, Singapore, ed. V.M. Malhotra, SP-200, American Concrete Institute, pp. 113-129.

Poston, R. W., Kesner, K., McDonald, J. E., Vaysburd, A. M., and Emmons, P. H., 2001, "Concrete Repair Material Performance - Laboratory Study," *ACI Materials Journal*, V. 98, No. 2, March-April, pp. 137-147.

Shoenberger, J. E., Hodo, W. D., Weiss, C. A., Malone, P. G., and Poole, T. S., 2005, "Expedient Repair Materials for Roadway Pavements," ERDC/GSL TR-05-7, U.S. Army Engineer Research and Development Center, Vicksburg, MS, 84 pp.

The Society for Protective Coatings, 2003, "Surface Preparation of Concrete," SSPC-SP 13/NACE No.6, Pittsburgh, PA, 18 pp.

U.S Army Corps of Engineers, 1995, "Evaluation and Repair of Concrete Structures," Engineer Manual 1110-2-2002, Washington, DC, 184 pp.

## SECTION 3 - UNITS OF MEASUREMENT

### 3.1 General

In the United States, two systems of measurement are commonly used: the traditional in.-lb system, and SI metric. This chapter discusses the use of both systems, and conversion from one to the other. ICRI documents contain dual units with in.-lb units appearing first followed by equivalent SI metric units in parentheses. See ASTM E 29 for guidance in determining the number of digits which are to be considered significant.

#### 3.1.1 Rules for correct usage of units names and symbols

Note: a unit name is its full, written name, such as kilogram or microgram. Its symbol is the letters or symbols used to abbreviate it, such as kg or  $\mu\text{g}$  (see Section 3.2).

- When spelling out the full name of a unit, print the unit name in lower case, even those derived from a proper name, such as newton or pascal. Print unit symbols in upright type, no italic text. See IEEE/ASTM SI 10 to determine whether a symbol should be in upper or lower case. In general, symbols are lower case text, unless the name is derived from a proper name, such as N or Pa. Also, SI decimal prefixes greater than  $10^6$  are upper case - M, G, T, P, E, Z, and Y. Therefore, the symbol for megapascals is MPa.
- Leave a space between a numeral and a symbol (except for percentages) - write 45 kg or 37 °C, not 45kg or 37°C. Do not leave a space between a unit symbol and its decimal prefix - write kg, not k g.
- Do not use a plural of unit symbols - write 45 kg, not 45 kgs.
- Do use the plural of written unit names - write “several kilograms.”
- Use symbols in conjunction with numerals (the area is 10 m<sup>2</sup>); write out names if numerals are not used, such as “area is measured in square meters.”
- Indicate the product of two or more units in symbolic form by using a dot positioned above the line - write kg·m·s<sup>2</sup>.
- Do not mix names and symbols - write N·m or newton meter, not N-meter or newton-m.
- Do not use a period after a symbol except when it occurs at the end of a sentence, with the exception of “in.” and “gal.” which use the period to differentiate them from the actual words “in” and “gal”.
- Always use decimals, not fractions - write 0.75 g, not  $\frac{3}{4}$  g.

#### 3.1.2 Degrees

Do not abbreviate the word “degree.” When using Fahrenheit or Celsius, the word is replaced with the ° symbol, such as 38 °C. When referring to an angle, spell out the word.

##### Example:

*Correct:* Maintain a slope of 60 degrees.

*Correct:* The temperature of the concrete should not exceed 40 °C.

#### 3.1.3 Mass versus weight: pounds, kilograms, and newtons

In the in.-lb system, pound (lb) is always a unit of force, unless explicitly stated otherwise. In SI, kilograms are units of mass, and newtons are units of force. Newtons are obtained by multiplying

kilograms by  $9.81 \text{ m/s}^2$ , which is the gravitational constant,  $G$  (this is from force = mass x acceleration, where acceleration is the gravitational constant). In the in.-lb system,  $G$  is  $32.2 \text{ ft/s}^2$ , and is included automatically when measuring in pounds, as it is always a force; it is very unlikely in concrete repair measurements or calculations to ever need to divide pounds by  $G$  to obtain pounds as a unit of mass.

The SI system, however, commonly uses units of mass to express the amount of a substance or object. When converting from in.-lb to SI, be sure to convert to the appropriate units, either kilograms or newtons. For instance, pounds of cement in a mixture would be converted to kilograms, while a dead or live load in pounds per foot would be converted to newtons per meter.

### 3.2 Unit symbols

Units should be abbreviated as a symbol only if accompanied by a numeral. Do not add an “s” to the end of a unit symbol to make it plural.

#### **Acceptable symbols for inch-pound units:**

degrees Fahrenheit = °F

foot = ft

gallon = gal. (note period)

inch = in. (note period)

kips per square inch = ksi or kip/in.<sup>2</sup>

ounce = oz

pound = lb\*

pounds per square inch = psi or lb/in.<sup>2</sup>

pounds per square foot = psf or lb/ft<sup>2</sup>

speed = mph

ton = (no symbol)

yard = yd

\*Always double-check SI conversions of pound. Pounds are always units of force, but may be converted to SI units of force or mass. The SI equivalent for force is the newton (N); the SI equivalent for mass is the kilogram (kg). See Section 3.1.3.

#### **Acceptable symbols for SI units:**

degrees Celsius\* = °C

gram = g

kilogram = kg

kilopascal = kPa

liter = L

megagram = Mg

megapascal = MPa

meter = m

millimeter = mm (*note: avoid use of centimeters*)

newton = N

newton-meter = N·m

pascal = Pa

speed = k/h

\*The SI unit of temperature is the kelvin (K); however, degrees Celsius is widely used and accepted ( $K = °C + 273.15$ ).

#### **Time:**

(Abbreviate as shown in mathematical expressions; spell out in sentences.)

hour = h

minute = min

second = s

year = yr

day = (no symbol)

week = (no symbol)

month = (no symbol)

For time of day, use am or pm (lowercase).

### 3.3 Metrication

In accordance with ICRI Board Policy, all new and revised documents shall use dual units. All conversions shall conform to the latest version of IEEE/ASTM SI 10, supplemented where applicable by ASTM E 621.

#### 3.3.1 Base units

The following four base SI units are defined in terms of accepted standards or reproducible phenomena.

Quantity	Unit	Symbol
length	meter	m
mass	kilogram	kg
time	second	s
temperature	Kelvin	K

#### 3.3.2 Derived units

Derived units are formed by combining base units, supplementary units, and other derived units according to the algebraic relations linking the corresponding quantities. Examples of derived units are shown in the following.

Quantity	Unit	Symbol
area	square meter	m <sup>2</sup>
density, mass	kilogram per cubic meter	kg/m <sup>3</sup>
velocity	meter per second	m/s
volume	cubic meter	m <sup>3</sup>
force	newton	N
frequency	hertz	Hz
pressure, stress	pascal	Pa

#### 3.3.3 Other units

There are a number other units currently in use that are not strictly SI, but these units will continue to be used because of widespread acceptance. Some of these are shown in the following.

Quantity	Unit	Symbol
time	minute	min
time	hour	h
time	day	d
volume	liter (0.001 m <sup>3</sup> )	L
mass	metric ton (1000 kg)	t
area	hectare (10,000 m <sup>2</sup> )	ha
temperature	degree Celsius	°C

### 3.3.4 Decimal prefixes

Prefixes used in SI to indicate multiples of the units are listed in the following. Note that multiples of the mass unit are formed by adding prefixes to the word “gram”, not to the base unit kilogram. Also note that prefixes are typically used to represent multiples or submultiples of 1000.

Prefix	Multiplication factor	Symbol
tera	$10^{12}$	T
giga	$10^9$	G
mega	$10^6$	M
kilo	$10^3$	k
milli	$10^{-3}$	m
micro	$10^{-6}$	$\mu$
nano	$10^{-9}$	n
pico	$10^{-12}$	p

### 3.4 Conversion of units

Converting from one system of units to another requires two distinct steps:

- Multiplying or dividing by the appropriate conversion factor
- Rounding off to an appropriate number of significant digits

#### 3.4.1 Conversion factors

Conversion factors for measurements commonly used in the concrete industry are as follows:

To Convert From	Multiply by	To Obtain
<i>Length</i>		
in.	25.4	mm
ft	0.3048	m
yd	0.9144	m
mile	1.60944	km
<i>Area</i>		
in. <sup>2</sup>	645.16	mm <sup>2</sup>
ft <sup>2</sup>	0.0929034	m <sup>2</sup>
yd <sup>2</sup>	0.8361274	m <sup>2</sup>
<i>Area per volume</i>		
ft <sup>2</sup> /gal.	0.02454	m <sup>2</sup> /L
<i>Force</i>		
lb	4.448222	N
kip	4.448222	kN
<i>Mass</i>		
lb	0.4535924	kg
kip	435.924	kg
ton	0.9071847	t
<i>Mass per volume</i>		
lb/ft <sup>3</sup>	16.018846	kg/m <sup>3</sup>
lb/yd <sup>3</sup>	0.5932764	kg/m <sup>3</sup>
<i>Volume</i>		
fl oz	29.57	mL
gal.	3.785412	L
ft <sup>3</sup>	0.02831685	m <sup>3</sup>
yd <sup>3</sup>	0.7645549	m <sup>3</sup>

<i>Pressure (stress)</i>		
lb/in. <sup>2</sup>	6.894757	kPa
lb/ft <sup>2</sup>	47.88026	Pa
kip/in. <sup>2</sup>	6.894757	MPa
<i>Temperature</i>		
° F	(° F – 32)/1.8	° C

### 3.4.2 Significant digits

Given the number of digits in the conversion factors and that conversions are usually made on a calculator, it is certainly possible to obtain converted values that have no practical meaning. In all conversions, the number of significant digits retained should be such that accuracy is neither sacrificed nor exaggerated.

### 3.4.3 General rules for rounding

- After estimating the precision of a value, the converted value should be rounded to the minimum number of significant digits such that a unit of the last place is equal to or smaller than the converted precision.
- Attempt to understand the degree of precision of the original measurement. Determine whether it is expressed to the nearest inch, pound, gallon, or whatever. This knowledge will allow you to round to the proper number of digits.
- If the inch-pound measurement is expressed as a combination of units, convert to the smaller unit and then multiply by the appropriate conversion factor. For example, 5 ft 6 in. should be converted to 66 in. before converting.
- Do not round off either the unit or conversion factor before multiplying.
- After multiplying by the conversion factor, round off to a number of significant digits to represent the accuracy of the original measurement.
- After rounding off, move the decimal point as necessary to express the converted value using one of the preferred prefixes.

### 3.4.4 Soft metric conversion

Soft conversions are generally appropriate for reporting measured values such as test data or dimensions of existing structures. To make soft metric conversions, apply the conversion factor from IEEE/ASTM SI 10, then round to the number of significant figures that will give an accuracy equivalent to that of the original value. Show the resulting soft converted value in parentheses following the original value.

#### Example:

Make a soft metric conversion of a compressive strength test (ASTM C 39) result of 4030 psi.

$$4030 \text{ psi} \times 6.894757 \text{ kPa/psi} = 27785.87071 \text{ kPa} = 27.78587071 \text{ MPa}$$

By rounding to three significant digits, the soft conversion in a document would be "... compressive strength test (ASTM C 39) result of 4030 psi (27.8 MPa)." Some judgment must be applied to determine the number of significant digits. The number of significant digits retained should be such that precision is neither sacrificed nor exaggerated.

### 3.4.5 Hard metric conversion

Hard conversions are appropriate for codes and specifications and for making recommendations, setting requirements, or discussing products that are available in that system of measurement. Apply the appropriate conversion factor from IEEE/ASTM SI 10, and then round to the standard dimension that would be used when design and construction are in the other system of units. Show the original value

followed by the hard conversion and separated by the word or.

Example:

Make a hard metric conversion of a bar spacing of 16 in.

$$16 \text{ in.} \times 25.4 \text{ mm/in.} = 406.4 \text{ mm}$$

The 406.4 mm value could be rounded to 410 mm, to have the same precision as the original 16 in.; however, it would be more appropriate to use further rounding for a hard conversion that reflects actual field practice. The hard conversion in a document would be "... bar spacing of 16 in. or 400 mm."

Using the word or indicates that 400 mm is an alternative to, but not necessarily an exact equivalent of 16 in. Always consider using actual dimensions or products and equipment that are available and manufactured to SI dimensions when making a hard metric conversion, and vice-versa when going from SI to in.-lb units.

## APPENDIX A – References

### A.1 Cited references

ACI 104R (1997), "Preparation of Notation for Concrete," *2006 ACI Manual of Concrete Practice*, ACI International, Farmington Hills, MI, 11 pp.

ASTM E 29-06b, "Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications," *2006 Annual Book of Standards*, ASTM International, West Conshohocken, PA, 5 pp.

Cendrowska, T., and Schultz, D., (1999), "Must We," *ASTM Standardization News*, Nov, pp 24-27  
<http://www.astm.org/COMMIT/BuildingCodeLanguage.pdf>

## APPENDIX B - GENERAL GRAMMAR

### B.1 Rules of grammar

Please refer to an appropriate grammar textbook for complete rules on proper English usage. Items included in this appendix are commonly misused, and are provided as a “watch list” for committees writing technical documents.

#### B.1.1 *Apostrophes*

##### **When to use apostrophes:**

Use apostrophes only to show possession.

##### **Example:**

*Correct:* Technical document approval is left to TAC's discretion.

*Correct:* This is a productive use of members' time.

##### **When not to use apostrophes:**

Do not use an apostrophe when referring to decades or when making acronyms plural.

##### **Example:**

*Correct:* This was not a popular technique in the 1950s.

*Correct:* A lower level outlet (LLO) was constructed. LLOs are used frequently.

Contractions, such as “don't,” “won't,” “it's,” and “can't” should be avoided. It is always correct to use the full words instead of a contraction.

#### B.1.2 *Dangling modifiers*

A dangling modifier does not refer clearly to what it modifies. Make sure that the phrase or clause logically agrees with the subject of the sentence. Rewrite so that the subject of the sentence is the doer of the action expressed by the modifier. If that is not possible, use a different construction.

##### **Example:**

*Incorrect:* Before finishing lunch, the carpenter left.

*Correct:* The carpenter left before I finished my lunch.

#### B.1.3 *Infinitives/split infinitives*

An infinitive consists of “to” plus a verb, for example, “to break.” When a word appears between “to” and a verb, it is called a split infinitive, for example, “to carefully paint.”

##### **Example:**

*Incorrect:* The candidate decided to formally launch her campaign.

*Correct:* The candidate decided to launch her campaign formally.

When a split infinitive is more natural and less awkward than not splitting the infinitive, it is acceptable to split the infinitive.

##### **Example:**

*Awkward:* We decided actually to enforce the law. *Better:* We decided to actually enforce the law.

#### B.1.4 *Parentheses and brackets*

When setting text off in parentheses, keep the thought brief. If the phrase can be set off by commas instead, that is preferable. Text in parentheses is a distraction to the reader that can draw attention away

from the point of the main sentence.

Example:

*Correct:* An acceptable gap is not larger than 1 in. (25 mm).

*Correct:* The contractor (or person designated by the contractor) should perform this task.

*Incorrect:* The contractor (or person designated by the contractor, like John, who worked on the last bridge project that Acme Construction completed last summer even though there were horrible storms that year and it was nearly impossible to maintain a schedule) should perform this task.

### **B.1.5 Semicolons**

Semicolons are probably the most misused of all punctuation.

**When to use semicolons:**

- To separate complete clauses of compound sentences. Bear in mind that the clause before the semicolon and the clause after the semicolon must both be able to stand as independent sentences or else the semicolon is misplaced. It is always correct to break the clauses into two sentences.

Example:

*Correct:* Do not pump concrete through aluminum pipe; this can ultimately cause irregular expansion.

*Also Correct:* Do not pump concrete through aluminum pipe. This can ultimately cause irregular expansion.

- To separate items that are listed within a sentence of the body text that are complex or contain internal punctuation. Use semicolons when more than three items are being listed in text. When three or less items are being listed and are uncomplicated expressions, commas are usually sufficient to separate them.

Example:

*Correct:* Successful concrete construction depends on careful planning and execution of all procedures; experienced, available personnel; effective on-site troubleshooting; agreeable weather conditions or proper provisions to accommodate unfavorable conditions; and proper-quality materials.

- As end punctuation for all but the last item in a bulleted, numbered, or lettered list. See Section 1.5.2 for details and examples of acceptable styles for lists.
- To separate the keywords of the document.

## **B.2 Commonly misused terms**

### **B.2.1 Alternate/alternative**

Alternate usually means “an action by turns or step-by-step.” Alternative usually means “one or the other.”

### **B.2.2 Assure/insure/ensure**

The verb “assure” must always take a person as its direct object. Therefore, you can assure people that certain events will take place.

Example:

*Correct:* The designer should assure the owner that the plans are accurate.

The verb “insure” refers to protection against financial loss.

Example:

*Correct:* To protect the owner's investment, the building should be insured.

The verb “ensure” means “to make certain.”

Example:

*Correct:* Take care to ensure that mixture proportions are correct.

Be careful in the use of “ensure” in mandatory language documents. Used improperly, “ensure” could legally imply a guarantee that should be avoided. For example, do not state, “Use of this equation will ensure crack control.” Also, “ensure” should be used only if the party required “to make certain” is typically assigned that responsibility and if the requirement is practicable.

**B.2.3 Criterion/criteria**

Criterion is singular; criteria is the plural form.

**B.2.4 However**

According to *The Elements of Style*, by Strunk and White, a sentence should not begin with “however” when the meaning is “nevertheless.”

Example:

*Correct:* “The roads were almost impassable. At last, however, we succeeded in reaching camp.”

*Incorrect:* “The roads were almost impassable. However, we at last succeeded in reaching camp.”

When “however” comes first, it means “in whatever way” or “to whatever extent.”

Example:

*Correct:* However you advise him, he will probably do as he thinks best.

**B.2.5 “Per” versus “/”**

Typically, a slash (solidus) should be used between unit abbreviations when one unit is being measured per the other. The exceptions are units commonly expressed as acronyms, such as mph and psi.

Example:

*Correct:* For best results, 3 gal./lb or 9 L/kg should be added.

Use the word “per” to separate units that are not abbreviated.

Example:

*Correct:* Many ounces of water per pound of cement are needed.

**B.2.6 Practical/practicable**

“Practical” applied to persons means sensible and businesslike and applied to things it means efficient and workable, as contrasted with theoretical. “Practicable” means possible or feasible, able to be done, capable of being put into practice or of being used.

Example

*Correct:* The use of ice is a practical approach for reducing the temperature of fresh concrete.

*Correct:* It is not practicable to consolidate cylindrical specimens of zero-slump concrete by rodding.

**B.2.7 *That/which***

The general rule of thumb is that if the clause can be deleted without changing the meaning of the sentence, then “which” should be used. If deleting the clause changes the meaning, then “that” should be used.

Example:

*Correct:* The book that I borrowed is on the shelf. (Identifies the book in question.)

*Correct:* The book, which I borrowed, is on the shelf. (Offers detail about the book.)

Perform an electronic search of the document to replace any inappropriate “which” with “that.”

## APPENDIX C: QUICK REFERENCE

### C.1 Document searches and replacements

Once a document is complete, the following global replacements will help to ensure the document conforms to ICRI style as closely as possible.

- In nonmandatory-language documents, search for all occurrences of "shall" and "must" and replace with "should" and "may" accordingly (Section 1.4.1).
- In mandatory-language documents, search for all occurrences of "should" and "may" and replace with "shall" and "must" accordingly (Section 1.4.1).
- Search for all occurrences of "which" and verify that each use is correct. When it is not, replace with "that" (Section A.2.7).
- Search for "buzz words." Replace unacceptable terms such as microsilica, superplasticizer, and rebar with silica fume, high-range water-reducing admixture, and reinforcing bars, respectively.
- Search for first mention of any abbreviations or acronyms. Make sure abbreviations and acronyms are defined at first mention.
- Search for "Fig." and "Table" and verify that all artwork is cited somewhere in the text. (Make sure citations of artwork that have been removed are deleted or updated accordingly.)
- Run a spell-check program on the whole document.

### C.2 Last-minute verifications

Perform a final check of the final draft for these often-overlooked items:

- Do all section headings match the Table of Contents? Have sections been renamed, deleted, or moved?
- Are all pages numbered?
- Do line numbers appear on each page?
- Does the correct roster appear (Section 1.1)?
- Are references up-to-date and cited appropriately?
- Is text double-spaced?
- Is revised text distinguished from unrevised text (for revisions to existing documents) (Section 1.1)?
- Are originals of figures and tables (or photocopies, if originals are already at headquarters from a previous printing) included?
- Did the equations and symbols properly print?