



LTRC Publication Guidelines

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Publication Basics

A research study is not complete until the results have been published. Communicating research results in an accurate, logical report is just as important as the research itself. This document is probably the only way in which recognition of the researcher's work can be achieved, and a permanent record of those achievements can be established. This guide presents some of the requirements for writing interim and final reports and provides solid information for the creation of all written materials to be published by LTRC.

Organization

Research reports are written to serve as a basis of decision and action. The expert opinion of the report writer is therefore required in the form of recommendations; these recommendations should be the core of the report. It is then important that the whole report be put together to contribute to the single end of giving weight to the recommendations.

Creating a good written report involves these five main steps:

1. Preliminary analysis
2. Assembling data
3. Organizing data
4. Effective writing

The fact that three of these steps occur before the actual writing is an accurate indication of the importance of preparation and execution. The preparatory steps represent at least three-fourths of the job. If the writer thoroughly understands the research problem in advance, the actual writing will almost take care of itself. While the form and content of the research report is fairly defined, all good writing conforms to the basic structure of introduction, exposition, and resolution. The following are some references that you will find useful in your writing:

- Day, R., *How to Write and Publish a Scientific Paper*, ISI Press, Philadelphia, 1983.
- Zinsser, W., *On Writing Well*, Harper & Row, New York, 1976.

1. Preliminary Analysis

The first step in writing is to identify exactly what you hope to accomplish, or what your purpose is. If you are writing a report, this question will already have been answered by the research study proposal. Then ask yourself what the chief components of the problem are. Remember that no part of the preliminary analysis—the statement of purpose, scope, or plan of procedure—is necessarily final. In the course of the investigation, you must always expect the unexpected, and when it arrives, you may have to change your course accordingly.

2. Assembling Data

The work of assembling data will vary with the type of report. For any study, the preliminary assembling of data will consist of a literature search.

To gather information, you can begin at the library home page at <http://www.ltrc.lsu.edu/library.htm>. Here you can contact the LTRC librarian by utilizing the “Chat with Library” function and access the library catalog. LTRC also offers a “Research Links” page at <http://www.ltrc.lsu.edu/library-research-links.html>, which lists resources and databases available for research. As LTRC subscribes to new services, they will be listed on this page, ensuring correct and current information.

Additional resources in addition to LTRC:

TRIS ONLINE/NTL Integrated Search: <http://ntlsearch.bts.gov/tris/index.do>

TRB Research In Progress: <http://rip.trb.org/>

Once the literature search is accomplished, the next step is to begin on a laboratory and/or field investigation according to the proposed work plan. Although this collection of data will follow the proposed work plan, it may be necessary to change this pattern during the course of the investigation. For example, it may become necessary to make a statistical evaluation of a certain phase of the study. In this case, it will be almost mandatory to revise the pattern of data collected. In general, data accumulation will depend a large extent on the type of methods of analysis (statistical, graphical, empirical, etc.).

3. Organizing Data

Once the collection of information is complete, it's time to bring order to the process. In organizing data, a sense of relative values is fundamental. What facts are the most significant? What is their significance? It is not easy to set aside facts and statistics, which have been laboriously obtained, simply because they obscure the view of more important matters. But unless this cutting is done, the people for whom the report is intended will not be able to understand it.

Arrange the facts coherently and in order of significance. You should be guided by the reader's point of view. What does he want to know, and how can it be presented for his clearest understanding? Very few authors are experienced or talented enough to write a cohesive report without making a preliminary outline. Even something as basic as the list of the 20 parts of a report presented on page 14 brings direction and order to the process of writing. You are strongly encouraged to assemble your writing based on a comprehensive outline of the information that can be found on page 14.

4. Effective Writing

The qualities of style essential to a well-written report are *correctness*, *clarity*, and *conciseness*.

Correctness is attained principally by using words correctly. Choose words with care, and consider all the implications of your choice to ensure that you are conveying your intended meaning.

Clarity is writing that is easy to understand with a lack of insignificance. It reduces confusion and gives a clear expression—be clear and to the point.

Conciseness is expressing or covering a great deal in only a few words. It's being brief in form but thorough in scope. Never say in three words what could be stated with one.

Correctness

Punctuation. Punctuate correctly. Reference later parts of this manual or consult a style manual if in doubt. Parts of this guide are derived from the *United States Government Printing Office Style Manual* and other style manuals generally accepted as authoritative by publishers, such as the *Chicago Manual of Style* and the *Franklin Convey Style Guide*.

Style. To achieve uniformity and consistency in publications, the LTRC editorial staff uses certain standard reference works for guidance. In matters of spelling, definition, and compounding of words, *Webster's Third International Dictionary (Unabridged)* is generally followed.

Published standards of scholarly organizations are accepted in questions of usage of technical terms. For technical and engineering usage, refer to the *McGraw Hill Dictionary of Scientific and Technical Terms* and the *Wiley Dictionary of Civil Engineering and Constructors*. Other matters of style and usage are based on published documents that are widely accepted as authoritative (e.g., *Chicago Manual of Style* and *United States Government Printing Office Style Manual*).

Clarity

Your Audience. Keep in mind the requirements of the prospective reader. Your reader may not be interested in specific details or may only be interested in specific aspects of your research. In either case, including all raw data is not necessary or desirable. It can be filed and made available to support your findings if questions arise.

Sentences. Write short sentences. Twenty words are about the average sentence length for business and technical writing. Each sentence should contain one complete thought. Also, try to use a variety of sentence types and lengths to keep the reader interested.

Paragraphs. Paragraphs should represent logical divisions of the subject matter. There should always be a good reason for putting a group of sentences in a particular order. Use connectives (since, although, etc.), connective adverbs (however, nevertheless, moreover, etc.), and transitional phrases (on the other hand, in the next place, in addition to, etc.) to create flow between sentences within paragraphs.

Sequence. The report must be in logical order. (This is where an outline is essential.) Every sentence and paragraph must logically follow the preceding one. Logic is the guide that readers will use to follow the writer's thoughts. Without it, the reader will quickly lose interest in the writing.

Conciseness

Avoid verbosity. Ideally, the report should be less than 100 pages. It is not necessary to include all the raw data, although, it is necessary to write out the first draft of a report completely. However, any good writer knows that disciplined pruning is always necessary to eliminate the repetition of words and thoughts. The secret of good writing is to strip every sentence to its cleanest components. Cut out every long word that could be a short word, every adverb that carries the same meaning as the verb, and every unnecessary sentence and paragraph. Your writing will be more forceful by virtue of what is left out.

Use Strong Verbs. In order to shorten sentences and express direct messages, try to avoid simple verbs, such as *is, are, was, were, can, could, has, had, have, do, did, done, make, use, come*, etc. While these are commonly used verbs necessary to communicate, they are sometimes used too often making sentences wordy and overall weak.

Avoid: It can be seen in figure 2 how the structure behaves under pressure.

Use: Figure 2 shows how the structure behaves under pressure.

Avoid False Subjects. False subjects tend to make sentences longer and often mask the sentence's true subject. Eliminate terms such as "it is" or "there are" to be more concise.

Avoid: It is observed that the predicted values were comparable with the measured values.

Use: Investigators observed that the predicted values were comparable with the measured values.

Avoid: There are two dogs in the car.

Use: Two dogs are in the car.

Use the active voice. Active voice is generally more precise and less wordy than the passive voice. The active voice takes the form of “A does B”; the passive takes the form of “B is done [by A].”

1. Readers prefer active sentences. In active sentences, the actor (the subject) comes before the action (the verb); the sentence is shorter, more forceful, and more confident:

Passive: The test equipment will be monitored by scientists.

Active: Scientists will monitor the test equipment

2. Passive voice can be used when you don’t want the subject or actor to be known or if you are unsure:

The failure happened because the sand was not loaded properly.

3. Passive voice is acceptable when you need to make a smooth transition. Sometimes, in order for readers to grasp concepts, keywords from separate sentences need to be close together:

To estimate the M_r , state agencies used different approaches. One of these approaches is the use of empirical correlations with physical properties of tested soils.

4. Make sentences active by restricting the sentence and turning the clause around:

Passive: The results are outlined in figure 5.

Active: Figure 5 outlines the results.

Passive: Specifications were provided by design engineers.

Active: Design engineers provided specifications.

5. Change the verb to make a sentence active:

Passive: The results were achieved after the second attempt.

Active: The results occurred after the second attempt.

Avoid jargon. Jargon is the bane of too much writing. There are two types of jargon: technical terms and obscure, pretentious language marked by long words and redundancy. Technical terminology is sometimes difficult to avoid. If such terminology is known by all of your intended readers, then there is no problem. However, if such terms may not be known to any part of your potential audience, then they should be defined the first time they are used. The second type of jargon—Inflated, pretentious language—should always be avoided.

Editing

Once you complete the report and technical standard page, you will submit the entire document to your project manager. From there, your project manager will submit an electronic copy and a hard copy to be edited by LTRC's publication staff.

To reduce the number of edits, authors should be detailed and precise in correcting the edits made. This will result in quick editing, and the report will get prepped for final production faster.

Look for these proofreading symbols throughout your report to understand what changes need to made:

Proofreading Symbols Meaning

^	insert
,^	insert a comma
¶	begin a new paragraph
No ¶	do not begin a new paragraph
○	add a period here
—	Delete
strikeout	Delete work or phrase
^-	insert a hyphen
^-	insert a dash
==	make upper case
/	make lower case
~	reverse these items
()	close up a space
▲	Insert a space
SP	spelling

It is the writer's responsibility to present LTRC with a final copy of the report, typed in the most current template version found at <http://www.ltrc.lsu.edu/publications.html>, and produced with a high quality printer on good quality paper. In addition to submitting a hard copy, an electronic copy must also be submitted by e-mail or CD.

Basics before Beginning

Spacing, Size, and Margins

- Line spacing on a final copy should be 1.25 spaces.
- Margins should be 1.25 inch on the inside margin, one inch on all other sides.
- After every sentence, there should be one space. This also includes after a period, colon, question mark, an exclamation point, or closing quotation marks.
- Double space between paragraphs.
- The type in tables or figure should be clearly legible and no smaller than 11-point.
- For body text, use 12-point serif font Times New Roman.
- Submit all materials on single-sided, 8 1/2 x 11-inch white paper.

Justification

All body text should be left-justified to prevent extra spacing caused by other justifications.

Page Numbering

Page numbers have already been preset on LTRC's Word template but for additional use and understanding:

- Page numbers should be 3/8 inch from the bottom of the page located at the outside bottom corner of the page. Remember that document pages will be printed on the front and back side.
- The page number for an odd numbered page should be on the right-hand side of the page, meaning that the page will appear on the front
- The page number for an even numbered page should be on the left-hand side of the page, meaning that the page will appear on the back

This is very important because the 20 parts of the report listed on page 14 should fall on a right hand page (front page) and should be given odd numbers. If this does not happen naturally, a blank page must be inserted (see next section on how to insert a blank page), so the new section will begin on an odd numbered (front) page.

Each page throughout the report is to be numbered except for the following:

- Technical Report Standard Page
- Project Review Committee Page
- Title Page (p. *i*)
- Introduction (p. *1*)
- Blank sheets
- Heading pages for appendices

Use small, italic Roman numerals (*ii*, *iii*, *iv*, etc.) for all pages up to the Introduction. Use italic, Arabic numerals (2, 3, 4, etc.) for the body of the report beginning with the Objective as page 3 (since the Introduction is page 1 but not numbered).

Page numbers should be clearly separated from the text or any illustrations, figures, etc.

Element Headings

Start each major element (items 1 through 20 on page 14) on a separate right-hand page as noted in the previous section.

Headings for the *first-level head* (major element headings) should be centered and typed in bold and upper cased followed by a double space.

The *second-level head* should also be centered, typed in bold, and all major words should begin with a capital letter followed by a double space.

The *third-level head* (section headings) should be left-justified and typed in bold with all major words beginning with a capital letter followed by the text on the next line.

Fourth level headings (paragraph headings) should be indented, typed in bold with all major words beginning with a capital letter followed by a period with paragraph text on the same line.

If an extra level of heading is needed within a major element, the highest level heading within the element should be centered and typed in bold using upper and lower case letters.

The proper format for headings follows:

FIRST-LEVEL HEAD

(upper case, boldface, centered at top of an odd numbered page—double spaced after)

Second-Level Head

(first letter capitals, boldface, centered on separate line—double spaced after)

Third-Level Head

(first letter capitals, boldface, flush left, on separate line—start text on next line)

Fourth-Level Head. *(first letter capitals, indented, boldface, followed by a period—paragraph text immediately following on the same line)*

Example on the following page using the four heading levels:

- ¹ Major element heading
- ² Major section heading
- ³ Section heading
- ⁴ Paragraph heading

¹ METHODOLOGY

² Data Collection

³ Topographic Data

The topographic data used as input to the numerical calculations was based upon USGS quad sheets....

⁴ Land Topographic Data. The land topographic data was primarily based upon using 7.5 ft. and 15ft. USG Squad sheets....

⁴ Inland and Offshore Bathymetric Data. The inland and offshore bathymetric data was based on....

³ Barrier and River Data

Barriers and rivers which occur in the coastal zone have a controlling influence on flood levels.

² Surge Simulation Model

The overland flooding model used in the study has been developed by the Federal Emergency Management Agency....

³ Grids and Input Files

The offshore and inland grids were based on the Lambert Plane Coordinates (southern grid). The offshore grids....

Equations

Number the equations in order, beginning to end. Fractions in displayed equations should be stacked, in accordance with preferred mathematical practice. When creating an equation in the text, the equation should be indented and the equation number should be placed flush right on the same line as the equation. This serves as a reference point for that equation when it is used again in the text. Number all displayed equations with Arabic numerals in parentheses.

Note: when you want to reference an equation that has been previously mentioned in the text, be sure to reference it with the parenthesis around it, e.g., "...see equation (44)."

Next, if you need to define the variables of the equation, make sure the word "where" is lower cased, followed by a comma, and then by a series of definitions or explanations. This can either be in list or paragraph format separated by commas or semicolons if needed.

Example of possible formats:

List Format:

$$M_r = 2.12 + 3.44 qc + 63.15 fs \quad (7)$$

where,

M_r = resilient modulus (ksi),

qc = tip resistance (ksi), and

fs = sleeve friction (ksi).

Paragraph Format:

$$M_r = 2.12 + 3.44 qc + 63.15 fs \quad (7)$$

where, M_r equals resilient modulus (ksi), qc equals tip resistance (ksi), and fs equals sleeve friction (ksi).

Putting Together the Report

The following list contains all the required elements in proper sequence for an interim or final report acceptable to LTRC. For consistency, each part of the report must be titled accordingly in the listed order. Any deviations from this format must have the approval of the LTRC group manager and the publications and electronic media development program manager.

- | | |
|-----------------------------------|--|
| 1. Technical Report Standard Page | 11. Objective |
| 2. Project Review Committee | 12. Scope |
| 3. Title Page | 13. Methodology |
| 4. Abstract | 14. Discussion of Results |
| 5. Acknowledgments (optional) | 15. Conclusions |
| 6. Implementation Statement | 16. Recommendations |
| 7. Table of Contents | 17. List of Acronyms/Abbreviations/Symbols |
| 8. List of Tables | 18. References |
| 9. List of Figures | 19. Glossary (optional) |
| 10. Introduction | 20. Appendix (optional) |

Authoring Templates

Authors are required to format their reports with the LTRC Word template found at <http://www.ltrc.lsu.edu/publications.html>. This tool makes it possible to automatically label headings, paragraphs, figure and table captions, and other elements. LTRC's Web site also includes the most up-to-date information regarding editorial procedures.

1. Technical Report Standard Page

This form will be furnished by LTRC for insertion in all interim and final reports and is included in the LTRC report template as the first page. To download the template, go to <http://www.ltrc.lsu.edu/publications.html>. Contract researchers are required to complete the entire page as well as the abstract (part 16) and key words (part 17). The length of the abstract should not exceed that space provided on the form and will largely be the same as that information appearing in the Abstract portion of the report.

2. Project Review Committee

Reports submitted for publication are reviewed and recommended for publication by the Project Review Committee (PRC). The final publication decision is made by LTRC on the basis of the committee recommendation. To view the official proposal rating form, go to LTRC's Publication Web page at <http://www.ltrc.lsu.edu/publications.html>. The PRC page is prepared by the project manager after the publication decision is made.

Report Review Criteria

- The text should be written in simple, concise, and effective language
- The content of the report should be new or original, deal with issues that are timely, and have lasting value
- Coverage of the subject should be complete, well organized, and supported by understandable and useful tables, figures, and references
- Data presented must be valid, and research methods described should be appropriate to the studies reported
- Conclusions should be valid, appropriate, and properly supported
- The report must be useful to practitioners, researchers, or both
- Generic names of products and equipment should be used unless the author considers the trade names or manufacturers' names essential to the purpose of the report

3. Title Page

Include the study title, authors, affiliation or department, type of report, project and report numbers, conducting research agencies, month and year of publication, and a standard disclaimer statement. Note that this page is counted as page *i*, but the number does not appear on the page.

The disclaimer statement appears on the lower portion of the title page, just before the date of publication. For federally funded projects, the disclaimer should read:

The contents of this report reflect the views of the author/principal investigator who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the views or policies of the Louisiana Department of Transportation and Development, the Louisiana Transportation Research Center, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

For state funded projects, the disclaimer should read:

The contents of this report reflect the views of the author/principal investigator who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the views or policies of the Louisiana Department of Transportation and Development or the Louisiana Transportation Research Center. This report does not constitute a standard, specification, or regulation.

Authors' Names and Affiliations

The names and current affiliations of all authors should be listed on the title page. If the research was performed while the author had another affiliation and the author wishes that affiliation listed in addition to the current one, the author should note that both affiliations are to be used.

4. Abstract

The abstract should be as brief as possible and include:

- the principal objectives and scope of the investigation
- a brief description of the methodology employed
- a summary of the results or findings

A well-prepared abstract enables readers to identify the basic content of the report quickly and accurately, determine its relevance to their interests, and to decide whether they need to read the report in its entirety. When writing the abstract, remember it may be the only section read and should be self-contained. It should contain no bibliographic, figure, or table references.

The Abstract is the first page that will have a number on it, which is *iii*. It will be located on the bottom right hand of the page.

5. Acknowledgments

Significant contributions by personnel not directly responsible for the study may be acknowledged. The support and direction of the Project Review Committee may be acknowledged and the names of committee members listed. This portion of the report is optional.

When listing the names of those whom you wish to acknowledge, only professional and academic titles are acceptable (Dr. Smith). Social titles (Mr., Mrs., Ms.) are not appropriate.

Research Sponsorship

Authors of reports that report results of research sponsored directly or indirectly by federal programs should indicate this sponsorship in the Acknowledgments section.

6. Implementation Statement

The implementation statement describes the manner in which the results of the investigation may be implemented and what value they might have in application.

7. Table of Contents

The table of contents lists, in the order in which they appear, the divisions and subdivisions of the report. It may be nothing more than the main headings, roughly equivalent to the chapter headings of a book. Major headings should be upper cased while all other headings, with the exception of figures and tables, should have all major words in the title capitalized—headings should appear exactly how they are within the text:

OBJECTIVE.....	3
SCOPE.....	5
METHODOLOGY.....	7
Data Collection.....	7
Topographic Data.....	7

8. List of Tables

This part of the report may be omitted when the number of tables is fewer than five.

Using Tables in the Report

Tables should supplement, not duplicate, the text. Use the following guidelines in preparing tables for publication:

1. Number tables consecutively in the order first cited in text, using Arabic numerals. Reference must be made to each table by number at the appropriate place in the text.
2. Tables must duplicate LTRC style as closely as possible.
 - All tabular material should be single spaced.
 - Table captions should be typed in bold and centered *above* the table with only the first letter capitalized.
 - The table title is placed on the line below the table number.
 - The word “table” is spelled out and capitalized when referring to it in text
3. A period should not follow a table title. Within the table itself, all fonts and font sizes should be consistent with the report’s style.

4. Give each column in the table a head. [In some cases, the first (stub) column may have no head.] All heads should be aligned in flush left format.
5. Insert a full-width rule at the end of the table (and above the footnotes, if any).
6. Use lower case italic superscript letters for footnotes.
7. Check the accuracy of all totals included in tables before submitting report.
8. For use of measurements, see abbreviations section on pp. 25-26. The size of type in a table should be no smaller than 11-point. Actual measurement symbols and signs may be used for tables (%, ", etc.)

Example of correct table layout:

Table 4
Typical ranges for impact angles used in preliminary analyses

Load Condition	Approach Angles, degrees
Usual	5 – 10
Unusual	10 – 20
Extreme	20 – 35

Note: After establishing the title for the table on one line, be sure to separate the heading and Table number into two lines by holding down the Shift key and Enter key simultaneously. This will break up the text on two lines, and when you update the link in the List of Tables, the entire title will appear on one line next to the table number.

9. List of Figures

This part of the report may also be omitted if the number of figures is fewer than five.

Using Figures in the Report

Use the following guidelines in preparing figures for publication:

1. Give each figure a caption. If a figure contains several parts (a, b, c, etc.), cite each part in the caption and label each corresponding part on the figure using the same size type as that in the rest of the figure.
2. Figure captions should be typed in bold and centered *below* the figure box with only the first letter capitalized. Use the figure number and a title below it with no additional explanation.
3. Number figures consecutively in the order first cited in text using Arabic numerals; text references of figures should be by those numbers (see figure 5). Never should a figure be referred to as “the figure opposite” or “the photograph on this page.” The exigencies of typing may rule out that placement and then the reference would be wrong.
4. LTRC requires that published figures be clear and legible. The type in published figures must not be less than 11-point. In addition, letters, symbols, and line weights must be uniform and the same size throughout the figure (i.e., if wording on the ordinate and abscissa is in 11-point type, symbols used to identify data points also should be in 11-point type). Figures must never be more than one page long.
5. The word “figure” is spelled out and capitalized when you refer to it within the text: “Figure 1 shows...” or “...see Figure 8.”
6. For oversized figures, use 3/4-inch margins on the left and 1/2-inch on other sides. The figure box as well as the caption must be included within that area.

7. If a table, figure, or illustration appears on the same page with straight copy, it should be centered horizontally within the established margins and should be set off by at least three blank lines from the copy above and below. If these items appear on a page by themselves, they should be centered horizontally and vertically within the page margins.
8. If you are using a figure or table, refer the reader to it before explaining it in the text. If the graphic is important to the explanation, place it next to the explanation. If not, place it in the Appendix. Illustrations, figures, or tables appearing in an appendix or separate section of a report should follow the same placement guidelines. Do not violate established margins used in the text.
9. Be sure to hold the Shift key down while enlarging illustrations and pictures in the body copy to prevent unnecessary stretching.

Example of correct figure layout:

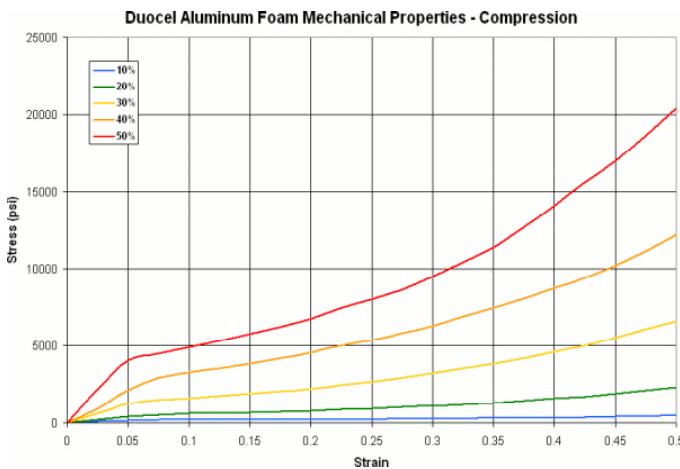


Figure 1
Stress-strain relationship for Duocel

Note: After establishing the title for the figure on one line, be sure to separate the heading and Figure number into two lines by holding down

the Shift key and Enter key simultaneously. This will break up the text on two lines, and when you update the link in the List of Figures, the entire title will appear on one line next to the figure number.

10. Introduction

The introduction is not only desirable, but necessary. Its purpose is to supply sufficient background information to allow readers to understand and evaluate the results of the present study without referring to previous publications on the topic. Remember: this page should be considered page 1 even though no numbering should appear on it. The introduction should briefly and clearly state your purpose in conducting the study.

A good introduction:

- presents the nature and scope of the problem and what prompted the investigation
- reviews the pertinent literature and any earlier work that has a bearing on the present study
- presents any other pertinent information that must be understood before the questions under study can be approached

11. Objective

The objective of the report should be a clear, concise, and comprehensive description of the goals of the research study. The objective may be provided by the Project Review Committee (PRC) or the Request for Proposals (RFP). Additions or changes to the original objectives should be included.

12. Scope

The scope should not be confused with the objective. The objective defines the goal to be attained; the scope determines the boundaries of the ground to be covered. It governs the degree of comprehensiveness to be adopted and the consequent scale of the report. It also rules out irrelevant items. In other words, the scope answers the questions of what should be put in and what should be left out.

13. Methodology

The reader of the report may place a greater confidence in its conclusions if he knows how they were reached. Hence, a brief and definite statement of the nature of the study is essential. The methodology should include a description of materials, apparatus or equipment, treatment of data (whether computer, statistical, or mathematical), standard sampling and test methods, and so forth and can be presented in chronological order. Standardized test procedures should be referenced but not described. Variations from standard procedures should also be explained.

14. Discussion of Results

This element is as difficult as it is crucial. It is the core of the report since it is the basis from which conclusions are drawn. It is imperative that the evidence be organized and presented so the reader can follow the reasoning, step by step, to the writer's conclusions. This element of the report should present a comprehensive analysis of the entire problem. When writing it, keep in mind logical order, interdependence of parts, relative importance of parts, emphasis, and sequence. Processed data and data summaries in either graphic or tabular form are desirable. Raw data should only be included if absolutely essential and then should appear in the Appendix.

15. Conclusions

The findings of the investigation are presented in the order of their importance with the most important first. Conclusions must be drawn from unquestionable premises and be based on adequate data. They must agree in every respect with the details presented in the preceding pages. If the conclusions are made on the basis of limited materials, equipment, etc., then a statement to that effect must be made.

16. Recommendations

Sometimes this may be part of Conclusions. However, it is best to separate this element whenever feasible. It should include any future course of action that may be or should be taken to confirm the findings. This may involve either field evaluation of materials and/or equipment or cost analysis and savings in cost. In general, recommendations should be made concerning the integration of the findings by their inclusion into specifications, standards, procedures, methods, or techniques.

17. List of Acronyms, Abbreviations, & Symbols

In this section, list and define all abbreviations, acronyms, and symbols used in the report in alphabetical order.

The Use of Acronyms in the Report

Do not use obscure abbreviations. Abbreviations, acronyms, and symbols must be fully defined the first time they are used in the report; the definition should be given first, followed by the abbreviated term in parentheses.

Example:

According to the Federal Highway Administration (FHWA)... The FHWA report said...

Once you define an acronym, it can be used throughout the rest of the report, including titles or headings.

The Use of Abbreviations in the Report

Abbreviations allow writers to avoid unnecessary repetition and are particularly useful in limited space, such as in lists, tables, charts, graphs, etc.

1. Common units of measure such as feet, inches, millimeters, pounds, etc., should be spelled out in the body of the text unless it is preceded by a number (e.g., 3 in.):

Investigators measured valves in inches.

The valve's diameter is 3 in.

2. When abbreviating, keep in mind that most abbreviations are the same when singular and plural:

30 ft. and 1 ft.

13 cm and 1 cm

3. Avoid using the symbol form of abbreviations (with the exception of tables and figures):

12 percent (not 12%)

3 ft. (not 3')

56 in. (not 56")

4. However, when speaking of temperature, it is proper to use the degree symbol followed by an “F” for Fahrenheit or a “C” for Centigrade:

125 °F

32 °C

5. There should be one space before and after any abbreviation or symbol:

The truck was 30 ft. wide and 5 ft. tall.

The probability associated with the F-test is designated as $Pr > F$.

The temperature was 76 °C.

6. Units used for the reporting of data shall be English units, followed by equivalent metric SI units in parenthesis if necessary.

The spans are 320 ft. (100 m) long.

Here are some commonly units and their proper abbreviations (pay attention to the use of periods):

English Units

Length:

Inch(es).....	in.
Foot/feet.....	ft.
Yard.....	yd.
Rod.....	rd.
Mile.....	mi.

Area:

Square inch.....	sq. in. or in ²
Square foot.....	sq. ft. or ft ²
Square yard.....	sq. yd. or yd ²
Square rod.....	sq. rd. or rd ²
Square mile.....	sq. mi. or mi ²

Volume:

Cubic inch.....	in ³
Cubic foot.....	ft ³
Cubic yard.....	yd ³
Cubic Meter(s).....	m ³
Cubic Millimeter(s).....	mm ³
Liters.....	L

SI fundamental units:

Meter.....	m
Kilometers.....	km
Kilogram.....	kg
Second.....	s
Ampere.....	A
Kelvin.....	K
Mole.....	mol
Newton.....	N
Grams.....	g

The Use of Symbols in Report

Carefully distinguish the following:

- All capital and lower case letters
- Capital O, lower case o, and 0 (zero)
- Lower case l (el) and number 1 (one)
- Letter X and multiplication sign x
- Prime ', apostrophe ', and superscript ¹

English and Greek letters such as:

- B and β,
- k and κ ,
- n and η , and
- u and μ

Pressure:

Pound.....	lb.
Pound force.....	lbf
Pound force per square inch...	psi
Kilopound per square.....	ksi
Pound per square foot.....	psf
Kilopounds per square foot....	ksf

Density:

Pound per cubic foot.....	pcf
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18. References

Because the research report usually involves a great amount of reading and studying, this element is especially important. A full list of references cited should be given at the end of the report. It is necessary that each numbered reference in this section correspond to the designated number (in brackets and italicized) in the body of the report.

1. Be sure that references are complete. Include the names of corporate or personal authors or editors; title of article, chapter, book, or report; publisher or issuing agency; location of publisher and year of publication; volume and issue or report number; and page numbers.
2. References to unpublished papers presented at meetings should include name(s) of author(s); title of paper; and title, sponsor(s), location, and date(s) of meeting.
3. References to program manuals, tapes, or other documentation for models should refer to the specific edition being cited and should list the specific department within an agency that has responsibility for the model's continuing use and development (e.g., "Interactive Transit Assignment Model. UTPS tape. Office of Planning Methods and Support, Federal Transit Administration").
4. If a reference has no date, use "undated."
5. In the list of references, use the number and a period then proceed to use the following style for the contents of the reference:
 - Author's last name first, followed by initials. In case of multiple authors, put each last name first, followed by the initial. Multiple authors names should be separated by a semicolon.
 - Title of article, book, or report
 - Volume and issue or report number
 - Publisher or issuing agency
 - City and date of publication (this is the proper place to put the year, not with the title)
 - Page numbers
 - NTIS data (optional)

Detailed reference style instructions are available on request from the editorial staff. The following examples illustrate the basic LTRC style for references:

TRB Publications

1. Zahavi, V., and Ryan, J.M. "Stability of Travel Over Time." In *Transportation Research Record 750*. Transportation Research Board, National Research Council, Washington, D.C., 1980, pp. 70–75.

Book

1. Shinar, D. *Psychology on the Road: The Human Factor in Traffic Safety*. John Wiley and Sons, Inc., New York, 1978.

Article in Journal or Other Periodical

1. Jolliffe, J.K., and Hutchinson, T. P. "A Behavioral Explanation of the Association Between Bus and Passenger Arrivals at a Bus Stop." *Transportation Science*, Vol. 9, No. 3, May 1975, pp. 248–282.

Government Report

1. Dempsey, B. *Climatic Effects of Airport Pavement Systems: State of the Art*. Report DOT2DRD-75-196. FHWA, U.S. Department of Transportation, 1976.

Other Irregular Publications (Reports, Theses, Dissertations, etc.)

1. Jones, J. J. "Glass-Resin Composites." NASA Report CR-518, National Aeronautics and Space Administration, Washington, D.C., Aug. 1966.
2. Jones, J. J. "Fatigue at Interfaces." Technical Report NONR 200 (90), No. 100, Columbia University, New York, 1970.

Web Page

1. Stevens, R.C. *Testimony Before United States Senate Special Committee on the Year 2000 Technology Problem*, September 10, 1998. <http://www.senate.gov>. Accessed October 5, 1998.

Using References in Report

1. References should be numbered in the reference list in the order in which they appear in the text. Denote a reference at the appropriate place in the text by an italic Arabic numeral in italicized brackets, placed at the end of the sentence before the period, e.g., *[2]*. For more than one reference, use separate brackets with a comma in between.

Example:

Transportation control measures are used to reduce mobile source emissions *[1], [2], [3]*.

2. Do not cite as a reference unpublished material, personal communications, telephone conversations, or similar material that would not be available to readers in printed form in a library or from the originating agency. Instead, cite the unpublished work in the text and enclose the author's name along with the term "unpublished data" in parentheses. Double-space between references on the list. Do not repeat a reference in the list, and do not use *ibid.*, *idem.*, *op. cit.*, or *loc. cit.*
3. If a reference is cited more than one time in the text, repeat the number first assigned to the reference.

Footnotes

Do not use footnotes in the text. Incorporate such notes within the text, or delete the notes entirely. Footnotes are only acceptable when contained in tables or figures.

Clearances and Copyrighted Material

Authors must assume full responsibility for securing any necessary clearances and written permissions for publication from any contracting or supervisory agencies involved in the research or from holders of copyrights on material used in the report. All contributions to the work must be properly acknowledged. When a report that contains previously copyrighted material, authors must obtain written permission from the copyright holder(s) to publish the material.

Bibliography

There is a difference between a list of references and a bibliography. A list of references is used to identify the sources of information cited in the text, and all of the references listed will correspond to citations in the text. If the writer merely consulted works but did not cite or refer to them at specific places in the report, he or she should use a bibliography, which is a list of all works consulted. Works in a bibliography should be in alphabetical order by author's last name.

19. Glossary (optional)

Writers may choose to list difficult or specialized words with their definitions in a glossary. Defined words should be bolded and a double space should separate each definition.

20. Appendix (optional)

All data which cannot be worked into the body of the report without interrupting the thought, or are too technical, are put in the appendix. Any reproduced materials must be of excellent quality and immediately relevant to the content of the report. Writers may not include copyrighted material (book or magazine excerpts) without the express written permission of the author.

Include pertinent material in the report itself or, where necessary, include a note stating that background material, such as derivation of formulas, specifications, or survey forms, is available in the Appendix. Every attempt should be made to limit information to one appendix.

Appendices

Having more than one appendix is acceptable only in cases where vast amounts of data or corollary information are to be included. Photocopies of books, articles appearing in other publications, faxes, or copyrighted material are not acceptable. All information presented must be clean and legible originals.

When creating more than one appendix, you should have a list of the appendices on the first page of the Appendix:

APPENDIX

- Appendix A Typical Profile of Tip Resistance (q_c), Sleeve Friction (f_s), and Predicted M_r (LA333 Site, Test Point C8)
- Appendix B Test Results for Verification of DCP Models
- Appendix C M_r Estimated From LADOTD Method

LTRC Publications and Electronic Media Office

Authors are welcome to contact the LTRC Publications and Electronic Media Office (225.767.9150) at any time regarding publication specifications, reference lists, and related matters. Note: Reports that do not conform to the specifications in this guide are subject to delay in publication pending return of the report to the author(s) for revision or completion.

Executive Summary

Executive summaries are at the discretion of the project manager depending on the size of the final report. Because executive summaries will be the primary printed piece, they will reflect the most important elements of the final report and should include most parts of the report (e.g., Objective, Introduction, Methodology, etc.). However, executive summaries should omit the Appendix because it will appear on a CD with the final report.

Formatting rules for executive summaries will follow those of final reports. Tables and figures should be included only if they are essential to the content of the executive summary. Since the executive summary is a condensed version of the final report, the page limit should not exceed 75 pages.

Additional information on executive summaries:

- The principal investigator must use final report template available online at <http://www.ltrc.lsu.edu/publications.html> to create the executive summary.
- The principal investigator is responsible for generating the executive summary and carrying out the necessary edits until completion.
- A final report will still be published with an executive summary, but it will be limited in distribution (e.g., LTRC staff, state library copies, DOTD chief engineer, etc).
- A CD included with an executive summary will include the complete final report.

Common Errors

In any writing, there are certain areas that seem to plague the average writer. These errors, while common, are nonetheless incorrect and are frequently based on erroneous information or a reluctance to double check the rules. What follows are the most frequently committed grammatical errors or problems encountered by the editorial staff of LTRC. It is by no means a comprehensive list but is provided to help you avoid simple mistakes that hinder the publication process and to make your writing the best it can be.

Agreement

Agreement is a standard rule in any form of writing. By having sentence agreement, it means that subjects (nouns or pronouns) should agree in number with the sentence verbs.

The report is finished. (not the plural are finished)

He was the engineer who designed the bridge. (not the plural he were)

Capitalization

1. Capitalize directions when referring to a specific region:

South Louisiana

the Midwest

the North

Do not capitalize if referring to a direction or a general area:

eastern Mississippi

south of the border

toward the north

2. Capitalize main words in headings and subheadings as well as titles of books, articles, and other documents. However, articles (*a, an, the*), coordinate conjunctions (*and, but, or, nor, for, so, yet*) or short prepositions (*to, of*) do not get capitalized unless they appear as the first word.
3. When referring to parts of your report, capitalize the first letter (e.g., see Appendix).
4. Civil, military, religious, and professional titles are capitalized when immediately preceding a personal name and are used as part of the name (sometimes replacing the title holder's first name). Titles are normally lower cased when following a name or used in place of a name.

Governor Jindal

Kip Holden, the mayor of Baton Rouge,...

Amy Stevens, who is a psychologist,...

Colons

Colons, unlike periods, commas, and semicolons, do not indicate a stop. Instead, colons indicate that a list or related thoughts will follow.

Example 1:

The following conclusions can be drawn from research results obtained in this project:

- Clusters of two or more FRP piles are capable of providing adequate sideways protection for the low and medium energy performance levels.
- Pier mounted elastic spring fenders are not practical for high energy head-on impact.
- Inelastic energy absorbing fenders are well suited for use as pier mounted crash cushions.

Example 2:

The focus of the effort is to identify or propose fender systems that are: (1) modular, (2) easily installed or replaced, and (3) suitable for retrofitting existing bridges or for use in new construction.

Commas

Some writers seem to think sprinkling commas every few words is a good rule, but it makes for difficult reading. A few rules on how to use commas:

1. Use a comma to join two independent clauses with these conjunctions: and, but, or, for, nor, so, yet.

The experiments were recently concluded, but their results have not yet been published.

2. Use a comma when joining a dependent clause and independent clause.

After such a collision, one expects that both the fender and the barge will suffer extensive damage.

3. A comma is needed to set off a phrase that cannot stand alone as a sentence. Use the comma only if there is a phrase such as “But, to be fair, she did get it done on time.”
4. Do not use a comma between a month and year in a date: not November, 1990 but November 1990. The comma stops two sets of numerals from running into one another, as in November 20, 1990.
5. The comma is preferred before the last item in a list: “the first, second, and third chapters.” Leaving it out (“the first, second and third chapters”) is a habit picked up from journalism. Omitting the final comma runs the risk of suggesting the last two items (in the example above, the second and third chapters) are a special pair.

6. Commas set off transitional words and expressions when introducing sentences or when linking together two independent clauses. Some transitions include: accordingly, consequently, for example, for instance, further, furthermore, however, indeed, nevertheless, nonetheless, on the contrary, on the other hand, then, and thus.

They, however, cannot provide protection for head-on collisions.

The fender retracts under impact, thus it absorbs energy by action of gravity and friction.

7. Commas, similar to periods, go inside closing quotation marks. However, commas go outside parentheses or brackets.

*“...Test System for Site Characterization,”
...the Louisiana Transportation Research Center (LTRC), and....*

That versus Which

While *that* and *which* can sometimes be used interchangeably, there are better uses for each word.

That should be used restrictively (essential to the sentence's meaning) to identify a particular item being talked about:

Bridge fender systems that provide acceptable collision performance should be identified.

Which is used non-restrictively (can be omitted and not lose essential meaning of the sentence) to add something about an item already identified:

Properly designed fender systems help protect bridges against catastrophic failures, which can cost millions of dollars.

Which should be used restrictively only when it is preceded by a preposition. Otherwise it is almost always preceded by a comma, a parenthesis, or a dash.

The third case in which the voids were filled with concrete were tested.

Dashes

Dashes can act as a way to set off ideas within a sentence. In this case, writers should use the em dash (—). To create an em dash, hold down the Alt+Ctrl+Num- keys together.

Hyphens, however, should be used in measurements (12-in. opening), when words modify each other (air-void), and when two or more words act together to create a new meaning (one-half, double-checked, etc.)

Data

From Latin, data is a plural noun: “The data are,” not “the data is.” The (now nearly obsolete) singular is datum.

Italics

The advent of word processing has enabled the individual to create a document using typesetter’s marks, previously impossible with a typewriter. Therefore, italicize any word that would conventionally be underlined; make sure to differentiate between quotes (“ ”) and inch marks (“”). Italics are also used for titles published works including: books, magazines, newspapers, and other works individually produced or published.

Effect versus Affect

Affect means “to influence” or “to have an effect on.”

Many variables can affect a vehicle’s position on narrow roadways.

Effect is usually a noun, and it means “an outcome or result.”

A parametric study is conducted to investigate the effect of using simple spring buffers.

E.g. versus i.e.

The abbreviation e.g. is for the Latin exempli gratia, “for example.” Whereas, the abbreviation, i.e., id est in Latin, means “that is.” They’re not interchangeable. Both abbreviations should be followed by a comma when used in text.

It's versus Its

There is no shortcut; all you can do is memorize the rule. It's with an apostrophe means it is; its without an apostrophe means belonging to it. An analogue might provide a mnemonic: think of “he’s” (“he is” gets an apostrophe) and “his” (“belonging to him” doesn’t).

Lists

Lists are essential to technical writing. They assist the reader in making the content easier to remember and read. When creating lists, there are two types to consider: displayed lists and paragraph lists.

Displayed Lists

1. Use a displayed list for a long series of items and any series you want to emphasize.
2. Use numbers or lower case letters (followed by a period and not enclosed by parenthesis) or bullets to identify each item in a list.
3. The first letter of each item should be capitalized unless the listed items complete a thought begun in the introductory sentence:

Examples:

Specifically, the objectives consisted of the following:

- *Review and document....*
- *Investigate the impact of....*
- *Examine the potential...*
- *Develop a recommended...*

Bridge protection systems generally are approached by:

1. *reducing the annual frequency of...*
2. *estimating the probability of...*
3. *reducing disruption costs of...*

- When introducing a list, use anticipatory words or phrases, such as *the following*, *as follows*, *thus*, and *these*, followed by a colon.
- When items in the list are complete sentences, end each item in a period.

Paragraph Lists

- If the list is not meant to be emphasized, and there are less than six items, list items within the paragraph.

Example:

Three different data collection methods consist of the following: (1) video taping traffic and then analyzing with an image-sensing processor in the lab, (2) spreading sand on the pavement to measure the wheel path from the road edge, and (3) installing tubes of different lengths transversally on the roadway to measure the lateral position of vehicles.

- Use lower case letters or numbers for each item in the list enclosed by parenthesis, e.g., (1) or (a).
- Capitalize items only when each item is a complete sentence or if an item begins with a proper noun.
- If the list proceeds with a preposition or a verb, there is no need for a colon to introduce the list.

Example:

The main study of the test was to (a) determine moisture unit weight, (b) discover limits, and (c) classify soils.

Parallelism

The most important thing to remember when creating both types of lists is that all items in the list parallel each other in structure. By beginning items with the same type of word (noun, verb, adjective, etc.), writers will ensure that their lists are parallel.

Numbers

The old rule about spelling out numbers less than 10 holds true for the most part, but there are some exceptions.

1. Never begin a sentence with a numeral: either spell out the number, or rewrite the sentence to move the number from the beginning.
2. Very large round numbers should be spelled out: not 1,000,000,000, but one billion. If ever you need real precision in expressing very large numbers, scientific notation might make sense.
3. Be consistent in a series of numbers. Either spell out numerals or use numerals for every member of the list:

Avoid: "...pages two, six, 10, and 23."

Use: "...pages 2, 6, 10, and 23."

4. Dates should always get numerals (e.g., October 3, 1990).
5. There is no reason to use both numerals and words for the same number. Do not use redundancies like two (2) or 12 (twelve).
6. The only time you should mix spelling and numerals is in very large numbers:

Avoid: 8,600,000

Use: 8.6 million

7. Use numerals for anything difficult to spell out: not *four and sixteen seventeenth*, *thirteen thousand three hundred twenty six*, or *three point one four one five nine*. You can, however, spell out simple fractions like *one half* or *two thirds*.
8. When numerals are followed by percentages, measurements, or are decimals, use the numeric figure:

5 in.

.566 mm

7 percent

Proofread

You should always read over your work carefully before handing it to someone else, looking for typos, misspelled words, problems with agreement, missing words, and so on. Remember, though, proofreading is only one part of the revision process.

Semicolons

Semicolons are primarily used to link sentences and separate thoughts.

1. Use a semicolon when combining two sentences that are similar in content.
2. A semicolon should be used to separate items in a series when one or more commas have already been used in that series.

Spell Check

The spelling checkers built into most word processors leave a lot to be desired, but they're not all bad. Spelling checkers are usually right when they tell you a word is misspelled (only names and rare words are likely to be stopped incorrectly). The problem, though, isn't false positives, but false negatives—when the spelling checker tells you something is right when it isn't. If you type *to* instead of *too*, the spelling checker will let it slip right through, since both are legitimate words. Typos are one thing, but if you have any question about the meaning or usage of a word, use a real dictionary, not a spelling checker. Just remember that a computerized spelling checker doesn't absolve you from the need to proofread everything carefully.

Quotation Marks and Punctuation

Commas and periods go inside quotation marks, while semicolons and colons go outside, regardless of the punctuation in the original quotation. Question marks and exclamation points depend on whether the question or exclamation is part of the quotation or part of the sentence containing the quotation.

Some examples:

Periods always go inside:

See the chapter entitled “The Conclusion, in which Nothing is Concluded.”

Commas always go inside:

The spokesman called it “shocking,” and called immediately for a committee.

The question mark is part of the outer sentence, not the quoted part, so it goes outside:

Have you read “Fundamental Principles of Engineering”?

The question mark is part of the quoted material, so it goes inside:

He asked, “How are you?”

All quoted material goes in “double quotation marks”; if you need a quotation inside a quotation, use ‘single quotation marks’ (also called “inverted commas”) inside:

“This for quotations, ‘this’ for quotations inside quotations.”

Quotations inside quotations are the *only* place for single quotation marks—don’t use them to highlight individual words.

Checklist

Before submitting any report for editing, please make sure the following checklist is complete:

- All parts of the Technical Standard page are filled in (including the correct number of pages of the report)
- Page numbers are italicized in Times New Roman font and are properly assigned (pp. 9-10)
- Line spacing of the report is 1.25 in.; all body text is left-justified (p. 9)
- References are at the end of sentences, italicized, and in separate brackets (p. 29)
- Equations are indented and equation numbers are flush right surrounded by a parenthesis; equations are correctly referenced in text (p. 13)
- Headings are set up correctly (pp. 10-12)
- Tables and figures (including captions and headings) are centered with text (pp. 18-22), table and figure numbers and headings are on separate lines, and references to tables and figures in text are capitalized
- Table of Contents/List of Tables/List of Figures correspond with the correct page numbers

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