Technical Report Writing

CHAPTER 1 Introduction

A. Course Overview

An overview of this course is presented below as Figure 1-1. Take a moment to glance through the topics to be covered and then consider this one central idea. The premise of this course is that good technical reports don't just happen. They are "designed". Their design may be learned and that knowledge can be applied in your everyday work in the same way as you apply your other technical skills. We cannot all be William Shakespeare or Ernest Hemingway, but it is possible to acquire enough writing skill to write simple, declarative sentences and readable reports. Subjects you know about, you can also learn to write about.
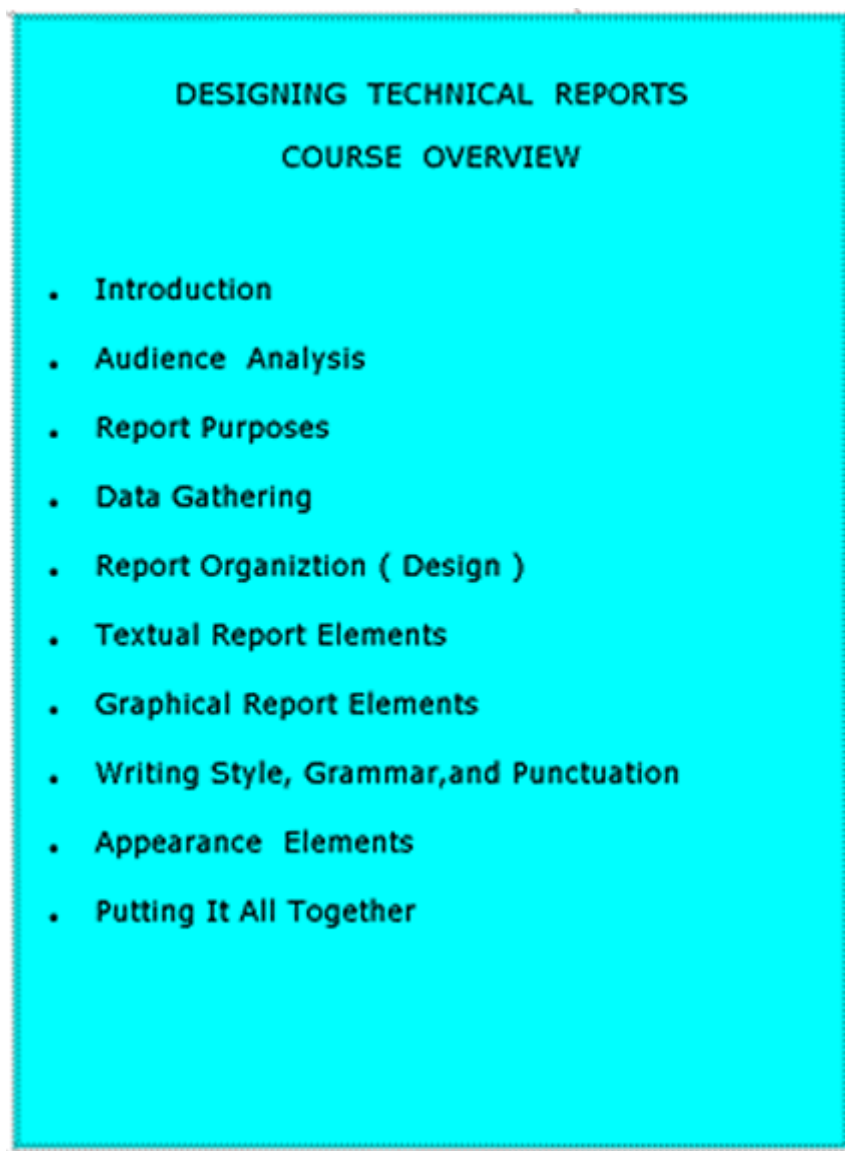
DESIGNING TECHNICAL REPORTS

COURSE OVERVIEW

- Introduction
- Audience Analysis
- Report Purposes
- Data Gathering
- Report Organiztion (Design)
- Textual Report Elements
- Graphical Report Elements
- Writing Style, Grammar,and Punctuation
- Appearance Elements
- Putting It All Together

Figure 1-1

B. Types of Reports

The suggestions presented in this course may be employed whether you are writing a single page letter report or a multi-volume research study. That is true because technical reports do, or at least should, have an explicit purpose and an identifiable audience. If you know clearly "why" you are writing and "who" will read your report, you have the basis for the report design. Your audience, and their needs, must remain at the forefront of your thinking as you write. In most organizations, the audience is a multi-layered collection of people. Some of your intended readers may be known to you while others may not. Once you have determined the purpose of your writing, you need to analyze your audience to the best of your ability. This course will suggest some ways to do that in systematic fashion.

C. Audiences

Three broad categories of audiences for a technical report can usually be identified from the beginning.

1. Technical
2. Non-Technical
3. Mixed

Technical audiences are made up of people in the same field as yours. They are the most obvious audience but are seldom your most important audience. They are people such as other engineers, technicians or scientists. They may be people you know within your own organization or they may work outside of it. Their interests may include other things as well, but it is almost certain that they will have an interest in the subject of the report which is similar to your own.

Non-technical readers of your report may include for example, citizen advisory boards, financial experts, legal or administrative readers, and many, many others. Their needs will be quite different from your "technical" readers. As they read your report they are looking for certain things which it is your job, as a technical writer, to provide.

The most common audiences include both technical and non-technical readers. Such **Mixed or Multi-layered audiences** are more difficult to write for, but there are several principals of report design which, if followed, will provide each reader with the information he or she needs to use your report efficiently.

Above all, there is one thing nearly all your readers have in common. They are usually busy people who have a great deal of reading to do every day. If you hand them a thick, turgid, complicated and badly written report you will alienate them immediately. Their first instinct, when handed such a report, is to ask, "Is there any way I can avoid reading this ?". Overcoming this natural reaction is a challenge, but you can make it easier on both them and yourself if you design your report properly. Principles of good report design are mainly covered in Chapter 5 later in this course. Once the subject of your report has been identified and its purpose defined, your first task is to analyze your audience.

D. Audience Analysis and Why You Need to Care

One of your early tasks as a report writer is to identify and analyze your audiences. You want to know things about them such as; what their technical background is, what their function in the organization is, what their interests are and what level of detail they need from your report for it to be useful to them.

These questions are dealt with in some detail later in Chapter 2, but for now, recognize that unless you ask these questions you are doomed to almost certain failure in your purpose. Those who must act upon the basis of your report will not act unless you give them a good reason to. They may be inclined to favor your recommendations or embrace your ideas but they will not be convinced unless you convince them. You can only do that if you give them the information they must have to make their decisions and do their jobs.

E. Summing Up

Figure 1-2 (below) illustrates your split personality as technical writer/practitioner. Most of us work within some organizational system with which we try to communicate through our technical writing activities. In this course, the aim is to help you do that in the most effective way possible.
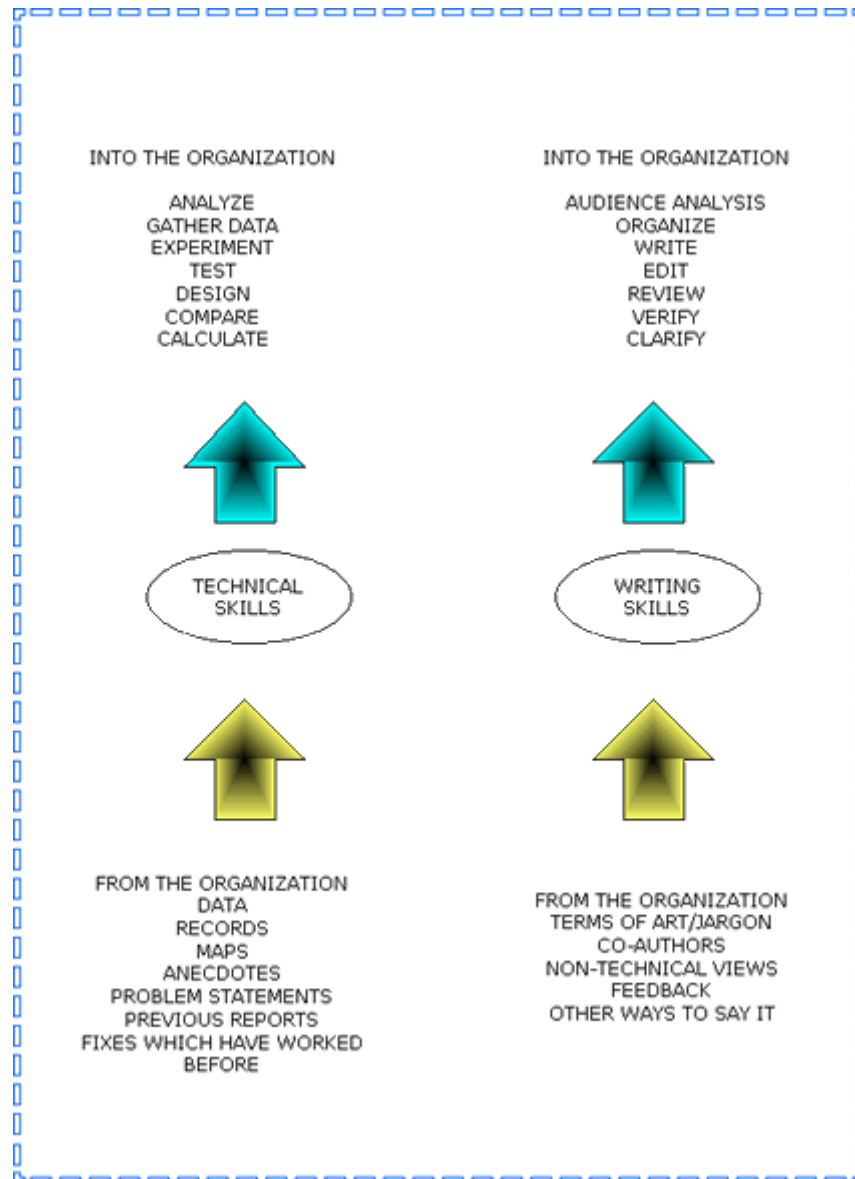
INTO THE ORGANIZATION

ANALYZE
GATHER DATA
EXPERIMENT
TEST
DESIGN
COMPARE
CALCULATE

TECHNICAL
SKILLS

INTO THE ORGANIZATION

AUDIENCE ANALYSIS
ORGANIZE
WRITE
EDIT
REVIEW
VERIFY
CLARIFY

WRITING
SKILLS

FROM THE ORGANIZATION
DATA
RECORDS
MAPS
ANECDOTES
PROBLEM STATEMENTS
PREVIOUS REPORTS
FIXES WHICH HAVE WORKED
BEFORE

FROM THE ORGANIZATION
TERMS OF ART/JARGON
CO-AUTHORS
NON-TECHNICAL VIEWS
FEEDBACK
OTHER WAYS TO SAY IT

Figure 1-2

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Tips and Tricks 1

Design the Report

Four Main Steps

- PREPARE THE PROTOTYPE DRAFT

- PREPARE THE FINISHED MASTER COPY

- SOLICIT EVALUATION FROM OTHERS

- SEND THE REPORT INTO THE SYSTEM

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Technical Report Writing

CHAPTER 2 Audience Analysis

A. Chapter Summary and Why You Must Do This

Very few technical reports are written for a single, simply identifiable, reader. Because your audience is usually a complex group of people each with different needs, desires, expectations and backgrounds some thought must be given to each if you hope to communicate with him or her.

B. The Primary Audience

Your first task in audience analysis is to identify the primary audience. This is not necessarily the audience closest to you in the organization. Your immediate supervisor, who will review your report and send it on to others, is obviously an important audience member but is not necessarily the most important. The primary audience will be determined by the nature of the report but will always be that person or group who will make the most important decisions regarding your technical problem. Often, that will be the decision to fund or not to fund the project. Sometimes it will be the decision to proceed to the next step, or do further research or implement changes within your organization.

Whoever makes those decisions is the Primary Audience to whom you need to address your report.

C. Secondary Audiences

There will usually be many secondary audiences. Your immediate supervisor will often be among these because he/she must concur with your report before they pass it along to others who may make the final decisions. Examples of other secondary audiences include; regulatory agencies, funding agencies, co-workers in other parts of your own organization who may be affected by your recommendations, and possibly citizen groups who have an interest in the results of your technical problem solutions.

Recognize too, that there may be some audience members who are completely unknown to you. They may come upon your report in the course of their work but you may never have guessed that they even existed. You cannot design your report for these unknown readers but you can design it so that even they may be able to gain some useful information from it.

D. What Information Do They Have ?

Think of each of these audiences as individuals who have certain information or knowledge, but may not have other information they would need to understand your report. One of your tasks, as technical writer, is to provide whatever information may be missing so that your readers will understand your message. You have to do some guessing in this because you may not know all of the people who will read your report. If in doubt, it is best to include a little more information rather than a little less. This must be done carefully so that you don't insult your readers by implying that they are more ignorant than they are. In general though, the wider the range of knowledge among your audiences, the more basic information you will need to include.

E. What Will They Do With Your Report ?

Each of your readers will use your report in a somewhat different way. For example, the Finance Director needs budget figures so that he knows how your proposal may affect the rest of the organization. A City Councilor will look for the political effects of the plan you propose. A Regulatory Agency reviewer may be expected to look for compliance with existing rules.

For each main audience group, ask yourself how they may use your report. If the subject of the report is at all controversial, then you must also anticipate that some audience members who oppose your plan may attempt to use your report against you. Knowing that in advance is a great advantage and allows you to anticipate that criticism and include answers to those objections in the report.

F. What Are Their Prejudices ?

Most of us have prejudices of some kind or another. If you've worked with your current boss for a long time you probably know some things he/she likes and some things he/she doesn't like. For example, you might know that the boss doesn't like complicated solutions but prefers simpler ideas. Knowing that tells you clearly how you must fashion your report to gain approval. If you have a choice, a simpler solution to the problem is more likely to win favor. If you don't have a choice; i.e., if you can't find a simple solution, then you will want to point that out in the report and explain why you can't present a simple answer to the technical question.

G. What are Their Functions and Concerns ?

Apart from their personal preferences, each of your readers will have concerns that relate to their jobs. Some are obvious such as, Production Managers, Finance Directors, Regulatory Specialists, etc. Your report must address their concerns if those audience members are in the decision making loop. Ignoring any legitimate concern of this kind will ensure that your report will either not be approved or worse yet, if approved, will not be supported and implemented by some important members of the team.

H. How Will Your Report Affect Them ?

Finally, it is human nature for each of us to look at any proposal from our own selfish point of view. Many people view change as threatening. Suggestions to change the way things have been done for a long time will almost always meet resistance, especially from those who may have a career interest in keeping things the way they are. Be alert to these feelings as you write your report. Be certain that when you do recommend change that it is really necessary or desirable. If you are convinced that it is, then ask yourself, who will resist it? Then be prepared to offer those who might be opposed some reasons to support the change so that it will be less threatening to them.

I. Time and Money

No matter how widely varied your audiences' interests are there are two things everyone of them may be expected to understand. These are time and money. Your report must answer these two basic questions for every reader.

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Tips and Tricks 2

Time and Money

Your audience(s), no matter what their background, training, interests or positions of authority all have two things in common. They all want to know what your idea will cost and how long it will take to accomplish.

If your report doesn't answer these two questions, it is Dead on Arrival.

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Technical Report Writing

CHAPTER 3 Report Purposes

A. Chapter Summary

Your dual role as technical writer requires that you be able to formulate two kinds of problem statements. You need first to define the technical problem to be solved and outline your proposed solution to it. Of equal importance, the rhetorical purposes of your report must be clear. Is the report intended merely to describe some factual situation or, as is more likely, is it intended to influence someone to do something? Both kinds of purposes are discussed in this Chapter and some good and bad examples are offered.

B. Technical Problem Statements

In your role as technical problem solver, your first task will usually be to define the problem to be solved. It has been said that a clear, unambiguous problem statement is three quarters of the solution. Technical reports are written to address both technical and organizational problems. Early in the report you must let your reader know what those problems are.

The Organizational or Client problem is the central focus of your report. How you define and express it determines in large part your ability to solve it. It is also important to let your reader know why the problem matters. In other words, why should the reader care about this problem? What are the consequences of failing to address it? And how do you propose to go about solving it?

Often the simplest way to begin is with the lowly list. On a piece of paper begin listing the problems to be solved as you understand them. Don't be too critical at this stage of the process. Your aim here is to simply get these ideas down on paper so you can refine them later. List all the problems you think might need to be addressed in your report but don't worry about how, or even if, you can solve them.

Once you're out of ideas and satisfied that you've identified most of the problems, begin editing them. See if you can eliminate some first. Are some of the things you've listed unimportant? Are some beyond what you were originally asked to do? Are some so difficult that you can't hope to solve them within the budget and time constraints of this project? If so, eliminate those and see what you're left with.

Now prioritize the remaining problems putting the most important first and secondary or minor problems last. The last, and most difficult step comes now. Try to state each problem as precisely, but as generally as you can. It is important that you state the problem in the broadest possible terms at this early stage in the process so that you don't cut yourself off from possible solutions or fail to investigate promising, though unlikely, alternatives.

As an aid in doing this, I have included the Tip & Trick at the end of this chapter. Very few technical/engineering problems, no matter how complicated, cannot be analyzed using the three part problem statement presented below.

C. Rhetorical Problem Statements

You, as technical writer, have a second equally, important job in defining the rhetorical purpose of your report, and each of its parts.

Ask your self first, Why Write This Report? The reasons will usually fall into the following general categories:
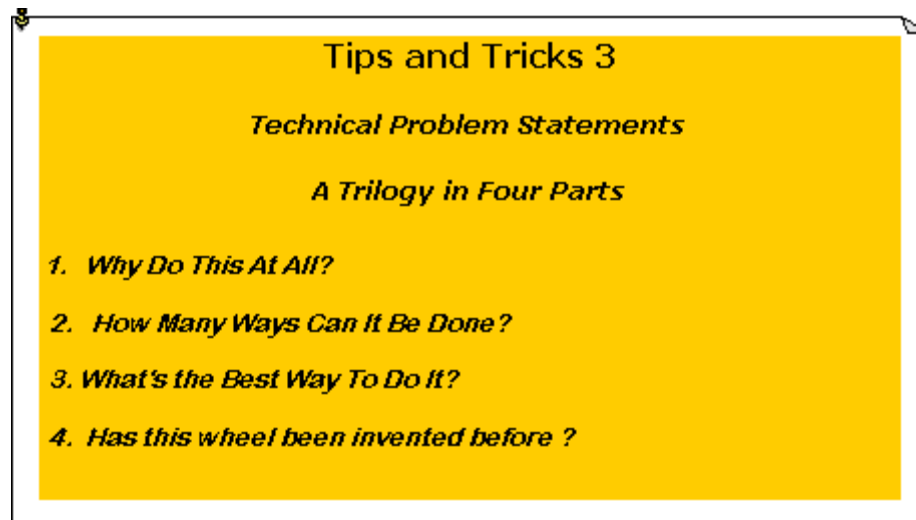
- To Persuade or Cause Change

- To Inform or Report Results

- To Support a Decision to be Reached

- To Obtain Funding or Support for Future Work or Research

From these, select the one that best describes the most important reason you are writing. That will be the basis of your rhetorical problem statement which should appear early in your report and in any cover document you use to transmit it. Remember that your reader wants to know first, Why Should I take My Valuable Time to Read this Report? Unless you give him/her an acceptable answer your report will not be read, period.

D. Summary: Why You Must Clearly Define Both Problems

Unless, and until, you have defined both the technical problems to be solved and the rhetorical reason you are writing the report you can't answer such questions as; what am I doing, why am I doing this, how am I going to do this, and how will I convince others that what I have done is worthwhile ?

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Tips and Tricks 3

Technical Problem Statements

A Trilogy in Four Parts

1. Why Do This At All?

2. How Many Ways Can It Be Done?

3. What's the Best Way To Do It?

4. Has this wheel been invented before ?

* * * *

Go Back To Main Course

Technical Report Writing

CHAPTER 4 Data Gathering

A. Summary

Data gathering is often more art than science. In this Chapter we'll review some important but often overlooked data sources, some unlikely data sources, the importance of the client or organization as a source of data, and some pitfalls to avoid.

Also, the important concept of the "level of detail" needed by each audience member will be addressed. As a final reality check, always subject your data to common sense tests. Does this answer really seem reasonable based on what you already know about the real world? If it doesn't, look again!

B. Previous Reports/Literature Searches

The basic message here is "Don't Re-invent The Wheel". Previous reports by your own organization and by others are an important source of data and may save you days or months of work. Always find out if someone else has addressed the problem you are working on previously. Get copies of earlier related reports. There are almost always some. Treat these with caution though. They may contain errors or may be seriously out of date or not precisely on target, but once you've satisfied yourself that some parts of them provide reliable information, use them to the fullest extent possible. One caveat = give credit where credit is due. Cite the previous reports fully and thank their authors for doing some of your job for you. If you change the data in any way, say so. It is unfair to others to change their data and subject them to criticism for your possible errors.

C. Sources of Data

The data, i.e., the facts upon which your report is based, will usually fall into one or more of the following categories:

- Original Data

- Borrowed Data (Credit the Source)

- Data provided by The Client

Original data from tests, measurements, analyses, etc. are those facts you've developed under the most carefully controlled and thought out conditions you can devise. Good empirical data results from careful, meticulous work. Sloppiness will produce garbage and invite criticism. You must be careful here however to balance time and cost against the ultimate value of the data within the context of your technical problem. This is much easier said than done, but ask yourself before you start how precise you need to be. Would an error of 1 percent, 10 percent or even 100 percent make any difference in the conclusions you draw from the data? Decide how much error you can tolerate and still infer meaningful results.

Borrowed data is discussed above under previous reports. If you have a choice, always use what appears to be the most reliable data source for your report purposes. This is especially true when you have several sources but the data from each differs somewhat. If the differences are small, cite all the sources and average the data in some way. If the differences are large, it is best to use the one source you feel the most confidence in and explain in your report why you are making that choice. If you feel you must include the other data sources, bury them in an appendix where hopefully no one will find them.

Data provided by your client is often problematical. You may at first feel that you have some "right" to rely

upon this data. Don't be fooled. Review this data as you would any other. Is it complete? Is it accurate? Does it meet your reality checks?

For example, if your client tells you that his water system provides 1 million gallons per day of water for each of his 5,000 customers, do some simple math. This amounts to 200 gallons per person per day. The national average is between 100 and 150. Numbers like these are either in error or there must be some explanation for this high water use. Are there major leaks in the system? Is there a large industrial water user such as a cannery? Whatever the reason, you must find it and explain it and then deal with it in your report.

In all data, including your own the watchwords are:

- Completeness

- Accuracy

- Reliability, i.e., reproducibility

- Reasonableness (Reality Checking)

Some unlikely sources, which may at first seem a joke to you, include the following commonly available books and places:

The Public Library
City Hall
State and Federal Agencies
The Telephone Book
The Sears Roebuck Catalog
Hobby Clubs
Magazines in your field

Many writers of technical reports use these routinely for answers to sometimes simple questions such as, what is the population of Arizona, or how much does chain link fence cost, or how many sources of crushed rock might be available to build this road?

Don't overlook these obvious sources. The quality of the data is independent of the prestige of the source. A fact is a fact.

D. Inconsistent & Incomplete Data

When the data is inconsistent or incomplete you need to decide early whether to try to salvage it, or dump it. Some very crude data can be useful, if only for a first approximation, but measure the time and effort you must spend to make sense out of data that doesn't at first appear to make sense. If you decide to dump it, your early decision will help you by possibly allowing you time to gather better data.

Incomplete data can often be "filled in" by making reasonable assumptions about what happened during the periods for which the data is missing. Be cautious here too. Remember that when you do this you are, in effect, making up facts. Make absolutely certain that the assumptions you make are reasonable and express them explicitly in your report. Don't let somebody find out later that you made up data you didn't have. You will appear foolish and possibly may be conceived as deceitful.

E. Levels of Detail and The Excess Perfection Syndrome

Remember your audience? If not, this is the place to be reminded of them. Each member of that audience has different needs for the data in your report. Suppose you are writing a report on improvements to the water system. The City Councilman may only need to know a few facts; How much will it cost? When can it be

done? How will it affect rates or taxes? etc.

The Water Superintendent needs much more detail. He may have a hundred questions such as; how much are annual chemical costs going to have to increase ? What additional power requirements will your plan entail ? Will additional staff be needed to operate the system ? Are added tests required by the regulatory agency ?, etc.

There is one simple device for meeting these widely varied needs for detail in your report.

Write the report moving from the general to the specific.

As you discuss each topic in the report put the most important facts and conclusions first. These are, by definition, those facts and conclusions which every reader needs in order to understand your report and the problem it is written to solve. This topic will be revisited in Chapter 5, Report Organization, but it is mentioned here because it is one of the central ideas of good report writing.
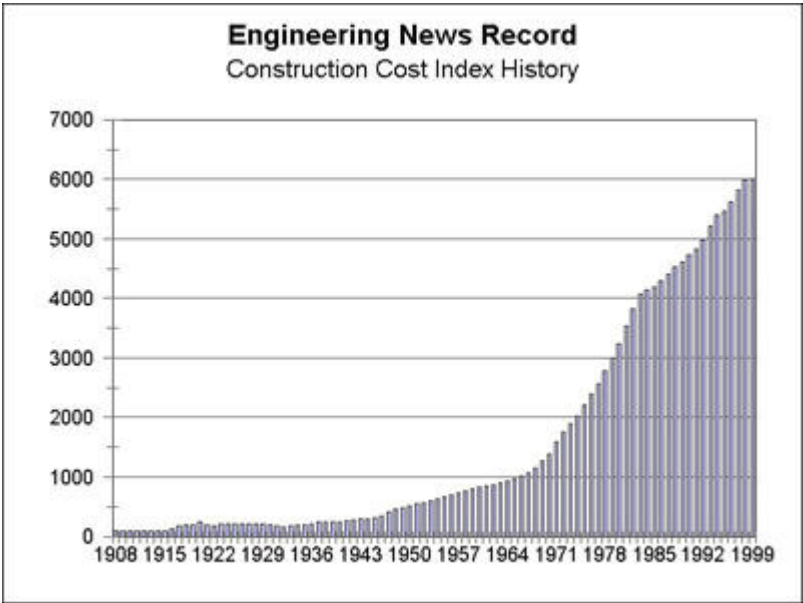
Figure 4-1

D. Summary: Why You Must Clearly Define Both Problems

Unless, and until, you have defined both the technical problems to be solved and the rhetorical reason you are writing the report you can't answer such questions as; what am I doing, why am I doing this, how am I going to do this, and how will I convince others that what I have done is worthwhile ?

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Tips and Tricks 4

The Parameter Cost Concept
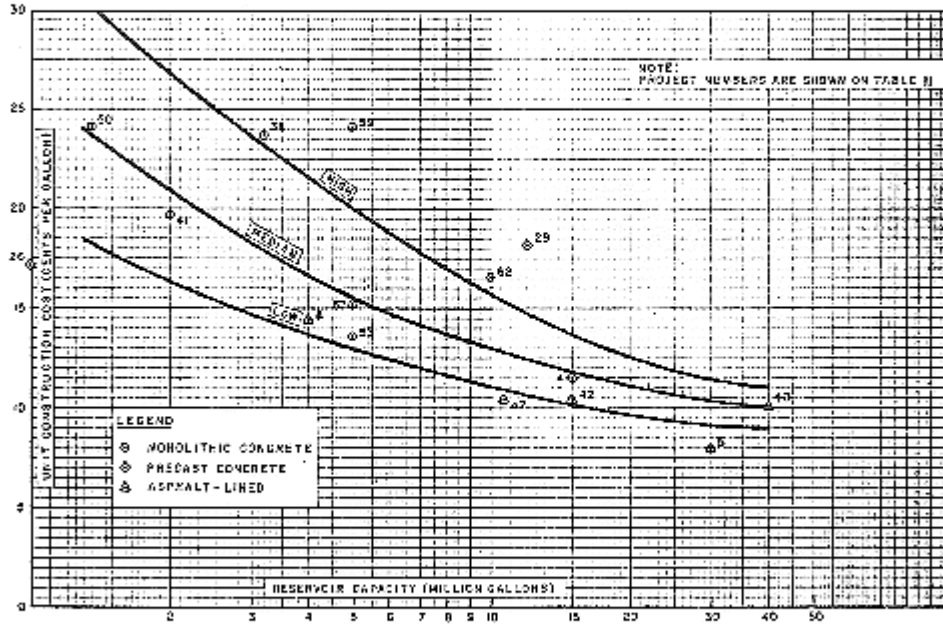
Figure 4. Construction cost of partially buried reinforced concrete reservoirs. (ENR-LA = 2500)

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CHAPTER 5 Report Organization

A. Summary

Report design is a process which can be learned. In this Chapter basic report formats are described and ways to use them effectively are offered. Cloning reports from other reports is a way to save time while improving report design in the process. The usefulness of "generic" report elements, to both the reader and the writer, is also covered.

B. Basic Report Formats

There are a number of report formats available to you as you begin to think about how to organize your report. Except for very short reports, the chronological format is almost useless when dealing with complex, multilevel audiences. No one wants to read this:

"I arrived at the project site at 8:00 am, first investigated the construction completed yesterday, then spoke to the superintendent regarding Change Order No. 7. I then left to view the work under construction that day and while there noticed that the concrete being delivered appeared to have excessive slump, ... etc. etc.".

This format works well for daily, short reports of 1 to 4 pages but you, and your readers, simply cannot take the time to wade through this kind of detail for reports of greater length or complexity.

A somewhat better format, which works well for short to medium length reports of about ten to twelve pages is the Problem, Analysis, Solution approach. This can be effective when there is only one technical problem to be discussed and the number of possible solutions is also limited. More complex problems with multiple solutions do not fit well into this format because the length of the report will grow rapidly as the number of alternatives increases.

Some organizations have developed standardized report formats to which you may be required to conform. When this is the case, there are still many things you can do to make your report readable, concise and useful. Here are three suggestions for accomplishing that.

1. The Outside - In Approach

In Chapter 4 the principle of writing the report by moving the discussion from the general to the specific was mentioned. This means, simply, that the discussion is more readable and easily scanned if you make certain that the most important ideas in each section, subsection, and paragraph appear first rather than last. Here are two sample (made up) paragraphs which illustrate this principle.

Paragraph A

"Three tests of the system were performed. In the first, the system was subjected to average loading conditions while disabling the emergency by-pass line. No problems were encountered except during simulated power failure. Without the availability of the emergency bypass, water could not reach the secondary cooling coil and overheating rapidly developed. In the second test, the emergency by-pass line was reactivated and the system subjected to a 50 percent overload. Although efficiency dropped from 63 percent to 52 percent, no other problems were encountered over the 6 hour test duration. Test three increased the overload to 100 percent for 6 hours. Serious overheating developed despite the emergency bypass working properly. Efficiency fell to 28 percent and complete system failure appeared likely had the test continued beyond 6 hours. From these tests we conclude that the emergency bypass is essential to ensure continuous, unattended operation and should be increased in size from 4 to 6-inch. It is also recommended that a backup to the bypass line be installed which will automatically augment cooling at system operating temperatures in excess of 100 degrees F."

A better way to write this is to reverse the discussion by stating the conclusion and recommendation first, rather than last, For example;

Paragraph B

"A larger bypass line with automatic, temperature controlled backup is recommended. Such a system will protect against overheating and lowered efficiencies under extreme load conditions and permit safe, unattended operation of the system. Tests performed to verify this are detailed in Appendix D."

Compare these two paragraphs. Not only is paragraph B much shorter, it tells the reader immediately the most important results and conclusions drawn from the tests. Many readers will not even need to read the rest of the paragraph. If they do, they'll also find out why the recommendation is being made. This is probably the second most important thing most readers will want to know. If the reader still would like more detail, the last sentence tells where that can be found. The specific details of the tests are of interest to some readers presumably, but not to all. They shouldn't be left out of the report but they are best placed out of the way of the main ideas.

This leads to a second principle of report writing which can do wonders for improving readability.

2. Small Report - Big Appendix.

In general, the more data, facts, test results and similar detail you have the more likely it is that you will overwhelm your reader and yourself with it. It may be very good data and you may be justly proud of it, but it will swamp the most attentive reader if you let it. To avoid this problem, many writers summarize their data in the main report as succinctly as possible, and then present it in full in a large, often separately bound appendix.

3. The Executive Summary

During World War II, Winston Churchill ran the British war effort with what most historians concede was consummate skill. Churchill had a rule for all subordinates who reported to him. It was that he would not read anything from them which ran over two pages. He made no exceptions to this and those who worked for him soon learned that their ideas would not even reach him if they broke that rule. Forced to state their case in this short span soon taught them to say what was really important first, and very clearly. If the idea had merit they were invited to submit more detail, but only if they had really presented their ideas well.

The Executive Summary serves the same function. In it, only the most important information can be presented. The size of an executive summary is not defined but they typically run only a few pages. To cram as much useful information as possible into it, the writer must distill his entire report into some graphs, maps or other figures, tables, and some text. Every trick of concise data presentation must be used. When well done however, an executive summary presented at the beginning of your report will get your message to the most readers in the smallest possible space.

C. Outlines, Checklists, 3 x 5 Cards

Discussed presents an orderly way to write a technical report. It is an excellent guide and recommended. But report writing, in fact, is not nearly so neat and tidy.

At the beginning of an assignment the writer never has all the facts and data needed to write the final report. He may not even have a complete picture in his mind of what that report will finally look like. In the real world both the writing problem and the technical problem solving go on together and each alters the other. Without some kind of organizational framework within which to work, the writer's task would be impossible. There are at least three good ways to keep things somewhat organized amidst this chaos.

Outlines are very useful tools. With a good outline you have the advantage of knowing where you are going with this report. You have a place to put the data as it is developed and you have a kind of plan for not only

writing the report but for solving the technical problems as well. This syllabus is written from an outline. The finished report is little more than the original outline expanded again and again adding detail each time. To be really useful though, outlines need to be thought out carefully and checked for completeness. Even then, permit yourself to modify your outline as you write to account for new, unforeseen facts or results or questions arising from the technical problem solving process.

Another humble, but very useful tool is the check list. Several generic examples are included in this syllabus but you should develop some of your own if you do much writing.

Sometimes technical report writing requires that you somehow organize large quantities of data from many different sources. This task may seem very daunting at first but a stack of three by five cards can be a great aid. On them you might jot notes describing the data you have. Simple notes are best; what it is, where it came from, how reliable you consider it, and where you think it might fit into your report. Now, find a large table, like a conference table, and spread the cards out on it. No particular order is needed; just get them out there where you can see and read them all as you walk around the table. As you wander, think about each card and how or where it might fit into your report. Think too about the importance of each card to the objective or purpose of the report. Try grouping the cards in various ways; by subject or in chronological order, for example. As you do this, perhaps several times, usually some pattern will emerge from the groupings. This won't always happen but often, surprisingly, it does.

D. Cloning

Word processors have made cloning, that is, the production of several reports out of one basic report, into a fine art. Use this technique whenever you can, but especially if you produced a very good, well organized report of some particular type. Apart from the hours saved by not having to retype pages of more or less interchangeable text, the great advantage of cloning lies in the fact that the report organization, its design, is already provided for you. Sometimes you have to make modifications but if you've chosen your parent report well, these will be few and simple and you can begin your writing knowing you have a good plan to work within.

E. Generic Report Elements

Many technical reports have elements in common with others. As an example, this syllabus begins each chapter with a Chapter Summary. Other reports typically end each section with a list of conclusions reached based upon the facts , data and analyses presented in that section. Look for these in the reports you read and look for opportunities to create them in the reports you write. They help your reader by giving him a consistent and recognizable pattern he can use to reduce his reading time while increasing his understanding of your report. They help you by reminding you to do certain essential writer's tasks like bringing each part of the report to a logical conclusion, bridging to the next section of the report, repeating important information to reinforce it in the reader's mind, etc.

CONSTRUCTIVE STRING SAVING

Make it a practice to find and save the best examples of reports, graphs, maps, tables and formats that you can find. These can be your own work or the work of others.

Here are five reasons you might want to do this :

1. They will allow you to build a portfolio of your best work.
2. They permit you to clone your best ideas and adapt them to other purposes.
3. You can build a library of "generic" report elements.
4. Recycling these ideas will save time.
5. Patterns will emerge from this collection and develop into useful standard report formats.

* * * *

AS YOU NEAR COMPLETION OF YOUR REPORT, WATCH OUT FOR THE 'EXCESS PERFECTION SYNDROME'. THIS IS THE IDEA THAT IF YOU COULD JUST HAVE TWO MORE DAYS YOU COULD MAKE THIS REPORT "PERFECT". ACTUALLY, YOU CAN'T. YOU MIGHT MOVE A PERCENTAGE POINT OR TWO TOWARD "PERFECTION" BUT YOU CAN NEVER REACH THAT GOAL. IF YOU WERE TO GRAPH YOUR PROGRESS I WOULD PROBABLY LOOK LIKE THE CHART BELOW. MOST TASKS REACH NEAR PERFECT AT THE POINT WHERE 95 TO 100 PERCENT OF THE EFFORT HAS BEEN MADE. IF YOU PUT IN ANOTHER TEN PERCENT YOU MIGHT REACH 98 PERCENT PERFECT BUT THE LAW OF DIMINISHING RETURNS GOES TO WORK AND YOU FIND YOU'VE OVERSPENT THE TIME AND MONEY BUDGET AND STILL CAN'T REACH 100 PERCENT PERFECT.

The Excess Perfection Syndrome

* * * *
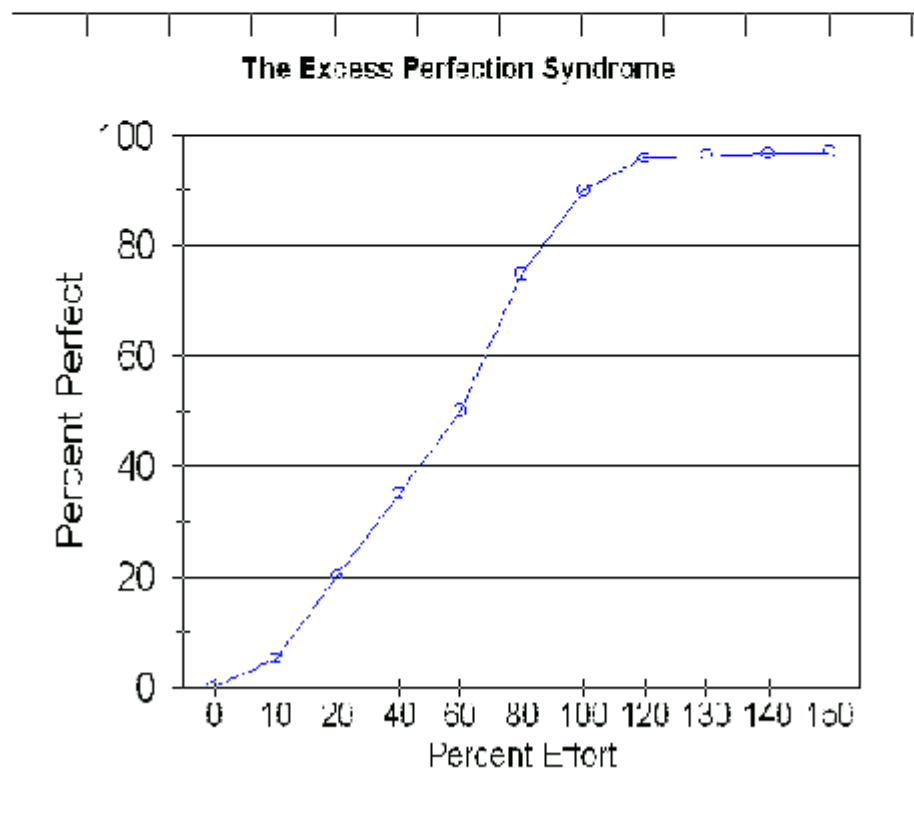
Go Back To Main Course

Technical Report Writing

CHAPTER 6 Textual Report Elements

A. Chapter Summary

There are several useful ways to categorize the sections of a technical report. In this Chapter, they are grouped according to their rhetorical purpose. This is the most useful way to look at these pieces of text which, taken together, make up the bulk of most technical reports. The main elements are:

- Descriptive
  - Analytical
  - Comparative
  - Conclusive
  - Persuasive
  - Summaries

The purpose of each is discussed in turn and examples are provided. Finally the role of reference lists, indexes and appendices completes this Chapter.

B. Each Element Has a Purpose

It is helpful to think of your report as made up of elements or sections, each one of which serves your basic rhetorical purpose. Look critically at your outline or report plan before you begin writing to see whether this is true or not. If some part of your plan doesn't seem to support your purpose consider eliminating it. It will probably only add word weight to your report and interfere with getting your main message to the readers.

While not an all inclusive list, the following six elements can usually be found in all technical reports.

C. Descriptive Elements

These are perhaps the simplest report elements to write. Their purpose is to provide the reader with a word picture of some thing, condition or problem addressed in your report. Your High School English teacher would have called this "expository" writing. Most of the sentences in a descriptive paragraph are declarative,; i.e., they simply state a fact or objectively describe a situation.

If you have a great deal of description to provide do either or both of the following. First, wherever possible, generalize. For example, if you need to describe the condition of the street system of your City say something like, "Most of the streets are in fair to good condition, except on the east side where poor subgrade soils have led to numerous potholes and larger pavement failures." When you can't easily generalize, compress the description by creating tables or graphs to illustrate the conditions.

D. Analytical Elements

The analytical sections of the report, by contrast, are often the most difficult to write. Explaining to your reader an often long and difficult reasoning process can be challenging. Again, in order not to lose the majority of your audience's attention, you must write in a way that is almost the reverse of the actual process you probably used to arrive at your conclusions. Analysis usually proceeds in the opposite direction; i.e., from the particular detail to the generalization. It helps to formulate the analytical sections or paragraphs of your report by stating first your conclusions and then, second, third, fourth, etc. your reasons for believing them to be correct.

E. Comparative Elements

There are very few technical problems for which there is only one "right" solution. For that reason, you will frequently need to be able to compare several possible solutions to each other and present to your audience the one you believe should be selected. Comparisons may be further complicated by the fact that you may wish to compare your solutions on several bases. Look now at **Figure 6-1**, below.

Listed in order of overall score

Key no.	Brand and model	Price	Overall score 0———100	Evenness	Mulching dispersal	Bagging VAC	Bagging CAPACITY
	SELF-PROPELLED GAS MOWERS: REAR-BAGGERS						
▶	John Deere JX75	$800		⊖	⊖	⊖	○
▶	Honda Harmony HRB215K3SXA	680		⊖	⊖	⊖	⊖
▶	Honda Masters HR215K1HXA	900		⊖	⊖	⊖	⊖
▶	Honda Harmony HRM215K3SDA	600		⊖	⊖	⊖	⊖
▶	White LC210 **A CR Best Buy**	390		⊖	⊖	⊖	⊖
▶	Yard-Man 12A-979L **A CR Best Buy**	400*		⊖	⊖	⊖	⊖
▶	Cadet SC621 **A CR Best Buy**	430*		⊖	⊖	⊖	⊖
▶	Arlens 911506	670*		⊖	⊖	⊖	⊖
▶	Scotts 21995X8	380*		○	⊖	⊖	⊖
▶	Toro Super Recycler 20487	620		⊖	⊖	⊖	⊖
▶	Snapper P216012	550		⊖	⊖	⊖	⊖
▶	Arlens 911504	470		⊖	⊖	⊖	⊖
▶	Lawn-Boy GoldPro 10525	510		○	⊖	⊖	⊖
▶	Toro Super Recycler 20043	500		⊖	⊖	⊖	⊖
▶	Lawn-Boy Silver Series 10335	390*		○	⊖	⊖	○
▶	John Deere JS61	430		⊖	⊖	⊖	◐
▶	Lawn Chief 12AE458K022	370		○	○	⊖	○
▶	Honda Harmony II HRT216SDA	470*		⊖	⊖	⊖	○
▶	Sears Craftsman 37754	340		○	⊖	⊖	⊖
▶	Toro Recycler 20021	400*		○	○	⊖	⊖
▶	Lawn-Boy SilverPro 10324	395		○	⊖	⊖	○
▶	Murray 20615X8	270		⊖	○	⊖	○
▶	Murray 20615X92	270*		⊖	○	⊖	○
▶	Sears Craftsman 37752	270		○	⊖	⊖	○
▶	Sears Craftsman 37759	370		○	⊖	⊖	⊖
▶	Husqvarná 560HS	445*		⊖	○	○	○
	SELF-PROPELLED GAS MOWERS: SIDE-BAGGERS						
▶	Yard Machines 12A-264C	220		○	○	⊖	○
▶	Sears Craftsman 37742	280		○	⊖	⊖	◐
▶	Scotts 22646X8	290		○	◐	⊖	○
▶	KGro PowerPro HSDSP2255A	230		○	◐	○	●

Figure 6-1

This kind of "comparison matrix" can save pages of text. Ask yourself how many words it might take to compare twenty lawnmowers to each other at the level of detail this table does. Also note that the table is arranged so as to provide what is likely to be the most important information to the reader first. It lists price first, an overall rating second, even-ness third and so on. Finally, to make this an even better example, the table uses a graphical system of rating each set and feature, shown in the upper right hand corner of the table. In the original, this is also in color which makes the effect even better. You can tell at a glance which are the better sets and which less desirable. They are listed in order of best to worst and you need only look for the solid black circle symbols along side each model to tell why it was down-rated.

Use this kind of comparison wherever you can. It is easily understood by most of your readers and reduces your job as technical writer to summarizing it in the text of your report.

F. Conclusive Elements

As you complete each main task of your technical investigation, take the time to assess the results. It is time well spent and will save you hours when you begin the writing part of your task. Ask yourself, what can we conclude from what we've just done? Are the results what we expected? Are they considerably different or surprising in any way? Are they reasonable? Or, will they require that we change our original plan of attack? If the answer to the last question is yes, then it is clearly time to go back and look at your report outline. Does it still fit the data you have or must you reformulate your writing plan as well as your technical problem solving procedure?

If the plans are both still good, this is a good time to write part of your report. Start with a simple list. List on a piece of paper the main conclusions you now feel confident in reaching. Then re-order the list so that the most important conclusions are first and secondary conclusions or side issues are listed last. Look at this list critically. Are these the conclusions you can support with your data? Is your logic correct or can someone shoot holes through it?

So far, so good. Now write the conclusive sections of your report within the framework you've decided upon. State the main conclusions first followed by the most telling reasons you arrive at those conclusions. Then, direct the reader to the parts of the report where he/she may find the detailed data that supports those conclusions.

G. Persuasive Elements

Technical reports are very often written for the expressed purpose of persuading someone else to do something the author(s) of the report desires. Sometimes the desired action is to fund some project. At other times the report is written to effect some change within the organization. Whatever the reason, if you cannot convince others of the logic of your proposal, it will fail.

To persuade someone to do something, even something they are inclined to do anyway, you must give them some reason to do it. In other words, few of us do anything we think might harm us, or upset the status quo with which we are comfortable, or which might require more work on our part unless we can see something in it for us.

Persuasive elements usually appear in the conclusions and recommendations sections of your report. They need to be written as convincingly as possible. Remember, you are not trying to convince yourself; you are trying to convince your primary audience. If you failed early on to identify and characterize that audience, you have no chance of convincing "them". If you do know that audience pretty well, you have the first of your persuasion problems solved. You know what kinds of arguments to present. You know, for example that the Budget Director is concerned about costs, primarily and perhaps improved productivity second. You know your boss wants to look good to his superiors. Does your report make him look good? Can you rephrase some parts of it so that he can get credit for his contributions to the report? You need to state your recommendations as positively as possible and support them with the best arguments and evidence you have.

Your second problem in persuasion is to anticipate objections. It is likely that your solution will have some

negative effects somewhere. It will probably cost something. It may require that additional staff be hired. It will probably affect the way people in your organization work. All these things are threatening and you must do two things about them.

First, do not duck these issues. And second, offer suggestions for meeting these reasonable objections. Everybody has problems; even your boss. Don't bring him/her yet another problem. Bring solutions.

H. Summaries/Reiteration

Winston Churchill, again. Churchill had a three part formula for any speech. It went something like this; tell them what you are going to tell them, tell it, then tell them what you just told them. Translated for our purposes this advice may be rephrased; Summarize each main report section, sandwich in the substantive discussion and data, and then reiterate the main points. It may at first seem wasteful to repeat what we've already said elsewhere in our report, but it is repetition with a purpose. The reader needs to be reminded from time to time what those main points are. It is easy for him/her and, even for you as the writer, to forget where this discussion is all leading. The longer and more technically involved the report, the truer this is.

Try to summarize often but briefly. It is a good idea, just to remind yourself to do so, to begin each section with a summary or overview of the contents of that section. This has a decided advantage for some of your readers. Many of them do not need to know, and haven't got the time for, all the detail in your report. Help them by letting them know what is in each section before they have to read it all only to find out it does not contain any information of value from their point of view.

I. References & Bibliographies

Listing references is tedious but necessary. Whenever you can, list them all in one place and number them. It is by far the easiest way for you and for your readers, particularly if you have many references to cite.

Bibliographies, a list of books cited, can be structured similarly. Most secretaries' handbooks can be relied upon to suggest some of the proper forms for creating these. Some of the better word processors will even create these for you as you write and tie the reference to the text in the report.

J. Indices

Creating an index is more of an art than most of us wish to undertake. Still there are several indexing computer programs around which help take much of the work out of this chore. Only the longest, most formal reports require an index but if you feel you need one, by all means include it. It is of tremendous help to your readers by saving them from thumbing through and guessing where in this long document you hid some obscure detail they need.

K. Appendices

It is not unusual for the appendix to a report to be longer than the report itself. This is the place to bury that mass of detailed data that few, if any, of your readers really need. In many kinds of reports it simply cannot be left out. The report might be incomplete without it or cannot be checked by others, but only you and a few of your audience members will need to look at that data again.
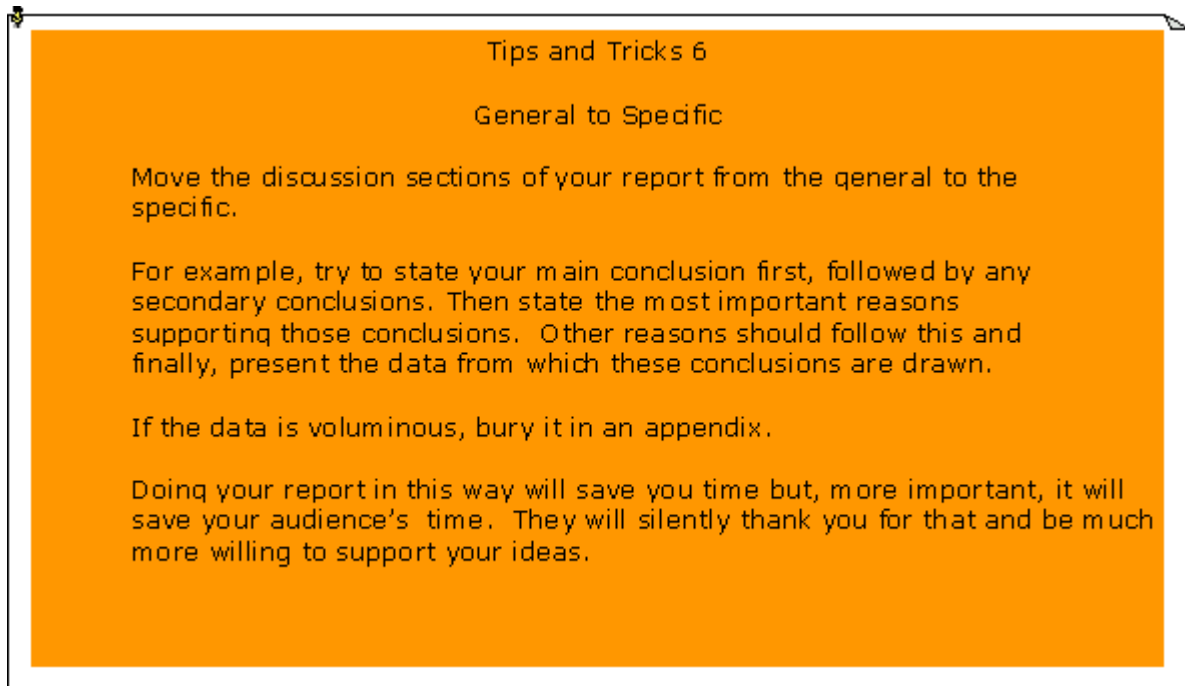
L. Executive Summaries

The executive summary is the first thing to look for in any sizable report, after you've read the title. If you don't find one, you know the writer did not consider his audience's time of much value or failed to understand how busy they are. By that failure, the author has made sure that at least half of his potential audience will not read his report and probably not support his recommendations.

PAGE AND FIGURE NUMBERS

Number the pages of your report and the Figures, maps, graphs and other illustrations by Chapter or Section. This is preferable to simply beginning with page 1 and numbering pages consecutively thereafter.

The advantage of this will be obvious if your report goes through several revisions from the first through the final draft. Each major revision will otherwise require renumbering the entire report, including all the Figure numbers. Number the Figures separately and don't give them a page number. Doing so will avoid renumbering all the Figures each time you decide to add or delete one. Don't worry if the Figure numbers go; 4-1, 4-2, 4-6, 4-8. It doesn't matter to the reader and needn't matter to you that there is no Figure number 4-3, 4-4 or 4-5.

* * * *

Tips and Tricks 6

General to Specific

Move the discussion sections of your report from the general to the specific.

For example, try to state your main conclusion first, followed by any secondary conclusions. Then state the most important reasons supporting those conclusions. Other reasons should follow this and finally, present the data from which these conclusions are drawn.

If the data is voluminous, bury it in an appendix.

Doing your report in this way will save you time but, more important, it will save your audience's time. They will silently thank you for that and be much more willing to support your ideas.

* * * *

Technical Report Writing

CHAPTER 7 Graphical Report Elements

A. Chapter Summary

In this, and in Chapter 9, the parts of your report which make the first, and often most telling, visual impression are described. The use of white space to guide the reader's eye and maps, graphs, schematics, tables and other illustrations all contribute to, and sometimes determine, the overall effectiveness of the report.

B. White Space

The reader of your report will find it much easier if you provide an occasional rest from his/her labors. The effective use of "white space" does this and makes your report look better, scan more easily and places the emphasis on the most important points. Look at other reports you've seen where the authors have done this and you'll see how spacing things properly can increase the effect of the message.

C. Maps and Aerial Photographs

Maps are an integral part of many reports in the Civil Engineering field as in many others. A good readable map answers the first question many readers have which is, where in the world is this project? By contrast, find a report in your own organization which does not have good maps. There are many such reports around so it won't be difficult to find an example.

Aerial photographs and mapping products derived from them are attention grabbers! The three examples below are good examples.

Figure 7-1a
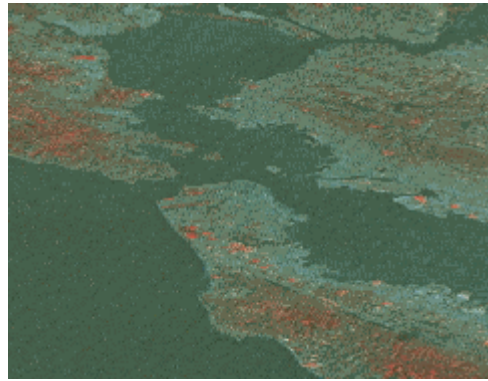
Figure 7-1b
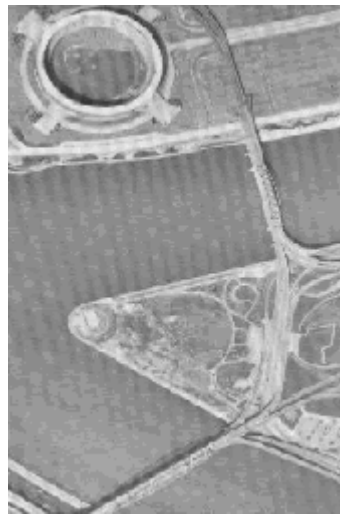
Figure 7-1c

What is the effect of such a report on you, the reader? Do you find yourself annoyed and frustrated because you can't read the maps? Are they so poor that you can't even tell what it is they are trying to show? Are you angry at the author of that report because he didn't take the time and trouble to reproduce a good map at an appropriate scale to illustrate his ideas?

There are several examples of maps included in this Chapter. Look at the Figures below. They have been chosen because they represent what good maps can and should be.
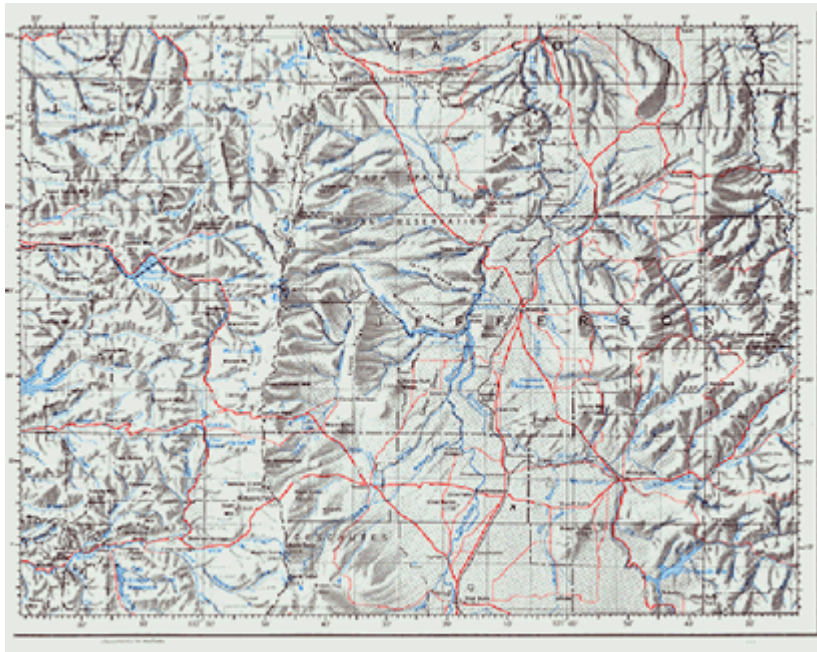
Figure 7-2a
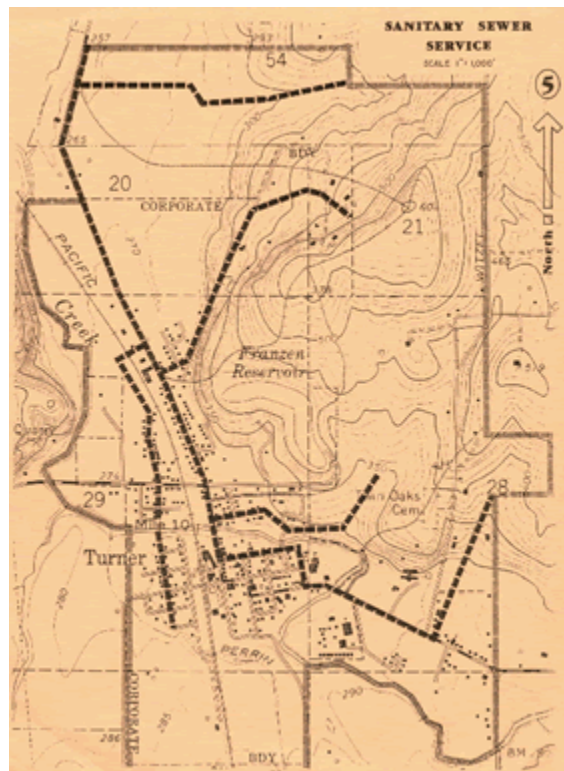
Figure 7-2b

There are many others examples around and you should be able to find some in your own library. They all share some characteristics in common, including;

- A North Arrow

- An Appropriate Scale

- Usually a Graphic Scale

- Often, a Screened Back Background

- Frequently, Color to Highlight Important Features

- A Legend

- A Common Base Map to Permit Easy Comparison

The increasing use of Computer Aided Design and Drafting (CADD) and Geographic Information Systems (GIS) is making production of such maps easier and easier. If you have access to such systems, use them to produce the kind of maps that clarify your ideas and win your reader's appreciation and support for those ideas.

D. Graphs

Graphs represent one of the best ways to illustrate numerical data in a concise and dramatic way. The example below is offered to show how this is accomplished. Graphs are especially helpful when you wish to show trends over time or the effect of one variable upon another. The key to good graphs however is simplicity.
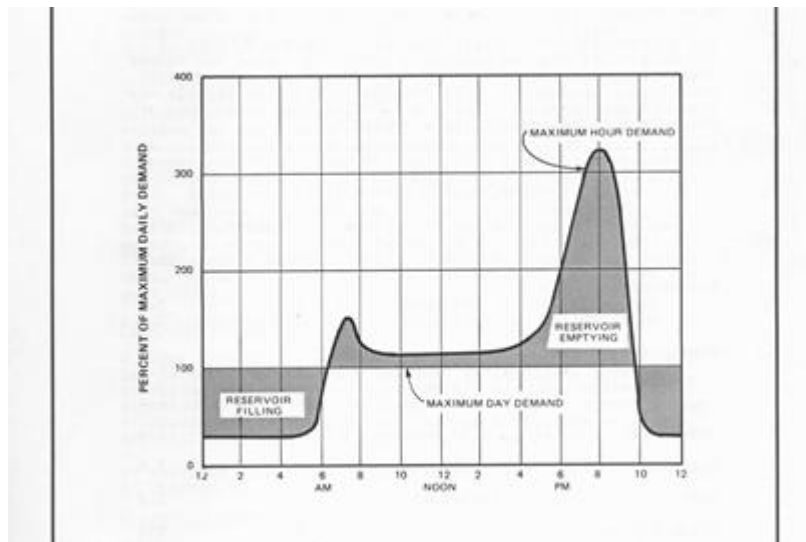
Figure 7-3

Some of the pitfalls in creating and integrating graphs into your report arise from failing to remember to keep graphs as simple as possible. Trying to show too many things on a graph is worse than not graphing the data at all. A graph with too many lines, especially when they cross and/or relate to different scales tends to confuse your reader and distort the data.

Suppressed zeros are another way to distort data. Most readers expect to read graphs from left to right and

from the bottom up. When you depart from these conventions, the reader may get confused. It may occasionally be necessary to do so, but be sure to explain fully in your report why the data is plotted in this non-conventional way.

The type of graph; bar, line, pie, area, 3-D, logarithmic, etc., is also important. Complicated but unusual graphs can be very helpful to you in your technical investigations but need to be used with great caution in your report. Consider again your audience. Will they understand this log/log plot of variable a vs. variables b,c,d,e and f? If not, include this graph in an appendix intended for your technically inclined readers and find a way to summarize the conclusions you've drawn from this graph in the main body of your report.

E. Schematics, Flow Diagrams

A very powerful tool for conveying technical ideas is the "schematic diagram". As used here, this term means a drawing or illustration which shows how something works, rather than how it actually looks. An example can be seen below.
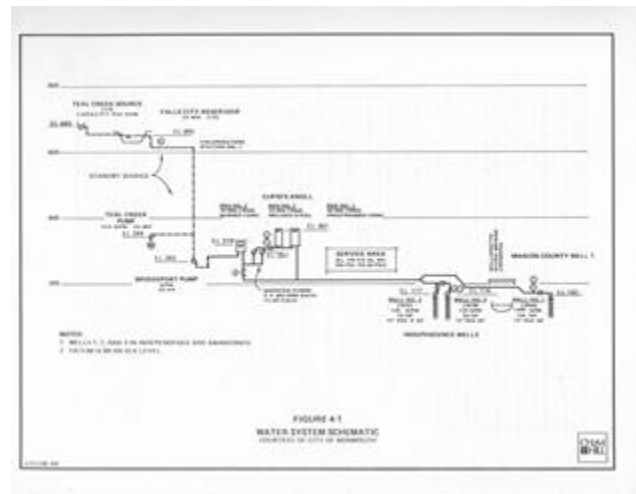
Figure 7-4

Think of these as "idea-grams". They are meant to explain fairly complex systems in the simplest terms the author can devise. Flow diagrams are similar. They show how something flows through the system, what happens to it along the way and what the end result of a process is. The water treatment flow diagram is good and well drafted. It could be improved however by rendering the main flow, the flow of water through the system, in a heavier line weight. The other flow paths, such as the chlorine feed lines, are less important and need to be suppressed.

F. Tables and Highlighting the Important Stuff

Tables represent a kind of hybrid between textual and graphical report elements. They are very important though and need a little thought and attention to detail in their design. Very simple tables, such as in the example below, do not require much explanation in the text of the report but more complicated tables, do. As a concise way of presenting data though, a table is hard to beat.

Figure 7-5

They also have an advantage to you as technical writer. With a good tabulation of data, your job is to explain in the text of the report the meaning and significance of the table.

Certain features of tables can add greatly to their impact. Lines are very helpful in guiding the reader's eye to those things you particularly want him/her to notice. Shading, boldface type, separation and similar tricks can also be used to accomplish that same objective.

HIGHLIGHTS OF
PRIMARY DRINKING WATER REGULATIONS

FINAL RULE
FOR CONTROL OF TRIHALOMETHANES IN DRINKING WATER

(TO BE USED IN CONJUNCTION WITH FULL TEXT OF REGULATIONS)

APPLICABILITY	COMMUNITY WATER SYSTEMS WITH GROUND OR SURFACE SOURCE USING ANY FORM OF DISINFECTANT			
CONTAMINANTS	TRICHLOROMETHANE (CHLOROFORM)	BROMO-DICHLOROMETHANE	DIBROMO-CHLOROMETHANE	TRIBROMOMETHANE (BROMOFORM)
MAXIMUM CONTAMINANT LEVEL (MCL)	0.10 mg/l SUM OF THE ABOVE 4 COMPOUNDS TOTAL TRIHALOMETHANES (TTHM)			

EFFECTIVE DATES	SYSTEMS SIZE (POPULATION)	MONITORING	COMPLIANCE
	> 75,000	NOV. 29, 1980	NOV. 29, 1981
	10,000 TO 75,000	NOV. 29, 1982	NOV. 29, 1983
	< 10,000	STATE DISCRETION	STATE DISCRETION

SAMPLING REQUIREMENT	MINIMUM 4 SAMPLES PER QUARTER PER PLANT TAKEN ON THE SAME DAY ANALYZE FOR TTHM	
SAMPLING LOCATIONS	25% AT EXTREME OF DISTRIBUTION SYSTEM 75% AT LOCATIONS REPRESENTATIVE OF POPULATION DISTRIBUTION	

MINIMUM MONITORING FREQUENCY (WHEN APPROVED BY THE STATE)	GROUNDWATER SYSTEMS	SURFACE WATER SYSTEMS
	ONE SAMPLE PER YEAR FOR MTP (MAX. TOTAL TRIHALOMETHANE POTENTIAL) IF MTP < 0.10 mg/l	ONE SAMPLE PER QUARTER FOR TTHM IF TTHM LEVELS ARE CONSIDERABLY BELOW 0.10 mg/l AFTER ONE YEAR OF DATA COLLECTION

REPORTING REQUIREMENT	AVERAGE OF EACH QUARTERLY ANALYSIS	
PUBLIC NOTIFICATION	IF RUNNING ANNUAL AVERAGE OF EACH QUARTERLY SAMPLE EXCEEDS MCL	

Figure 7-6

G. Avoiding Clutter & Confusion

In all graphical elements of your report it is essential that you avoid clutter, confusion, business and sloppiness. These things interfere with your main goal which is communication. Do this by being careful about where you place labels in graphs, titles in tables, notes appended to either and reference marks or ticks.

H. Color, Line Weight and Style

These features of the graphical elements of your report are important little details which often spell the difference between an effective illustration and one that only confuses or obscures your message. Some people naturally have an eye for this sort of thing while others do not. If you are one of the latter, the best advice that can be offered is to find someone in your organization who does and seek their advice.

I. Linking Text and Graphics

It is common for a technical report to be built around the graphical elements within it. This technique is used by many good technical writers and they have devised ways to link the graphics to the text. Phrases and formulas for doing this may be found in parts of this syllabus, as examples. However you do this, don't forget that it is essential. Without this kind of "connective tissue" your report will be a skeleton from which the muscles have become detached.

J. Numbering Figures & Graphs

At the end of Chapter 6 the suggestion was made that Figure numbers follow the Chapter or Section numbering scheme of your report. It is nice, but not essential, that Figure numbers be consecutive starting with, for example, Figure 4-1 and proceeding by ones through Figure 4-X. If you can, do this. But if you can't, don't worry about it. The only essential thing is that each Figure or Graph or Table have a unique number so that your references to it in the report will be unambiguous.

K. Summing Up

The graphic elements of your report are important for at least the following reasons:

- They are often the only thing which will be looked at by some readers.

- They create the overall impression of the quality of your work.

- They allow you to convey complex ideas in simple ways.

- They are often the most concise way to present certain kinds of data.

* * * *

FIGURE NUMERO UNO

In any technical report there is, or should be, at least one graphic illustrating the main conclusion of the report. That Figure is all important!

It must be clear. It must be comprehensive and it must be there. Without it your report is incomplete. If it is really good, your entire report can be understood by every one of your readers simply by looking at this Figure.

* * * *
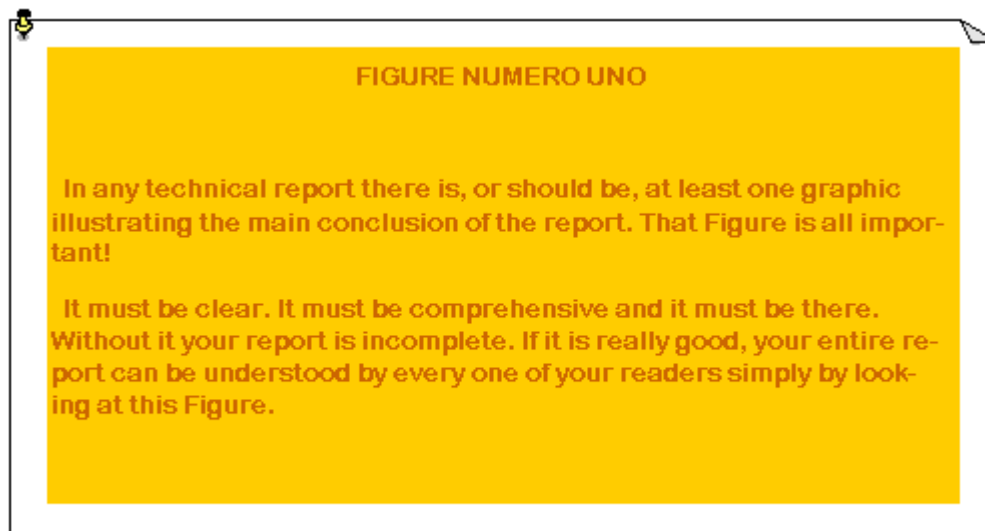
Technical Report Writing

CHAPTER 8 - Writing Style, Grammar, Punctuation & Spelling

A. Chapter Summary

English 101 this is not. Your language, grammar, spelling and usage skills are presumed to be at least adequate for everyday communication. In this Chapter, the emphasis is on ways to increase those skills and avoid some of the most common errors found in technical reports.

The choices we make in word and sentence length and structure, style and "terms of art" create the impression our report makes on our audience. It is their, our audience's, needs which is our best guide in making these choices.

B. Audience Analysis

In deciding upon a writing style you must, again, return to the analysis of your audience. The style you choose will be determined by the things you know, or can reasonably assume, about your readers. The information and knowledge they have will guide you as you choose the words, sentences and paragraphs which will ultimately be your report.

If your audience is largely technically oriented, educated and inclined, then your style is likely to be characterized by longer sentences, more complex sentence structure, technical terms and jargon and references to things only a fellow technician would be expected to know about. But, this is seldom the case. Even in reports or articles written for technical journals, it is probable that your audience will be much more varied than this. Even if it is not, such writing is very difficult to read and tends to sound stilted and pompous.

For all except the most narrow audiences a much simpler style is recommended. Try to avoid the kind of dense technical writing which may be found in such publications as the Journal of the American Medical Association or even Scientific American.

C. Reading Level (7th Grade)

The daily newspaper is written for a seventh grade reading level. It is intended for a general audience and, sad though it may be to say so, that is the level at which most Americans can read and comprehend. Your report may aim a little higher, but not much. Remember that many of your readers are not accustomed to reading technical material and following intricate and convoluted analyses. If you have any of the style analysis tools such as Grammatik II or RightWriter, subject a sample of your writing to them. See what they tell you about your usual style. Is it complicated, passive voiced and does it have a high "fog-index"? If it does, consider how you can reduce the reading level required to understand your writing. Doing so will make your message accessible to more of your intended audience.

D. Sentence Length

It is axiomatic that long, complex sentences are more difficult to understand than shorter simpler ones. As you analyze your own writing and that of others, this is perhaps the easiest place to start toward making it more easily read and understood. Here's a quick example of a long sentence rewritten into two shorter ones. It is taken from an early draft of this syllabus, Chapter 5:

First the original sentence;

"Apart from the hours saved by not having to retype pages of more or less interchangeable text, the great advantage of cloning lies in the fact that the report organization, its design, is already provided for you."

Rewritten;

"Cloning can save you hours by not having to retype pages of generic, interchangeable text. But its great advantage is that the report's organization is already present in the original report. "

The re-write has six fewer words and is easier to read and understand. This kind of reduction can almost always be done with any long sentence. It can also be overdone. You can expect, in a technical report, that there will be some long sentences. They are not out of place in such writing but their number should be minimized.

E. Word Choices

The words you choose to express your ideas greatly affect the impression you make on your readers. During the Apollo Moon Landing mission NASA chose to use terms such as; "Lunar Excursion Module", and "Extra Vehicular Activity". The first described what was essentially a dune buggy. The second meant that the astronauts got out of the dune buggy and walked around on the moon's surface. This kind of stilted, pseudo-scientific terminology seems to some of us, ludicrous. It is using ten dollar words to express two-bit ideas and NASA carried this sort of thing to extremes. Other examples abound in the speech and writing of people like Howard Cossell and in much advertising copy.

Avoid this stuff. If you have a simple idea, try to express it simply. If you have a complicated idea, use the simplest terms you can think of to describe it. The best word in any particular context is not necessarily the shortest or simplest; it is the word that says exactly what you want to say.

F. Active Voice and Action Words

Much technical writing suffers from overuse of the passive voice. It is very difficult to overcome this but your writing will be much improved if you can.

G. Technical Terms and Jargon

Technical terms and jargon are unavoidable in technical report writing and it is not suggested that you even try to avoid them. They have advantages in that, they provide a kind of short-hand for you and your reader. It would be almost impossible for you to describe, for example, a water treatment plant without using any chemical names. But, if some of your audience is unlikely to understand those names or know why certain chemicals are used in water treatment processes, you've lost them.

The easiest way around this is to define any technical terms you will use in your report somewhere early in the report. If there are not too many such terms, it is a simple matter to define them the first time they are used. A brief paragraph describing, for example, the chemicals commonly used in water treatment and the reasons for using them would help your non-technical readers and save you the trouble of trying to think up synonyms for them.

H. Synecdoche

This obscure word is defined by Webster to mean; " synecdoche (sin neck dough key) n. A Figure of speech by which a more inclusive term is used for a less inclusive term, or vice versa. For example, head for cattle or the law for a policeman."

It can also be used in a slightly different sense and provides you, as technical writer, with a powerful tool for making seemingly complex ideas much more understandable. The tax system of the United States is, you would probably agree, pretty complex. Yet, if you reduce it to its simplest terms it is not. Suppose that instead of fifty states, there were only two; one of them rich and one of them poor. The federal tax system collects taxes from both states, uses some of the money to run the government and then gives back to the poor state, through some program, more money than it gives back to the rich state. In short, it re-distributes the wealth. Of course it is not really this simple, but on its most elemental level it is.
Such over-simplified examples can be useful to you as a writer attempting to explain technical subjects to non-technical audiences.

It is a good technique and an excellent exercise to try to think up a synecdoche like this for the problems you are called upon to describe and explain.

I. Common Mistakes

A well written technical report must first be technically correct. Your reader expects you, as a technical advisor, to know how to spell, how to use words correctly and how to punctuate. If you don't know how to do these things, your other technical abilities are cast in a shadow of doubt.

a. Spelling Checkers - If you are not already producing your technical reports using a good word processor, start. There is no quicker way to check your report for spelling and other grammatical errors, such as doubled words.

b. Usage Notes - Some word processors also offer usage note for commonly misused words. Here's an example from Textra 6.0:

"ACCEPT: v. to take or receive something that is offered, usually with approval; to agree or consent to; to receive or regard as true or proper

EXCEPT: prep. excluding, leaving out; other than, but (a) v. to omit, to exclude (b)

correct usage: She accepted his invitation to dinner.
He hoped she would accept the terms of the contract.
Finally, she believed he was sincere and accepted his apology.

He didn't say anything all night except that he was tired. (a)
He decided to except Jeff from his invitation list. (b)

incorrect usage: Everything accept the rice was delicious.
Everyone accept Joanne was wearing a red hat.

She didn't except his invitation to the party.
He was not willing to except her refusal.

NOTES: Accept is only a verb while except is both verb and preposition. Take a look at their different meanings to decide which one to use. "

This kind of help for about 100 commonly misused words is just a keystroke away. If your word processor doesn't offer this feature consider one that does or find a separate program which gives you access to at least an electronic dictionary so you can look these words up for yourself.

c. Style and Grammar Checkers

If you feel your writing style needs major surgery, then programs such as Grammtik II, RightWriter and similar aids may be for you. They offer help in reducing sentence and word length, proper usage of those tricky words like "accept" and "except" or "allusion" and "illusion" and spelling. The better programs will also calculate the fog index of your writing and the reading level needed to comprehend it and will often annotate your text with suggestions for changes.

d. Consistency in Terms and Style

Much confusion arises from taking some of this advice too seriously. Many writers, in a effort to bring some variety and interest to their writing, go to extremes to find different ways to describe the same thing. This can be dangerous and confusing in a technical report. If, for example, Chapter 1 of your report referred to a water reservoir as "a reservoir" continue to use that term. Don't change to calling it a "pool" in Chapter 3 and then in Chapter 8 calling it an "impoundment". Many of your readers may not understand these terms to be

synonymous, which indeed they are not.

In team writing the problem of consistency in style can also arise. No two people write in exactly the same way and it is seldom that there is only one "correct" way to say something. In organizations where team writing is practiced this problem can be largely overcome through the use of style manuals and frequent meetings among team members to review and mutually offer constructive criticism.
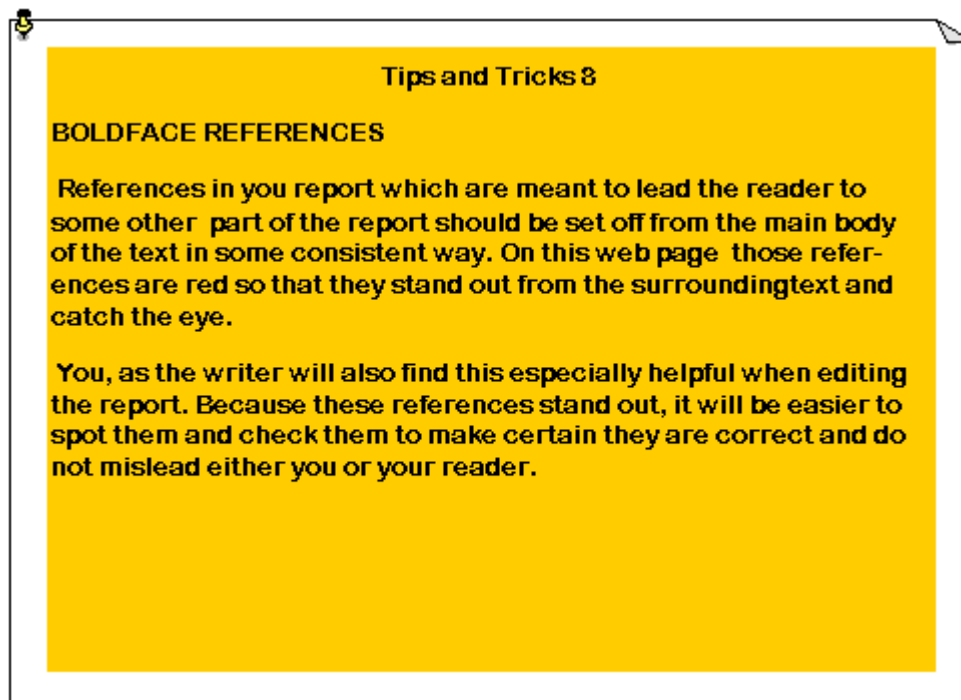
J. Summing Up

This is not a course in basic English grammar and usage. You are presumed to have a good working knowledge of the language that you use daily in your work. But all of us can improve our language and communication skills through attention to some of the details discussed in this section. In a report, which will inevitably be mainly words on paper, words are our most important tools. Skill in using those tools to fashion reports which can be read and understood by the audience we hope to communicate with is a basic for success.

BOLDFACE REFERENCES

References in you report which are meant to lead the reader to some other part of the report should be set off from the main body of the text in some consistent way. You, as the writer will also find this especially helpful when editing the report. Because these references stand out, it will be easier to spot them and check them to make certain they are correct and do not mislead either you or your reader.

* * * *

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BOLDFACE REFERENCES

References in you report which are meant to lead the reader to some other part of the report should be set off from the main body of the text in some consistent way. On this web page those references are red so that they stand out from the surroundingtext and catch the eye.

You, as the writer will also find this especially helpful when editing the report. Because these references stand out, it will be easier to spot them and check them to make certain they are correct and do not mislead either you or your reader.

* * * *

Technical Report Writing

Chapter 9 Appearance Elements

A. Chapter Summary

How your report looks often determines whether or not it is read and acted upon in the way that you intended. A simple, but inviting, cover will give your report a chance of achieving its purpose. It cannot substitute for good technical work or competent writing but without a reasonably presentable face on it, your report may not even get read.

B. A Matter of Taste

The Latin phrase has it; de gustibus non est disputandum, there is no disputing matters of taste. What may appear attractive to you may not to me, obviously. In technical report writing however, you and I do not matter nearly so much as our audience. Consider, as you decide questions of style and appearance, what their likes and dislikes probably are. Again, you'll be guessing, but if you follow some basic principles of design and keep it simple you are not likely to go very far astray.

C. Simpler is Usually Better

One of those principles is that simpler is almost always better. Logos present an excellent example of this principle. They are nearly always simplifications of some idea, picture or often letters of the alphabet. Think of some of the better known corporate and sports logos (below); IBM, 3M, Chrysler, the Pittsburgh Steelers, the Minnesota Twins, the Cubs, the Seahawks, the Iowa State Hawkeyes ..... All are simple, eye-catching, bold and repeated again and again in everything related to their owners.

Figure 9-1a

Figure 9-1b

Figure 9-1c

D. Format Standardization

Organizations which produce many reports find it very useful to standardize report formats. This has several advantages including simplifying the report writing process and allowing the organization's work products to look consistently good. This is done by both large and small organizations both in the public sector and in private consulting work.

The best part of this is that it is not very difficult to do. Simply select from among your existing reports several that look good and adopt the best features from each. Try to keep it simple and let it be a useful checklist. The title page is a good place to start. This standard format also serves to remind the writer to include certain essential information while at the same time contributing to the appearance of the report.

E. Covers, Bindings, Color and Logos

The first thing your potential audience sees of your report is the cover. Make that first impression count. Make it attractive and invite the reader to open it to see what's inside.

Bindings, such as wire spiral bindings, which allow the report to be opened and lay flat are very desirable. They are expensive but if your report is one which is likely to be used again and again by your readers, they may be worth that extra cost. Some reports are designed from the beginning to be amended and updated frequently. For these, three ring view binders are often the best choice. Whatever you choose, think of how your report will be used by your target audience and then select the best binding you can afford.

Color is also expensive but becoming less so with the improvements in color copying technology. Use color sparingly in technical reports however. Not only is it expensive but it creates a few problems you need to think about ahead of time. Never rely on color alone to convey your message. If, for example, you want to depict six different land use categories on a map in color, also use six different shading patterns. In this way you can make black and white copies of the map cheaply and not lose the information by doing so.

A very useful thing to know about your primary audience is whether or not they have such a symbol of their identity. If so, use it in your report which is, after all, written for them. It makes your report "customized" and identifies your client audience as the important part of the process that they are. It makes them feel good and appreciated and lets them know that this report was written for them, not for just anyone.

F. Tabs and Dividers

Longer reports require that division into smaller segments to avoid a lot of page flipping to find specific information. Tabs and dividers are very useful here and should be part of most of your lengthier reports. Labeling, or at least numbering, the tabs is highly advised.

G. Large Format Maps and Figures

When Figures or maps get larger than 11" x 17" you'll need to find some way to incorporate them into the report other than binding them. A map pocket inside the back cover works very well for this if only one or two such Figures are needed. If a larger number are needed you may have to go to a separately bound volume

with an oversized cover, etc. This is to be avoided if possible because of both the cost and time involved. But if you must, do it. The information those Figures contain may be essential to your reader and you must make it a accessible to him/her as possible.

H. Fancy Fonts

Desktop publishing programs are wonderful but they do tend to allow some of us to get carried away. The number and variety of styles, sizes and shadings possible may tempt you to try them all in one document. Resist that temptation. Two or three sizes and, at most, two styles of font are about all that are really needed to produce a good looking technical report. Try to select styles that are easy to read. Try them out within your organization if you can. You can print out a sample page from the report using the fonts you think you'll use and ask 3 to 10 people to read it and tell you how they like each.

I. Costs

Making a report look good does cost something but it need not be overwhelmingly expensive. While you need to consider these costs remember that they are usually only a small part of the total project budget. An ugly report costs something too. If it loses your primary audience because they are turned off by its appearance then the money you saved on cheap covers, sloppy bindings, and illegible maps is money thrown away.

J. Time = $$$

Whether you work in a public agency or in the private sector, time is always money. This syllabus is filled with many tips for saving time, in the long run. The suggestions on standardization, cloning, customized tab sets, covers, etc. will all do that. Your job may not primarily be to produce reports but if report writing is any significant part of your job, use these suggestions to save time later. When the deadline looms on the horizon, you won't have the time to spend setting these things up.

K. Summing Up

The perfect technical report has never been written but some excellent examples exist. Whatever their content, those best examples "look good". If they don't it is not likely any of us would run across them. A little planning and attention to detail at the beginning of the report writing process will pay off at the end by resulting in a report someone will want to open and read.

L. Custom Report Covers and Tab Sets.

Even the most mundane report can be made to look better and easier to read. A customized cover which invites the reader's attention and tells him/her quickly what this report is about is the front door to your house of communication.

Labeled, tab dividers segment your report into useful pieces. They are the doorways to the rooms of that house and they make the floor plan clear to your reader.

* * * *

Tips and Tricks 9

Appearance Elements

Color. lineweight, shading patterns and bullets may all be used to good effect in your report and help to invite the reader.

Be careful of two things, however. First, it is very easy to over do graphics and create a page that is so "busy" it serves to confuse your reader rather than drawing attention to what is really important.

Second, don't depend on color alone. Parts of your report may be Xeroxed in black and white and given to others. Differnce denoted only by color will be lost and may make the copy unintelligble.

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Technical Report Writing

CHAPTER 10 Putting It All Together

A. Summary

Once you've completed the technical tasks, it's time to bring all the data together into a complete, coherent report. This process often starts before all the data is available. In other words, you frequently need to begin writing the report before you have all of the information you need to complete it. You will feel a great deal less uncomfortable about this if you've thought through the purposes and intended audiences for your report. With them in mind, you should already have a complete, but flexible, outline for the final report.

How do you tell when it's time to begin writing? You are ready to begin writing when you have enough data to answer the most important technical questions posed by your report. If you are ready to draw some conclusions, you're ready to begin writing the substantive portion of the report. In other words, don't begin writing before you have something to say but don't wait until you know all the answers either. You will almost never have enough time in the real world to complete the report on schedule if you wait until every detail has been investigated and every doubt resolved.

Putting it all together requires the following main tasks:

- Editing the Structure of the Report

- Editing the Report Contents

- Checking Numbers and References

- Assembling the Completed Report for Final Printing and Distribution

In doing these tasks, a personal computer will be a great aid and is strongly recommended.

B. Editing for Structure

Editing is an art, but it can be learned. Whether you are editing your own work or someone else's, you will save a great deal of time if you edit the structure of the report before you begin to read each Chapter or section. Look over the whole report first to be certain it fits the outline and organizational scheme you decided on earlier. If it doesn't, reorganize it before going on so that it does. Unless you do, you will waste hours or days reading text that is in the wrong place in the report or is repeated unnecessarily. You will find yourself frustrated by having to wade through pieces of text which, because they are misplaced, do not relate to the subject of the Chapter or Section. If you find this, you know that the writer has forgotten the outline and his job as writer. That job is to craft the report in such a way that the rhetorical purpose of each paragraph, section, chapter and graphic is served.

C. Editing for Content

Once you are satisfied that the report is organized in a logical way according to your original plan, you can begin editing for content.

Check Those Numbers! In technical reports, numbers are all important. Certain numbers will necessarily be repeated in several places within the report. These are especially important because if they are wrong one place they are likely to be wrong in another place. Such numbers can cause discrepancies if they are different in different parts of the report. Don't, for example say in Chapter 2 that the project will cost $3,350,000 and then say in Chapter 7 that the cost is 3,530,000. This kind of easily made transposition error confuses the reader and makes him doubt your technical ability as well as your ability to write, or add or multiply.

A second category of numbers which may cause problems are those from which many other values are derived. For example, in the design of a water system, the design population, the average day demand in the design year, and the assumed fire flows must be carefully selected or calculated. They provide the basis for every pipe size in the system, every well capacity, every storage reservoir, every pump and many other system components and directly affect the cost of the project to the users. You can make numerical mistakes in a report and still be considered a good technical writer but those mistakes had better be in insignificant things, not in basic numbers.

Checking References

There are two kinds of references which often appear in technical reports about which the author need be concerned. If you refer to many previous reports or cite numerous authoritative sources, a List of References or Bibliography is advisable. It will save you much work by not having to repeat each full citation throughout the report. Listing and numbering them saves both you and your reader a lot of time and effort. Help him/her and help yourself by devising an easy way to refer to information sources succinctly.

A second, even more important reference, is the "internal" reference. Suppose, for example, that in Chapter 2 of your report you write the following sentence:

".......................Costs for each of the three alternatives are calculated in **Chapter 7**................."

Suppose that somehow, by mistake, you either don't calculate those costs or you decide to put them in Chapter 8, instead. Your reader may find them or he/she may not. Either way, the reader will be annoyed at being sent him on a search and at having his/her time wasted.

One way to help avoid this problem is to highlight all text in the report which refers to some other part of the report. In the example above, the reference to Chapter 7 is bold faced so that it stands out from the rest of the paragraph . This system has two very important advantages and is recommended even for rough draft reports.

Its first advantage is to you and to those who have to edit your writing. It allows you both to more quickly cross check internal references to be certain that they really do agree. Your reader also receives a benefit from this practice because you lead the reader's eye to important parts of your report. This allows him/her to quickly scan the report, find the information he/she needs and not be forced to read every word. This, and other tricks mentioned in previous Chapters make, you report "scan-able." Few technical reports are ever read word for word, cover to cover. If you hope to get your message to the reader, you must assume he/she will scan the report first and if they don't find what they are looking for, will toss it aside.

Checklists

A number of generic checklists are included in this syllabus for your use. But feel free to change them to fit your needs and the kind of reports you write. As an aid to your memory, a checklist can't be beat. It will serve you best by never allowing you to make that big, stupid mistake we all dread; like leaving out the conclusion section.

D. Writing Reports on the Computer

If you don't use, or feel you don't need, a computer, please reconsider. Even if all your reports are short and routine, a computer can be a great aid in many ways. Software, i.e., programs in the following general categories, are most helpful to technical writers:

1. Word Processors
2. Spreadsheets
3. Form Generators
4. Desktop Publishing

5. Style/Grammar Checkers
6. Presentation Graphics
7. CADD
8. Special Purpose Programs*

* Special Purpose Programs are those designed to do some special job you need to do in your position; especially one you do repeatedly. An example might be a program to calculate Chlorine feed rates for a water treatment plant based on flow and source water quality factors. If the program you need doesn't exist, ask around. Chances are some one of your colleagues have either found it or written one. If not, consider writing it yourself.

Even if you are not a typist, as I am not, a computer can bring you benefits of speed, accuracy, and improved appearance of the finished report. Perhaps most important, the computer gives you the ability to easily clone your reports for other purposes. You can take one report, already written, and with either major or minor editing, produce a second report thereby saving you hours, or days of dull work. You will, with a computer, also have opened the door to other possibilities. You can exchange data between programs so that you might, for example, import a spreadsheet calculation into your word processor and use it as a table of data then add a graph to illustrate the data from your graphics package.

To be computer illiterate today is to place yourself at least ten yards behind in the 100 yard dash. In some occupations this is not true, but you, as a technical practitioner and writer, have not chosen one of those occupations.

The cost of computer hardware and software has trended downward from the beginning of the Personal Computer age a decade ago. Even so, we cannot all afford all the things we'd like to have, or at least like to try. The following two sections describe some writing tools which are good, available and affordable. The lists are just personal opinion and others with more knowledge can produce better lists. The programs were selected mainly because they are low cost, or proven or involve little risk for the novice. Experienced PC users have no need of this list but beginners may appreciate a few suggestions.

E. Ten Shareware Programs for Technical Writers

- Word Processor PC-Write

- Spreadsheet PC-Calc or Express Calc

- Form Generator EZ Forms

- Desktop Publishing Rubicon Publisher

- Style/Grammar Checker RightWriter

- Presentation Graphics Graphics Workshop

- CADD DanCADD 3D

- Print Enhancer Print Partner

- Flat File Data Base PC-File

- File Compression PKZip

This list is based mainly on the listings in Shareware Magazine, published by PC-SIG. More on this, and other

shareware sources, below. Evaluation copies of shareware may be obtained for $3.00 to $5.00 per disk. Registered versions typically run $20.00 to $100.00, seldom more.

Several equally good alternatives to certain shareware programs exist. For a nominal cost you may try several in each category and decide which you like best. Then, register your copy and tell the author you appreciate his work.

The Number 1 Shareware source on the West Coast:

PC-SIG
1030 D East Duane Ave.
Sunnyvale, CA 94086
Orders: 800 - 245-6717
Information : (408) 730-9291

F. Ten Commercial Programs for Technical Writers

- Word Processor - MS Word
- Spreadsheet - Excel
- Form Generator - Formtool Gold
- Desktop Publishing - MS Publisher
- Style/Grammar Checkers - Grammatik II
- Document Interchange - Adobe Acrobat
- CADD - AutoCADD
- Print Enhancement - Bitstream Fonts
- Internet Search Engine - Copernic Basic
- Utility - Norton System Works

Top selling programs are reported weekly in several of the popular computing magazines and by Softsell, a trade publication for computer software dealers. This list is based only partly on those sources and partly on personal prejudice. Expect this list to change frequently.

Free and Public Domain Programs

There are so many free programs around that no attempt is made here to even list them. Important sources for such programs include; PC Magazine, PC World Magazine, PC-SIG in Sunnyvale California, the Houston PC Club in Texas and any of a hundred local and national RBBS's (Bulletin Boards). Their size is usually small and their usefulness often limited but they are worth investigating.

Two such programs you will find very handy are CO.COM and WHEREIS.COM . CO.COM can replace the DOS command "DIR". It allows you to selectively copy, erase, move or re-sort the files in any directory or subdirectory. It works something like X-Tree but it costs nothing.

WHEREIS.COM will find any file on your hard disk even if you've forgotten exactly what you named it. As long as you can remember even a part of the name, WHEREIS.COM will find it for you. You can, for example, type <WHEREIS *.WQ1>and the program will search all the directories and subdirectories on your hard disk a list all the files having the file extension ".WQ1". Many useful public domain programs exist to solve these and similar problems

A PC can help you write faster, better and more easily . Give it a try.

* * * *

Tips and Tricks 10

Ten Useful Links for Technical Writers

- TenLinks. com http://www.tenlinks.com
- BuildingTeam.com: http://www.buildingteam.com
- AboutCivilEnqineering: http://www.civilenqineer.about.com
- Technical Writing: http://www.techwriters.com
- Construction Specifications Institute: http://www.csinet.orq
- ASCE : http://www.asce.orq
- Engineering Software Center: http://www.engsoftwarecenter.com
- Guideme.com: http://www.quideme.com
- Engineering News Record: http://www.enr.com
- AIA : http//www.aia.org

These links are based on the author's experience in Civil Engineering
The list may obviously be expanded for other disciplines based on your
own experience or that of your professional colleaques.

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