U.S. Department
of Transportation
Federal Railroad
Administration

Office of Research,
Development and Technology
Washington, DC 20590

GUIDELINES FOR WRITING TECHNICAL REPORTS

A comprehensive guide to understanding the requirements of full-length FRA Office of Research, Development and Technology Technical Reports.

Created September 31, 2018

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1. OVERVIEW TO TECHNICAL REPORTS

The Federal Railroad Administration's (FRA) Office of Research, Development and Technology (RD&T) publishes *Technical Reports* that provide in-depth description and analysis of research work undertaken by FRA or its sponsored organizations. The reports present research to internal and external stakeholders, complete with technical specifications and results for final publication on FRA's eLibrary.

The design of this reference document offers explanation and examples on the types of information to include in *Technical Reports*, and where to incorporate this information within the framework of the Technical Report Template. While not exhaustive, the guidelines will help authors to effectively communicate the key messages and ideas of the research study.

2. FORMATTING AND READABILITY

The format of FRA's Technical Report Template meets our agency's report writing guidelines and standards. All draft submissions must use the Technical Report Template. The Technical Editors will not accept draft submissions not formatted per the template due to not meeting FRA's report writing standards, and thus the original author(s) must reformat the draft and return it to the Program Manager.

TECHNICAL REPORT FORMATTING REQUIREMENTS:

- **ALL** authors must have an Open Researcher and Contributor ID (ORCiD ID) for new reports not submitted into the editing process. Accessing its website allows the **free** generating of the ORCiD ID by following the instructions. For additional information, consult with the Program Manager.
- Only Microsoft Word XML *.docx* format will be accepted.
- **DO NOT** modify heading styles, spacing, font, language preference (default set to: American English), or template layout:
  - o 1" margins
  - o An indent of 0.25" from the left margin is for the first-level bullets. An additional indent of 0.25" is for each descending sub-bullet.
  - o Times New Roman, Arial, Helvetica, or Calibri 12-point font must be the main text for the document.
- For rules related to grammar, spelling, punctuation, and general form, FRA uses the U.S. Government Publishing Office's (GPO) Style Manual, available online.
- Use the built-in "Citations and Bibliography" feature. Learn how to add a citation and create a bibliography.
- Use the Word "References" feature to insert references/citations. Learn how to add citations in a Word document.

- Follow American Psychological Association's (APA) references format. See the REFERENCES section for more details.
- Use the accessibility checker to ensure the *Technical Report* is 508 compliant. Click here for information on how to use the accessibility checker.
- Avoid using blank spaces (including carriage returns) for formatting purposes.

Checklist of General Layout and Formatting Requirements:

- ✓ Has the document been formatted using Style elements (e.g., Heading 1, Heading 2) and/or Outline in a hierarchical manner (e.g., Heading 1 to Heading 2 to Body Text)? **The template has built in headers that are not to be changed**.
- ✓ Are page numbers formatted as opposed to manually typed?
- ✓ Have footnotes or endnotes been created using Word's footnotes feature?
- ✓ Is the list style being used as opposed to manually typed characters (e.g., hyphens, numbers, or graphics)?

FIGURES

- Include figures to illustrate or support the important points of the *Technical Report*. Each figure must have a short caption and MUST include a 508-compliant alt-text title and description (i.e., the body of the report should accurately describe the figure, so it is acceptable to add a shortened sentence). To learn how to how to add alt-text, see this video: Improve accessibility with alt text.
- Figures (also known as illustrations) may be graphs, drawings, photographs, etc.
- Use colors that have high contrast against each other or the background.
- Provide appropriate figures for the given context so readers may easily interpret it.
- If a contractor or other company owns the graphic and the graphic was never published, then you would add a copyright attribution under the graphic, e.g., © TTCI.
- If the graphic is published and/or altered by the author, then a copyright attribution and reference citation should be added under the graphic.
- Manually type equations and use Microsoft's 'Symbols' if possible; workaround is to capture equations as images and briefly describe it in the alt-text. An additional workaround is to capture the equation(s) in a table, but note that the requirement for header rows and alt-text still applies.

WRITING GUIDANCE

- Use plain language. Visit this link on the "Checklist for Plan Language" published to plainlanguage.gov. Section 4 provides additional information.
- Strive for clarity, concision, accuracy, and objective tone
  - The draft should read as though one author wrote it.
- Avoid slang, conversational tone, and clichés

- Use American English, not UK English (e.g., center, not centre; behavior, not behaviour; organization, not organisation)
- Maintain parallel structure as well as consistency with acronyms, abbreviations, and terminology
- For each section, ask: "Does this information belong here?"
- Use active voice and avoid passive voice. Active voice clearly establishes *who* has taken *what* action and simplifies the sentence (e.g., the company polluted the lake). Passive voice camouflages who has taken action (e.g., the lake was polluted by the company).
- Check for subject-verb agreement
- Apply the right verb tense (i.e., use past tense for research work completed in the past)
- Follow publishing rules regarding diacritical marks (i.e., symbols that tell the reader how to pronounce a letter, such as à, é, ç, etc.
- Run spell check and the accessibility check in Microsoft Word prior to submitting the draft report

3. BASIC STRUCTURE OF A TECHNICAL REPORT

The guidelines accompanying the Technical Report Template will help authors think through the structure of the report, and present the appropriate type and level of content according to each section and subsection. *Technical Reports* begin by laying out/establishing the fundamental premise of the research study and then build upon it to provide an in-depth analysis of the research work carried out.

The Technical Report Template contains the following sections/subsections/elements. It may be useful to refer to the Technical Report Template while reviewing the guidelines:

The items below are cross referenced to the section. Press ctrl and then click the text to follow link:

TECHNICAL REPORT COVER PAGE
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REPORT DOCUMENTATION PAGE
METRIC/ENGLISH CONVERSION FACTORS
ACKNOWLEDGEMENTS
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    1.2 OBJECTIVES
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    1.5 ORGANIZATION OF THE REPORT
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3. CONCLUSION
4. REFERENCES
APPENDIX A. APPENDIX HEADING [Optional]
ABBREVIATIONS AND ACRONYMS
FOOTER

TECHNICAL REPORT COVER PAGE

The cover page has a header with FRA's logo, positioned on the top left of the page and FRA's city/state location along with the office in which these reports are written for on the top right of the page. **DO NOT** change the positioning or size of the header.

Add the report's title and (if applicable) subtitle above the image. Capitalize the first letter of each word in the "Title of Report," except for prepositions such as on, in, to, for, and with. Insert an image that captures the subject of the report. Add an alt-text description to the image. To learn how to do so, see this video: Improve accessibility with alt text.

The footer on the cover page contains a unique report documentation number and the following text: "Final Report | Month 20YY." **DO NOT** change this as the RD&T Technical Editor enters this information.

NOTICE

DO NOT move or modify the content on the "NOTICE" page.

REPORT DOCUMENTATION PAGE

The Standard Form 298 is provided by OMB No. 0704-0188. **DO NOT** resize or reposition this form. Complete the following fields with the requested information. Original authors are responsible for the items in **BOLD**. Follow the instructions below on which fields to fill in:

1. REPORT DATE. RD&T's Technical Editors will enter the publication date.
2. REPORT TYPE. Information for a *Technical Report* is already entered. **DO NOT** modify.
3. **DATES COVERED**. Enter the start date and end date [MM/20YY] for the research work conducted, which includes the time needed to draft the report. Authors must fill in this information.
4. **TITLE AND SUBTITLE**. Enter this information, as shown on the title page. Authors must fill in this information.

5a. **CONTRACT NUMBER**. Enter all contract numbers as they appear in the report, e.g., F33315-86-C-5169. Consult with the RD&T Program Manager about this information. Authors must fill in this information if applicable.

5b. **GRANT NUMBER**. Enter all grant numbers as they appear in the report, e.g., AFOSR-82-1234. Consult with the Program Manager about this information. Authors must fill in this information if applicable.

5c. **PROGRAM ELEMENT NUMBER**. Enter all program element numbers as they appear in the report, if applicable, e.g., 61101A/. Leave blank if information is unknown.

5d. **PROJECT NUMBER**. Enter the project number as it appears in the report, if applicable, e.g., 61101A/. Leave blank if information is unknown.

5e. **TASK NUMBER**. Enter all task numbers as they appear in the report, e.g., 05; RF0330201; TO4112. Consult with the RD&T Program Manager about this information. Authors must fill in this information if applicable.

5f. **WORK UNIT NUMBER**. Enter all work unit numbers as they appear in the report, if applicable, e.g., 001; AFAPL30480105. Leave blank if information is unknown.

6. **AUTHOR(S)**. Enter the name(s) and ORCiD IDs of the person(s) responsible for writing the report, performing the research, or credited with the content of the report. Enter names by first name - middle name (or initial) - last name (i.e., plus any additional qualifiers) format. E.g., Richard K. Smith, Jr. https://orcid.org/0000-0001-2345-6789, Rebecca T. Williams https://orcid.org/0000-0001-2345-6789, and Leslie P. Chan III https://orcid.org/0000-0001-2345-6789. Authors must fill in this information.

7. **PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**. Enter this information for the company/organization performing the research. Authors must fill in this information.

8. **PERFORMING ORGANIZATION REPORT NUMBER**. Enter a unique alphanumeric report numbers assigned by the performing organization, e.g., BRL-1234; AFWL-TR-85-4017-Vol-21-PT-2. Authors must fill in this information.

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES). Information for the organization(s) financially responsible for and monitoring the work is already entered. **DO NOT** modify.

10. SPONSOR/MONITOR'S ACRONYM(S). Information for FRA is already entered. **DO NOT** modify.

11. SPONSOR/MONITOR'S REPORT NUMBER(S). The Technical Editors will enter this information, which is a unique alphanumeric identifier assigned to this report.

12. DISTRIBUTION/AVAILABILITY STATEMENT. Information about the report's distribution/availability is already entered. **DO NOT** modify.

13. SUPPLEMENTARY NOTES. The RD&T Program Manager overseeing this project will enter this information.

14. **ABSTRACT (maximum 200 words)**. Provide a quick overview of the report. The abstract is a stand-alone section to help readers understand at a glance the findings and conclusion of the report. It concisely conveys the purpose of the research, its significance, and its main message. The abstract does not include data-related details, except for the most significant. Authors must fill in this information.

15. **SUBJECT TERMS**. List any keywords pertinent to the subject matter of the report, including RD&T core subject matter terms (e.g., track research, rolling stock research, train control and communication, or human factors). If the report mentions certain terms or their abbreviations frequently, be sure to add them to the keywords. Repeat keywords used in the title to optimize the search (i.e., with the right set of keywords, readers have a

greater likelihood of finding the *Technical Report* when conducting an eLibrary search. Authors must fill in this information.

16. SECURITY CLASSIFICATION OF (16a-16c). Information is already entered. **DO NOT** modify.
17. LIMITATION OF ABSTRACT. No information is needed here.
18. NUMBER OF PAGES. The Technical Editors will enter this information when finalizing the report for publication.

19a. NAME OF RESPONSIBLE PERSON. Add the name of an individual associated to the work/research who will field phone calls related to this report, if applicable.

19b. TELEPHONE NUMBER. Add the responsible person's contact phone number if applicable.

METRIC/ENGLISH CONVERSION FACTORS

DO NOT move or modify the contents of this table. This information is intended for readers' reference.

ACKNOWLEDGEMENTS [Optional]

If appropriate, the author(s) may acknowledge FRA staff for technical contributions. Neither FRA nor FRA staff should be acknowledged for providing funding.

CONTENTS

Update this table after content has been added to the Technical Report Template and the report is ready for submission; check for accuracy. **DO NOT** manually update the table of contents. To learn more about how to update a table of contents in Word, by visiting Microsoft Office's website on this topic.

ILLUSTRATIONS

Technical Reports include figures to illustrate with visual examples related important aspects of the research, such as site location or crash impact, or provide graphical data to support or summarize analytical findings. Figures may be graphs, diagrams, screen captures, photographs, etc.

A table of figures is pre-populated and inserted at the beginning of the report (refer to "page v" of the Technical Report Template). The table of figures is automatically generated when all figures are captioned using the "References" Insert Table of Figures" feature. **DO NOT** manually edit the table of figures. Learn more about how to update a table of figures.

Helpful Tips:

- Place figures in the most appropriate context within the report so that readers can easily interpret it based on the text directly preceding it.
- Each figure must have a short caption and include an alt-text description. To learn more about this see this video: Improve accessibility with alt text to find out more about this topic.
- All background images and watermarks must be removed.

- All images have their text wrapping set to “In Line with Text.”
- All multi-layer images must be grouped together to create one figure.
- Do not insert an image/figure into a text box or table.
- Number figures consecutively, starting with Figure 1.
- Images should be in PNG, JPEG, or JPG format.
- Figures should be visually clear and legible. The Technical Editors recommend a white background, not shaded; this helps to create the best contrast and make the information clearly discernible.
- Provide high-resolution (300 dots per inch [dpi] or greater) photography or artwork if necessary and provide original drawings or illustrations at the beginning of the cycle.

TABLES

Tables can be included in *Technical Report*s to present qualitative or quantitative information by ordering, segmenting, grouping, or arranging information into rows and columns.

A listing of tables is automatically generated at the start of the report. (Refer to page vi of the Technical Report Template.)

Insert tables using the “Insert” feature in Word. To learn more about how to insert or draw a table in Word, visit Microsoft Office’s website on this topic.

Checklist for Formatting Tables:

- ✓ Do all tables have a logical reading order from left to right, top to bottom?
- ✓ Do data tables have the entire first row designated as a “Header Row” in table properties?
- ✓ In table properties, is “Allow row to break across pages” unchecked? In other words, table cells cannot break across pages.
- ✓ Is alt text added to the table in “Table Properties?”?
- ✓ Tables are not used to control page formatting.
- ✓ No nested tables (i.e., a table placed inside of another) are to be used.
- ✓ Do the tables have merged or split cells (i.e., this not 508 compliant)?

EXECUTIVE SUMMARY

The Executive Summary provides a clear and succinct overview of the full-length report by synthesizing its key points of the research study, including results and recommendations. While *Technical Reports* tend to be written for a specialized audience due to the complex nature of the research being conducted, the Executive Summary should be easily understood by general readers, regardless of knowledge or expertise.

Checklist for the Executive Summary:

- ✓ Is it 1 to 1½ pages, maximum?
- ✓ Is it written in active voice?

- ✓ Does it answer the basic journalistic questions of *Who, What, When, Where, Why*, and *How* regarding the study?
- ✓ Does the opening paragraph describe the research project and its purpose?
- ✓ Does it present contextual information to explain the project's background and principal issues?
- ✓ Does it highlight the report's major findings or results?
- ✓ Does the closing paragraph provide a synopsis of the report's concluding section, such as recommendations or suggested next steps?
- ✓ Is it consistent in the usage of the same key words, terms, technical phrases, etc. that are used in the main body of the report?
- ✓ Have the authors checked for and eliminated information in the Executive Summary that is not discussed in the main body of the report?

INTRODUCTION

Provide a short and concise paragraph about the premise of the research project being presented in the *Technical Report*. Answer basic questions of who (or which organization) was responsible for carrying out the research work; when did the research work begin (month and year); and when did it end (month and year). Also, identify whether FRA sponsored or funded the research work.

Continue developing content for the Introduction per the following subsections: Background, Objectives, Overall Approach, Scope, and Organization of the Report. (See below for more guidance on each of these subsections.)

BACKGROUND

Provide contextual information that would answer these questions: Why was the work done? What must be known to understand the rest of the report? Explain the historical issues behind the research and its significance. Address questions such as: Did a specific issue or event act as the impetus for this study? Is it a subsequent phase of an earlier RD&T study? Is it breaking new ground?

OBJECTIVES

Provide a broad statement describing what the research should achieve through the work conducted for the project.

OVERALL APPROACH

Summarize the approach taken to conduct the research work, including major tasks completed for the project, if applicable.

SCOPE

Describe what the project work covered and what was intentionally omitted. (For example: *The work reported here does not consider passenger rail cars.*)

ORGANIZATION OF THE REPORT

Outline the basic structure of the report to help readers understand how it is organized. The information in this subsection should correspond closely with the main headings listed in the Table of Contents.

SECTION 2 TITLE

With the introduction, background, and overall context of the research laid out in the first section, the next section and its subsections delve into the findings and objective analysis of the study and elaborate on any aspect of the research to demonstrate the value of the work conducted.

Depending on how authors choose to organize their findings and analysis, the *Technical Report* may have one or more main sections (e.g., Section 2, Section 3, Section 4, etc.), with additional subsections as needed to provide more detailed-level information in specific areas. For example, the main section may focus on methods used in the research, and then be further divided into separate subsections on "Materials," "Apparatus," and "Procedures."

The following provides an example of the formatting style for up to three subheading levels in *Technical Reports*—the accompanying [Technical Report Template] is also formatted accordingly:

SUBSECTION 1

Continuation of the above section

SUBSECTION 2

Continuation of the above section

SUBHEADING 2.2.1

Continuation of the above subsection

SUBHEADING 2.2.2

Continuation of the above subsection

SUBHEADING 2.2.3

Continuation of the above subsection

SUBHEADING (NEXT LEVEL, IF APPLICABLE)

Continuation of the above subsection

SUBHEADING (NEXT LEVEL, IF APPLICABLE)

Continuation of the above subsection

CONCLUSION

Typically, no more than 1 page in length, the Conclusion delivers the high-level takeaways from the report, lessons learned, recommendations, and if applicable, next steps or additional phases of the study. It emphasizes the value and impact of the research conducted. If the results were not definitive, future work may be suggested and outlined in this section. **DO NOT** include figures or tables in this section.

Also, do not introduce any new point or issue that has not been discussed in the body of the report. Therefore, any information included in this section is based on observations and data already presented in the report.

REFERENCES

The Technical Report Template is automatically formatted using the APA citation style. However, authors may choose to use the APA or Institute of Electrical and Electronics Engineers (IEEE) citation style. The format used must be consistently applied for each bibliographic entry in this section and the information (e.g., publication title, name of author, publication date, etc.) for the bibliographic citations must be accurate for intellectual property law purposes.

- Use the "built-in" bibliography feature to add a citation and create a bibliography. The Technical Report Template includes this feature.
- Visit the website for information and guidance on APA citation style.
- Visit the website for information and guidance on IEEE citation style.
- Verify that all bibliographic references are accounted for, whether footnotes or bracketed citations, and all web addresses work.

APPENDIX [Optional]

This section is for information not essential to explain your findings but supports your analysis (i.e., repetitive or detailed information), validates your conclusions or pursues a related point. Excerpts from an appendix may be placed in the main body of the report, while the entire document or set of data is included in the appendix.

The appendix requires a title. It should be the Heading 1 style without a number. Each separate appendix should be lettered (e.g., Appendix A, Appendix B, Appendix C, etc.). The order in which they are presented at the end of the report follows the order they are mentioned in the body of the report. Each appendix must be referenced within the body of the report.

Appendices must be inserted as text in the report with no use of headings just plain text and formatted per the fonts and alignment used in the report. Read more about how to insert a document in word.

DO NOT insert a file as an "embedded object" or as a hyperlink. If an appendix file is NOT a Word document but another file format such as pdf or excel file, attach the original files with the submission.

ABBREVIATIONS AND ACRONYMS

The last section is a listing of abbreviations and acronyms found in the *Technical Report*. This should be organized alphabetically so that readers can find terms and definitions easily.

FOOTER

The Technical Report Template footer includes the report page number. Note that Page 1 does not begin until the Executive Summary. **DO NOT** modify this information or any other information found in the footer, such as the report documentation number and the report's publication date on the cover page.

4. WRITING STYLE & REQUIREMENTS

U.S. Government Publishing Office's (GPO) Style Manual

For rules related to grammar, spelling, punctuation, and general form, FRA uses the U.S. Government Publishing Office's (GPO) Style Manual as a reference guide. The latest edition (*GPO Style Manual*, 2016) is available for purchase at GPO's Online Bookstore: United States Government Publishing Office Style Manual 2016 Paperback | U.S. Government Bookstore. It is also available free of charge on GPO's website:

Writing in Plain Language

Writing in plain language is essential to helping readers with the following:

- Finding key information
- Comprehending and interpreting key information
- Using information to meet their needs

The more clearly and directly you communicate, the more likely your readers will understand the information you are trying to convey, and can appreciate the value of the research undertaken by your team.

Helpful Tips:

- Use common terminology, not code or jargon (e.g., Task Order).
- Use American English.
- Spell out acronyms at their first mention.

To see how the plain-language approach improves the readability of a document, compare the examples below.

> ***Before:*** The following enumerated summary is intended only to highlight certain information contained elsewhere in this report.
>
> ***After:*** This summary highlights information contained in the report.
>
> ***Before:*** Longitudinal rail stress (LRS) is caused by environmental temperature changes due to solar radiation and air convection in conjunction with the boundary constraints on continuous welded rail.
>
> ***After:*** The cause of longitudinal rail stress (LRS) is by the effects of heat and wind on constrained continuous welded rail.

For more information about the Federal government's plain language initiative, visit the plainlanguage.gov site.

508 Compliance

All FRA *Technical Reports* must be compliant with the requirements of Section 508 of the Rehabilitation Act, which mandates that all electronic documents be accessible to people with disabilities. Since the Technical Reports Template provided by your RD&T Program Manager is 508 compliant and has been formatted to meet this requirement, **DO NOT** modify any formatting aspect of the Technical Report Template—including those related to fonts, heading styles, page numbering, table of contents, footnotes and/or endnotes, graphs and images, and bulleted lists, as applicable.

For more information on Section 508, visit Section508.gov | GSA Government-wide Section 508 Accessibility Program.

5. REPORT SUBMITTAL PROCEDURE

Once the drafting phase of the *Technical Report* is completed, it is ready for submission to RD&T's internal editorial review process. In this section, the Technical Editors provide "Helpful Tips" and a "Submission Checklist" to assist in preparing the document for final submission.

After the RD&T Program Manager leading the project receives the draft, the Technical Editors will coordinate the editorial review process within RD&T to obtain approvals from the RD&T Program Manager, Division Chief, and Director. Keep in mind that as the draft continues to undergo further editorial review, the RD&T Program Manager may follow up with the authors regarding questions or issues that have come up during the editorial review.

With the successful completion of the approval cycle, the Technical Editors prepare the document for final publication. The Technical Editors finalize the report and convert it to PDF. The finalized version is forwarded to FRA's RD&T webmaster, who uploads the *Technical Report* onto FRA's eLibrary for public view.

Helpful Tips:

- Engage with FRA RD&T Program Manager acting as the point of contact for the research study with any questions about the Technical Report Template style, formatting, etc. prior to the end of the period of performance of your contract.

Visit FRA's eLibrary to view examples of recently published *Technical Reports*.

Submission Checklist:

- ✓ Did the authors use the Technical Report Template and follow the guidelines provided by the RD&T Program Manager?
- ✓ Is the content properly formatted according to the Technical Report Template, such as using the correct font type and size?
- ✓ Is the appropriate content entered into each subsection of the *Technical Report*? (e.g., Summary, Background, Objectives, etc.)
- ✓ Does each figure have meaningful alt-text descriptions?
- ✓ Do all URLs have descriptive hyperlinks? I.e., avoid generic phrases like "Click here," instead provide the title of the web page to indicate the content of the linked page if readers were to click on the hyperlink and be re-directed.
- ✓ Are all web addresses linked to the correct web destinations?
- ✓ Are all mentioned sections and appendix sources cross-referenced throughout the report?
- ✓ Is the reference section properly formatted per the recognized standard (APA or IEEE)?
- ✓ Is the document title name concise, generally limited to 20–30 characters, and does it clearly convey the main topic of the report?
- ✓ Have all track changes been resolved (accepted or rejected)?
- ✓ Have all comments been removed and formatting marks been turned off?
- ✓ Is the document free of background images or watermarks?
- ✓ Do complex images (e.g., charts and graphs) have descriptive text?

- ✓ Are e-mail links accessible?
- ✓ If there are tables, are unnecessary blank cells/rows/columns deleted?
- ✓ Did the authors proofread the document for any spelling or grammatical errors by running spell check in Word one last time?
- ✓ Is the document saved in Microsoft Word .docx format?
- ✓ Did the authors run an accessibility check, and is the document fully accessible?
- ✓ Has the document been reviewed in Word using the "Print Preview" function for a final visual check?