



Minnesota
Department of
Transportation

Minnesota Department of Transportation Research Report Guidelines

**RESEARCH
SERVICES
&
LIBRARY**

**Office of
Transportation
System
Management**

August 2015



To request this document in an alternative format call [651-366-4718](tel:651-366-4718) or [1-800-657-3774](tel:1-800-657-3774) (Greater Minnesota) or email your request to ADArequest.dot@state.mn.us. Please request at least one week in advance.

Minnesota Department of Transportation Research Report Guidelines

Prepared by:

**Center for Transportation Studies
University of Minnesota**

August 2015

Published by

Minnesota Department of Transportation
Research Services & Library
395 John Ireland Boulevard
St. Paul, MN 55155-1800

NOTE:

Please check the following website for updates of this document and the requirements for publishing research reports:

MnDOT Research Services website: <http://mndot.gov/research>

Research Report Guidelines:

<http://mndot.gov/research/documents/ReportGuidelines2015.pdf>

Research Report Template (MS Word):

<http://mndot.gov/research/documents/ReportTemplate.docx>

Report Template Tips and Tricks (Video):

<https://www.youtube.com/watch?v=X12TZdkvXD8&feature=youtu.be>

Table of Contents

Chapter 1. Understanding the Process	1
1.1 BACKGROUND	1
1.2 REPORT REVIEW PROCESS	1
1.3 DISTRIBUTION	2
1.4 RESPONSIBILITIES	2
Chapter 2. Formatting the Report	4
2.1 REPORT FORMAT	4
2.1.1 <i>General</i>	4
2.1.2 <i>Font</i>	4
2.1.3 <i>Report Pages</i>	5
2.1.4 <i>Abbreviations</i>	5
2.2 REPORT CONTENTS	5
2.2.1 <i>Report Cover</i>	6
2.2.2 <i>Alternative Format Note</i>	6
2.2.3 <i>Technical Report Documentation Page</i>	6
2.2.4 <i>Title Page</i>	6
2.2.5 <i>Acknowledgments</i>	7
2.2.6 <i>Table of Contents</i>	7
2.2.7 <i>List of Tables and List of Figures</i>	8
2.2.8 <i>Executive Summary</i>	8
2.2.9 <i>Introduction</i>	8
2.2.10 <i>Report Body</i>	9
2.2.11 <i>Conclusion and Recommendations</i>	9
2.2.12 <i>References</i>	10
2.2.13 <i>Appendices</i>	10
2.2.14 <i>Graphics</i>	10
2.3 UNITS OF MEASURE	11
Chapter 3. Preparing the Electronic File	12
3.1 ELECTRONIC PUBLISHING REQUIREMENTS	12
3.1.1 <i>Software</i>	12
3.1.2 <i>Graphics</i>	12
3.1.3 <i>Accessibility</i>	12
3.1.4 <i>Maps and Special Graphics</i>	13
3.1.5 <i>Files</i>	13
3.1.6 <i>Other Documents</i>	13
3.2 DELIVERABLE REQUIREMENTS	13
Chapter 4. Frequently Asked Questions	14
Appendix A: Instructions and Example to Complete Technical Report Documentation Page	
Appendix B: Example Title Page	
Appendix C: Examples of Acknowledgments	
Appendix D: Example of Table of Contents	
Appendix E: Rules for Writing Metric Symbols and Names	
Appendix F: Section 508 Compliance: Making an Accessible Document	
Appendix G: Checklist for Submission of Reports	
Appendix H: Federal Highway Administration Memo	

Acknowledgments

This guide originally drew from the following sources:

1. Upper Great Plains Transportation Institute. *Research Report Guidelines*. 2007.
2. Arizona Transportation Research Center. *Guidelines for Preparing ATRC Research Reports*. 2003.
3. Utah Department of Transportation–Research Division. *Guidelines for Preparing Utah Department of Transportation Research Reports*. 2007.
4. Washington State Department of Transportation. *Research Report Guidelines*. 2007.

Chapter 1. Understanding the Process

1.1 Background

MnDOT has the following expectations regarding the final reporting process:

- The Principal Investigator (PI) will use [MnDOT's report template](#) and follow the 2015 MnDOT Research Report Guidelines in preparing the final report.
- While initial report drafts may be submitted as a PDF, the final draft must be submitted in a current version of Microsoft Word (.docx).
- The PI will ensure that all content is original and/or reprinted with appropriate permissions.
- The PI will perform a thorough spelling and grammar check of the final draft. When the report goes through an editorial review, only the abstract, executive summary, first chapter, and conclusion receive a thorough edit.
- The PI will honor the conditions of their contract by submitting the final report on time. The report must be submitted by the scheduled end date for the final report task, which is two months before contract expiration date.
- The publication process can take up to four full months, so the PI will plan accordingly when submitting the initial draft for review.
- If the PI is pursuing a patent related to the project, please check with MnDOT about the process and timing for publicizing the information.

1.2 Report Review Process

Research reports go through a technical and editorial review process before the final submittal of the report. Here is a quick look at the report review process.

- The PI works with the project's Technical Advisory Panel (TAP). The panel consists of the PI, Technical Liaison (TL), Project Coordinator (PC), and other experts who may contribute to the project and provide input during the research process and the writing of the report.
- When a draft research report is ready, researchers should submit a Microsoft Word and/or PDF file of the draft report to the research reports Program Coordinator at the Center for Transportation Studies (CTS) at the University of Minnesota. Use the e-mail address ctsrept@umn.edu and copy the project's PC.
- The CTS Program Coordinator distributes copies of the report to the TL for technical review. The TL distributes it to the TAP members. The TAP members return their technical comments to the TL, who then sends them to the CTS Program Coordinator. The CTS Program Coordinator sends them to the PI for incorporation.
- Once technical comments have been incorporated, the PI sends the draft, in Microsoft Word, back to the CTS Program Coordinator so she/he can send it out for editorial

review. If the need is immediate, the CTS Program Coordinator will have both the editorial and technical reviews done simultaneously.

(Reports must follow the editorial guidelines that are outlined in Chapter 2, *Formatting the Report*. The guidelines help ensure quality and consistency in the presentation of research results. It is highly recommended that all researchers review this chapter prior to working on a draft report. Time can be saved by following these guidelines from the beginning of the process.)

- The PI receives editorial comments from the CTS Program Coordinator and incorporates them into the report. At this time, the PI also works with CTS to draft alternative text for the report's figures and images. The TL and the CTS Program Coordinator are available to resolve questions or concerns.
- The PI submits to CTS, in separate files, the report, the technical report documentation page, and the title page in Microsoft Word.
- A last review of the final deliverable will take place. If necessary, the PI may be asked to make minor corrections and resubmit deliverables.
- The CTS Program Coordinator submits the final PDF of the entire report to MnDOT.

1.3 Distribution

Promoting the availability of research results is an important component of advancing implementation and innovation.

MnDOT will send e-mails announcing newly-published research reports to transportation practitioners on its Report Dissemination Categories list. The project's TL determines who receives the announcement. PIs may submit additional e-mail addresses.

In addition, MnDOT will continue to highlight research results and the availability of research reports in its publications and communications.

1.4 Responsibilities

Electronic publishing involves several key steps, with researchers and MnDOT sharing responsibility for the tasks involved in publishing a research report.

The following summary describes who is responsible for the key tasks.

Researchers (PIs) are responsible for the following tasks:

- Producing the draft research report.
- Submitting all deliverables as outlined in the deliverable section.
- Submitting e-mail addresses of those they would like to receive announcements of report availability.
- Addressing all technical comments. In cases of disagreement regarding technical or editorial content, the PC will initiate a resolution process.

- Incorporating editorial comments and ensuring grammar and spelling are correct.
- Adhering to these guidelines. Exceptions to the guidelines are allowed if they add to the reader's understanding of the content. These guidelines are specific to MnDOT reports and may differ from requirements of other publishing organizations.
- Writing descriptions of graphics to meet Americans with Disabilities Act (ADA) requirements.

CTS is responsible for the following tasks:

- Working with the TL to facilitate the addressing of technical comments.
- Providing editorial review, which consists of:
 - checking for compliance with RS&L's Publishing Guidelines, which are primarily about formatting and consistency;
 - copyediting the abstract, Executive Summary, and the Conclusions chapter; and
 - writing a short description for the website.
- Reviewing draft and final reports and associated metadata.
- Generating report covers and finalizing the tech doc and title pages.
- Producing a PDF of the final report.
- Formatting the final report so it is ADA-compliant.
- Sending the final PDF and supporting files to MnDOT for publication.

MnDOT is responsible for the following tasks:

- Posting PDFs to the website.
- Sending e-mail announcements.

Chapter 2. Formatting the Report

These guidelines apply to research reports that are produced for the Minnesota Department of Transportation (MnDOT). Researchers who prepare reports are responsible for following these guidelines, which help ensure quality and consistency in the presentation of research results.

2.1 Report Format

Reports must be formatted according to these guidelines using [our report template in Word format](#). Reports that are not formatted according to the guidelines will be returned to the author, who will be responsible for revising the report.

2.1.1 General

- Follow the *Chicago Manual of Style* for guidelines related to punctuation.
- Another information source is *Guidelines for Preparing Federal Highway Administration Publications* (Chapter 5 of FHWA's *Publications and Printing Handbook*), found here: <http://www.fhwa.dot.gov/legregs/directives/orders/h17104.htm>.
- Your report will go through an editing process at CTS. The editor will primarily check for compliance with these formatting guidelines. It will be the author's role to make corrections in response to the edit. Please note that the editor will not check for grammar and spelling except in the executive summary and abstract. Frequently, grammar issues that are flagged in the executive summary are also prevalent throughout the report. It is the author's role to check the remainder of the report for these issues as well as for errors in spelling, grammar, mathematical equations, etc.
- Electronic research reports must be accessible to people with disabilities under Section 508 of the Rehabilitation Act of 1973, as amended, and required by Minnesota State law as of 2009. See section 3.1.3 Accessibility for details.
- It is the author's role to obtain permission to use copyrighted material. Permission must be obtained to use any table, photo, artwork, screenshots of online maps, or significant excerpts of text. The author will be liable for any violation of copyright laws.
- It is acceptable to put references in footnotes. A footnote can also be used as a supplementary comment that does not warrant its own appendix. Only use an asterisk if a numeral could lead to confusion (e.g., being mistaken for an exponent).
- Be consistent in the use of capitalization, hyphens, titles, specialized terms, etc., with the exception of material that is directly quoted or imported appendix content.

2.1.2 Font

- Use the typeface Times, or a variation of Times, as the report font. MnDOT requires that you use 12-point font.

2.1.3 Report Pages

- Use one-inch margins on all sides.
- Single-space the report body.
- Assign style headings to your report sections and figures in order to create an automatic Table of Contents, List of Figures, and List of Tables.
- Align your text to the left. Justification can create irregular spacing when saved as a PDF.
- Begin each chapter on its own page; include the chapter's title at the top of the page.
- Use Arabic numerals for page numbering in the report's body. Start page numbering with the introduction (Chapter 1). This page numbering style should end with the references.
- Leave the technical report documentation page, title page, acknowledgments, table of contents, list of tables, list of figures, and executive summary unnumbered. An exception can be made for the executive summary if you wish to use lowercase Roman numerals to distinguish it from the rest of the report.
- Center page numbers at the bottom of the page within the one-inch margin.
- Do not include author name, decorative elements, date, logos, or other information on the top or bottom of the page.
- Do not include any blank pages in the report.
- Avoid placing the last line of a paragraph by itself on a following page, particularly when it would fall on an otherwise blank page. Likewise, avoid positioning the first line of a paragraph alone on a preceding page.

2.1.4 Abbreviations

- Define abbreviations, acronyms, and symbols the first time they appear in the Abstract, the Appendix, the executive summary, and the report text, and then use the abbreviation in additional uses; for example, the Federal Highway Administration (FHWA) or the Minnesota Department of Transportation (MnDOT).

2.2 Report Contents

Organization of the report may vary depending on its subject, length, and complexity. However, in most situations reports should contain the following elements in the order shown below:

- Report cover (furnished by CTS).
- Alternative format note (furnished by CTS; see section 2.2.2).
- Technical report documentation page.
- Title page.
- Acknowledgments (optional).
- Table of contents (not required for reports with fewer than 10 pages).
- List of tables (not required for reports with fewer than 10 pages).
- List of figures (not required for reports with fewer than 10 pages).
- Executive summary (3-page maximum).
- Report body.
 - Chapter 1: introduction.
 - Subsequent chapters.

- Final chapter: recommendations and/or conclusions.
- References.
- Appendices (optional).

Direction on each of the above elements is provided below. Please note documents that should be sent as separate files.

2.2.1 Report Cover

CTS furnishes this item.

2.2.2 Alternative Format Note

CTS furnishes this item. This note serves as the second page of the finished report file and instructs readers how to request the report in an alternative format.

2.2.3 Technical Report Documentation Page

Submit the Technical Report Documentation (TRD) Page as a separate Microsoft Word file. Information services and libraries use information on this page for their databases, which transportation practitioners and others access to find information.

Either fill in the following elements of a blank technical report documentation page or provide the following information:

- Title and subtitle.
- Report date.
- Author(s), name, and address of organization(s) that conducts the research.
- Contract or grant number.
- Sponsoring agencies' names and addresses.
- Type of report (final, interim).
- Abstract (maximum 250-word summary of the report's most significant information). Please note that your abstract should be revised at the end of the project to incorporate results and findings.
- Document analysis/descriptors (also known as keywords). These are terms that would help the report be found in a Web or database search. Once you provide them, CTS library staff will adjust them per the Transportation Research Thesaurus to adhere to standard vocabulary.

An example and instructions for completing the TRD page are shown in Appendix A. If a report consists of separate volumes, a TRD page is needed for each volume.

2.2.4 Title Page

Submit the title page as a separate Microsoft Word file. Provide the following information for the title page, vertically and in order:

- 1) Title of the report in **bold**. Note that the title is limited to 250 characters including spaces.
- 2) Type of report (final report, interim report, summary report, other) in **bold**.
- 3) Prepared by: (can be *italicized*, but not necessary).
- 4) Author's name(s) (only separate names if authors are from different organizations).
- 5) Organization(s) represented by the author(s).
- 6) Date (month, year) of publication (same size font as #2) in **bold**.
- 7) Published by (can be *italicized*, but not necessary):
Minnesota Department of Transportation, Research Services & Library, 395 John Ireland Boulevard, Mail Stop 330, St. Paul, MN 55155 (five lines total).
- 8) Any applicable disclaimer(s).

Use this disclaimer:

This report represents the results of research conducted by the authors and does not necessarily represent the views or policies of the Minnesota Department of Transportation or (author's organization). This report does not contain a standard or specified technique.

The authors, the Minnesota Department of Transportation, and (author's organization) do not endorse products or manufacturers. Any trade or manufacturers' names that may appear herein do so solely because they are considered essential to this report.

See Appendix B for title page layout.

2.2.5 Acknowledgments

The inclusion of acknowledgments is optional. The acknowledgments page recognizes the individuals and organizations that funded or significantly contributed to the research project. Keep acknowledgments to a maximum of one page. The acknowledgments page comes before the table of contents and the executive summary. See Appendix C for examples.

2.2.6 Table of Contents

General rules for the table of contents are as follows and are illustrated by example in Appendix D:

- Reports consisting of 10 or fewer pages do not require a table of contents.
- Titles for each chapter listing should read exactly as in the report body.
- Tables of contents should reflect the hierarchy of chapters and sections. Hierarchy can be reflected by indenting sections. Table of contents items should be identical to text headings. Appendix titles (but not page numbers) should be included in the table of contents.
- If chapters are written separately by different authors, their names should not appear in the table of contents, but should be noted under the appropriate chapter heading in the report body.
- The table of contents should not include a listing of any pages that are not numbered.
- Table of contents pages are not numbered.

2.2.7 *List of Tables and List of Figures*

If the report includes tables and figures, a list of tables and list of figures are required, following the table of contents. The list of tables and/or list of figures sequentially list each table/figure number and title, as well as the page number on which it appears. You may add the list of figures and/or list of tables on the same page as the table of contents, if space allows without going to a new page. Otherwise, begin the list of tables and/or list of figures on a new page. If the list of tables and list of figures can fit together on one page, it is permissible to have them do so; otherwise start the second list on a new page.

2.2.8 *Executive Summary*

An executive summary is required for all MnDOT reports. The executive summary provides a concise synopsis of the research issue, the main findings or results, conclusions, the significance of the research, recommendations and next steps and potential benefits. Limit the length of the executive summary to no more than three pages. The executive summary should be able to stand alone as a brief summary of the research project. Because it is written for a general audience, technical details should be limited.

Readers often turn first to the executive summary for an overview of the project. Because of its importance, you may be asked to rewrite or rework the executive summary to better reflect the research project findings and conclusions.

In cases of a complex research project with multiple parts, researchers may choose to prepare a summary document, usually 10 to 20 pages. This summary document may be produced as its own report, with the approval of CTS and MnDOT. This does not replace the need for an executive summary in the main report.

In a few cases, because of patent rights or length and complexity of the material, only an executive summary will be published. In this instance, the summary will be longer and contain more detail. The decision to publish only an executive summary will be made jointly by the TAP, MnDOT's Research Services & Library (RS&L), the PI, and other relevant MnDOT offices. Note that a decision to publish only an executive summary does not eliminate the author's contractual requirement for submittal of a full report to MnDOT in publishable format. In these cases, the cover and box #13 of TRD will state "Summary Report."

2.2.9 *Introduction*

The introduction serves as the report's first chapter. It addresses the following:

- The purpose of the report (research objective).
- A description of the research problem and its historical background.
- Research goals and the basic approach to the project.
- The scope and limits of the research. This describes what is and is not covered in the report.
- A brief overview of the general organization of the report.

Unlike the executive summary, it does not include research results, conclusions, recommendations, or implementation.

While both the introduction and the executive summary discuss the research issue, the introduction describes the research issue within the context of preparing the reader for what is to follow in the report. It emphasizes the historical background of the research problem, what the research attempts to discover, and the basic scheme of the procedure or methods used. The introduction also briefly describes the general organization of the report so that the reader knows what to expect.

The introduction will vary depending on the objectives stated in the work plan. In some cases the introduction may mention previous research done in the report's topic field including the chief contributions of others.

2.2.10 Report Body

The report body's organization and content vary depending on the nature of the research project, but usually follow the direction that the work plan outlines. Information to be included and organization of the report will be determined at TAP meetings and will usually follow the direction indicated in the work plan. Most reports include the background of the research problem; the research approach and methods; an analysis of research results; conclusions; and recommendations for implementation and further testing. Segment the report into chapters numbered sequentially beginning with Arabic numeral 1. Subheadings should be distinguished by numbered subsets (1.1, 1.2, etc.) and/or through font changes and indentations as used in this document. Start each chapter on its own page, with the introduction as the report's first chapter.

Design headings to distinguish chapters, sections, subsections, etc., from each other as well as from body text and table/figure labels. Consistency is the most important aspect of heading format. Make chapter headings stand out the most (e.g., larger font, centered, bold). Make other levels of headings display hierarchy through diminishing size and/or distinction. For example:

- Level 1 chapter titles (including "Acknowledgments," "Table of Contents," "References," etc.): **Times New Roman, 14 point, bold, centered [Heading 1 style]**
- Level 2 (i.e., 1.1): **Times New Roman; 12 point; bold [Heading 2 style]**
- Level 3 (i.e., 1.1.1): Times New Roman; 12 point; not bold; *italics* or underline [Heading 3 style]
- Table/Figure Labels: **Times New Roman; 11 or 12 point; bold; no italics or underlining**
- Body text: Times New Roman, 11 or 12 point (12 recommended); not bold; no italics or underlining [Normal]

2.2.11 Conclusion and Recommendations

The final chapter within the body should generally contain recommendations and/or conclusions, as well as next steps and potential benefits.

2.2.12 References

References may be cited through the use of footnotes in the report's text. Alternately, place a reference number to a citation in parentheses or brackets at the end of a sentence in the text, like this [1] or (1) or use the (Author, year) format. Create a reference section at the end of the report that lists the full citations, using a commonly-used reference style such as the *Chicago Manual of Style* (Author-date system) or the APA (American Psychological Association) format.

List complete references, including names of authors or editors; article title; chapter, book, journal, or report title; publisher or issuing agency; location of publisher; year of publication; volume and issue or report number; and page numbers.

In the main reference list, include only references cited in the text, numbered in the order in which they are first cited. If you wish to list other references that are not cited in the report, use the same format, but without numbering each. These should be listed under a separate heading, "Additional References." Place this immediately after "References" but do not list it separately in the table of contents.

Attribute unpublished material, telephone conversations, and other personal communication in the reference section. Your report may be returned to you if key information is missing.

For web sources, include the complete URL and the date accessed. Because of the impermanence of web pages, be sure to include enough detail so that a user can find the source even if the URL changes over time.

Sample reference for a standard:

ASTM International (2003). ASTM Standard C33, "Specification for Concrete Aggregates." DOI: 10.1520/C0033-03, www.astm.org.

2.2.13 Appendices

Appendices, if used, are placed at the end of the research report, and consist of materials that support the report but are not critical in understanding project results. Appendices follow the report body.

- Label appendices by letter (Appendix A, Appendix B, Appendix C, etc.)
- Include an unnumbered title page for each appendix. The title page should include the appendix letter (e.g., Appendix A) and the appendix title.
- Begin numbering each appendix after the title page. Use the following page numbering system for each appendix: letter of appendix followed by a dash and page number (i.e., A-1, A-2, A-3, etc., for Appendix A, B-1, B-2, B-3, etc., for Appendix B, etc.)
- Where possible, reference appendices in the text.

2.2.14 Graphics

Because some readers may print reports in black-and-white, use colors that will allow for clear and legible graphics to be printed in black-and-white. MnDOT acknowledges that this is not always possible. Clarity can be created through the use of patterns such as lines, cross-hatching, and dots.

- Provide graphics that are extractable in their original form. If they are not extractable from a Microsoft Word file, provide them in separate (e.g., .jpg) files.
- Place graphics immediately after they are referenced in the text, at the end of the applicable chapter, or in the appendix section.
- Embed graphics in the page on which you intend them to appear in the report; do not use object links to other files.
- Make all efforts to avoid placing graphics so the report must be turned sideways for viewing. If sideways placement is unavoidable, place it so that the top of the graphic is on the left side of the page.
- Check to make sure that your colors convert properly after saving the file as a PDF document.
- Include brief captions to describe each graphic.
- To enable accessibility, include text descriptions for all images in the document, including photographs, graphs, equations, charts, illustrations, and maps.
- Keep the type size to 10 points or larger to ensure legibility.
- Number tables and figures separately and consecutively as they appear, and use a two-number format to indicate the chapter number (for example, Figure 1.1 is the first figure in Chapter One). Use a period (i.e., 1.1) rather than a hyphen (i.e., 1-1) in your numbering scheme, because Adobe Reader reads the latter as "one through one."
- Refer to each table and figure in the text.
- Place table numbers and titles above the graphic. Place figure numbers and titles below the graphic.
- Illustrations do not always look the same in printed form as they do on a computer screen. Use the highest possible resolution.

2.3 Units of Measure

The United States Congress passed legislation in 1998 making the use of metric units of measurement by states optional for the highway industry. On January 26, 1999, the decision was made that MnDOT would revert to the English system of units. However, following the lead of the Federal Highway Administration's (FHWA) November 25, 2008 memo (see Appendix L), MnDOT reports should utilize English units of measurement, followed by metric units in parentheses. For example, 19 inches would be written as "19 in (482.6 mm)."

Charts and graphs should be produced only with English units.

Chapter 3. Preparing the Electronic File

The requirements in this chapter are critical to facilitating the electronic publishing of research reports.

3.1 Electronic Publishing Requirements

Follow the requirements in this chapter when submitting a research report for publishing. All research reports will be published as PDF files. Our goal is to receive all draft and final report submittals in Word or a Word-compatible format and PDF. You may use whatever software you prefer to generate the report, as long as it can produce PDF files for the draft and final submittals.

Remember also to follow the editorial guidelines in Chapter 2: *Formatting the Report* when creating the report.

3.1.1 Software

- It is required to use Microsoft Word (compatible with Word 2010) to create the report. PIs should use MnDOT's [Microsoft Word report template](#).
- While the draft report can be submitted as a PDF, the final draft must be submitted to CTS as an editable Word document.

3.1.2 Graphics

- Embed graphics into the document.
- Do not use object links to other files. (An object link is a highlighted link to a separate file, often a file that contains a graphic. Even if the separate file is provided, the file may not be placed into the PDF during PDF conversion).
- Figures and other images should be referenced and described within the text of the report.

3.1.3 Accessibility

Research projects funded by federal agencies, MnDOT and other state agencies, and the University of Minnesota are required to make electronic products accessible to people with disabilities under Section 508 of the Rehabilitation Act of 1973, as amended, and required by Minnesota State law as of 2009. See <http://www.section508.gov> for more information. The federal General Services Administration also has guidance and checklists for creating accessible documents. See <http://www.gsa.gov/portal/content/103565>.

In order to make electronic research reports accessible to those with low vision, please include text descriptions for all images in the document, including photographs, graphs, equations, charts, illustrations, maps, and static tables (i.e., tables where one cannot scroll across rows).

CTS will address other accessibility elements, including the use of heading tags to differentiate document sections and verifying table formatting.

3.1.4 Maps and Special Graphics

Some graphics cannot be easily placed within the body of a Word report.

- If the graphic is small, generate a TIF file at a resolution of 200 dots per inch and import the TIF file into your document.
If the graphic is large or created in specialized software, generate a PDF of the graphic from the software. Please note the PDF of the graphic will take at least one page, even if it appears less than one page).

3.1.5 Files

- Include all parts of the report, except the title page and TRD page, as one document.
- The TRD and title pages should be submitted in separate Word files.

3.1.6 Other Documents

- Scan those documents that are not electronically available and provide them to CTS to scan into the PDF report file.
- Scan graphics at a resolution of 200 dots (pixels) per inch.

3.2 Deliverable Requirements

The PI is responsible for providing the deliverables listed below, after addressing all technical and editorial comments. Clearly label all files. Deliverables must follow the standards set forth in Chapter 2: Formatting the Report.

1. Title page file (Microsoft Word).
2. TRD page file (Microsoft Word).
3. The complete report in Word; Microsoft Word 2010 or newer is preferred. Note that the complete report should also include the title page and executive summary.
4. E-mail addresses of those whom you would like to receive an e-mail announcement of the report's publication.
5. Any graphics that could be used in other communications in separate files (save as .jpg or .gif).

Chapter 4. Frequently Asked Questions

Q: Why does it take 4 months to publish a research report?

A: The publication process involves the PI, TL/TAP, the Center for Transportation Studies, MnDOT Research Services, and an outside editor. Once a draft is submitted, the report must undergo both a technical and editorial review. Next, the PI then incorporates the reviewers' suggestions and provides a final draft to CTS. Finally, CTS addresses formatting and accessibility concerns before submitting to MnDOT for approval. Because multiple entities are collaborating on multiple steps, it can take up to 4 months to finish the process.

Q: What if I need to use special software?

A: Often researchers use specialized software to generate maps, figures, or mathematical formulas. To incorporate those maps, figures, or mathematical formulas into a document or PDF, generate a TIF file from the specialized software and import the TIF file into the document in the location where you want the graphic to appear. If this does not work, generate a PDF of the graphic from the software for CTS to insert into the final PDF report file. Please note the PDF of the graphic will take at least one page, even if it appears less than one page. If it is not possible to generate a PDF of the graphic, scan the graphic and provide the scan to CTS.

Q: What if I have documents that are not available in electronic form?

A: If you have documents as part of your report that are not electronically available, scan those documents and provide them to CTS.

Q: Who prepares the cover?

A: Do not prepare a cover. CTS will prepare the report cover with the correct report number and incorporate it into the final PDF.

Q: Why is it important for me to provide keyword descriptors about the project?

A: Libraries and search engines use those keyword descriptors to categorize reports. Accurate keyword descriptors help users locate your report on the Web.

Q: What is covered in the editorial review?

A: The primary purpose of the editorial review is to assure conformity with the research report guidelines. The editor checks heading format consistency, formatting of references, page numbering, table of contents formatting, and display of graphics. The editor checks the abstract, executive summary, introduction, and conclusion for errors in spelling and grammar, but does not check the body of the report for such errors.

Q: Why do I need to create descriptive text for each of my graphics?

A: Research projects funded by the federal government; MnDOT and other state agencies; and the University of Minnesota are required to make electronic products accessible to people with disabilities under Section 508 of the Rehabilitation Act of 1973, as amended, and required by Minnesota State law as of 2009. This text is able to be read audibly by Adobe Acrobat, providing a description to visually-impaired users. Report text is also read by Adobe Acrobat.

Q: How do I know whether I am complying with copyright laws when using graphics?

A: It is the PI's responsibility to determine whether they have complied with regulations. Online map sources have rules that must be followed before using their images. Journals and online sources have varying rules on whether permission is needed to use graphics.

Q: Can I use software other than Microsoft Word?

A: No. MnDOT requires Microsoft Word format and the use of our [Report Template](#).

Q: Who will edit the report for grammar and spelling?

A: When the report goes through our editorial review, only the abstract, executive summary, first chapter, and conclusion receive a thorough edit. Therefore, the PI should perform a thorough spelling and grammar check of the final draft.

Appendix A

Instructions and Example to Complete Technical Report Documentation Page

Instructions to Complete the Technical Report Documentation (TRD) Page

To submit the Technical Report Documentation (TRD) Page, the author can submit the actual form (see page A-3). Alternatively, CTS can complete the form using the information provided by the author on a separate Word document. In either case, the author should complete the following items.

4, 5, 7, 9, 13, 16, and 17

All other item numbers should be left blank to be completed by CTS where necessary.

In the second case, the author needs to provide CTS with the same information in a separate Word document.

Instructions for these items are as follows:

Item 4 – Title and Subtitle: The title should be the same as that of the report. When a report is prepared in more than one volume, this block should show the main title plus the volume number and the subtitle for the volume being reported.

Item 5 – Report Date: Indicate the month and year of the date shown on the report title page.

Item 7 – Author(s): List name(s) as listed in the same order as on the title page.

Item 9 – Performing Organization Name and Address: Provide the name and address, including zip code, of the organization responsible for the research and preparation of the report. This should be the same as the organization name appearing on the title page.

Item 13 – Type of Report and Period Covered: State “interim report,” “draft report,” “final report,” etc. For interim reports, indicate the time period covered (e.g., “Summary Report 1999-2001”).

Item 16 – Abstract: This is a brief (250 words or less) factual summary of the most significant information contained in the report. An abstract should state the purpose, methods, results, and conclusions of the work effort. For purpose, include a statement of goals (objectives, aims). For methods, include experimental techniques or the means by which the results were obtained. Results (findings) are the most important part of the abstract and selection should be based on one, or several, of the following: new and verified events, findings of permanent value, significant findings that contradict previous theories, or findings that the author knows are relevant to a practical problem. Conclusions should address the implications of the findings and how they tie in with studies in related fields. When a report consists of a number of volumes, include the title of each of the other volumes in each abstract. If the report contains a significant bibliography or literature survey, mention it also.

Reports presenting the results of computerized model development will use the following structure for the preparation abstracts:

- Technical Model description (nature of the model or simulator)
- Areas of model application
- Special model requirements
 - Areas of model application
 - Other special considerations

The editor will check the abstract for understandability and will make suggestions that will help the author aim it toward a lay-audience.

Description: A one- to three-sentence description will be written by the editor for use in MnDOT's ARTS database deliverable screen.

Item 17 – Document Analysis/Descriptors: This is a listing of the terms (keywords) that identify the major concept of the research. *It is especially important to identify keywords and phrases that may not appear in the report title or abstract, so as to more broadly encompass the entire research area. This will expand the field of possible terms for literature searches so that researchers can broadly identify all research sources related to their topic area.* Supplying keywords is particularly important for libraries that do not have the capability to search several different data fields, but must rely on keywords used as index entries for cataloging. For this reason, it is important to select specific and precise terms or short phrases that identify the principal subjects covered in the report.

Technical Report Documentation Page

1. Report No. MN/RC 2014-02 [CTS]		2.		3. Recipients Accession No.	
4. Title and Subtitle Estimating the Crash Reduction and Vehicle Dynamics Effects of Flashing LED Stop Signs			5. Report Date January 2014		
			6.		
7. Author(s) Gary A. Davis, John Hourdos, Hui Xiong			8. Performing Organization Report No.		
9. Performing Organization Name and Address University of Minnesota Humphrey Institute of Public Affairs 301 19th Ave. S. Minneapolis, MN 55455			10. Project/Task/Work Unit No.		
			11. Contract (C) or Grant (G) No. (C) 89261 (wo) 195 [CTS]		
12. Sponsoring Organization Name and Address Minnesota Department of Transportation Research Services & Library [CTS] 395 John Ireland Boulevard Mail Stop 330 St. Paul, Minnesota 55155			13. Type of Report and Period Covered Final Report		
			14. Sponsoring Agency Code		
15. Supplementary Notes http://www.lrrb.org/PDF/201402.pdf [CTS]					
16. Abstract (Limit: 250 words) <p>A flashing LED stop sign is essentially a normal octagonal stop sign with light emitted diodes (LED) on the stop sign's corners. A hierarchical Bayes observational before/after study found an estimated reduction of about 41.5% in right-angle crashes, but with 95% confidence this reduction could be anywhere between 0% and 70.8%. In a field study, portable video equipment was used to record vehicle approaches at an intersection before and after installation of flashing LED stop signs. After installing the flashing stop signs, there was no change in the relative proportion of clear stops to clear non-stops when minor approach drivers did not face opposing traffic, but the relative proportion of clear stops increased for drivers who did encounter opposing traffic. Random samples of 60 minor approach vehicles were selected before and after installation of flashing LED stop signs and speeds for these vehicles when about 500 feet from the intersection, and average deceleration rates over the final 500 feet, were estimated using trajectory-based methods. Average approach speeds tended to be highest in June, somewhat lower in July, and lower yet in September and November, with September and November having roughly equal average speeds. The average deceleration rates showed a similar pattern.</p>					
17. Document Analysis/Descriptors Stop Signs, Flashing traffic signals, Crash modification factor, Crash causes, Driver performance			18. Availability Statement No restrictions. Document available from: National Technical Information Services, Alexandria, Virginia 22312		
19. Security Class (this report) Unclassified	20. Security Class (this page) Unclassified	21. No. of Pages 52 [CTS]	22. Price		

Technical Report Documentation Page Information

Item 4: Estimating the Crash Reduction and Vehicle Dynamics Effects of Flashing LED Stop Signs

Item 5: January 2014

Item 7: Gary A. Davis, John Hourdos, Hui Xiong

Item 9: Department of Civil Engineering
University of Minnesota
500 Pillsbury Drive SE
Minneapolis, MN 55455

Item 13: Final Report

Item 16:

A flashing LED stop sign is essentially a normal octagonal stop sign with light emitted diodes (LED) on the stop sign's corners. A hierarchical Bayes observational before/after study found an estimated reduction of about 41.5% in right-angle crashes, but with 95% confidence this reduction could be anywhere between 0% and 70.8%. In a field study, portable video equipment was used to record vehicle approaches at an intersection before and after installation of flashing LED stop signs. After installing the flashing stop signs, there was no change in the relative proportion of clear stops to clear non-stops when minor approach drivers did not face opposing traffic, but the relative proportion of clear stops increased for drivers who did encounter opposing traffic. Random samples of 60 minor approach vehicles were selected before and after installation of flashing LED stop signs and speeds for these vehicles when about 500 feet from the intersection, and average deceleration rates over the final 500 feet, were estimated using trajectory-based methods. Average approach speeds tended to be highest in June, somewhat lower in July, and lower yet in September and November, with September and November having roughly equal average speeds. The average deceleration rates showed a similar pattern.

Item 17: Stop Signs
Flashing traffic signals
Crash modification factor
Crash causes
Driver performance

Appendix B

Example Title Page

Estimating the Crash Reduction and Vehicle Dynamics Effects of Flashing LED Stop Signs

Final Report

Prepared by:

Gary A. Davis

John Hourdos

Hui Xiong

Department of Civil Engineering

University of Minnesota

January 2014

Published by:

Minnesota Department of Transportation

Research Services & Library

395 John Ireland Boulevard, MS 330

St. Paul, Minnesota 55155

This report documents the results of research conducted by the authors and does not necessarily represent the views or policies of the Minnesota Department of Transportation or the University of Minnesota. This report does not contain a standard or specified technique.

The authors, the Minnesota Department of Transportation, and the University of Minnesota do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to this report.

Appendix C

Examples of Acknowledgments

Acknowledgments can be listed after the report's title page. See below for sample language.

ACKNOWLEDGMENTS

The authors express appreciation to the Office of Maintenance and the Materials and Research Laboratory of the Minnesota Department of Transportation for support of this research, and are indebted to Dr. O.S. Kwon of the 3M Company, Minnesota, for donation of hydrogel, as well as to Dean Kourtjan of the North Star Steel Co., Minnesota, for spectrographic analysis of rebar steels.

ACKNOWLEDGMENTS

The fabrication and procedures presented in this report were developed in conjunction with Shannon & Wilson, Inc., Geotechnical Consultants, St. Louis, Missouri. The authors would also very much like to thank the following individuals and organizations for their contributions to this document.

Ron Atkins – Instrumentation/Electrical Consultant

Dave Newcomb – Department of Civil Engineering, University of Minnesota

Carl Lenngren – Department of Civil Engineering, University of Minnesota

Alberta Research Council

Monica Penshorn – Physical Research Section, Minnesota Department of Transportation

Carol Isberg – MnROAD

Office of Research Administration, Minnesota Department of Transportation

ACKNOWLEDGMENTS

The financial and logistical support provided by the Local Road Research Board, the Minnesota Department of Transportation, the Center for Transportation Studies at the University of Minnesota, Wheeler Consolidated, Inc., and Sibley County for this work is gratefully acknowledged.

Acknowledgments

The author would like to acknowledge the help of several people whose work was instrumental to the completion of this study.

1. Kevin Kosobud, MnDOT assistant concrete engineer
2. MnDOT District 7B, Windom, maintenance personnel
3. Steve Oakey, MnDOT District 7, Mankato, materials engineer
4. Duane Pingeon, MnDOT District 7B maintenance superintendent

ACKNOWLEDGMENTS

We would like to extend our deepest appreciation to the following people for their generous help and support: Ronald Lawrenz, Charles Bongo, Daniel Engstrom and Erna Janssens-Verbelen with the fieldwork: Ronald Lawrenz, Daniel Engstrom, and James Almendinger during discussions and with interpretation; and Shorn Mallman and Ronald Lawrenz by making the facilities of the St. Croix Watershed Research Station available.

This project was conducted with funding provided by the St. Croix Watershed Station, Science Museum of Minnesota, the Minnesota Department of Transportation, and from the A.W. Mellon Foundation grant to Prof. Eville Gorham, Department of Ecology, Evolution and Behavior, University of Minnesota. We greatly appreciate the help by Eville Gorham in reviewing the interim status reports and the draft of the final report.

Appendix D

Example of Table of Contents

TABLE OF CONTENTS

1. INTRODUCTION.....	1
1.1 Background	1
1.2 Research Objectives.....	1
1.3 Literature Review.....	2
1.4 Summary of Weigh-In-Motion (WIM) Data	3
1.4.1 Class 9 Trucks.....	3
1.4.2 WIM Station 35	3
1.4.3 WIM Station 36	4
1.4.4 WIM Station 37	4
1.4.5 WIM Station 39	4
1.4.6 WIM Station 40	4
1.5 Report Organization.....	4
2. WIM DATA MONITORING AND MODELING	5
2.1 Gross Vehicle Weight (GVW).....	5
2.2 Mixture Models.....	5
2.3 EM Fitting Verification.....	6
2.4 Vehicle Class 9 Gross Vehicle Weight (GVW).....	8
2.5 Front Axle Weight (FXW) or Steering Axle Weight (SXW)	12
2.6 Equivalent Single Axle Load (ESAL)	13
3. SUMMARY AND CONCLUSION	14
References	15
Appendix A: WIM Sites in Minnesota	
Appendix B: Weigh-In-Motion (WIM) Data	
Appendix C: Processed Data of Selected WIM Stations	
Appendix D: Data Processing Instructions	
Appendix E: Data Processing Scripts	
Appendix F: Vehicle Classification Scheme	

LIST OF TABLES

Table 2.1	Material Properties Affected By Asphalt Grade
Table 2.2	Acceptable Criteria for LSAM (Ken DOH)
Table 2.3	Penn DOT LSAM Gradation Band

LIST OF FIGURES

Figure 2.1	Types of Large Stone Asphalt Mix
Figure 3.1	Aggregate Gradations
Figure 4.1	Results of Marshall Mix Design

Appendix E

Rules for Writing Metric Symbols and Names

RULES FOR WRITING METRIC SYMBOLS AND NAMES

- Print unit symbols in upright type and in lower case except for liter (L) or unless the unit name is derived from a proper name.
- Print unit names in lower case, even those derived from a proper name.
- Print decimal prefixes in lower case for magnitudes 10^3 and lower (that is, k, m, μ , and n) and print the prefixes in upper case for magnitudes 10^6 and higher (that is, M and G).
- Leave a space between a numeral and a symbol (write 45 kg or 37 ° C, not 45kg or 37°C or 37° C).
- Do not use a degree mark (°) with Kelvin temperature (write K, not °K).
- Do not leave a space between a unit symbol and its decimal prefix (write kg, not k g).
- Do not use the plural of unit symbols (write 45 kg, not 45 kgs), but do use the plural of written unit names (several kilograms).
- For technical writing, use symbols in conjunction with numerals (the area is 10 m²); write out unit names if numerals are not used (carpet is measured in square meters). Numerals may be combined with written unit names in nontechnical writing (10 meters).
- Indicate the product of two or more units in symbolic form by using a dot positioned above the line (kg·m·s²).
- 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 (write “12 g”, not “12 g.”) except when it occurs at the end of a sentence.

RULES FOR WRITING NUMBERS

- Always use decimals, not fractions (write 0.75 g, not $\frac{3}{4}$ g).
- Use a zero before the decimal marker for values less than one (write 0.45 g, not .45 g).
- Use spaces instead of commas to separate blocks of three digits for any number over four digits (write 45 138 kg or 0.004 46 kg or 4371 kg). This is because in the United States, the decimal marker is a period; in other countries a comma usually is used. Note that this does not apply to the expression of amounts of money.

CONVERSION AND ROUNDING

- When converting numbers from inch-pounds to metric, round the metric value to the same number of digits as there were in the inch-pound number (11 miles at 1.609 km/mi equals 17.699 km, which rounds to 18 km).
- Convert mixed inch-pound units (feet and inches, pounds and ounces) to the smaller inch-pound unit before converting to metric rounding (10 feet, 3 inches, = 123 inches; 123 inches x 25.4 mm = 3124.2 mm; round to 3124 mm).
- In a “soft” conversion, an inch-pound measurement is mathematically converted to its exact (or nearly exact) metric equivalent. With “hard” conversion, a new rounded, rationalized metric number is created that is convenient to work with and remember.

VISUALIZING METRIC

A few basic comparisons are worth remembering to help visualize metric:

- -One millimeter is about 1/25 inch or slightly less than the thickness of a dime.
-One meter is the length of a yard plus about 3-1/3 inches.
-One gram is about the mass (weight) of a large paper clip.
-One kilogram is about the mass (weight) of a softbound model building code book (2.2 pounds).
-One liter is about the volume of a 4 inch cube (100 mm x 100 mm x 100 mm). One liter of water has a mass of 1 kilogram.
- -One inch is 1/64 inch longer than 25 mm (1 inch = 25.4 mm; 25 mm = 63/64 inch). Four inches are about 1/16 longer than 100 mm (4 inches = 101.6 mm; 100 mm = 3-15/16 inches).
-One foot is about 3/16 inch longer than 300 mm (12 inches = 304.8 mm; 300 mm = 11-13/16 inches).
-Four feet are about 3/4 inch longer than 1200 mm (4 feet = 1219.2 mm; 1200 mm = 3 feet, 11 1/4 inches).
- The metric equivalent of a typical 2-foot by 4-foot ceiling grid is 600 x 1200 mm, so metric ceiling tiles and lighting fixtures are about 3/8 inch smaller in one dimension and 3/4 inch smaller in the other.
- Similarly, the metric equivalent of a 4 by 8 sheet of plywood or drywall is 1200 x 2400 mm, so metric sheets are about 3/4 inch narrower and 1 1/2 inches shorter.
- “Rounding down” from multiples of 4 inches to multiples of 100 mm makes dimensions exactly 1.6 percent smaller and areas about 3.2 percent smaller. About 3/16 inch is lost in every linear foot.

The metric units in this guide are those adopted by the U.S. government (see the *Federal Register* of December 20, 1990; Federal Standard 376A, *Preferred Metric for Use by the Federal Government*; and PB 89-226922, *Metric Handbook for Federal Officials*). They are identical to the units in the following publications, which constitute the standard reference works on metric in the United States:

- ASTM E 621, *Standard Practice for Use of Metric (SI) Units in Building Design and Construction*, and
- IEEE/ASTM SI-10, *Standard for Use of the International System of Units (SI) – The Modern Metric System* (revision and redesignation of IEEE Standard 268 and ASTM E 380).

For editorial matters, also refer to:

- American National Metric Council, *Metric Editorial Guide*, and
- U.S. Metric Association, *Metric Units of Measure and Style Guide*.

Appendix F

Section 508 Compliance: Making an Accessible Document

Descriptions

Depending on who is writing the description, the figure should be described in broad terms. If the caption is sufficiently descriptive or there is analysis in the text, then the author may determine that no description beyond what is already presented is necessary.

If the figure is a graph, make sure to include parameters of the graph – what are the data lines, what is plotted on the x and y axis, what is the title, etc.

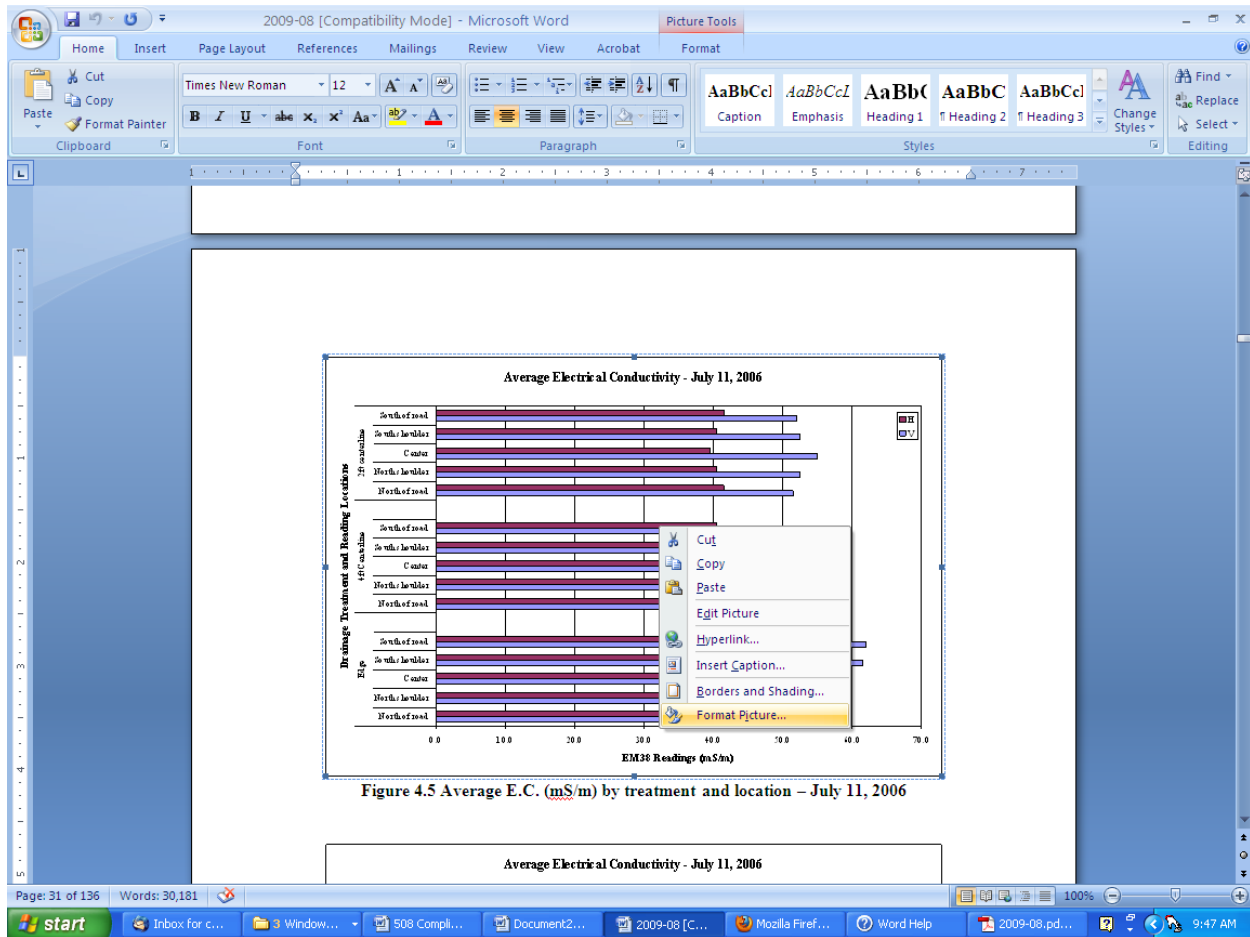
If the figure is a photograph, generally “Photograph” is an adequate description.

Equations will appear tagged as figures in the text – they will not be read well by the reader. Generally, equations can simply be described as “Equation.”

Adding Descriptions

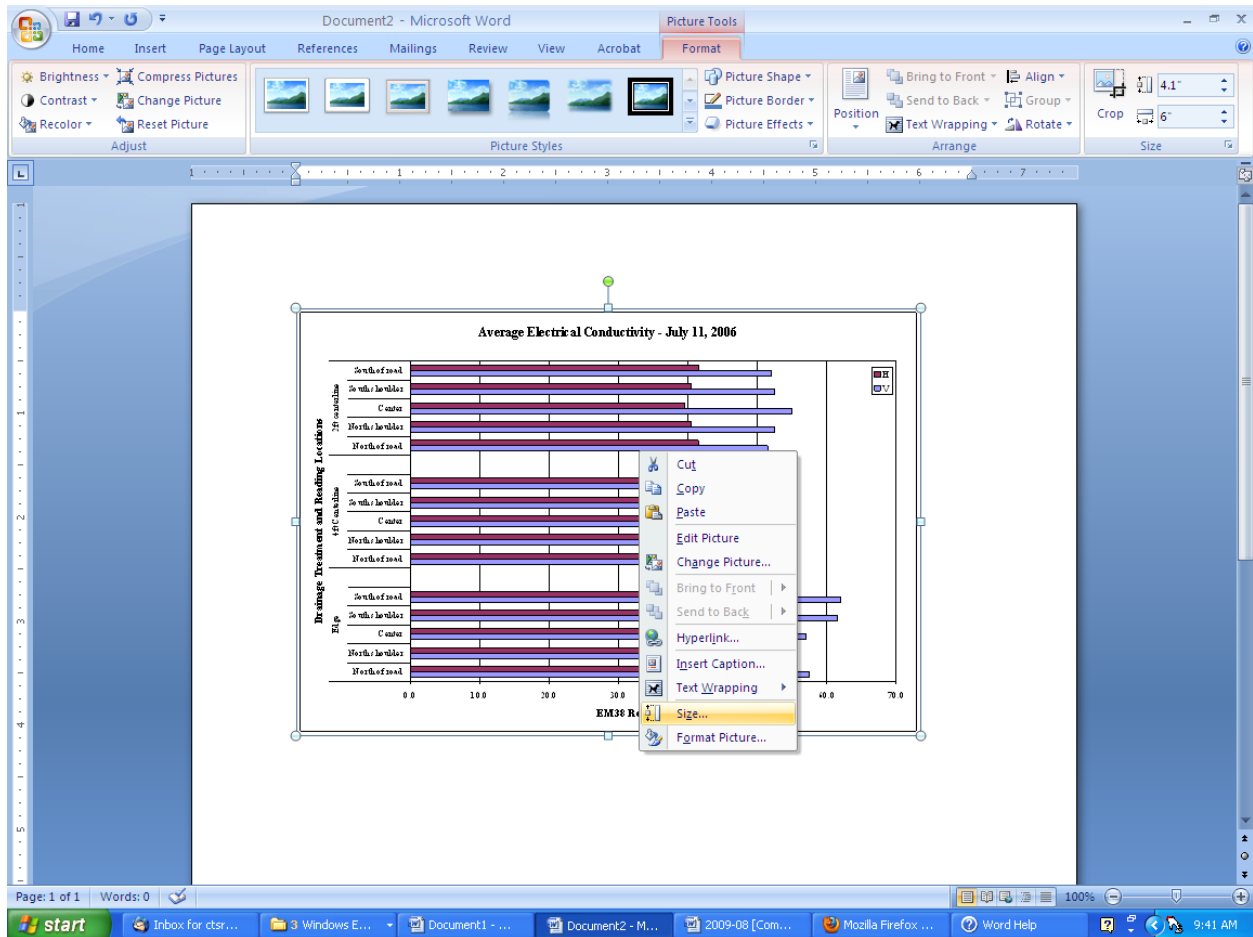
The most important thing to do to make a document accessible is to add alternative text to all figures. To add or edit alternative text:

For earlier versions of Word or for documents opened in Word 2010 that are not .docx, right click on the image and select “Format Picture...”



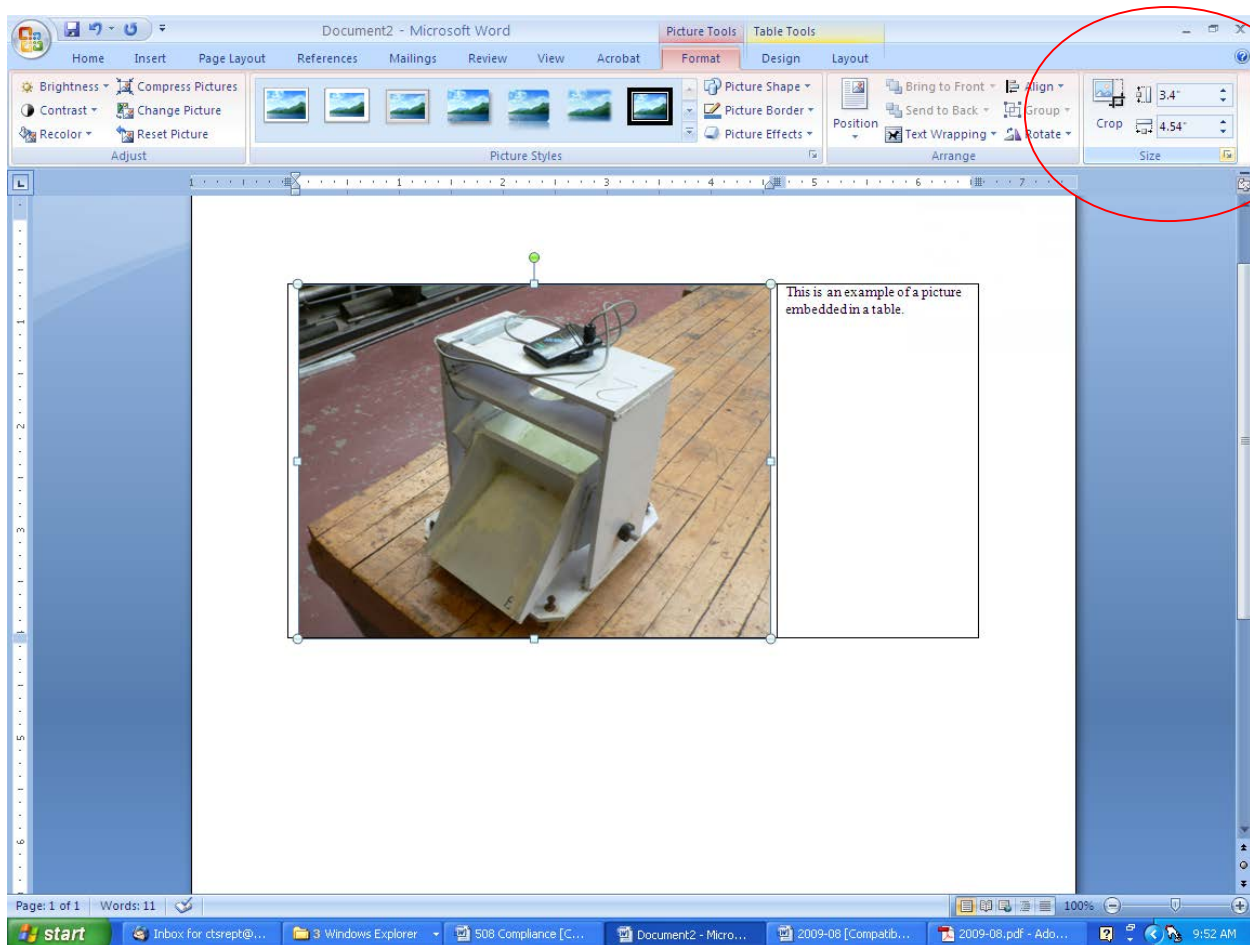
A dialog box will appear. Select the “Alt Text” tab. You can type the alternative text into the box. When you are done, click OK.

For documents created in Word 2010, right click on the picture and select “Size...”



A dialog box will open. Select the “Alt Text” tab. You can type the alternative text into the box. When you are done, click OK.

If you put a picture in a table, you cannot just right click to get the alternative text dialog box. First, highlight the picture in the table. Then, go up to the ribbon (in Word 2010) and select the “Format” tab under “Picture Tools.” Go to the far right of the screen, and select the arrow in the lower right corner of the “Size” section.



A dialog box will appear. Select the “Alt Text” tab at the top. Type in your alternative text. When you are done, click OK.

Any equations that you use will also need alternative text. Follow the steps above to add alternative text.

If you use tables that you create in Word or Excel, no alternative text is necessary. However, if you place a table in as a picture (e.g. copy and paste in a screen shot), alternative text will be necessary. Follow the same process to add alternative text.

Creating the ADA-Tagged PDF

CTS will take responsibility for converting the Word document to a PDF, ensuring the presence of alternative text, and tagging the PDF’s elements.

Appendix G

Checklist for Submission of Reports

MINNESOTA DEPARTMENT OF TRANSPORTATION RESEARCH SERVICES & LIBRARY CHECKLIST FOR SUBMISSION OF RESEARCH REPORTS

When you feel you are ready to submit your first copy of a draft research report, please use this list as a guideline to ensure that the basic elements of the report are included and are accurate before submitting the draft to the Center for Transportation Studies.

- ☐ Clearly mark the initial submission “Draft.” Remove “Draft” from the Final Submission.
- ☐ Verify correct use of MnDOT reference; it must appear as “Minnesota Department of Transportation (MnDOT)” in first reference, then as “MnDOT” in subsequent references.
- ☐ All abbreviations/acronyms must be spelled out on the first reference.
- ☐ Report must include a table of contents, a list of figures, and a list of tables, each beginning on a separate page.
- ☐ Check for inclusion of an executive summary and an Introduction (*Chapter One is always the Introduction*).

- ☐ Number pages starting with the introduction; center page numbers at the bottom of the page.
- ☐ Appendices should have their own cover page and their own numbering system (i.e., A-1, A-2, A-3, etc., for Appendix A, and B-1, B-2, B-3, etc., for Appendix B and others). Appendix cover page includes the appendix number and title, but is not numbered.
- ☐ Be sure the report includes a chapter on conclusions and recommendations and that they are clear.
- ☐ Spell-check the document.
- ☐ Make sure all graphics are present and labeled. Do not use object links to other files.
- ☐ Be sure that graphics include text descriptions.
- ☐ Make sure all copyright permissions are secured.
- ☐ Please e-mail reports to the CTS Program Coordinator at ctsrept@umn.edu.

The Electronic Publishing Guidelines and template can be found at:
<http://mndot.gov/research>

Appendix H

Federal Highway Administration Memo



U.S. Department
of Transportation
**Federal Highway
Administration**

Memorandum

Subject: **INFORMATION:** Update on Metric Use
Requirements for FHWA documents

Date: November 25, 2008

From: Jeffrey F. Paniati
Executive Director

In Reply Refer To:
HIPA

To: Associate Administrators
Chief Counsel
Acting Chief Financial Officer
Directors of Field Services
Federal Lands Highway Division Engineers
Acting Resource Center Director
Division Administrators

The FHWA is modifying its policy on the use of metric measurements in its daily activities. The use of metric measurements will now be optional in all FHWA documents, including letters, memoranda, publications, reports, and information on FHWA Web sites.

The FHWA has long supported the conversion to metric measurements. Consistent with Section 5164 of the Omnibus Trade and Competitiveness Act of 1988 and Executive Order 12770, issued by President George H. W. Bush on July 25, 1991, we developed a 5-year Metric Conversion Plan for highway documents and plans. By 1995, the vast majority of State departments of transportation (DOT) indicated they would comply with FHWA's conversion completion date of September 30, 1996. As a result, they expended considerable financial resources to convert design, contracting, and other documents, such as *Standard Specifications*, from the inch-pound system to metric measurements in compliance with the Metric Conversion Plan.

For the Federal-aid highway program, the momentum established by the plan came to an end in 1995. Section 205(c)(2) of the National Highway System (NHS) Designation Act of 1995 prohibited us from requiring any State DOT to use the metric system during project development activities. Although the State DOT's had the option of using metric measurements or dual units (metrics/inch-pounds), all of them abandoned metric measurements and reverted to sole use of inch-pound values.

MOVING THE
AMERICAN
ECONOMY

Our most recent guidance on this subject was contained in a memorandum dated June 1, 2001 (posted at <http://www.fhwa.dot.gov/programadmin/contracts/0601metr.cfm>). It explained that Section 5164 of the 1988 Act requires all Federal Agencies to use the metric system in their procurements, grants, and other business-related activities except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms. Therefore, FHWA continued to use metric measurements in our daily business activities except in documents intended for a broader audience, such as the general public, when dual units (metric values followed by the inch-pound value in parenthesis) were appropriate.

Given that all our partners have abandoned metric measures, we have concluded that continued mandatory use of metric measurements in FHWA's daily business activities is impractical. Accordingly, I am rescinding the prior guidance, dated June 1, 2001, on this issue. The use of metric measurements is no longer mandatory in our daily business activities. Each office may use its own judgment on the value of metric measurements or dual units based on the audience for each document. For offices that wish to use dual units, we encourage a reversal of past practice by presenting them in the format of inch-pound value followed by metric value in parenthesis.

Under the NHS Designation Act, State transportation officials may continue to decide whether to prepare documents using the inch-pound system, metric measurements, or dual measurements. This flexibility applies to all documents developed in compliance with Federal-aid requirements, including the National Environmental Policy Act and other environmental requirements.

If you have any questions, please contact Mr. Edwin Okonkwo at 202-366-1558 of the Office of Program Administration.

cc:
Office Directors