Guidelines for Academic Writing

at the Faculty of Civil Engineering

at RWTH Aachen University
# Table of Contents

1. Introduction ......................................................................................... 4
1.1. Objective of the Guide ................................................................. 4
1.2. Position of the Faculty on the Quality of Scientific Work ............... 4
2. Scope of the Work ............................................................................ 4
2.1. Page Layout and Typeface ............................................................ 5
2.1.1. Margins .................................................................................. 5
2.1.2. Headers and Footers ............................................................... 5
2.2. Font Size, Spacing and Alignment ............................................... 5
2.3. Structure and Headings ............................................................... 5
3. Structure of the Work ..................................................................... 6
3.1. Title Page .................................................................................. 6
3.2. Indexes ..................................................................................... 7
3.3. Abstract .................................................................................... 7
3.4. Structure of the Main Chapters .................................................. 7
3.4.1. Introduction ......................................................................... 7
3.4.2. Material and Methods .......................................................... 8
3.4.3. Results ................................................................................. 8
3.4.4. Discussion ........................................................................... 8
3.4.5. Conclusions ......................................................................... 8
3.5. Glossary and Definitions of Terms ............................................... 8
3.6. Appendix ................................................................................... 9
4. Affidavit ....................................................................................... 9
5. References and Citation ................................................................... 9
5.1. Direct and Indirect Citations ....................................................... 9
5.2. Citability of Sources ................................................................ 10
5.2.1. Printed Sources .................................................................. 10
5.2.2. Digital Sources .................................................................... 10
5.2.3. Gray Literature ................................................................... 10
5.3. Citation Techniques .................................................................. 10
5.3.1. References in the Text ............................................................ 11
5.3.2. References with Footnotes .................................................... 11
6. Bibliography ................................................................................ 12
6.1. Reference of Books .................................................................. 12
6.2. References of Articles from Journals and Collective Works .......... 13
6.3. Sources from the Internet .......................................................... 13
1. Introduction

The following guideline is intended to serve as a basis for the preparation of student scientific writings at the Faculty of Civil Engineering of RWTH Aachen University. At the individual chairs and teaching areas of the faculty different specifications may apply. Please inform yourself about any additions, changes or chair-specific guidelines.

1.1. Objective of the Guide

This guideline contains instructions and regulations for the preparation of student scientific writings at the Faculty of Civil Engineering. Compliance with formal criteria is an essential part of the production of such works. The aim of the guideline is therefore to ensure the formal quality. Nevertheless, each scientific work is an individual output of the author. Against this background the author alone is responsible for the quality of the work and its evaluation must be carried out accordingly. Following the recommendations of the guideline are not a sufficient criterion for assessing the quality of work.

1.2. Position of the Faculty on the Quality of Scientific Work

The Faculty of Civil Engineering of the RWTH Aachen University considers itself to be in a leading position in Germany in terms of research and teaching. This position must be secured and expanded through high quality scientific work. The foundations for this are laid in the training of students and future scientists. Every scientific work written at the Faculty of Civil Engineering - as part of the course or work as a research/student assistant - must meet a quality standard. This also applies to language requirements, spelling and grammar, requirements for citation, the typeface and the quality of figures and tables. Theoretical and experimental work must be equally comprehensible, complete and comprehensibly prepared.

If the standards to be applied are largely not achieved or if there are significant deficits in individual aspects of quality of the work, this must be taken into account in the evaluation of the work. In extreme cases this can lead to the failing the respective examination.

The basis for this guideline are recommendations by the German Research Foundation (DFG)'s committee on self-regulation in science (Safeguarding Good Scientific Practice, 2013).

2. Scope of the Work

The respective examination regulations provide a first rough guideline regarding the scope of final papers, seminar papers or student research projects. These regulations specify how many pages the thesis should comprise. This number of pages is to be understood using the usual formatting (e.g. Arial font, font size 12, single line spacing), whereby illustrations and tables may be included in the text to a limited extent.

As an indication of the time required, the number of CPs (credit points) allocated for the preparation of the work is to be taken as a guide, whereby one CP corresponds to 30 hours of work. It should be noted that the number of pages does not directly indicate the amount of work involved, as this depends very much on the type of work. For example, if the assignment contains a literature research, this may result in a larger volume of text for the work. If instead elaborate experimental investigations or programming work is carried out, the text length may be shorter.
Page layout and text formatting have a significant impact on the number of pages and the volume. In the following a reasonable formatting is presented as an example.

2.1. **Page Layout and Typeface**

2.1.1. **Margins**

Make sure that the page layout has sufficiently wide margins. Advantageous are 2.5 to 3 cm on the left and right, 2 to 2.5 cm on the top and bottom. If you choose a symmetrical margin width, even and odd pages can have the same layout. This offers advantages for double-sided printing. An asymmetrical layout with a wide margin on the left should be the rule, since pages printed on one side are bound on the left.

2.1.2. **Headers and Footers**

Components that should be part of the header or footer (the formatting of this guide serves as an example):

- Page number (can be inserted automatically). For single-sided printing the page number on the outside right or in the middle.
- Chapter number and chapter headings of the first level (facilitates orientation for the reader)
- possibly frames or over- or underlining

Additional information may be given on:

- the title of the work
- the author (for copyright reasons)

2.2. **Font Size, Spacing and Alignment**

A sans-serif font (e.g. Arial, Calibri) has proven to be the best font for scientific texts. Suitable font sizes are:

- for continuous text 10.5 to 12 point
- for footers 8 to 9 point
- for footnotes 7 to 8 point.

For readability reasons, the line spacing should be between 1.1 and 1.3. After paragraphs, a uniform, defined spacing should be used instead of blank lines, for example, a 6-point spacing. In word processing programs, this spacing can be fixed in the style sheet.

The alignment of the text in justification creates a more closed typeface than with left-justified flutter, but is often connected to large character and word spacing. The automatic and conditional hyphenation can help. When breaking lines, it should be ensured that words and numbers that belong together are not separated. This concerns, for example, references to figures and tables ("see Table 1") or values and their units ("250 m"). A protected blank character is a remedy.

2.3. **Structure and Headings**

The work is to be divided into numbered chapters. Numbering is not to be used from the fourth level onwards. Further sub-levels can be identified by section headings highlighted in bold.
The size and printing (bold, small caps, etc.) of the headings can be highlighted according to the outline level, bold and underlining should not be combined.

Example:

1 HEADING 1
(Arial bold, 14, "small capitals", paragraph distance before 12 points/after 3 points)

2.1 Heading 2 (Arial bold, 12, preceding paragraph distance 12 points)

2.1.1 Heading 3 (Arial bold, 11, preceding paragraph distance 6 points)

2.1.2 Heading 3 (Arial bold, 11, preceding paragraph distance 6 points)

Heading 4 (Arial bold, 11, preceding paragraph distance 6 points)

Subchapters of an outline level are only practical if there are at least two subchapters.

3. Structure of the Work

The structure of scientific papers is always formally similar: the introduction may be followed by an overview of material and methods, and in the main part by a presentation of the results, completed by conclusions and, if necessary, an outlook. Usually a short summary of the work can be found in the first or last chapter of the text.

The rough structure of the work follows the scheme introduction - main part - conclusion, whereby the introduction and conclusion must be understandable without reading the main part. The following list shows a possible structure of scientific papers:

- Title page
- Table of contents
- If applicable, the task definition
- Abstract
- Main chapters (introduction, material and methods, results, discussion, conclusions)
- Bibliography or list of sources
- If applicable: List of abbreviations
- If applicable: List of figures and tables
- If applicable: Appendix
- Affidavit

3.1. Title Page

The title page should contain:

- Indication of the type of work (e.g. "Seminar paper", "Bachelor’s thesis", "Master’s thesis") and the academic degree to be obtained ("Bachelor of Science RWTH Aachen University", "Master of Science RWTH Aachen University")
- Title of the work, subtitle if applicable
- Supervising chair and professor, if applicable supervising scientific employees
- Names of all authors including academic degree
- Date of submission
The title page gives a first impression of the work. Therefore, it should be designed in an attractive and clear way. If the first page is illustrated by a picture, it must have a thematic reference to the work that should become clear when reading the title.

3.2. Indexes

The table of contents lists all chapters with numbering, chapter name and page number. Further indexes (figures, tables, units) are to be inserted as required. Each index should start on a separate page. With word processing software directories can be created automatically.

3.3. Abstract

If the task definition requires the preparation of an abstract or summary, it must include the following points:

- Motivation and goal of the work
- Methods
- essential findings, results, statements
- if applicable: Outlook, and needs for research and further development

For seminar and final papers, the length of the abstract should not exceed one DIN A4 page.

3.4. Structure of the Main Chapters

Within the main chapters (introduction, material and methods, results, discussion, conclusions), clear and meaningful headings should be chosen. General headings, such as:

- Goal of the work
- Analysis
- Concept

should be avoided.

Each chapter should have its own short introduction which shows how the chapter fits into the overall context of the work. If you conduct your own research, you should make sure that the results are sufficiently evaluated and, if appropriate, lead to a recommendation or the like. In the case of longer chapters that are central to the work, it is very useful to summarize the main findings and results of this chapter in the form of a short summary or conclusion.

3.4.1. Introduction

The introduction serves as an introduction to the topic, clarifies the relevance of the research question as well as the objective of the work and gives an overview of the structure and approach. It thus provides the reader with an orientation guide.

The introduction should contain:

- Motivation of the work
- Classification of the work in a superordinate overall context
- Objectives of the study and hypotheses, if applicable
- Methodical approach
- Outline of the work
- If applicable, organizational chart / flow chart with the work steps
• Targeted results, if applicable

3.4.2. Material and Methods

This chapter is intended for experts and should help to ensure that the methodological approach can be understood exactly and repeated if necessary. This chapter is usually characterized by a pronounced use of technical terms. Both the materials used (type, composition, quantity) and the experimental conditions (e.g. type of testing machine used) are described in detail.

3.4.3. Results

This chapter presents the results of the investigations. If the chapters "Results" and "Discussion" are separated, it is important to ensure that the results in this chapter are not yet interpreted and evaluated, but are only mentioned and described in a matter-of-fact and objective manner. In addition to the text section, tables and figures may be suitable for a clear presentation of the results. Only those results should be mentioned which are necessary for the understanding of the work. If the presentation of the original data is too extensive, they can also be included in the appendix of the work.

3.4.4. Discussion

In the discussion, the results of the research are interpreted and evaluated. Usually, findings of other authors are consulted in order to put the own results into an overall context. Thus, in this chapter many sources are usually cited. It is described whether the goals that have been set have been achieved or whether the hypotheses that have been put forward have been confirmed or refuted, and whether any new questions have been raised.

Depending on the requirements, it may be desirable and even useful to treat the results and the discussion in a joint chapter to avoid repetition.

3.4.5. Conclusions

Alternative terms for this chapter are "conclusion" or "outlook". Together with the introduction, this concluding chapter forms a framework for the entire work. No new results and findings are introduced here. The conclusions are derived from the chapters "Results" and "Discussion". As a rule, this chapter also contains short outlooks on future further work.

Contents of the conclusions should be:

• Summary / synthesis of the main results from the individual chapters of the text part
• Statements on the significance and relevance of the results
• Summarizing critical reflection of the methodology and results (if necessary, point out limitations)
• Presentation of possibilities and, if necessary, approaches for the continuation of the topic

3.5. Glossary and Definitions of Terms

Frequently, terms are not used uniformly in technical literature. For the understanding of the work, it may be helpful for the author to explain which terminology he or she uses and, if
necessary, to explain unfamiliar abbreviations. Unclear terms should be explained when they are first used in the text; alternatively, reference can be made to the glossary.

3.6. Appendix

The function of the appendix is to present information that is referred to within the main chapters or that would disturb the flow of reading or clarity there, in a coherent and clear manner at the end of the paper. This can include documentation of the investigations in form of extensive tables, longer evaluations or also by means of graphical material. It is up to the author to decide which materials should be included in the appendix and whether these are conducive to the understanding of the work as a whole and improve the comprehensibility of their own results.

The Appendix should be numbered separately and should be listed as a separate chapter in the table of contents.

4. Affidavit

In accordance with the comprehensive exam regulations students must acquire an affidavit for written exam work (excluding exams), confirming that the exam performance was completed without unauthorized assistance and that no other sources or aids were used other than the ones listed. If the paper will also be submitted electronically, the affidavit must also confirm that the written and electronic versions are identical.

For all written exam papers and work, registered starting October 1, 2015, you must use the affidavit form provided by the Central Examination Office. The separate, fully completed and signed affidavit form must be submitted together with the bound paper versions of your thesis/academic work.

5. References and Citation

In every scientific work, foreign and own ideas must be clearly marked. It must be made clear on which papers one’s own argumentation is based, which foundations were used for one’s own results and where assumptions and assertions have their origin.

The ideas of other authors are - as far as possible - to be taken from the primary source.

5.1. Direct and Indirect Citations

When reproducing the intellectual property of others, a distinction must be made between direct and indirect quotation. Direct citations are the exception in scientific publications, the form of the indirect citation should be used more often.

A direct (literal) quotation can be reproduced in full or in parts with omissions. This form of citation must be indicated by uniform emphasis, usually by quotation marks. Text excerpts and text contractions must never be chosen in such a way that there is a risk of distorting the statement of the cited author. Additions or changes are only permitted if the sentence structure, grammar and comprehension require it. Omissions and additions are to be marked with square brackets. A single omitted word can be indicated by two dots in brackets [..], a sentence by three dots in brackets [...] . Emphasis in direct quotations must be indicated as a separate change by an addition in square brackets, for example [emphasis not in original].
An indirect quotation is any form of a reproduction of the meaning of someone else's intellectual property: this can be a train of thought, an argumentation or any other textual reference to literature. This also includes illustrations, tables, data or equations. The indirect quotation is not in quotation marks, but is used in the continuous text. An independent formulation must be used.

5.2. Citability of Sources

5.2.1. Printed Sources

Printed sources include, for example, expert books, publications from scientific journals, anthologies and commemorative publications, prospectuses, brochures, industrial property rights, newspaper articles and legal sources. In principle, all printed and published (generally accessible) sources are citable, but not necessarily worthy of citation. The author of a scientific paper is responsible for checking the content of the source for consistency and citation worthiness. The quality, significance and plausibility of the source should be critically examined.

5.2.2. Digital Sources

In principle, digital (electronic) sources can be cited just like printed sources. However, it must be taken into account that sources in the Internet can have different objectives and vary in quality. Internet presences can change, entries in forums can be removed and entire pages can be deleted. When citing sources for Internet pages, some special considerations must therefore be taken into account, which are explained in more detail in Section 6.3. The factual verification of the contents and the selection of digital sources should be carried out very critically.

5.2.3. Gray Literature

In general, any source used, including an unpublished one, should be verifiable. The term "gray literature" refers to unpublished works that are not available from bookstores or libraries. These include, for example, leaflets, conference reports, Internet sources and unpublished scientific works. The latter are of particular relevance in the university context: seminar papers, bachelor's, master's and diploma theses are usually not published, but may contain a great deal of knowledge potential. Particularly when several papers are based on each other in larger research projects within a chair or institute, content from the same gray literature is regularly used. As a rule, these sources must also be cited, whereby the bibliography must indicate that the source is unpublished. This also applies to dissertations, where results from bachelor’s, master's or diploma theses are used. If corresponding sources have been written in close supervision by and in cooperation with a research assistant (the author of the dissertation) - without significant, delimitable personal contribution - deviations from this basic principle may be made in exceptional cases.

5.3. Citation Techniques

In the text part of the paper, a clear indication of the source must be inserted for each citation, directly or indirectly. In principle, a uniform way of citing is to be used for the whole work. The choice of the citation method can be influenced by the preferences of the individual chairs. Information on any existing guidelines should therefore be obtained.
By citing the source, it must be made possible for the reader of the work to find the cited passage, thought or argument in the source. In the case of short essays, this is usually possible without indicating the page number. In the case of books or very long journal articles, care must be taken to indicate the corresponding page number when quoting literally. When using internet sources, the complete URL must be given. In addition, a short description of the page, the date of access and an author or editor must be given so that it is clear who the author of the cited content is and the source can actually be found.

5.3.1. References in the Text

References in the text must be given immediately after the quotation. The references should be unambiguous and listed in the same form in the bibliography. The requirement for uniformity applies to the use of names, the type of brackets, the year and punctuation. If two authors are to be assigned to one source, they can be separated by an "and" or a slash. If there are more than two authors, they can be represented by the first named author and an " et al. 

- (Mustermann 2013)
- (Mustermann, Max 2013)
- (Mustermann 2013, p. 92)
- (Musterfrau et al. 2013)
- [Mus13]
- /Mus13/

If a train of thought or an argumentation from several sources is cited in the text, these can be summarized. A separation is possible by a semicolon, for example. The principle of uniformity also applies here.

- (Mustermann 2011; Musterfrau 2013)
- [Mus11; Mus13]

Technical titles or standards for which no representative author is available may be cited by means of an abbreviation which is used and explained in the same form in the bibliography.

- (Urban Planning Handbook, 1989, p.15)
- [DIN1045]

If there are several publications of an author within one year, these are to be distinguished as different sources. This can be done, for example, by using suitable suffixes (a, b, c) after the year number. The abbreviations must appear in the bibliography in the same form.

- (Mustermann 2012a)
- [Mus12a]
- /Mus12a/

5.3.2. References with Footnotes

Quotations can also be indicated in a footnote. The source is then indicated at the end of the page outside the body of the text. The footnote must be clearly indicated by a superscript number (= number of the footnote) or a superscript character directly after the quotation.

The source can be given either in the detailed citation or in the short citation. The detailed citation in the footnote contains the full reference and the complete bibliographical information of the source. As a rule, however, the short citation method should be used for reasons of
clarity and space. In the case of indirect citations, the footer should be preceded by a “Cf”. The short citation should contain the following information: Name of the author, if applicable, first name of the author (abbreviation), if applicable, self-chosen keyword or title of the publication, year of publication, page number. Several authors can be distinguished by semicolons or hyphens.


In the case of short citations, the complete bibliographic information must be given in the bibliography.

6. Bibliography

The list of sources gives an overview of all sources used in the work. These should be provided with full bibliographical references to enable the reader to find them easily. To improve clarity, it may be useful to make a subdivision into different types of sources (e.g. literature, internet sources, interviews).

Usually the sources are listed in alphabetical order of the surnames of the authors. It is important to ensure that the abbreviations used in the text correspond to those in the bibliography. If an author has published several articles, the corresponding sources must be sorted chronologically. If several publications of an author appearing within one year are to be noted, they are to be distinguished - as already mentioned - e.g. by suffixes.

- e.g. Mustermann, Karl, 1997a.

Formatting also contributes to the clarity of the bibliography. The first line of each source reference should always start left-justified, while all further lines should be indented to the right. This makes it easier to find your way around the directory and eliminates the need for blank lines between the individual source citations.

In the bibliography, care must be taken to use a uniform method of presentation. Several authors can be separated e.g. with a semicolon. Examples of possible styles of spelling can be found in the following notes on the different types of source references.

If the number of sources used is manageable, the source directory can be created manually. An alternative to this is offered by various literature management programs, which make work much easier as the number of sources increases. Examples are the programs Zotero (free of charge), Endnote (fee required) or Citavi. Furthermore, most word processing programs also offer functions that automate the management of the sources.

6.1. Reference of Books

- Surname and first name of the author (if there are several authors, list them all, from three on also: et al.; if necessary, abbreviation of the institution or publication (e.g. EAHV)
- Year of publication (if necessary, with a short form of the source used in the continuous text)
- Title of the book
- Optional: edition
• Place and name of the publishing house
• Year of publication of the book

e.g.


6.2. References of Articles from Journals and Collective Works

• Surname and first name of the author (if there are several authors, list them all, from three on also: et al.; if necessary, abbreviation of the institution or publication (e.g. EAHV)
• Year of publication (if necessary, with a short form of the source used in the continuous text)
• Title of the article
• Name of the journal/newspaper/collective work preceded by the word “in:“. A compilation is e.g. a conference transcript, which is published in connection with a scientific conference.
• Volume/issue/date or similar
• if applicable, publisher (eds.) and place of publication
• where appropriate, page number

e.g.


6.3. Sources from the Internet

• Surname and first name of the author or editor, if applicable, year of publication (with short form of the source used in the continuous text)
• If applicable, title of the article
• Name of the website
• Full URL
• Date of access with addition of "Access on:“.

e.g.

7. Tables, Figures and Equations

Figures, tables and equations should be numbered in a separate section. Clarity is increased if a consecutive numbering is used within the chapters and the chapter number is included in the numbering.

e.g.

**Fig. 2.5:** ... the fifth figure in the second chapter

**Table 7.4:** ... the fourth table in the seventh chapter

The figures, tables and equations used can be noted in a separate index. In the text, reference should be made to the corresponding figure, table or equation (e.g. "see Tab. 7-1"). Only tables, figures and equations that are important for understanding the work should be included in the text. Otherwise they can be added in the appendix.

**Table 7-1: Comparison of example values of the categories West and East (own presentation).**

<table>
<thead>
<tr>
<th></th>
<th>Example A</th>
<th>Example B</th>
<th>Example C</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>2.9</td>
<td>1.7</td>
<td>0.2</td>
</tr>
<tr>
<td>East</td>
<td>6.3</td>
<td>4.2</td>
<td>0.8</td>
</tr>
</tbody>
</table>

### 7.1. Tables and Figures

Tables and figures must be labelled additionally. Tables should be provided with a heading, figures with a signature. The inscription should be chosen in such a way that the contents of the figure or table are clearly visible.

The source of the illustrations is to be indicated if it is not the author's own illustration. The method of citation is the same as within the text: If it is a direct transfer from another work, a direct quotation is to be inserted; if the content of the representation is clearly changed, an indirect quotation is to be given, which is introduced with "Cf.". If it is a separate presentation, this can also be indicated.

### 7.2. Equations

Equations are set in a separate line in the text. They can also be indented. In order to be able to reference them, equations should be numbered consecutively with Arabic numerals within a chapter or the entire work, if possible right-aligned in the last line of an equation. Variables used in equations shall be explained directly below the equation, unless the meaning is derived from previous equations or a generally accepted nomenclature. Further explanations shall be included in the body text.

Example: \[ \sigma = E \cdot \varepsilon \] (7-1)

where: \( \sigma \) Stress
\( E \) Young's modulus
\( \varepsilon \) Strain

14
8. Internet Sources

9. Further Reading