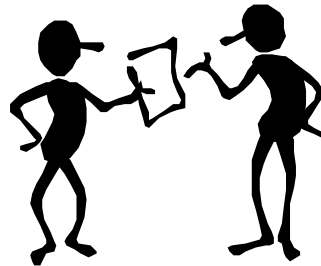


# Writing reports

## Introduction

Engineers spend significant amounts of time writing reports, whether they are design reports, construction reports, reports for clients, and so on. It is essential that all engineers be able to present their ideas in a logical manner which engages their audience.



Any report needs some clear guidelines:

- Why are you writing the report? (the purpose)
- Who will read the report? (the audience)
- What will it cover? (the scope)
- How will this be conveyed? (clear language, logical progression of topics, use of figures, tables, equations, appendices, references, etc)
- When is it required? (time management)
- Where is it required? (physical location)

These are the six basic questions that can be used in all problem solving tasks. These issues will be expanded in the sections that follow. Much of this report discusses the **how** issue. However, unless the **why**, **who** and **what** are right, there is little point in producing a nicely structured and formatted report which no-one reads. Likewise, if it is not delivered on time, and at the appropriate location, it may also be of little value.

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# The Intent of the Report

## The Purpose – Why write this report?

Whenever you write a report, the **purpose** must be clear in your mind. If it is not, you will have great trouble getting started. An example, relevant to students, might be to review the literature on a topic, or it might be to document the design calculations for a structure.

## The Audience – Who will read it?

Your audience must also be known. This allows you to adapt the language of the report to what the audience might reasonably be expected to know. For example, I have decided that this report will mostly be read by students. Hence, the main body of the report deals with brief reports, typical of those submitted by students.

One issue that you also need to keep in mind is that different members of your potential audience may read your report differently. Some people will want just an overview, and may read only the Summary, or perhaps the Conclusions as well (Figure 1). Others may also read the body of the report, and some may even get to the appendices.

Do not assume that each person will read all of your report.

Consequently, give the Summary careful attention and make sure that it really **does** summarise the main issues (including the main conclusions) of your report. It can be anything from a paragraph to several pages, depending on the size of the report. Put detail in the Appendices. Keep the body of the report as brief as possible, while still maintaining its integrity.

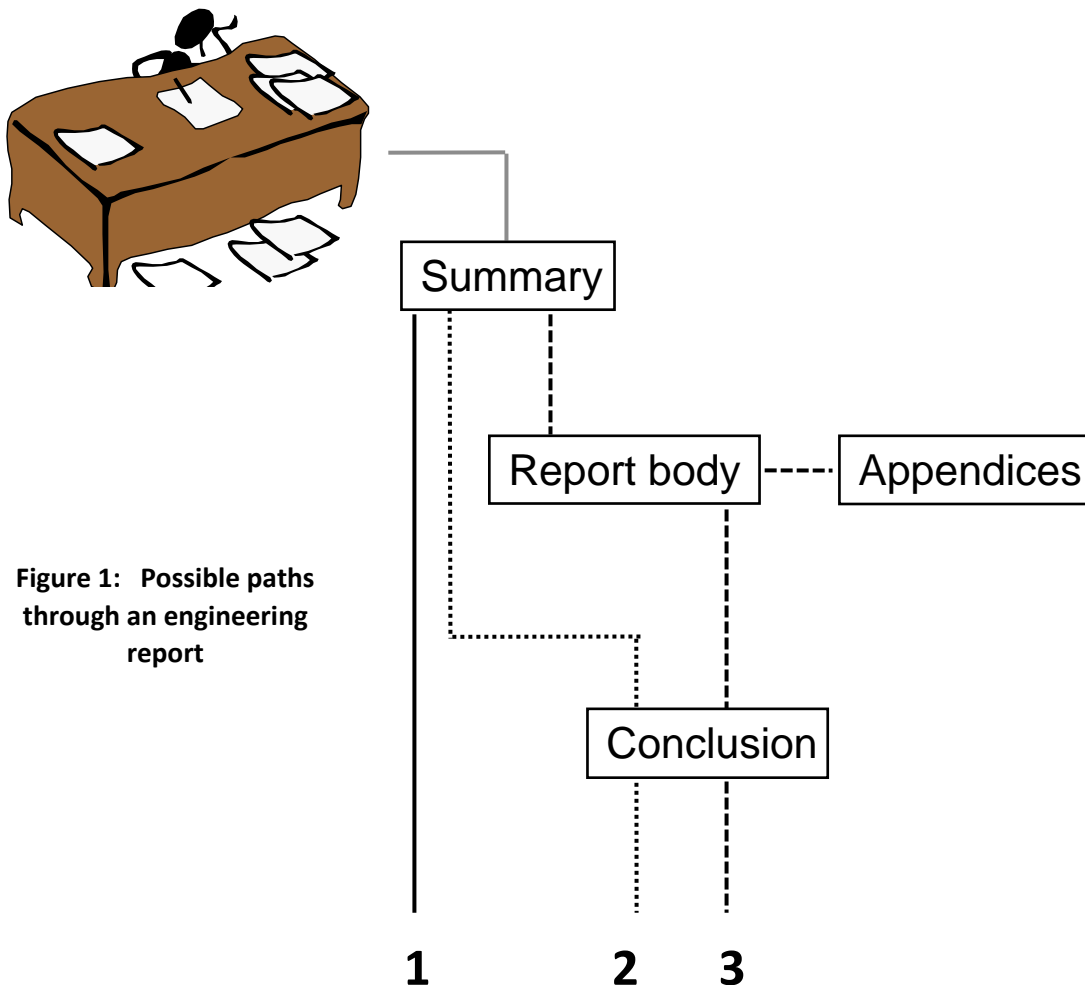


Figure 1: Possible paths through an engineering report

## The Scope – What will it contain?

The scope of the report more clearly identifies what will go into the report, and what will be left out. In the process of reviewing the literature on a particular topic, for example, you may have found interesting information on many related issues. You must decide how much of that goes into your report, and which of it will be left out. If you put too much into the report, you run the risk of boring your reader. If you put too little in, you run the risk of appearing incompetent. Getting this balance right requires judgement that can only be developed through practice.

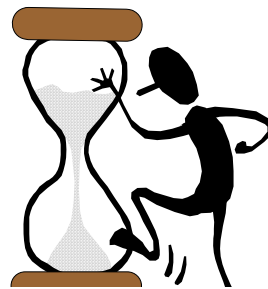
## The Structure and Presentation – How to present it?

Having identified in your mind why, for whom, and about what your report will be written, your task is now to **structure** it and **present** it in a manner which will be easy to read and pleasing to the eye. The structure will be dealt with in the next chapter. The presentation issues will be covered in the following chapter. Look at books which you find easy to read, or pleasing to use. What is it about them that makes them that way? Is it the structure of the chapters, or the layout of text on the page?

Word processors now make both structure and presentation easier through the use of spelling and grammar checkers, thesaurus lookup, figure and table captioning, paragraph numbering, bulleting etc. Make sure that you know how to use all of these features.

## The Deadline – When is it required?

Always know when a report is due. Failure to produce it by the due date may mean no further work from that client, delayed payment, or other unpleasant outcomes. Learning to manage time at university is a good start for the workplace. Some of you will find this easier than others. Information on personality type is available elsewhere [Hadgraft & Prpic, 1997].



## The Place – Where is it required?

Delivering your report to the client's head office in Melbourne may not be of much use if it is required the following morning for discussions in Tokyo.

## Basic Report Structure

The following components are present in almost all engineering reports:

1. Title page (including Authors)
2. Table of contents
3. Summary
4. Introduction
5. Body of the Report
6. Conclusions and Recommendations
7. List of References or Bibliography
8. Appendices

### Title Page

The title page includes the name of the report, who wrote it, their organisation and the date. Authors include those who made a major, direct contribution to the report or study. Minor contributors can be mentioned in the Acknowledgements section.

### Table of Contents

The Table of Contents lists all the major sections of the report. You can use your word processor to do this automatically for you.

Students reports should include the name of the subject, assignment, student, lecturer, the due date, and the date submitted.

### Summary or Executive Summary

This section briefly summarises the purpose of the study, major findings, conclusions, and recommendations. It is designed for those who do not have the time to read the entire report and as a means of refreshing a reader's mind at some later time. It is probably the most important section of the report, because it is almost certain to be read. The summary can be anything from 1-30 pages, depending on the complexity of the report. Most student reports should have a 1 page summary.

### Introduction

The Introduction is an extremely important part of any report. It should not include too much detail, but it should give the reader a good idea of where the report is going (including a brief description of the contents of the report).

Just as the Summary gives an overview of the total project, including principal findings and recommendations, the Introduction covers the following issues:

- **what** was the problem and its context,
- **why** was it a problem,
- **how** was the problem solved (briefly).

### Body of the Report

The body of the report is composed of a series of chapters that describe the subject of the report. The **body** of the report must address:

- **Why** was the study necessary? (the purpose)
- **When, where, how** and **by whom** the study was conducted?
- **What** were the findings?
- **What** conclusions were drawn?
- **What** recommendations were made?

The Introduction will deal with the first of these. A series of sections or chapters will cover the next two, and Conclusions and Recommendations will handle the last two.

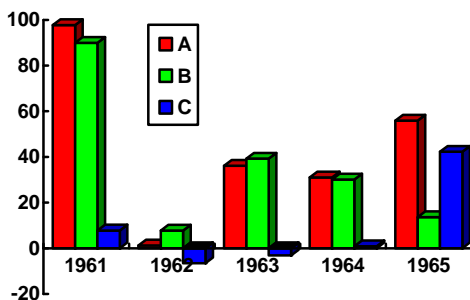
## Tables and Figures

Any substantial report is likely to contain many tables of data and figures which illustrate and support the content of the report. Attractive charts are now easily produced using spreadsheet programs, and should be used instead of tables where possible.

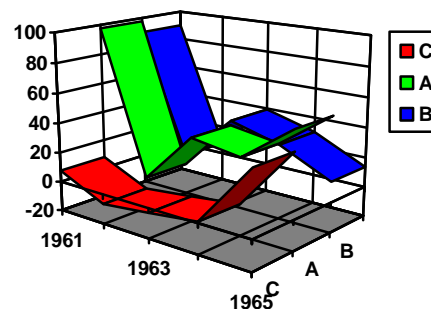
Consider the following two possible ways of presenting the data in the table below, and the advantages and disadvantages of each. These are just two of the more attractive ways of presenting such data. (By the way, you can easily use side-by-side figures like this by using a two cell table).

**Table 1: Sample Table**

Year	A	B	C
1961	97.70	89.93	7.77
1962	1.20	7.74	-6.54
1963	36.10	39.24	-3.14
1964	31.00	30.11	0.89
1965	55.90	13.64	42.26



**Figure 2: 3D columns**

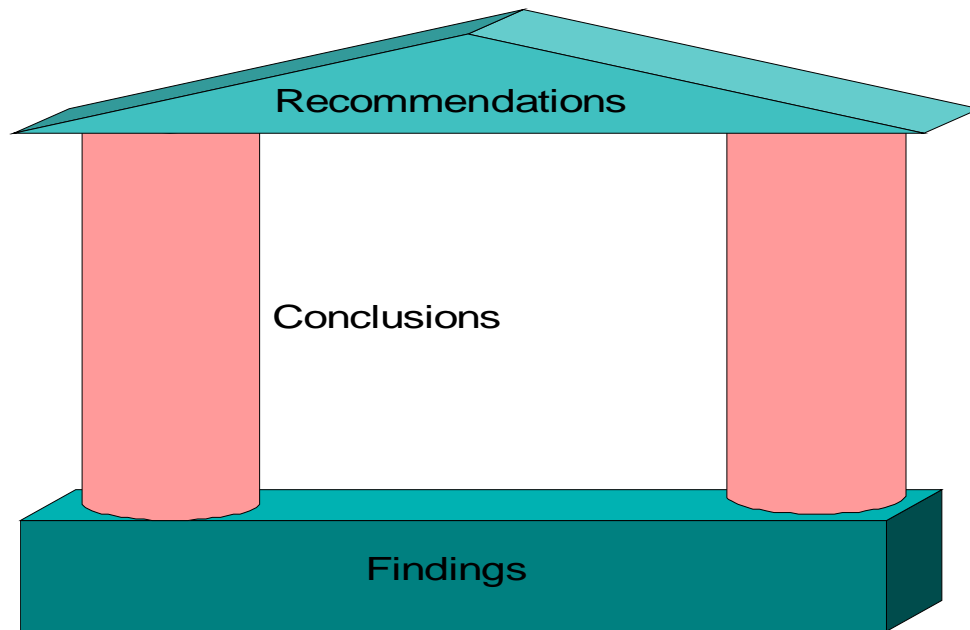


**Figure 3: 3D lines**

Figures are often centred in the text, with a **bolded caption** below it. (See figure 2 in this report). Tables usually have the caption at the **top** as shown above.

## Conclusions and Recommendations

Your report will typically describe some findings which have been derived from observation, experiment, calculation, etc. From these findings, you should draw some conclusions. The insights that you can extract from your basic findings are a key part of your report. You may also be expected to make some recommendations based on your conclusions. The findings are the foundations on which the conclusions rest, while the conclusions, in turn, support the recommendation (Figure 4) [Robertson, 1993].



**Figure 4: Relationship of Results to Conclusions and Recommendations**

### List of References or Bibliography

When you use material from other reports or books, you *must* properly acknowledge it, by citing the report or book in a list of references, and referring to the list at the places in the text where the material is used. You will have seen some examples in this report already. The two most common ways of citing are the use of numbered references or by author and year of publication.

The *list of references* is usually placed either at the end of the report. Citations and References are such important parts of writing in an academic environment, that an entire appendix of this report is devoted to them.

A *bibliography* is a listing of books or reports that contain similar or otherwise pertinent material that may prove useful to the reader who wants to pursue the subject matter further. Reports describing engineering studies do not usually contain bibliographies, unless the report is encouraging further study or explanation. (However, this report does).

### Appendices

Detailed material that is not essential to, but supports the information contained in the body of the report, should be placed in an appendix. Appropriate appendix materials include supporting data, detailed explanations of methodologies or procedures, derivation of formulas, conversion factors, and data collection formats, protocols, and checklists. Appendices are a powerful means of fully documenting and supporting the results of the study without cluttering the body of the report.

An appendix, however, is not merely a repository for marginal material; it can be a self-contained mini-report. If it is more than one page long, an appendix should have a descriptive title as well as a label. If it has sections, these should have section headings. If it has tables, these should be numbered and titled; if figures, they should be numbered and captioned. The pages of an appendix should be numbered, preferably in the same sequence as the main report. In general, an appendix, like the main report, should be designed for easy reading and reference.



# The Body of the Report

The body of the report contains the main thrust of your argument, and is normally made up of an Introduction, a number of chapters, plus Conclusions and possibly Recommendations.

## Organising the Body

The first step in effectively arranging the body of the report is to construct an **outline**. The outline should list the chapter, section, and sub-section headings and may contain notes or topics to be covered under each heading. The outline aids the writer in organising the body in a logical, comprehensive, and complete manner. It greatly facilitates the task of writing or dictating the report.

There are a number of possible ways to organise and present the material in the body of the report.

(You can use the **View | Outline** mode in Microsoft Word to construct your outline. Type a section heading, and it will automatically be entered as **Normal** text (a paragraph). Use the left and right arrows   in the toolbar above the text to promote or demote the heading to the appropriate level).

## Logical statements proceeding from problem to solution

The opening chapter or section states the problem and succeeding chapters lead the reader through the logical steps of development to the problem solution.

## Cause and effect

The report begins with descriptions of the causal factors surrounding a problem, then treats the effects indicated by the appropriate measures of effectiveness (MOE's). For example, the report of a congested route study in transport engineering, might begin with a description of traffic volume, vehicle classification, occupancy, and roadway geometry. The effects of these factors would then be described in terms of measured speed, delay, level of service and accidents.

## Time sequence

Previous traffic conditions may be treated first, then present conditions, followed by projected future conditions.

## Problems in order of importance

Each problem and proposed solution (if known) is presented in order of priority starting with the most severe.

## Location

Each intersection or roadway section (link) is described in turn. The order of presentation may be based on the type of road, size of facility, area of the city, magnitude of the problem, or any other logical scheme.

## Order of audience interest or familiarity

Treating the more popular subject first, regardless of its importance, may be a way to gain the readers' interest and then lead them into less familiar subjects.

## Grouping similar subjects together

In this approach, chapters are grouped by subject areas. For example, 'planning' chapters may be followed by 'design' chapters, which in turn, are followed by 'operations and safety' chapters.



## Tips on Body Content

A typical engineering report generally contains the following subjects:

### Introduction

- Purpose or objectives of the study
- Background, ie. what led to the study, or why was the study needed
- Scope of the study, i.e. what limits were placed on the study

### Body

- Methods used
- Data collected (type, amount, when, where)
- Analyses performed
- Findings
- Conclusions
- Recommendations

### Other subjects that may be appropriate for an engineering report include

- Alternatives Identified and Examined
- Basis for Evaluation of Alternatives
- Evaluation Results
- Cost Analysis of Impact
- Environmental Impact
- Implementation Plans or Recommendations

Limit content to that which is directly relevant to the objectives of the report. It should **not** be a history of the work covered, although that might be discussed early in the report. Discussions tangential to the main thrust of the report should be relegated to an appendix, or to a separate report if the issue is of sufficient importance.

### Use simple, clear, and concise language

Remember, an engineering report is a presentation of technical facts and their implications. It is not intended to be literary art. On the other hand, it should be written so as to **hold the reader's attention**, not bore him or her to death. try to strike a balance between being too pompous and too casual.

### Use a good style manual

While the elements of style in writing technical reports vary from one manual to the next, pick a good manual, adopt a set of conventions, and maintain a uniformity in spelling, grammar, punctuation and format. Examples of good technical writing style manuals are included in the references at the end of this document (eg. AGPS, 1990).

### Page numbering

Number every page except for the title page and the letter of transmittal. Page 1 may begin with the Summary or the first page of text. Advance pages are numbered with lower case Roman numerals. Appendices may continue the numbering of the main body or be numbered A-1, A-2, B-1, B-2, etc. Page numbers are typically placed at the bottom centre, or at the top, outside edge of each page.

### Section numbering

You should consider whether numbering sections is important. In engineering reports, numbering is probably the norm. Generally a system as used in this report is used.

(**Note:** you can do this very easily in Microsoft Word by using **Insert | Field | Auto No. legal**. Such numbering automatically renumbers itself. You must, of course, use **heading** styles so that Word understand the structure of your document).

### **Break up lengthy narratives of pure text**

Use headings and sub-headings to lead the reader through your train of thought and presentation of facts. Let each paragraph convey a single idea. Short, punchy paragraphs are easier to read than a few, very long ones. Leave a blank line between paragraphs.

Make ample use of summary tables and figures. Photographs may also be useful in describing certain situations or conditions. A picture or graphic is worth many words. It is now simple to produce attractive charts using packages such as *Excel*, so there is no excuse for hand-drawn and scrappy charts in a word processed document. (For example, investigate the use of 3D charts to make your charts more attractive - see figures 2 and 3). Simply move your charts into your word processor using "copy and paste".

### **Explain the methodology used**

The credibility of the results of an engineering study often hinges on the type and amount of data collected and the methods used to analyse those data. Therefore, the report should clearly, yet concisely, provide the reader with sufficient information about the data and methodologies employed to establish an acceptable level of confidence in the findings. The application of standard methods may be explained simply by reference to a text or manual on the subject. Special, or little known methods, require more explanation, which may be placed in an appendix to avoid cluttering the body of the report. The sources of data and information used in the study should be clearly identified. The amount, place, time, and conditions under which field data are collected should be specified.