

# The `csm-thesis` package

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Based upon the *Thesis and Dissertation Writer's Guide* provided by the Colorado School of Mines Office of Graduate Studies, Fifth Edition (Revised Spring 2009). This documentation includes the contents of the guide and additional formatting guidelines that have not yet been included within the guide. Please note that this document should not be considered to supersede the guide, the Office of Graduate Studies has final say on all theses. An additional advantage to using this document is that references to different sections of the text are all hyperlinked, allowing for easy traversal of the document.

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## About This Guide

The Colorado School of Mines Office of Graduate Studies (OGS) publishes this guide for graduate students in all departments who must prepare a master's thesis or doctor of philosophy dissertation as part of the requirements for a CSM graduate degree. In this guide, the word "thesis" refers to both the thesis and the dissertation, unless otherwise noted.

Every CSM thesis is deposited with the Arthur Lakes Library as part of its permanent collection and for long-term preservation. To produce a final manuscript of high quality, consistent adherence to the University's standards of organization and formatting is crucial. This guide is meant as a set of minimum guidelines for producing the final copies of your thesis.

Before submission to the Library, each completed thesis must receive final format approval from OGS. If you follow the formatting guidelines defined in this document, your thesis format will be accepted.

Some variations in thesis format may be accepted for the main body and references; however, every thesis must include the required parts of the front matter. In addition, every thesis must follow the conventions for page numbering and margins described in this document.

If you choose an alternative format, OGS retains the right to accept or reject this formatting at its discretion. Therefore, prior to submitting your thesis to the OGS for final format review, it is in your best interest to verify with the OGS staff that your format is acceptable. You will find examples of recommended and required page formats for various parts of the thesis in [Appendix C](#).

Unless stated differently, required forms referred to in this guide may be found online at the OGS website under Graduate School Forms,

<http://gradschool.mines.edu/GS-Forms>.

Included in [Appendix A](#) of this guide are procedure check lists for 1) writing and defending your thesis; 2) submitting required forms; 3) formatting your thesis, and 4) printing and submitting your thesis.

## Helpful Resources

Although this guide contains some writing tips, it is not a handbook for technical writing. Students who want to learn more about technical writing style, punctuation, and grammar may find information on campus at the LAIS Writing Center,

<http://writing.mines.edu/>.

The LAIS Writing Center is a free tutorial service available to all CSM students. Tutors in the Writing Center work *with* students to improve their writing; however, the Center is not a proofreading and editing service.

There are numerous manuals available to help students who are writing a thesis. Before purchasing a text or downloading information, you should consult with the OGS

and/or your faculty advisor for suggestions of the best reference tools specific to your discipline. A partial list of such style manuals appears in [Appendix B](#).

## Before Writing Your Thesis

You should begin your thesis process by the second semester of classes as a master's student or at least one year before you plan to receive your degree, as a Ph.D. student. Below are some items to consider as you begin the thesis process.

### Review OGS requirements

As a thesis writer, you are encouraged to communicate with the OGS staff to verify that you are following the necessary guidelines for producing the thesis. You should also be certain that you understand the process of registering for research credits.

### Review department requirements

CSM academic departments may have additional requirements specific to their discipline. It is your responsibility to know the deadlines specific to your department and whether or not special organization and formatting are required. If special department or committee requirements contradict the information in this guide, you must resolve the conflict before writing the thesis.

### Request thesis advisor and committee

At both the master's and Ph.D. levels, the student is responsible for choosing a thesis advisor. The Dean of Graduate Studies appoints the thesis committee, based on the recommendations of the student, thesis advisor, and department head. A signed Advisor/Thesis Committee form must be filed with the OGS.

### Present research proposal

After a thesis topic has been selected, a research proposal is written. The research proposal is a description of the research the student intends to undertake, which will be reported in a more detailed and comprehensive fashion in the thesis. The proposal is your opportunity to convince the advisory committee of your ability to pursue the project to a successful conclusion. After the thesis proposal has been formally approved by the committee, the Admission to Candidacy form is submitted to OGS. The thesis proposal itself does not need to be approved by the OGS.

## Writing Your Thesis

The work described in a CSM thesis must be conducted under the supervision of a candidate's advisory committee, and the thesis must state in detail all results obtained and

all methods and processes used in the research. Descriptions of method must be made in such a way that they may be duplicated by any competent researcher. Below are some other points to consider.

## Including proprietary research

Under special circumstances, CSM may agree to include proprietary research in a graduate student's thesis. The nature and extent of the proprietary research reported in the thesis must be agreed upon in writing by the principal investigator, student, and Dean of Graduate Studies (Proprietary Research Agreement form). In some cases, the proprietary nature of the underlying research may require the school to delay public access to the completed thesis for a limited period of time. In no case will public access to the thesis be denied for more than 12 months from the date the Statement of Work Completion form is submitted to the OGS.

## Following required guidelines

As you write your thesis, consult with your advisor and committee as necessary. Edit all drafts for correct sentence structure and grammar, paragraphing, punctuation and spelling. Specific OGS requirements for thesis organization, style and formatting are found in this guidebook.

## Registering for copyright

Students own the copyright to their thesis and you may wish to register your work with the Library of Congress. Typically, the holder of the copyright is required to submit two copies of the copyrighted work, a registration fee, and a completed application form (Form TX). To order forms, call the Copyright Office Form Hotline at 202-707-9100. Additional information is found at the Copyright Office website:

<http://www.copyright.gov/>.

## Obtaining publisher permissions

If you wish to include material in your thesis that has been previously published, permission from the publisher may be required. In addition, academic department policies vary regarding the inclusion of such material, and therefore the approval of your advisory committee is required.

## Completing Your Thesis

Once you have finished writing your thesis, there are required steps to perform before the process is complete and your degree is awarded. Those steps are described below and are summarized in a checklist in [Appendix A](#).

## Application to Graduate

Within five weeks of the beginning of the semester in which you expect to graduate, submit an Application to Graduate form to OGS.

## Schedule the thesis defense

The student must orally defend the written thesis in front of the advisor and advisory committee before the thesis submittal deadline that is set by the OGS each semester. Upon finishing the writing of your thesis, schedule the thesis defense, allowing enough time (roughly two weeks) for committee members to thoroughly examine the thesis. Keep in mind that several students may be arranging defenses for essentially the same time, with the same faculty members. You should also be aware of your department's deadlines for defending.

**Note:** The thesis defense is open to the public.

## Submit Thesis Defense Request form

At least one week before the thesis defense, submit the Thesis Defense Request form to your home department.

## Defend and revise the thesis

Your committee may require you to make additional revisions following your thesis defense. Be certain that you allow enough time between your defense date and the thesis submittal deadline to complete these revisions.

**Note:** Your department may have a maximum time allowed for the completion of revisions following the thesis defense; you should become aware of any such requirement.

## Obtain required signatures

Once your advisor and advisory committee have approved the defended and revised thesis, you must sign and date the submittal sheet (ii). Your thesis advisor (and coadvisor, if applicable) and department head must also sign and date the submittal sheet. Black ink is preferred for signatures.

**Note:** You must obtain all signatures prior to submitting the thesis to the OGS for final format evaluation.

## Obtain final format approval

After your department head and advisor have approved the defended and revised thesis and have signed the submittal sheet, submit the final draft to the OGS for format evaluation.



The format evaluation is a general review of the document to check for consistency, proper chapter sequence, correct font and margins, and proper table and figure placement. To receive approval, the draft you submit for evaluation by OGS must exactly duplicate the final

submission you will present to the library for preservation, including any labeled and folded plates, maps, and CD/DVDs.

**Note:** The OGS reviewer does not edit the thesis during format evaluation. You should plan to leave your thesis with the OGS for 24 hours.

## Print required copies

You are responsible for printing the final copies of the thesis that are submitted to the Arthur Lakes Library for binding and preservation. Details on printing requirements are found in the section **Printing Your Thesis**, page 17.

## Obtain virus scan for CD/DVDs

To submit any part of your thesis on CD/DVD, you must first have your disk certified by the AC&N department as virus free. To learn more about this requirement, see **Computer disks**, page 18.

## Pay fees

You must pay graduation and all other outstanding fees to the CSM cashier before submitting your thesis copies to the library for binding.

## Submit copies to Arthur Lakes Library

The award of a thesis-based graduate degree is conditioned on the student's submittal of the completed thesis to the campus library, ensuring its availability to the public. Although the student retains the copyright of the thesis, by depositing the thesis with the library, the student assigns a perpetual, nonexclusive, royalty-free license to CSM and permits CSM to copy the thesis and allow the public reasonable access to it. Detailed information on how to submit your thesis to Arthur Lakes Library is found on page 18.

## Check Out

You can obtain the required checkout card either at the OGS, Guggenheim Hall, or at the Graduation Salute, which is held each semester. Part of the checkout procedure is also the submission of the Statement of Work Completion form that may be found online at <http://gradschool.mines.edu/GS-Forms>. For your convenience, you will also find Graduation Information and Deadlines in this same location.

## Organizing Your Thesis

A thesis has three main parts: 1) front matter, 2) body, and 3) back matter. The elements of each main part listed here are further explained in separate sections, but they should appear in the sequence shown here.

## Parts of a Thesis

### Front Matter (preliminary pages)

1. Title page . . . . . (required)
2. Copyright page . . . . . (if applicable)
3. Submittal sheet or signature page . . . . . (required)
4. Abstract . . . . . (required)
5. Table of Contents . . . . . (required)
6. List of Figures . . . . . (if applicable)
7. List of Tables . . . . . (if applicable)
8. List of Plates . . . . . (if applicable)
9. Acknowledgments . . . . . (optional)
10. Dedication . . . . . (optional)

### Body

1. Introduction . . . . . (optional)
2. All chapters and sections of text . . . . . (required)

### Back Matter (supplementaries)

1. References Cited . . . . . (required)
2. Selected Bibliography . . . . . (optional)
3. Appendices . . . . . (if applicable)

A thesis might also include a **glossary**, a **list of symbols**, or a **list of abbreviations**. Any of these lists may either follow the last list in the front matter or precede the References Cited section in the back matter.

## Alternative Organization

In addition to the thesis organization described above, there may be cases where an alternative organization is appropriate.

### Multi-part thesis

With the approval of the faculty advisor, a student may combine research in related areas into a single thesis that includes published or unpublished papers and/or multiple projects. In a multi-part thesis, the research is arranged in a coherent order with consecutive page numbering throughout the body and back matter. A multi-part thesis has a single table of contents and other front matter as well as a single list of references and other back matter.

Please be aware that a multi-part thesis containing previously published material may be subject to copyright permission issues. Copyright policies are discussed on page 14, **Using Copyrighted Material**.

## Formatting Your Thesis

Producing text that is visually and stylistically *consistent*, gives a professional look and feel to your thesis. Though some thesis format elements are strictly required by the OGS, many formatting decisions are left to your discretion. However, once you have made those choices, you must apply them throughout the entire thesis. OGS requirements are marked with the light bulb symbol for quick identification.



### Using format templates

Microsoft and L<sup>A</sup>T<sub>E</sub>X both offer software for formatting a thesis. L<sup>A</sup>T<sub>E</sub>X may be downloaded from <http://www.Latex-project.org/>.

Software packages are also available for formatting references. One such application is EndNote.

**Note:** CSM does not provide technical support for these templates.

### Using student models

You should be cautious if you use a previous student's thesis as a model for your own. OGS changed certain format requirements beginning with the Spring 2007 Fifth Edition of this guidebook, and what was previously acceptable may no longer be so.

### Thesis Length

There is no upper page limit for a thesis; however, a bound volume is limited to the thickness of two inches, including folded maps, plates and CDs.

### Single-volume thesis

In order to stay within the two-inch limit for a single volume, we suggest the following practices:

- Write as concisely as possible.
- Use 1 1/2 line spacing rather than 2 in running text.
- Print the thesis on two sides of the paper, instead of printing single sided.

**Exceptions:** The pages of the front matter must be printed single sided. The first page of each new chapter in the thesis body must begin on an odd-numbered (right-handed) page, leaving the opposing page blank if necessary.



- Store large appendices as well as maps, plates, figures, tables, and other over-sized material on CD/DVD. This option is further described on page 18, **Computer disks**.

### Multi-volume thesis

A thesis thicker than two inches (including any supplementary elements such as folded plates or CD's), must be bound in more than one volume, and the writer must pay an additional binding fee for each volume. Each volume of the multi-volume thesis must have a title page that includes the volume number and a table of contents. You are encouraged to obtain advice from the Arthur Lakes Library Preservation Unit or the OGS about where to split thesis material into two volumes.

### Page Margins

The required thesis page size is 8 1/2 by 11 inches (letter size). The page margins given here are required and not optional.

- Top and bottom text margins: 1 inch wide.
- Inside text margin (binding side): 1 1/2 inch wide.
- Outside text margin: no less than 1 inch wide.
- Two-sided printing: the inside and outside margin widths should alternate pages. (Most word processing programs will automatically alternate margins on odd and even pages for documents that are copied on two sides).
- Page-number margin: 1/2 inch from either the top or the bottom edge of the page.

**Note:** Photocopying may enlarge an image, in which case, you should be certain that your margin widths stay within these requirements. For the same reason, when printing an electronic file or converting a file to PDF format, be certain to turn off the Scale to Page feature.

### Aligning Text

OGS prefers left-margin justification of paragraph text with "ragged right" edges. Right margin justification is accepted *only* if the word spacing is proportional, with no extra white space between words.

### Centering Text

When this guide directs that text and graphics be centered on the page between the left and right text margins, please note that is not the same as centering between the left and right edges of the paper. Keep in mind that the left and right margins on a page are not equal in width.

### Page Numbers



Requirements for the font style and location of page numbers in the thesis front matter differ from requirements for page numbers in the body and back matter of the thesis.



### Front matter page numbers

Roman numerals are used for page numbering of the front matter. Page numbers on the title page and copyright page are not displayed. Displayed page numbering begins on the submittal sheet, and is always roman numeral two (ii), regardless of whether or not a copyright page is included. The first page of the abstract is roman numeral three (iii), and so forth for the rest of the front matter.

Page numbers in the front matter are placed centered between the left and right text margins and  $\frac{1}{2}$  inch from the bottom edge of the paper.

### Main body and back matter page numbers

Arabic numerals are used for the page numbering of the main body and of the back matter. The page number on the first page of the body (Introduction or Chapter 1) is arabic numeral one (1). The arabic numbering continues consecutively throughout the rest of the thesis, including the back matter.

Page numbers in the body and back matter are placed at any appropriate place on the page. However, the placement of the page numbers must remain consistent throughout the body and back matter. Page numbers are usually placed at the top right text margin,  $\frac{1}{2}$  inch from the top edge of the page.

### Line Spacing and Indenting

The space between lines of all running text is  $1\frac{1}{2}$  or 2 lines (unless otherwise noted), and the first line of each paragraph is indented. Appropriate white space must separate text before and after short tables and figures that are included in text.



**Note:** Line spacing for figure or table captions is single spaced, as is that for multiple-line entries in lists (e.g., Reference Cited).

### Font or Typeface

Font or typeface affects the readability of your thesis more than any other style element; and as with other elements of the thesis, the font must be consistent throughout.

#### Font style

If you prefer to use a serif font, you may choose either Times or Times New Roman. If you prefer a sans serif font, you may use either Arial or Helvetica. You must use the same font style throughout the thesis;



including, e.g., lists, page numbers, headings and subheadings, chapter and appendix titles, and figure and table captions.

#### Font size

All running text must use a professional-looking type size; OGS recommends using between 10- and 12-point type.

#### Symbols

All symbols in the text, figures and tables must be typed or lettered, not handwritten.

## About the Front Matter

Front matter is the preliminary material that precedes the thesis Introduction or Chapter One, if the thesis has no introduction.

**Note:** All pages of front matter are copied single sided. That is, each page is blank on the back. See [Appendix C](#) for page examples. Roman numerals are used for page numbering of the front matter.



### Page Sequence

The sequence of the front matter is very important, and is as follows:

1. Title page . . . . . (required)
2. Copyright page . . . . . (if applicable)
3. Submittal sheet (page ii) . . . . . (required)
4. Abstract (page iii) . . . . . (required)
5. Table of Contents . . . . . (required)
6. List of Figures . . . . . (if applicable)
7. List of Tables . . . . . (if applicable)
8. List of Plates . . . . . (if applicable)
9. Acknowledgments . . . . . (optional)
10. Dedication . . . . . (optional)

If a thesis has not been formally copyrighted, and/or contains no figures, tables, plates, acknowledgments or dedication; then those items are not included. All other parts of the front matter are required.

## Title Page

The title page shows the thesis title and the author's name.

The thesis title, in ALL CAPITAL letters, is centered on the page between the left and right text margins, and between the top and bottom text margins. Long titles may be broken logically into more than one line, arranged in an inverted pyramid, 1 1/2- or double-spaced between lines.

The author's name, in upper- and lower case letters, is centered between the right and left text margins, and appears flush with the lower oneinch text margin. The word "by" in lower case letters, is centered one blank line (e.g., 1 1/2- or double-space) above the author's name.

The title page is unnumbered and blank on its back side.

**Note:** A title should be brief and descriptive, avoiding introductory phrases like "A Study to Determine..." or "An Investigation and Evaluation of..."

## Copyright Page

Although the student owns the copyright to the thesis, you may wish to register the thesis with the Library of Congress (see Registering for Copyright).

If an official copyright is obtained, the copyright page is the second page in the thesis, but numbering is suppressed, just as it is in the title page. The copyright page is always blank on the back side.

The thesis copyright page contains the 1) author's name, 2) the date, and 3) the statement, "All Rights Reserved," centered on the page. See the example in [Appendix C](#).

## Submittal Sheet

The submittal sheet contains the 1) submittal statement; 2) the signatures of the author, thesis advisor, co-advisor (if applicable), and department head; as well as 3) signature dates. To find the required submittal sheet format, see the example in [Appendix C](#).



### The submittal statement

The submittal statement is typed in paragraph form beginning at the top text margin, double-spaced, with the first line indented.

### Signature dates

The city, state and signature date are flush with the left text margin.

### Signatures

The lines for signatures are flush with the right margin.

**Note:** The page must be signed by all parties in black ink before the thesis is submitted to the OGS for final format review.

## Submittal sheet page number

Displayed page numbering in the thesis begins on the submittal sheet, and should be roman numeral two (ii), centered between the right and left text margins, 1/2 inch from the bottom edge of the paper. The submittal sheet is always blank on its back side.

## Abstract

The abstract, sometimes called the summary abstract, includes a concise statement of the thesis problem, a brief description of the research method or design, and a report of the major findings and conclusions.

### Abstract length

The abstract in a master's thesis has no length restriction. However, in a Ph.D. dissertation, the abstract limit is 350 words, or approximately 1 1/2 pages of text. This limit is set by the publishers of the Dissertation Abstracts International. Dissertation abstracts are submitted by OGS to this publication for indexing.



As an alternative, you may include a longer abstract in the thesis and also separately submit a shorter summary to OGS that adheres to the 350-word limit. The submission of the shorter summary is part of the graduation checkout requirement.

### Abstract format

Beginning with the abstract, the title for each part of the front matter is typed in all capital letters (e.g., ABSTRACT) and is centered between the left and right text margins, on the line one keyboard return below the top page margin. The text of the abstract begins two keyboard returns below the title.



The abstract page number is a roman numeral three (iii), centered between the left and right text margins, 1/2 inch from the bottom edge of the paper. The thesis title is not included on the abstract page, and the abstract page should always be blank on its back side.

## Table of Contents and Other Lists

It is **required** to include a table of contents in the front matter of the thesis. All chapters and sections in the thesis and their page numbers are listed in the Table of Contents. Pages that are not listed in the table of contents are the title page, the submittal sheet page, the copyright page, and the table of contents itself. Electronic material is included in the table of contents.



The table of contents and all other lists included in the front matter are single sided and begin on a separate page. In cases where a list of figures, tables or plates has only one or two entries, they may all be placed on one page with a suitable title such as LIST OF FIGURES AND TABLES. If included in the front matter, a glossary, a list of , or a list of symbols is placed as the last list. If these lists are included in the back matter, they are placed immediately before the REFERENCES CITED.

### List format

The title of the list, e.g., TABLE OF CONTENTS, appears only on the first page of the list. The title is centered between the left and right text margins and one keyboard return from the top margin. The list begins one keyboard return below the title. The listed titles and headings are 1<sup>1</sup>/<sub>2</sub>- or doublespaced. Longer entries that are multiple lines are single-spaced, and the second and subsequent lines are indented. The table of contents and other list pages included in the front matter, are numbered with roman numerals.

### List content

Each list entry must have exactly the same wording, capitalization and punctuation as the titles and headings in the text. In the case of long figure captions, the text in the list may be abbreviated (while retaining the sense of the whole caption). Figure subtitles may be omitted unless those subtitles distinguish several items within the same title.

For each list item, leader dots (spaced periods . . .) extend from the entry on the left side of the page to the page number that is flush with the right margin. The dots are aligned vertically. Items, such as plates, which will be inserted in the pocket on the back cover of the thesis, have the word “pocket” in the page number column.

## Acknowledgments

The acknowledgments page contains 1<sup>1</sup>/<sub>2</sub> or double-spaced paragraph(s), with an indented first line. In the acknowledgments, the author recognizes advisors, committee members, and other persons who provided special help or advice. Included here are also any fellowships or other support from outside agencies or from CSM, and any permissions received for extensive use of copyrighted material.

### Acknowledgments format

The capitalized title is centered on the line that is one keyboard return below the top text margin. Text begins two keyboard returns below the title. Page numbering continues in roman numerals, as in all front matter. The acknowledgments page is blank on its back side.

## Dedication

A dedication page is optional and not frequently included in a thesis. However, occasionally the thesis writer wants to dedicate the document to a professional colleague, friend or relative. A dedication typically expresses gratitude for someone’s support.

### Dedication format

If a dedication page is included, it is placed at the end of the front matter section, following the acknowledgments. Typically, a dedication page has no title; it simply states, e.g., “For my father.” Roman numeral page numbering continues on the dedication page, which is blank on the back side.

## About the Main Body

The body of the thesis is the main text. It may begin with an introduction or immediately with chapter one, and it may have several numbered chapters or unnumbered sections, depending on the preference of the department or advisor.

## Titles

The chapter or section title for each part of the body is typed only on the first page of that part in all capital letters (for example, INTRODUCTION) and not underlined. The title is centered between the left and right text margins, one keyboard return below the one-inch top page margin.

## Headings and Subheadings

Within each titled chapter of the thesis body, section headings are used to help the reader understand the organization of the information.

At least one paragraph of text must follow each heading or subheading. Headings and subheadings may not follow each other without some text between, and may not stand alone at the bottom of a page. If after the heading or subheading, there is not room for at least two lines of 1<sup>1</sup>/<sub>2</sub>- or doublespaced text before the bottom text margin, then the heading is placed at the top of the next page.

You must follow your department’s preference for the heading system and style, but two frequently used systems are the doublenumbering system or the three-level system.



### Double-numbering system

In the double-numbering system, each heading is preceded by a number. For instance, in the second chapter of a thesis, the first subheading is numbered 2.1. The use of heading numbers requires at least two subdivisions under each main division. That is, if there is a 2.1, there must be a 2.2. If

there is only one division under a heading, then that division is labeled as 2.0, not 2.1. An example page illustrating the numbering system is included in [Appendix C](#).

Numbered headings and subheadings use capital and lower case letters and are all placed flush with the left margin. Three single lines precede a heading or subheading, and one keyboard return follows it.

### Three-level system

The three-level system uses the following heading levels.

**A-Level:** This heading uses both capital and lower case bold letters, and is left justified. Three single lines separate the heading from preceding text, and one keyboard return separates the heading from the following text.

**B-Level:** This heading uses both capital and lower case bold letters, and is indented from the left text margin. Long subheadings are broken into two lines and single spaced, with the second line indented from the first line. Three single lines separate the subheading from preceding text, and one keyboard return follows the subheading before the text that follows.

**C-Level:** This heading uses both capital and lower case bold letters and is indented from the left text margin incrementally from the B-Level heading. Three single lines separate the subheading from preceding text, but the text of the subsection begins on the same line as the subheading.

### Paragraphs

Paragraphs beginning at the end of a page must contain at least two lines before the page break, an “orphaned paragraph” with only one line is not permitted. Additionally, the text flow may not be interrupted by a figure or table leading to blank space at the bottom of a page. This restriction *will not be waived* to force a figure or table into a particular section.

### Writing Numbers in Text

In scientific writing, it is customary to write out numbers one through nine in the text. It is also customary to use arabic numerals for numbers 10 and above, except when the number appears at the beginning of a sentence. Numbers appearing at the beginning of a sentence should always be written out. Other notable exceptions: arabic numerals are always used with percent, units or actual measurements, time (when used with a.m. and p.m.), fractional numbers, and data taken directly from a table or figure.

### Including Quotations

#### Short quotations

Quotations shorter than three typed lines are included in the running text and are preceded and followed by quotation marks. The source must be documented at the end of the quote. (See [Referencing Sources in Text](#), page 14.)

#### Long quotations

Quotations longer than three lines of text (block quotations) are single-spaced, indented from both the left and right text margins, and separated from the text above and below by one keyboard return. Block quotations do not require quotation marks.

#### Abbreviating quoted passages

It is acceptable to omit irrelevant information from a direct quote. In that case a number of ellipsis points (. . .) are used to show where information has been omitted. You should check a writing manual for further details on the correct use of ellipsis points.

### Including Figures and Tables

A figure is a graphic illustration of information, such as a line drawing, a graph, a map, a photograph, a plate, or a chart. A table is a graphic that contains a systematic arrangement of facts or numbers in rows and columns (that is, in tabular form). A table appearing in running text should show only information relevant to that text.

#### Placing a figure or table

A figure or table that covers more than a half page may be placed on its own, separate page. More than one table or figure may appear in sequence on a single page, if they represent sequential information. A figure or table included in running text must be contained on a single page and not continued to the next page. Use consistent line spacing to separate the figure or table from the preceding and following text.

Small, two- or three-column tables with only three or four items per column may be worked into the text without an identifying table number or caption.

#### Oversized figure or table

If a table must cover more than one page, headings for continuous columns are repeated on each page, and notes may appear either at the end of the table or on the page to which they refer. Sources appear at the bottom of the first page.

Figures and tables that are formatted wider than they are high may be turned to fit on the page within all margins. The entire illustration, including its caption and sources, is turned so that the top of the illustration is parallel to and just inside the regular binding-side text margin (landscape orientation). The page number, however, remains in the same position on the page (portrait orientation), as it is throughout the body and back matter of the document.

A figure or table too large to fit within the 6- inch by 9-inch text area may be reduced, but its caption font must be the same size and style as that used for the text in the rest of the thesis.

## Captions

Figures and tables are identified both by a number and by descriptive text contained in a caption. This combination of figure number and caption must appear below figures, while the corresponding table number and caption must appear above tables.

Captions may be placed flush with the left text margin or centered between the right and left text margins, but the location of all captions must be consistent throughout the text. If a figure or table fills the entire 6-inch by 9-inch text area on a page, leaving no room for the caption, then the caption for that illustration is centered alone on a separate preceding page.

For multi-part figures that are spread over separate pages, the full caption should appear under the first part (a) and captions for the following parts would be labeled, i.e., “Figure 4.3b: continued.” Captions should be complete, not abbreviated.

## Fonts

Figure and table captions must be in the same font (e.g., Times Roman) and size (e.g., 10-12 point) as that used for the text in the rest of the thesis. Single line spacing is required in captions.

As with figures, the font in a table matches the body text, and placement of numbers and captions must remain consistent. Notes and sources are typically placed at the bottom of the table or below the caption of a figure.

**Note:** You may use lower case superscript letters, numbers, or symbols in a table to refer to the bottom notes and sources; however, using reference symbols (such as an asterisk [\*]) or letters in a table of numbers is less likely to confuse a reader than using superscript numbers.

## Numbering a figure or table

Figures and tables are numbered consecutively throughout the text of the thesis. If numbered headings are used in the text, then a parallel numbering system is used for illustrations. For instance, the first figure in Chapter 2 would be Figure 2.1 and the following figure would be Figure 2.2, etc. Related figures may be identified either by using the same number with a lower case letter (Figure 4.3a, Figure 4.3b), or by different numbers (Figure 4.3, Figure 4.4).

Numbers for figures or tables that appear in appendices are preceded by the capital letter identifying the appendix, as in Figure A-3 or Table C-2.

## Referring to a figure or table in the text

The first reference in the text to a figure or table must precede it. If the figure or table is incorporated in the text, then the reference is in the preceding paragraph or on the same page. If the figure or table is on a separate page,

then the reference to it must be on the preceding text page. If two or more figures are referred to consecutively on one page, then they must follow on the page or the next pages consecutively.

The text reference should identify a figure or table by number (e.g., write, “See Figure 7.”), rather than by a relative location (e.g., do not write, “In the following figure . . .”).

## Including Photographs

Illustrative photographs included in the text of a thesis, should be scanned to a digital format and as either black and white or color. Color photographs should be printed in color. Do not glue actual photos onto a page. A photograph used as a figure is given a number and caption.



## Including Maps and Plates

You are encouraged to include larger maps and plates on CD or DVD. (For labeling requirements, see [Thesis Pocket Contents](#), page 17.)

If instead, you include actual maps or plates in the thesis (often printed on paper that is different from that used for the text), then they must be folded to 7 by 10 inches to fit the thesis pocket. Examples of more complicated folding of large graphics may be found in bound theses that are stored in the Arthur Lakes Library. Each plate must have a title, plate number, and author's name placed on the outside fold. Plates are a type of figure listed separately in the front matter, as are equations and tables.



## Including Equations

Equations appear either as part of running text in a paragraph, or are set apart from the text (displayed), depending on their length. In either case, punctuation must be used appropriately. Equations must be typeset; handwritten characters are not acceptable.

## Placing equations

Equations may occur in running text, but all numbered equations must be displayed, that is, placed on separate lines and either centered or indented a consistent distance from the left text margin.

## Numbering equations

All equations *referred to* in the text must be numbered, although not all displayed equations must be numbered. As in numbering figures and tables, a double numbering system is used for equations; for example, Equation 2.1, where 2 is



the chapter, and 1 is the first numbered equation in that chapter,

$$\Gamma - \delta \times a = 0. \tag{2.1}$$

The equation number is placed flush with the right text margin and enclosed in parentheses. Equations in running text are not numbered.

### Breaking equations

An equation too long for one line is broken before an operational sign. Unless the equation is centered, the second line can be flush right, aligned on an operational sign, or indented far enough from the right to make room for the equation number. Equations longer than two lines are aligned on operational or descriptive signs.

If a repeated part of the formula is replaced with an ellipsis (three spaced periods [. . .]), all appropriate punctuation and operational signs (for example, a final comma or sign in a series) are still included. Thus, the writer uses the following format:

$$\begin{aligned} &P_1, P_2, \dots, P_n \\ &P_1 + P_2 + \dots + P_n \\ &P = 1, 2, \dots \end{aligned}$$

not

$$\begin{aligned} &P_1, P_2, \dots P_n \\ &P_1 + P_2 + \dots P_n \\ &P = 1, 2 \dots \end{aligned}$$

## Referencing Sources in Text

There are various methods to reference sources in running text. Two popular methods are described below: 1) the numerical system, and 2) the author-date system (also known as the USGS system).

**Note:** Your thesis advisor must approve your choice of documentation system.

### Numerical system

In the numerical reference system, an information source is cited by placing a number in parentheses on the text line at the appropriate place in the text. The number corresponds to the entry with the same number in the back matter REFERENCES CITED list. In this system, references are ordered numerically throughout the thesis, from its beginning to end. If more than one reference is cited at the same point in the text, the reference numbers in parentheses are arranged in ascending order. These reference numbers may also be placed as superscripts. Here are two examples:

- ... likely to occur in natural hydrothermal systems (1).
- ... is the subject of numerous solubility studies<sup>(1,5,7)</sup>.

Table 1: Author-Date Reference Examples

|                                |  |
|--------------------------------|--|
| (Smith 1991)                   | (Smith et al. 1992)                      |
| (Jones 1990, 74)               | (Exxon 1996)                             |
| (Brown 1989, vol. 25)          | (Smith 1991; Jones 1990; Brown 1989)     |
| (Jones 2003, table 12)         | (Jones 1990a)                            |
| (Jones 1990, eq. [87])         | (Jones 1990b)                            |
| (Smith and Jones 1990)         | (personal communication, 1 August 2001)  |
| (Smith, Jones, and Brown 1989) | (B. Smith, letter to author, 1 May 1991) |

### Author-date system

In the author-date system, the simplest source reference gives the author’s last name and the source publication year enclosed in parentheses at the appropriate place in the thesis text. There may be slight differences in punctuation, so the author must choose a pattern from a good handbook, such as the latest edition of the *Chicago Manual of Style*, and apply the pattern consistently throughout the thesis.

Source references are placed just before a mark of punctuation or at a logical place in the sentence being documented. If some or all of the source citation is incorporated into the text, the parentheses are not necessary.

Smith and Jones (1991) reported...  
or  
In Smith and Jones 1990a, the case...

Source information may include page, volume, illustration (table or equation, for example), multiple or group authors, more than one reference from different authors or the same author, or an unpublished source not listed in the REFERENCES CITED. See [Table 1](#) for examples.

### Using Footnotes

Footnotes are used only to include extra, peripheral information that amplifies the text and might interest the reader, but that is not essential to the text. Footnotes may define acronyms or other terms, give copyright or trademark information, or provide supplementary information, *but they are not used* to document sources of text information.

Footnotes are indicated by a superscript number at the appropriate place in the text, *outside any punctuation*. Note that this differs from source reference numbers, which are placed inside punctuation. Footnotes are numbered consecutively throughout the thesis, and most word processing programs will automatically number and format footnotes on the page.

### Using Copyrighted Material

If you use copyrighted material in a limited way, permission to quote is not necessary. However, if you use extensive

material from a copyrighted work, you must obtain the owner's permission in writing. The publisher usually has the authority to grant permission to quote excerpts from the copyrighted work or can refer requests to the copyright owner or designated representative. The copyright owner may charge a fee for permission to quote. Permissions should be credited in the Acknowledgments, and the source should appear in the References Cited. Include the written release to use copyrighted material in an appendix to the thesis.

In many fields, it is common for candidates to publish their research results prior to completion of the degree and to include material from these prior publications, in whole or in part, in the thesis. To the extent that this practice encourages student participation in the wider research enterprise and a wider dissemination of student research results, we encourage departments to adopt this model.

**Permission to include previously published material.** The shelving of a thesis or dissertation in the Library and access to dissertations through UMI (ProQuest) Dissertation Publishing is a form of publication. Most journal and book publishers require authors to sign over copyright to articles or book chapters to the publisher. Publishers' copyright policies may, or may not, allow republication of these articles as part of a candidate's thesis or dissertation. Additionally, re-publication of journal articles as part of a thesis or dissertation is not explicitly covered under section 107 of the copyright act; the so-called "fair use" section.

Thus, in the case where copyright of articles or book chapters included in a thesis or dissertation has been turned over to an external publisher, *it is the responsibility of the candidate to obtain permission from the publisher to include these materials in a thesis or dissertation.* Copies of this permission should be included as an appendix to the thesis or dissertation.

To obtain permission, candidates should initially look at the publisher's website. Some publishers (e.g., The American Chemical Society and Elsevier) provide a document or policy statement on their website that explicitly allows materials produced by the candidate to be included in their thesis or dissertation without obtaining explicit permission. Others (e.g., IEEE, SEG and ASME) provide links and directions as to how to obtain the necessary permission from the publisher.

In these latter cases, please be aware, that despite a candidate's best efforts, publishers are not obligated to respond to requests for permission to re-publish. If a candidate has attempted to contact a publisher but has received no response, existing Copyright Law requires that this non-response be interpreted as a denial of permission to re-publish.

**Permission to include multi-authored papers.** In addition to the above permissions, in some disciplines, it is normal to consider the inclusion of materials that

are multi-authored in a thesis or dissertation. This is particularly true when collaboration and co-operation are required for researchers to undertake basic research efforts at the frontiers of their disciplines, either because of the nature of the work or the nature of the facilities involved. For materials included in a thesis or dissertation, however, it is presumed that the candidate is the primary owner of the intellectual activities described.

If co-authored material is to be included in a candidate's thesis or dissertation, the Thesis Committee and the Department Head/Division Director of the candidate's home department/division must approve of the appropriateness of the inclusion of this material in the thesis or dissertation. Additionally, if the material was co-authored by authors other than the candidate's advisor or thesis committee members, the candidate must obtain permission from each co-author to reproduce the material as part of the thesis or dissertation. Copies of this permission should be included as an appendix to the thesis or dissertation.

It is the practice of the CSM library to provide copies of theses/dissertations to library patrons upon request for a reproduction fee. As such, the Library asks students to provide them permission to disseminate theses/dissertations through this means.

**Note:** It is unlikely the standard permission to include copyrighted material in a thesis or dissertation that you receive from a professional society will also include permission for the Library to reproduce and distribute your thesis/dissertation. Unless specific approval is received from the external copyright holder, for library reproduction and dissemination, the Library can not provide copies of your thesis/dissertation to its patrons when it includes significant sections of externally copyrighted material.

## About the Back Matter

Back matter is the documenting and reference material that follows the main body of a thesis, and other information that supplements the main thesis text.

## Page Sequence

The back matter of the thesis may include the following:

- Glossary . . . . . (optional)
- List of abbreviations . . . . . (optional)
- References cited . . . . . (required)
- Selected bibliography . . . . . (optional)
- Appendix or appendices . . . . . (optional)

A glossary of terms and a list of are optional in a thesis and may be placed either right before the list of references cited or immediately following the last list of illustrations in the front matter.



It is probable that a thesis would not need a Selected Bibliography section (sometimes called additional readings) because all sources of information for the discussion are included in the References Cited. A thesis is not required to have appendices; however, if you want to include supplementary information that is too long to place in a footnote, then appendices are appropriate.

## Titles and Headings

The title for each part of the back matter is typed in all capital letters (for example, REFERENCES CITED or APPENDIX).

For references and bibliographies, the title is centered between the left and right text margins, one keyboard return below the one-inch top page margin. Appropriate space is left between the title and the line of text below. For appendices, the heading APPENDIX may either be placed at the top of the page as for the reference headings, or it may be centered on a separate page preceding the appendix. If there is more than one appendix, they are identified with capital letters APPENDIX A, APPENDIX B, etc.

## References Cited

The References Cited list is the only back matter that is required in each thesis. The list includes only sources that are cited in the thesis front matter, main body, or back matter (appendices). Other related material on the thesis topic that may be of interest to the reader may be listed in a Selected Bibliography.

### Order of references

The order of the items listed in the References Cited depends upon the citation system you choose to use in the thesis text. See the previous section (Referencing Sources in Text) for descriptions of the numerical and author-date reference systems.

In the numerical reference system, sources are ordered numerically as they appear from thesis beginning to end, and the sequence of the items in the references cited list in the thesis corresponds to those numbers in the text. In the author-date system, the list of sources is alphabetized by author's last name.

### Format of references

The format for reference entries may be chosen by the writer, but must have the approval of the writer's department and thesis committee. You must keep the format consistent throughout the list.

The two common list entry styles—a traditional and a modern—differ mostly in the use of capitalization, punctuation marks, and abbreviations. The OGS recommends the simpler modern format, which the most recent edition of

the *Chicago Manual of Style* identifies as appropriate for a scientific bibliography.

*The Chicago Manual of Style* has useful examples of entries for books, articles, public documents, anonymous or unpublished works, book series, and several works by the same author. Other examples of reference formats are found in the *American Chemical Society Style Guide* (especially for patents, reports, abstracts, oral presentations, and unpublished material) and in the style guides of journals in the thesis writer's field.

## Selected Bibliography

The Selected Bibliography may also be called additional readings. It lists sources of information that are related to the thesis topic and that might interest a reader who wants to pursue the topic. Selected bibliographies are optional and not typically included in a scientific thesis. The format and content of entries must be the same in both the References Cited and for the Selected Bibliography lists.

## Appendices

Appendix material is information that is not essential to the text but that contributes to it. Appendices are used to include information such as the following:

- Original data
- Long quotations
- Supporting legal decisions or laws
- Computer codes and programs
- Lithologic and petrographic descriptions
- Questionnaires
- Forms and documents
- Permissions to use copyrighted material
- Long tables

You may include long appendices on CDs or DVDs, instead of including them in the printed thesis copies. These disks, in jewel cases, will be inserted in the thesis pocket during the binding process. In either instance, appendices are listed in the table of contents.

### Numbering in appendices

Figure, table and equation numbers in appendices are preceded with the appropriate appendix letter, e.g., the first equation appearing in Appendix A, would be numbered (A-1).



## Thesis Pocket Contents

If a thesis includes plates, maps, CDs/DVDs, or other material that is not bound into the text, heavy-paper box pockets constructed to hold the material are attached to the inside of the back cover when the thesis is bound.

### Special types of pages

Plates and maps larger than the thesis page margins are folded to 7 by 10 inches to fit into the thesis cover pocket.

### Labeling pocket contents

Each plate or map must have a title, plate number and the author's name on the outside fold. Computer disks are labeled as described below.

### Electronic material

Original computer programs or data files that are part of a thesis may be included on a CD or DVD. Operating system formats may be Windows, Mac, or UNIX, but the operating system must be cited on the label. See page 18 of this guide for labeling instructions and [Appendix C](#) for a label example.

## Printing Your Thesis

After your thesis has been approved by the OGS, you are responsible for the printing of the required copies of the thesis that are submitted to the Arthur Lakes Library for binding and preservation.

### Volume thickness

Because of binding limitations, the thickness of the thesis must not total more than two inches. This limit includes thesis pages and foldout pages, maps, plates, and computer disks together (see [Multi-volume thesis](#), page 8).



### Number of copies

You will deliver six copies of your thesis (seven copies, if there is a co-advisor) to Arthur Lakes Library Preservation Unit.

**Note:** If you need seven bound copies, there is an additional fee paid, in addition to the graduation fee. Along with the hard copies of the thesis, you are advised to submit a back up of the entire thesis on a properly labeled CD/DVD. The copies are distributed as shown in [Table 2](#).

Table 2: Distribution of Thesis Copies

|        | Owner/Use           | Format      |
|--------|---------------------|-------------|
| Copy 1 | Library/Vault       | Bound       |
| Copy 2 | Library/Circulation | Bound       |
| Copy 3 | Department          | Bound or CD |
| Copy 4 | Student             | Bound or CD |
| Copy 5 | Advisor             | Bound or CD |
| Copy 6 | Library/Microfiche  | Unbound     |
| Copy 7 | Co-advisor          | Bound or CD |

### Print quality

The printing of all final thesis copies must be “letter quality.” Make certain that the type and graphics reproduce clearly, sharply, and with uniform blackness. Laser printing and superior quality inkjet printing are both acceptable methods.

### Printing one sided and two sided

You are encouraged to submit two-sided copies of the thesis. However, remember that although pages in the body and back matter of the thesis may be printed two sided, each page of the front matter and every new chapter must begin on a “new,” i.e., right-hand page.



### Required paper

Required copies of the thesis or dissertation must be printed on acidfree bond paper. Acid-free paper is widely used in books and other important documents intended to last for at least 100 years. Paper that is not acid free quickly yellows and deteriorates and is therefore not acceptable for the Library's preservation purposes.



In addition to acid-free paper, copies that are printed two-sided must be of 24-weight bond paper. For those printed single sided, 20-weight bond paper is acceptable.

Kinko's and CSM Copy Center (Guggenheim Hall) or other facilities can reproduce your thesis onto acid-free paper. Acid-free paper is also available from the CSM Bookstore for those students who wish to print using their own printer.

CSM Copy Center can also copy your thesis onto “CSM watermark paper,” a type of acid-free paper with the CSM logo embedded. Use of CSM watermark paper is not required, though many students prefer it.

### Proofing copies

You are responsible for checking each printed copy of the thesis to ensure that there are no missing pages and that all pages are in order. Crossing out of letters or words,

strikeovers, liquid-paper corrections, or erasures are not acceptable on final copies.

## Copying your thesis onto CD/DVD

With permission of your advisor and department, you may submit three (or four) of your required thesis copies on separate CD/DVDs: one each for the department, the advisor(s), and the student. The other three copies printed on paper are submitted to the Library.

**Note:** Although you submit copies of your thesis on CD/DVD, there is no downward adjustment of the graduation fee.

When the copies are delivered to the library for preservation, they must have all graphics and special materials (plates, figures, foldouts, maps, computer disks, etc.) folded, labeled, and placed in the same order as they are listed in the table of contents, just as is required when you submit your thesis to OGS for the final format approval.

## Photographs

Actual photographs are not acceptable in the thesis. You must scan photographs to digital format or make copies of pages with original photographs. Color photographs must be color printed.

## Computer disks

To reduce the size of the thesis, you are encouraged to put long appendices, plates, maps, and other oversized pages on CD/DVD, rather than as physical additions to the thesis. Additionally, original program or data files may be submitted on “readonly” CD/DVD.

The CD/DVD's must be submitted in a plastic jewel case at the same time the paper text of the thesis is submitted. The CD/DVD must have computer-printed (not handwritten) labels that contain the title of the thesis, the author's name, “Colorado School of Mines,” names and versions of all software used to create the files, and the contents of the disk. See the disk label example in [Appendix C](#).



### CD/DVD Virus-Scan Certification.

Required beginning Fall 2008, all CD/DVDs submitted with final thesis copies to the Arthur Lakes Library must first be scanned for viruses and other malicious software by IT personnel in the Academic and Computing and Networking department (AC&N). Disks proven to contain no problems will receive a signature of certification. Do not submit your CD/DVD for scanning until after your thesis receives final format approval by OGS.

## Plates

Plates larger than the margins are folded to 7 by 10 inches and submitted with the thesis. All plates must be labeled on the outside fold with the plate title, plate number, author's name, and thesis title.

**Oversized foldout pages** With OGS approval, you may include foldout pages. The pages must be folded so that 1½ inches remain at the left (binding) side. The right-hand fold should be ¼ inch from the right edge of the text page and should be an engineer fold. OGS staff is able to advise you in this matter and examples are available in theses stored in Arthur Lakes Library.

## Submitting Your Thesis to Arthur Lakes Library

In order that the Library might protect and preserve Colorado School of Mines graduate theses and dissertations, each graduate student in a thesis program must submit required copies of their thesis to the Library Preservation Unit prior to the thesis deadline set by the OGS.

### Where to submit

Submit your thesis or dissertation to Margaret Katz, Collections Conservator, Preservation Unit, Room 170. The Preservation Unit is open Monday through Friday, 8:00 a.m. to 11:30 a.m. and 12 noon to 4:00 p.m.

*Directions to the Preservation Unit:* When you enter the library lobby, turn right toward the Reference Room. Turn left just before the Reference Room and go down the long east-west hallway until you reach the elevator. Take the elevator down to Level 1. Turn left as you exit the elevator. The Preservation Unit is immediately to the left of the elevator behind double doors.

### What to submit

Arthur Lakes Library will accept from graduating students **ONLY** the six copies (or seven copies, if there is an officially designated co-advisor) that are required by the OGS. Binding of additional copies is the responsibility of the student or the department.

### Library thesis binding policy

Certain library materials, such as graduate theses and journals, are bound according to special guidelines for academic libraries in order to ensure that the resulting book has longevity of at least 100 years. These materials are sent to a binding company that specializes in creating books to meet this archival standard. An average turnaround time is four months.

The binding will be done to the Library's specifications; custom binding is not possible.

Students or departments wishing to customize the binding of their thesis (i.e., style, color, cover and spine stamping) or desiring faster turnaround, should deal directly with a commercial binding vendor. If you wish to pursue custom binding, you must notify the Library in advance, and then submit to the Library only the three copies that ultimately reside there.

Following are suggested local binderies:

- Denver Bookbinding (hardcover archival binding).  
Website: <http://www.denverbook.com/>.
- Kinko's Copies (soft cover bindings) at various metro-area locations
- CSM Copy Center (soft cover bindings), 1<sup>st</sup> Floor, Guggenheim Hall.

## Submission checklist

Before submitting your thesis or dissertation to the Library Preservation Unit, please take the following steps:

- Proofread your title page
- Obtain submittal sheet signatures and dates from your advisor(s) and department head.
- Receive final format approval from the OGS.
- Make the required six copies on acidfree paper. Only those students who have an officially-designated co-advisor may submit seven copies for binding.
- Check all thesis copies, making certain all pages are included and in proper order.
- Obtain the required virus scan certification from AC&N for all CD/DVDs included with the thesis. (See [Computer disks](#), p. 18.).
- Include accompanying material (maps, CDs, etc.), if applicable.
- Fold any maps and inserts.
- Pay all applicable graduation fees to the CSM cashier.
- Take the Graduate School's blue checkout card with you.

## Distributing the bound thesis

After the thesis has been bound and delivered to the Library, the copies for the department, advisor(s), and student are forwarded to the department. Contact your department office for information about its distribution policies

## Appendix A - Check Lists

### Thesis Writing and Defense Process

- ☐ Select thesis topic: Master's students, 2nd semester of classes; Ph.D. students, at least one year before you plan to receive your degree
- ☐ Select thesis advisor and committee  
**Submit Form to OGS:** Thesis Committee Form
- ☐ Write and present thesis research proposal  
**Submit Form to OGS:** Admission to Candidacy
- ☐ Submit thesis drafts to advisor and committee; revise and resubmit as necessary
- ☐ Schedule thesis defense  
**Submit Form to Academic Department:** Thesis Defense Request (at least one week before defense date)
- ☐ Defend thesis (at least five weeks prior to graduation)
- ☐ Submit requested post-defense revisions to advisor and committee for review
- ☐ Obtain required signatures (in black ink) on submittal sheet, page ii of the thesis
- ☐ Submit clean, final draft copy, including plates, maps, CDs, etc., as well as signed signature sheet, to OGS for final format review
- ☐ Pay graduation and all other outstanding fees to the CSM cashier
- ☐ Submit required copies of thesis to Library Preservation Unit  
**Submit Form to OGS:** Check-out Card and Work Completion Form (at least four weeks before graduation). Take Check out Card to Library Preservation Unit when delivering copies for binding

## Required Forms

Forms and specific deadline dates for the current semester may be found online at <http://gradschool.mines.edu/GS-Forms>. Thesis and graduation deadlines are also in the current Graduate Student Handbook. Individual academic departments may also have specific deadlines.

| <input type="checkbox"/> | <b>Title</b>                                      | <b>When to Submit</b>  | <b>Where to Submit</b>  |
|--------------------------|---|--|---|
| <input type="checkbox"/> | Thesis Committee Form                             | Upon selection of committee and advisor  | Office of Graduate Studies  |
| <input type="checkbox"/> | Admission to Candidacy Form                       | Upon successful presentation of thesis research proposal   | Office of Graduate Studies  |
| <input type="checkbox"/> | Graduation Application                            | Within 5 weeks of the beginning of the semester in which you expect to graduate  | Office of Graduate Studies  |
| <input type="checkbox"/> | Thesis Defense Request Form                       | At least one week before defense date; and at least six weeks before graduation  | Academic Department   |
| <input type="checkbox"/> | Submittal Sheet                                   | Signed and included as page ii in the thesis, following the successful defense and prior to the final format approval by OGS | Office of Graduate Studies  |
| <input type="checkbox"/> | Statement of Work Completion Form                 | Prior to delivery of required thesis copies for binding and preservation   | Office of Graduate Studies  |
| <input type="checkbox"/> | Checkout Card                                     | Obtained from OGS prior to delivery of required thesis copies for binding and preservation                                   | Signed by Arthur Lakes Library Preservation Unit and returned to OGS                    |
| <input type="checkbox"/> | Proprietary Research Agreement<br>(if applicable) | Submitted with delivery of thesis copies for binding and preservation  | Signed by Dean of Graduate Studies and then submitted to Arthur Lakes Preservation Unit |
| <input type="checkbox"/> | Copyright Application Form<br>(if applicable)     | Submitted at any time  | Library of Congress Copyright Office  |

## Required Formatting

**Is the required front matter properly formatted, placed in proper sequence, numbered with roman numerals, and printed single sided?**

- ☐ Title page
- ☐ Copyright page (if applicable)
- ☐ Submittal sheet (numbered as page ii)
- ☐ Abstract (numbered as page iii; does not exceed 350 words for Ph.D. dissertation)
- ☐ Table of contents
- ☐ List of Figures, Tables and Plates, etc. (if applicable)

**Are these formatting elements included and consistent throughout the thesis?**

- ☐ Margins: top and bottom text margin — 1 inch wide; inside text margin — 1<sup>1</sup>/<sub>2</sub> inch wide; outside text margin — not less than 1 inch wide.
- ☐ Alternating margin widths: If printed two sided, the inside and outside margin widths alternate with even- and odd-numbered pages.
- ☐ Roman-numeral front matter page numbers: centered, 1/2 inch from bottom edge of paper.
- ☐ Arabic-numeral main body and back matter page numbers: begins as page 1 on first page of Introduction or Chapter 1.
- ☐ First page of each chapter, if printing two-sided: begins on an odd-numbered (right-hand) page.
- ☐ Line spacing: 1<sup>1</sup>/<sub>2</sub> or 2 line spacing for body text; single line spacing for captions and multiple-line references
- ☐ Text alignment is consistent: left-margin justification with ragged right edges; or left and right margin justification with NO extra white space between words.
- ☐ Indentation: first line of each paragraph is indented
- ☐ Fonts: use standard fonts only, i.e., Times, Times Roman, Arial, or Helvetica, 10-12 point type; no handwritten symbols in text or equations
- ☐ Capitalization: proper capitalization for chapter or section titles and subheadings
- ☐ Headings and subheadings: at least one paragraph of text between headings and subheadings; at least two lines of text after a heading or subheading before the end of the page.
- ☐ Numbering: proper numbering for sections, subsections, figures, tables, equations, and footnotes; if numbering system not used for sections and subheadings, are they indented appropriately?
- ☐ References: only references cited in the text are included in References Cited; and all references listed in References Cited are included in the text
- ☐ Reference formatting: references are formatted consistently
- ☐ Oversized elements: plates and maps larger than the thesis page are properly folded to 7 x 10 inches, and labeled on the outside fold
- ☐ Photographs: import photographs into text as digital files; do not attach actual photographs
- ☐ CDs or DVDs are labeled and included in jewel cases

**Have you remembered these requirements for printing and submitting your thesis?**

- ☐ Proofread the thesis carefully (including the title page and acknowledgements page)
- ☐ Obtain the required signatures on the submittal page from the advisor(s) and department head
- ☐ Print front matter pages one-sided only; thesis body and back matter pages may be printed either one sided or two sided.
- ☐ Use acid-free bond paper (24-weight bond required for double-sided printing or 20-weight bond may be used for single sided printing); may use CSM watermark paper
- ☐ Print 6 (or 7) copies for binding and preservation
- ☐ Double check printed copies for out-of-order or missing pages
- ☐ Obtain virus scan certification from AC&N for all CD/DVDs included with the thesis
- ☐ Include all inserts and accompanying material: properly folded maps, plates, CDs, etc.
- ☐ Deliver copies to Arthur Lakes Library Preservation Unit with blue check out card





## Appendix B - Additional Resources

### Style Manuals

Style manuals typically cover only one style of technical writing. Your committee advisor may have information about writing guides specific to your academic discipline. The following are some good references that may be helpful.

- *Chicago Manual of Style* (15th Edition) Chicago: University of Chicago Press (2003).
- *Mastering APA Style: Instructor's Resource Guide*, Harold Gelfand & Charles J. Walker, Washington, DC: American Psychological Association.
- *MLA Style Manual and Guide to Scholarly Publishing*, Joseph Gibaldi, New York: Modern Language Association of America.
- *ACS Style Guide: A Manual for Authors and Editors* (2nd Edition), Janet S. Dodd, Ed., Washington, DC: American Chemical Association.
- *How to Write and Publish a Scientific Paper* (6th Edition), Robert A. Day and Barbara Gastel, Oryx Press.
- *A Guide to Writing as an Engineer*, David F. Beer and David McMurrey, John Wiley and Sons (2005).
- *A Manual for Writers of Term Papers, Theses, and Dissertations*, Kate L. Turabian, 6th Ed.

### Web Resources

- For MLA and APA styles: <http://www.english.uiuc.edu/>
- Citing electronic sources: <http://www.georgetown.edu/spendelow/handouts/eleccite.htm>

### Campus Resources

- Office of Graduate Studies  
Brenda Neely, 273-3412  
Guggenheim Hall, Room 318  
[bneely@mines.edu](mailto:bneely@mines.edu)  
<http://gradschool.mines.edu/GS-Graduate-Office-Staff>
- Campus Writing Center, 273-3085  
Stratton Hall, Room 311  
<http://writing.mines.edu/>
- Arthur Lakes Library  
Margaret Katz, Collections Conservator  
Preservation Unit, Room 170.  
[mkatz@mines.edu](mailto:mkatz@mines.edu)
- CSM Copy Center  
Guggenheim Hall, 1<sup>st</sup> floor



## Appendix C - Example Pages

- Title Page
- Copyright Page
- Submittal Page
- Abstract Page
- Table of Contents
- Combined List (Figures and Tables)
- Chapter (double numbering system)
- Chapter (three-level system)
- References Cited
- Figure in Text
- Figures – Sequential
- Figures – Landscape
- CD Labels
- CD Jewel Case Labels
- Plate Labels



THESIS TITLE CENTERED IN UPPER CASE LETTERS  
THE TITLE PAGE HAS NO PAGE NUMBER  
AND IS BLANK ON THE BACK SIDE

by  
Author's Name



***Example: Copyright Page.*** This is an optional page that follows the title page. No displayed page number, centered upper and lower case text, blank on the back side.

**Copyright by William G. Student 2006**

All Rights Reserved





Begin submittal statement one-inch from the top of the page, leaving a 1 inch top margin.

**Example: Submittal Page.** This is a required page that displays the roman numeral ii page number.  
Beginning with this page, front matter roman numeral page numbers are centered 1/2 inch from the bottom edge of page, which is blank on the back side. All signatures (in black ink) are required before the final thesis format review.

A thesis submitted to the Faculty and the Board of Trustees of the Colorado School of Mines in partial fulfillment of the requirements for the degree of Doctor of Philosophy (Geophysical Engineering).

enter correct degree title

or enter Master of Science

Golden, Colorado

Date \_\_\_\_\_

Hand-written signatures in black ink on line; printed name below line.

Signed: \_\_\_\_\_  
Student Name Printed

A single-space title line must follow each signee's name

Signed: \_\_\_\_\_  
Dr. Thomas L. Davis  
Thesis Advisor

If there is not a second advisor, omit this signature line

Signed: \_\_\_\_\_  
Dr. Ilya Tsvankin  
Thesis Advisor

Golden, Colorado

Date \_\_\_\_\_

Signed: \_\_\_\_\_  
Dr. T. K. Young  
Professor and Head  
Department of Geophysics

The submittal page is numbered roman numeral ii, even though a copyright page may precede it.

ii



**Example: Abstract Page.** This is a required page that displays the roman numeral iii page number.

Abstracts in doctoral dissertations are limited to 350 words or approximately 1 1/2 pages. There is no word limit for a master's thesis abstract. Each page of the abstract is blank on the back side. Note: the optional acknowledgments page follows the same format as the abstract page.

## ABSTRACT

The title is centered in all capital letters one keyboard return below the top one-inch text margin.

The solving of large, real world, combinatorial optimization problems has been of interest to the operations research community for some time. Because the algorithms used in solving these problems tend to have high computational time complexities (Order  $N^2$  or greater), even the theoretical solutions are difficult to achieve. Dealing with such problems in an industrial environment where other factors such as human interaction and non-determinism are present make the problem solution, and further, the implementation of the results, an even greater challenge. The contents of this document describe a method that can be used to solve these problems in an industrial environment. More specifically, the problems considered involve multiple objectives, each objective either being a combinatorial optimization problem or one that is somewhat subjective in its measurement. The method developed, which is grounded in the Analytic Hierarchy Process, is then used to solve a life optimization problem at the Coors Brewery in Golden, Colorado.

The first page of the abstract is numbered roman numeral iii.

→ iii



**Example: Table of Contents.** In the case where the Table of Contents or other lists are more than one page, the title appears only on the first page and each page of the list is blank on the back side (single sided).

## TABLE OF CONTENTS

|  |        |
|--|--------|
| ABSTRACT .....   | iii    |
| LIST OF FIGURES .....  | viii   |
| LIST OF TABLES .....   | xxii   |
| LIST OF SYMBOLS .....  | xxiv   |
| ACKNOWLEDGMENTS .....  | xxix   |
| CHAPTER 1 INTRODUCTION .....   | 1      |
| 1.1 Introduction .....   | 1      |
| 1.2 GPR Hardware .....   | 4      |
| 1.3 Electromagnetic Wave Propagation .....   | 9      |
| CHAPTER 2 SENSITIVITY ANALYSES OF THE FREQUENCY DOMAIN                               |        |
| SIGNAL PROCESSING TECHNIQUE .....  | 17     |
| 2.1 Backgroup and Previous Work .....  | 17     |
| 2.2 Signal Processing Tools .....  | 19     |
| 2.2.1 Convolution and Deconvolution Methods .....                                    | 20     |
| 2.2.2 Scattering Parameters .....  | 24     |
| CHAPTER 3 ESTIMATING THE SOIL PROPERTIES .....                                       | 82     |
| 3.0 Constructing the Forward Operator .....  | 82     |
| CHAPTER 4 SUMMARY AND CONCLUSIONS .....  | 181    |
| LIST OF SYMBOLS ( <i>placed here, if not included in front matter</i> ) .....        | 193    |
| REFERENCES CITED .....   | 195    |
| APPENDIX A RAMP GENERATOR .....  | 205    |
| APPENDIX B PROCESSING SOFTWARE .....   | 208    |
| APPENDIX C CONTENTS OF THE DVD-ROM .....   | 213    |
| Plots of Simulated Antenna Response Waveforms and the IMSP<br>Forward Response ..... | 216    |
| CD/DVD .....   | Pocket |



**Example: Combined Lists.** If more than one list has only one or two entries, then those lists may be placed on one page under a suitable title, keeping like listings together. In **all other** instances, each list appears on separate pages, i.e., List of Figures, List of Tables.

## LIST OF FIGURES AND TABLES

|   |    |
|---|----|
| Figure 1.1 General location of Kenai Peninsula and Cook Inlet (modified from Magoon, 1994). . . . .                               | 4  |
| Figure 2.1 Time series segment of approximately 2.5 minutes for stations k201 and k202. Electric fields are shown in red. . . . . | 36 |
| Figure 3.1 Apparent resistivity and phase versus period for station k201. . . . .   | 49 |
| Figure 3.2 Isostatic residual/gravity anomaly. The MT station locations are plotted as dots. . . . .                              | 51 |
| Table 1.1 Twist and Shear bounds for MT stations. . . . .   | 7  |
| Table 1.2 Input values for the static shift factors of stations k001 and k203. . . . .  | 9  |
| Table 3.1 Typical ranges of resistivities of earth materials. . . . .   | 49 |





**Example: Chapter page (double-numbering system).** If printed two sided, the first page of each chapter begins on an odd-numbered, or right-hand page. Page numbers in the thesis body are in arabic numerals, beginning with one (1) on the first page of chapter 1.

## CHAPTER 1

*The title is centered in all capital letters one keyboard return below the top one-inch text margin.*

### CHARACTERIZING THE RESPONSE OF A GPR

Calibrating the response of a GPR system is essential for making measurements of subsurface materials properties. Duke (1990) calibrated the overall response of a GPR system by making measurements of the . . .

*A least one paragraph of text must separate headings, subheadings and sub-sub headings.*

#### 1.1 Background and Previous Work

This chapter describes the methodology that has been used to determine the response of an impulse GPR. The characterization includes a response function for the receiving electronics, simulations . . .

#### 1.2 Signal Processing Tools

*Subsection headings are flush with the left margin.*

There are many techniques for making high frequency electrical measurements in electrical networks and antenna systems, and there are also many methods for manipulating the data from these measurements . . .

##### 1.2.1 Convolution and Deconvolution Methods

Convolution is a mathematical operation that can be used to describe how a linear network element modifies a signal as the signal passes through it . . .

##### 1.2.2 Scattering Parameters

Scattering parameters (S parameters) are often used to discuss the scattering of guided waves traveling in electrical networks (Smith, 1995) . . .

#### 1.3 The Response of the RTDGPR Receiving Electronics

Stations k201 through k204 were recorded . . .

*If there is not room for at least two lines of 1 1/2 or double-spaced text after the heading and before the bottom margin of the page, then place the heading at the top of the next page.*



**Example: Chapter page (three-level system).** If printed two sided, the first page of each chapter begins on an odd-numbered, or right-hand page. Page numbers in the thesis body are in arabic numerals, beginning with one (1) on the first page of chapter 1. This system uses heading levels A, B, and C with varying indentations.

## CHAPTER 1

The title is centered in all capital letters one keyboard return below the top one-inch text margin.

### CHARACTERIZING THE RESPONSE OF A GPR

Calibrating the response of a GPR system is essential for making measurements of subsurface materials properties. Duke (1990) calibrated the overall response of a GPR system by making measurements of the . . .

A least one paragraph of text must separate headings, subheadings and sub-subheadings.

#### Background and Previous Work

This chapter describes the methodology that has been used to determine the response of an impulse GPR. The characterization includes a response function for the receiving electronics, simulations . . . .

A-level section headings are flush with the left margin

#### Signal Processing tools

There are many techniques for making high frequency electrical measurements in electrical networks and antenna systems, and there are also many methods for manipulating the data from these measurements . . .

B-level subsection headings are indented from the left margin.

#### Convolution and Deconvolution Methods

Convolution is a mathematical operation that can be used to describe how a linear network element modifies a signal as the signal passes through it . . .

**Scattering Parameters** Scattering parameters (S parameters) are often used to discuss the scattering of guided waves traveling in electrical networks (Smith, 1995) . . .

C-level subsection headings are indented incrementally from the B-level indentation margin. The text begins on the same line as the subheading.

#### The Response of the RTDGPR Receiving Electronics

If there is not room for at least two lines of 1-1/2 or double-spaced text after the heading and before the bottom text margin of the page, then place the heading at the top of the next page..



**Example: Reference list.** The partial list below is an example of the author-date style, which is highly recommended for scientific material. Whichever reference style is chosen, format consistency throughout the list is imperative. For guidance, you are encouraged to refer to a respected style manual, e.g., The Chicago Manual of Style. Note that multi-line reference items are single spaced and all lines after the first line are indented. There is a blank line between each item.

## REFERENCES CITED

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- De Hoop, M. V. 1996. Generalization of the Bremmer coupling series. *J. Math. Phys.*, 37:3246-3282.
- . 1998. Direct, leading-order asymptotic, inverse scattering based on the generalized Bremmer series. In *Mathematical and numerical aspects of wave propagation*, ed. J. A. DeSanto, 249-253. Springer-Verlag.



**Example: Figure on text page.** This is an example of a figure included in running text. The space separating figures or tables from the text above or below, should be consistent throughout the thesis. The first reference in the text to a figure appears either on the preceding page or on the same page. Note: the page numbers for the main body and back matter of this thesis is placed at the upper outside margin, 1/2 inch from the top of page.

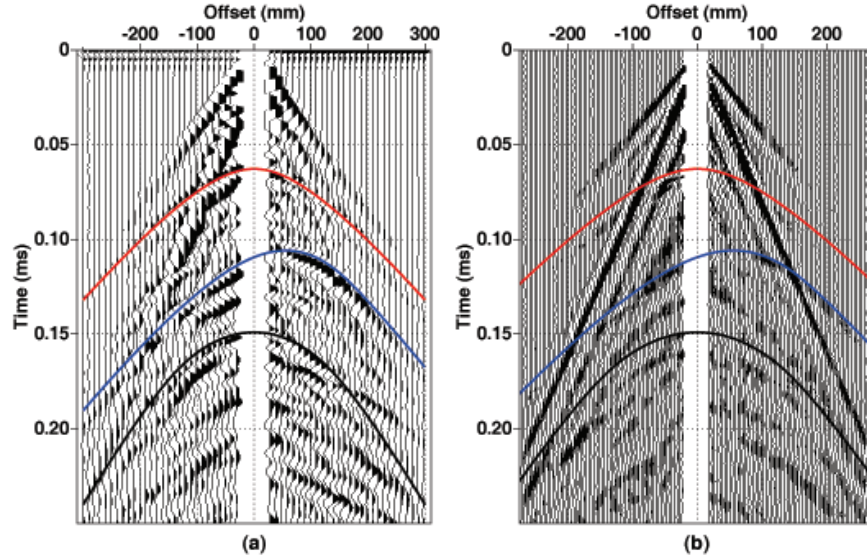


Figure 5.7 Horizontal component of the wavefield: (a) data recorded with the P-wave source and S-wave receiver transducer; (b) data recorded with the S-wave source and the laser vibrometer as the receiver.

Figure 5.7B shows the densely sampled dataset recorded with the laser vibrometer. Since most of the reflections are masked by the ground roll, I suppress that noise by applying FK filtering (Figure 5.8). As before, a close similarity exists between the two datasets recorded with the two different experimental setups. The PSV-wave can be identified at a zero-offset travelt ime of 0.11 ms. As expected, it has asymmetric moveout since the travelt ime does not remain the same when the source and receiver are interchanged. This asymmetry indicates that the model indeed lacks a horizontal symmetry plane, as should be the case for TTI media.

The PS-wave travelt ime picks were made using the laser dataset (the solid line in Figure 5.8). I intentionally reverse the polarity at negative offsets to facilitate correlation of PS travelt imes. Even on the horizontal component, the P-wave primary reflection can still be identified around the zero-offset time  $t_0 = 0.064$  ms. The solid line with apex at 0.064 ms, which marks the picked P-wave travelt ime from the vertical component, matches P-wave arrival on the horizontal component. It may also be possible to interpret the SS-wave primary reflection but it is not as prominent as the other modes because the P-wave transducer does not excite enough S-wave energy.





**Example: Sequential figures.** This is an example of sequential figures placed on the same page. Whichever caption alignment you choose must be used consistently throughout the thesis. This caption alignment is flush left, rather than centered. Fonts used in captions should be the same as in the text body. Captions are single spaced. Note on this page, another alternative page number placement for the main body and back matter; however, placement must be consistent throughout the thesis.

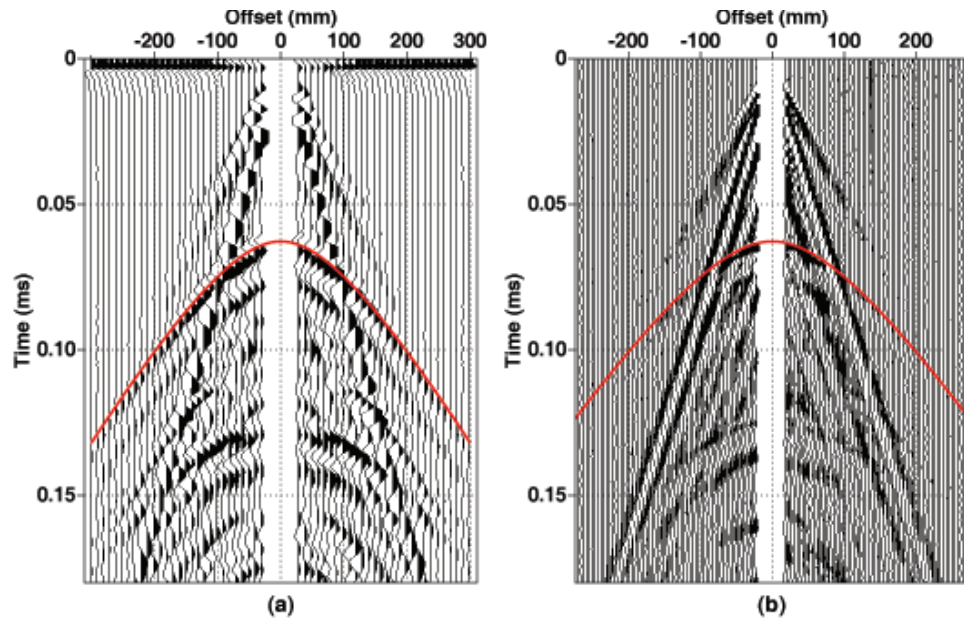


Figure 5.3 Vertical component of the wavefield: (a) Data recorded with the P-wave contact transducers; (b) densely sampled data recorded with the laser vibrometer. The first arrival is the direct P-wave, while the P-wave reflection from the bottom of the block arrives at 0.064 ms (zero-offset time). The solid line is the P-wave primary reflection traveltime picked from the laser dataset.

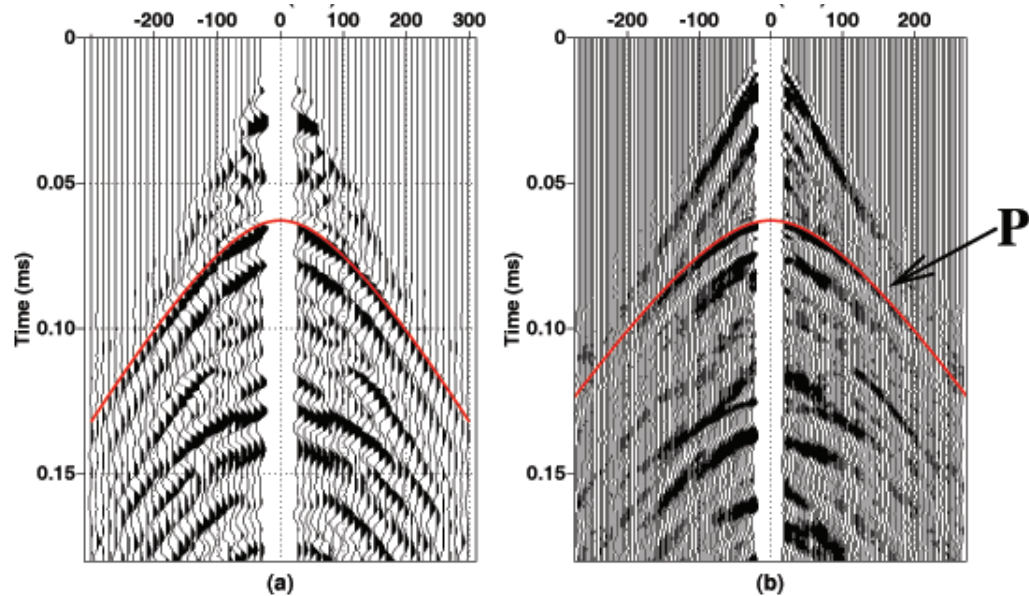


Figure 5.4 Data from Figure 5.3 after application of an FK filter to suppress the ground roll. The P-wave reflection can be more clearly identified at 0.064 ms.



**Example: Landscape-oriented figures.** This is an example of a figure placed on the page in landscape orientation (turned sideways). In this case, the entire illustration, including its caption and sources, is turned so that the top of the illustration is parallel to and just inside the regular binding-side text margin. The page number, however, remains in the same position on the page (portrait orientation), as it is throughout the body and back matter of the document.

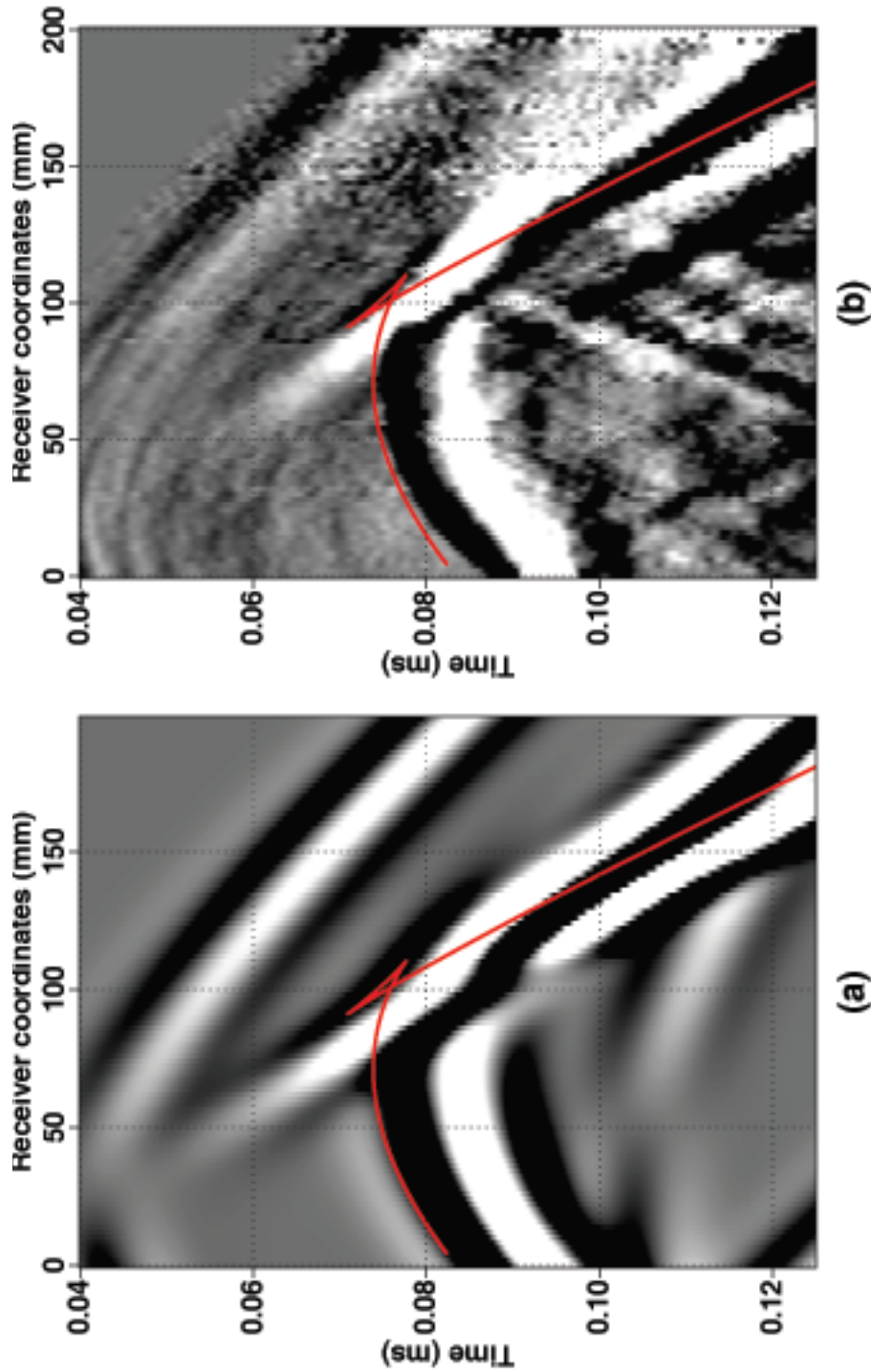
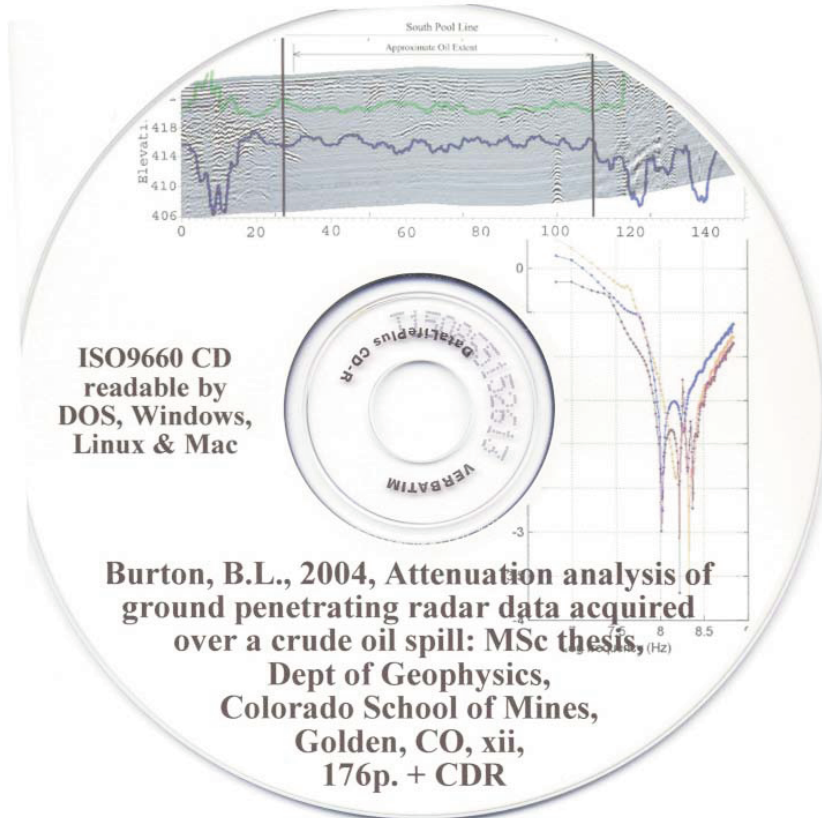
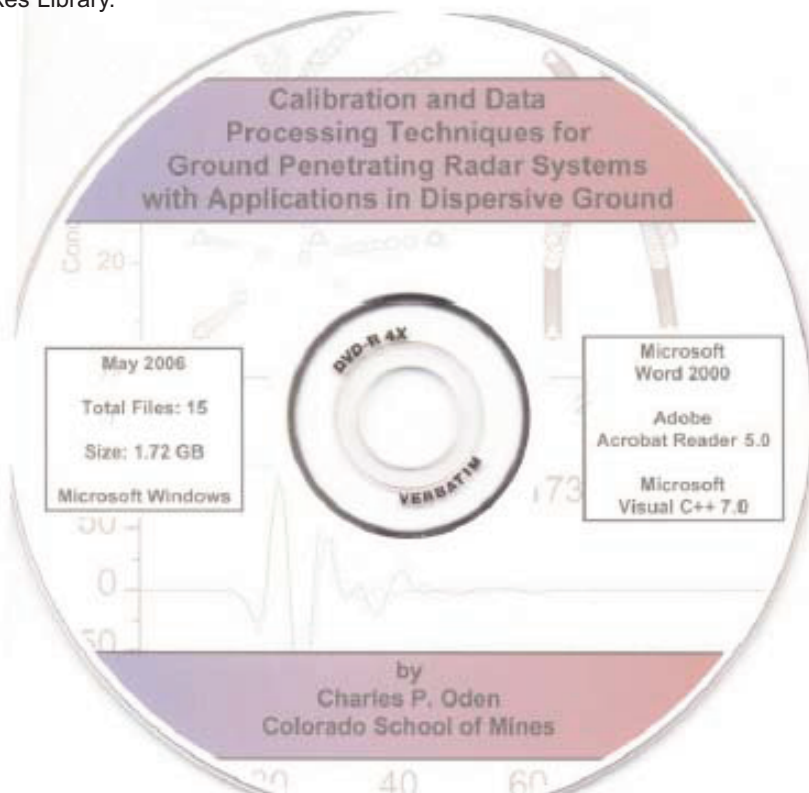


Figure 5.13 S-wave cusp in the transmission experiment: (a) The wavefield simulated with the spectral element method; (b) the wavefield recorded by the laser vibrometer. The solid line is the S-wave time modeled using the inverted parameters from Figure 5.11. The observed cusp is larger than that predicted by the group-velocity surface.





**Example: CD/DVD Labels.** CD/DVDs must be submitted in plastic jewel cases. The disks must have computer-printed (not handwritten) labels that contain the thesis title, author's name, Colorado School of Mines, name of the operating system, and names of all software used to create the files and contents of the disk. Beginning Fall 2008, all CD/DVDs submitted with a thesis must first be certified as virus free by AC&N personnel before they will be accepted by Arthur Lakes Library.





**Example: Jewel Case Labels.** CD/DVDs must be submitted in plastic jewel cases. Labels for the jewel case itself, as in this example, are optional. Labels for the disks are not optional (see the previous example page).

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| <p><b>Instructions:</b></p> <p>There are 7 files on this CD. To read these files you will need Adobe Acrobat Reader for “.pdf” files, Microsoft Excel for “.xls” files, and Microsoft Word for “.doc” files.</p> <ul style="list-style-type: none"> <li>– “.pdf” files were created with Adobe Acrobat 6.0 Standard</li> <li>– “.xls” files were created with Microsoft Excel 2002</li> <li>– “.doc” files were created with Microsoft Word 2002</li> </ul> <p><b>Contents:</b></p> <ol style="list-style-type: none"> <li>1) The file “contents.doc” contains a thorough explanation of the CD contents</li> <li>2) The files “macintyre.pdf” is a complete copy of the thesis in Portable Document Format (PDF)</li> <li>3) The file “sample.xls” is a list of samples from the study and analytical techniques utilized in their investigation</li> <li>4) The file “geochem.xls” contains raw geochemical data for samples in this study</li> <li>5) The file “isotope.xls” contains a list of samples and results for samples used in sulfur, carbon and oxygen isotope analyses</li> <li>6) The file “structural data.xls” contains information about the orientation of faults, fractures, and strata in the study area</li> <li>7) The file “correlation matrices” contains geochemical sample sets and their correlation matrices.</li> </ol> | <p style="text-align: center;"> <b>FAULT-CONTROLLED HYDROCARBON-RELATED BLEACHING<br/>AND SEDIMENT-HOSTED COPPER MINERALIZATION OF THE<br/>JURASSIC WINGATE SANDSTONE AT THE CASHIN MINE,<br/>MONTROSE COUNTY, COLORADO</b> </p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>700MB<br/>Total Files: 7<br/>File size: 130 MB</p> </div> <div style="text-align: center;">  </div> <div style="text-align: center;"> <p>Microsoft Word 02<br/>Microsoft Excel 02<br/>Adobe Acrobat 6.0</p> </div> </div> <p style="text-align: center;">             Timothy J. macIntyre<br/>M. S. Thesis         </p> <div style="text-align: center;">  </div> <p style="text-align: right;">             Colorado School of Mines<br/>Department of Geology and Geological Engineering<br/>September, 2006         </p> |
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**Example: Plate Labels.** If maps or plates are included in the thesis instead of or in addition to including them on a CD or DVD, then they must be folded to 7 by 10 inches. Each plate must have a title, plate number, and the author's name placed on the outside fold. Plates are a type of figure listed separately in the front matter, as are equations and tables. Examples of correctly folded oversize pages may be found in bound theses stored at Arthur Lakes Library.

***Slope Stability Analysis and  
Industrial Mineral Resource Assessment  
of the Nez Perce Mission Creek Quarry  
Lewis County, Idaho***

***Plate 1: Geologic Map***

Prepared By: Benjamin George, Colorado School of Mines  
Date: 11 May 2004

**Significant Parties:**

Nez Perce Tribe - Economic Development  
Bureau of Indian Affairs - Division of Energy and Mineral Resources Management  
Colorado School of Mines - Department of Geology and Geological Engineering

