Practical Guide to the Engineering Report

by

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THE REPORT

Engineering reports are technical documents aimed at specific audiences so they can learn about a topic to solve problems, make decisions, and carry out actions. Insights into the features of a report are helpful; your engineering report is a reflection of you, your competence, and your authority. To begin, decide what type of report you need to prepare based on its purpose and its intended audience. Sometimes reports travel through a chain of command with variation in the needs and prior expertise on the subject.

These factors will determine the **level of formality** of the report, how casual or business-like your language will be. Your level of formality reflects your attitude toward the topic as well. (Example: "Dine for lunch" is more formal than "Grab a bite.")

The **level of technicality** of your report may vary from non-technical, semi-technical, or very technical. (Example: John Doe enters the emergency room in cardiac arrest. A doctor may explain his case in non-technical terms to John's spouse, semi-technical terms to a nurse, or very technical terms to another doctor. A doctor would understand medical jargon, abbreviations, acronyms, and standards of vital numbers. If explained parenthetically, these terms could be included in a document to a nurse. Medical jargon would confuse a non-technical spouse.)

LANGUAGE

A technical report is basically a composition of language with word choice determining its effectiveness. Seen as a traditional argument, the technical report features language that focuses on its specific claim, its reasonable support, and its logical conclusion. Metaphorically, language is like the meat on the bones of a report.

Clear language states what you mean and is not open for interpretation. A document analyzing cause and effect, for example, clearly distinguishes between probable, possible, and definite causes. (Example: "Prevailing winds call for *possible* landfall on the Florida coast.")

Accurate language provides what a reader needs to make an informed judgment, requiring a fair balance of research and data presented. Accurate language avoids bias, exaggeration, understatement, and omission of vital facts. (Example: A site plan detailing storm water retention considers regulations that are pending.)

Concise language gets right to the point, avoiding wordiness. (Example: Jane Doe is an operator in the control room at a chemical plant; wordy instructions might delay the sequence of her actions during a chemical spill.)

Efficient language gives the audience what it needs to know without too much or too little information. (Example: Tests showing low chlorine residual in a public water supply need timely and specific attention, not background reading.)

User-oriented documents guide the reader to what they need. (Example: A table of contents or index helps for quick reference, as do headings, bullets, and lists.)

Language to Avoid

 Substandard language, like slang, reflects poorly on the author, and in turn the company. (Example: "We'll follow these rules even though they suck." Better: "We are committed to following the guidelines as presented.")

 Clichés are overused phrases that lack specific meaning and can cause confusion. (Example: "The case for proceeding with this project is a slam dunk." Better: "This project has a high probability of success.")

Euphemisms are less offensive or more polite phrases. (Example: "The body found at the site was a man who had been fired." Polite: "The deceased was a former employee.") Some euphemisms are deceptive or amusing. (Example: "The wife is a domestic engineer.")

Pretentious language uses big words to sound important or dramatic. (Example: "Essentially, the initial fabrication of the edifice was structurally insufficient." Better: "The building was structurally unsound.")

"Letterese" language uses fillers to sound official but adds nothing to the meaning. (Example: "Per your request at this point in time, please find enclosed…" Better: "I enclose your requested document.")

Colloquial language is conversational and often inexact. It can be appropriate for informal correspondence but not for an engineering report. (Example: "We can kick the can down the road to gain lots of extra time." Better: "Flexibility on deadlines is helpful.")

Insensitive language includes cultural stereotypes, jokes, or clichés; avoid them. (Examples of erroneous assumptions: Men are football fans. Women like cooking. Millennials live in their basements playing video games.)

ORGANIZATION

The readability of a report also relies on how the information is shaped, or organized. Outlining is a strategy for separating main topics from sub-topics; arrangement of those topics into a logical sequence provides coherence and emphasis. Depending on the report subject, logical sequencing might be chronological (order of events), emphatic (order of importance), or problem/solution. Reports in general have an introduction, a body, and conclusion. The following features add to the effectiveness of a report.

Titles of reports announce the topic and purpose; they are descriptive, not "cute," dramatic, or sensational. A colon often separates titles from their subtitles that give further focus on the topic of the report. (Example: Storm Water Pollution Prevention: Planning, Monitoring, and Reporting)

Readability of a technical document can be improved by presenting "chunks" of information that are more "digestible" than long, complex sentences, with multiple concepts within a sentence. Shorter paragraphs also make for easier reading.

Format - Standard report **formatting** usually favors a font like Times New Roman (known as a serif font), size 12, double spacing with indented paragraphs, and a "ragged right" margin on the right side (to avoid the auto-spacing gaps). If a document is single-spaced, paragraphs are not indented, but an extra line space separates paragraphs.

Orienting devices serve as guideposts for the reader; they organize, announce a subtopic within the report, and signal for later reference. Suggested tips for formatting follow:

- Section headings: centered, bold type, larger font
- Headings: left side margin, bold, size 12 font
- Sub-headings: left side, bold or italics, size 12 font
- Bulleted lists and numbered lists: indented, parallel in structure (consistent as either words, phrases, or sentences)

Highlighting devices such as bold, italics, and underline help to organize and emphasize topics. If overused, they can lose effectiveness.

DOCUMENTATION

In written reports documentation is an important concept both legally and ethically. When a report incorporates the work of others, it must be attributed to the source through citation. The "borrowed" material may be summarized, paraphrased, or quoted directly, but in *all cases must be cited* at that point in the report. A parenthetical citation follows the material to include the author's last name and a page number. A Works Cited page appears at the end of the report with an alphabetical listing of the authors of cited works. (If no author, use the title of the work in italics.) Another acceptable format is the numbered footnote system that is referenced numerically in the Bibliography. There are many acceptable formats for citing sources, but the main purpose is to credit the source and give information on finding that source.

Legal Issues – The use of work from others can raise complex legal issues, especially if not documented. The following overview does not serve as legal advice; consult an attorney when in doubt.

Copyright – ownership rights of authors or creators of content, whether written, electronic, visual, musical, etc. (must be cited) Internet material is not "free" for using without citation.

Copyright Infringement – failure to credit the copyright author or creator; becomes very serious when your infringement impacts the value of the copyrighted work

Proprietary – exclusive to a company or entity, their intellectual property (must be cited)

Fair Use – legal use of copyrighted material under certain circumstances: the use is limited in scope, the use is for educational purposes, the use is not for economic gain, the use does not infringe on the value to the copyright holder (must be cited)

Public Domain – information/materials created by government or public entities, made available to the public (must be cited)

Plagiarism – failure to credit the work of others, including their words and the wording of their ideas

Liability – can result from producing information that is incomplete, unclear, misleading, or defective

Ethics – moral compass on doing what is right; something can be legal but unethical

Incorporating the work of others in a report calls for certain conventions:

- The report is your work, not simply a string of quotations from others. Use direct quotations judiciously (usually for the specific wording), and embed them grammatically into your sentences. (must be cited)

- "Common knowledge" refers to information that is so commonly known as to appear widely in sources; it does not require citation. (Example: Storm surge impacts coastal areas during hurricanes.) When in doubt, it is better to cite.

- "Lead-in / lead-out phrases" help when incorporating quotations in your text. (Example: "Dr. John Jones of Alphabet Clinic states . . ." Your text then refers to the quotation: "These results are commonly accepted . . .") Lead-in phrases may be author tags to name the author or simply signal phrases to introduce a quotation. (Example, "Scientists have now concluded . . .")

- Special punctuation marks are used in direct quotations to meet certain needs:

  - Ellipses are three spaced dots (periods) to show omission. They can appear at the beginning, in the middle, or at the end of the exact quotation. (Example: "Frankly, my dear . . .")
  - Brackets are used to add your own clarification. (Example: "Clinton [Hillary] will appear at the convention.")
  - [sic] is a device that indicates an error in the quotation, not yours. The error can be spelling, grammar, word usage, etc. (Example: "This flu pandemic insures [sic] that our healthcare system will collapse.")

VISUAL SUPPORT

Graphic displays help put raw data into concrete form conveying information more visually than verbal text. Graphics are easier to interpret comparisons, trends, and relationships. Visual appeal is more universal than words. Graphics might offer data at a glance or offer a detailed display of statistics for expert analysis. The use of color in graphics helps to distinguish or highlight certain elements. Graphic support options are numerous; the following are simplified examples:

- *Charts* – use geometric shapes to show relationships

  - pie chart – shows percentages in slices of a pie
  - flow chart – shows tasks or actions with alternate paths
  -organizational chart – shows the hierarchy of management structure
  -tree chart – shows organization in branches
  -pictogram – shows data in graphic symbols or icons
  -bar chart / bar graph – shows comparisons

- *Tables* – columns and rows of numbers or words

- *Graphs* – x-y axis with values, lines showing changes over time

- *Diagrams* – drawings or schematics, usually more focused than photographs

  - Representational diagram – shows a simplified view with parts
  - Exploded diagram - shows parts in an assembly pulled out for better view
  - Cut-away diagrams – shows a cross section, inside view

- *Maps* – show geographic locations with specific, relevant features

- *Elements of Visual Support* - Each graphic needs the following:

  -an appropriate title
  -a legend or labels to explain the displayed values
  -a citation to attribute the data source and the creator of the graphic
  -a reference or explanation in the text of the report

SUPPLEMENTARY MATERIALS

Formal reports often have additional pages bound or stapled with the text of the report: "front matter" and "end matter," coming before and after. The following are options:

- Letter of transmittal: business letter from the author addressed to the intended party
- Title page: gives title of report, name of author, and date
- Abstract: also called executive summary, gives a brief overview of the report
- Table of Contents: outlines the topics of the report with page numbers
- List of Tables and Figures: lists the visual supplements that appear in the report with page numbers
- Appendix: follows the text of the report with visuals that require a separate page
- Works Cited or Bibliography: lists sources referenced in the document, including author, title, publishing information, and date of publication

COMMON TYPES OF REPORTS

Within the types of reports, there are many variations but also some common essential elements, including the need for examining the purpose, the audience, the appropriate format, and the research that will go into the report. An initial draft faces revision, editing, and proofreading. Some key elements of common types of reports are as follows:

Proposal – a strategy or argument for solving a problem, improving a condition, or supporting a product or service. Proposal reports may include the following:

1. Examine the problem
2. Address the benefits of solving the problem
3. Offer a realistic solution to the problem

4. Discuss costs, challenges

5. Anticipate objections

6. Give reasons to act

Progress Report – gives the status of an ongoing project, tracks activities. Details in such reports may affect the coordination of activities among individuals and teams, scheduling, allocation of funds, assessment of delays, and other decisions. Progress reports may include the following:

1. Overview of the project, background
2. Work completed
3. Work in progress
4. Work to be completed
5. Challenges

6. Concluding comments

Procedures / Instructions – **Instructions** tell how to perform a task to someone generally unfamiliar with the task. **Procedures** give guidance, rules, or accepted practices to those who generally know how to perform the task. The acronym S.O.P. refers to Standard Operating Procedures for the actions that conform to certain standards, usually safety and accuracy. Standard Operating Procedures are especially important when different people must perform the same task at different times, sometimes with different equipment or under different circumstances. The order of actions is important, so that procedures are often in numbered sequence. Such a report may include the following:

1. Overview:
   - Description of mechanism or controls
   - Materials, list of parts
   - Definitions, consistent terminology
   - Warnings, cautions, or notes
   - Use of highlighting and orienting devices for organization and easy access

2. Specific actions in sequence
   - Numbered steps in exact sequence, one step per number
   - Active voice verbs (such as "*Assemble* the necessary parts . . . ")
   - Parallel structure (consistent as words, phrases, or sentences)
   - Reason for each action, as needed
   - Regular maintenance instructions
   - Suggested frequency for each action

3. What to expect after following the procedures

HELPFUL TIPS FOR THE WRITTEN REPORT:
The Minute Detail You Always Wondered About

Grammar – When a compound subject has a singular and a plural word joined by *or,* match the verb to the latter subject. (Example: Company credentials *or* an I D badge *is* acceptable for entry. An I D badge *or* company credentials *are* acceptable for entry.)

Punctuation – Always important, sometimes critical, easy to overlook.

    - Comma – Often used to avoid confusion for items in a series (Example: "The important levers to engage in sequence are red, yellow, silver and black." Three levers? Or "red, yellow, silver, and black levers" Four levers?)

-***Colon*** – Used after a complete thought to signal a further explanation or list. (Example: "Essential safety gear must be stowed in easy reach: fire extinguisher, flashlight, and first aid kit.)

Spelling – Directional adjectives are not capitalized (such as "the *northwest* corner of the intersection"), but nouns of geographical area are capitalized (such as "the *Northwest* will see rain tonight.") (See also Commonly Confused Words below for more spelling tips.)

Numerals – If a number is one word, spell it out. Larger numbers belong in numeral form in the text, especially if the report is heavy on numbers. Sentences are awkward if they begin with a numeral; revise the sentence to avoid writing out the words of a large number. (Awkward example: "220 volts require a smaller gauge wire than 110 volts for the same service." Better: "For the same service, 220 volts require a smaller gauge wire than 110 volts.")

Qualifiers – Be cautious with absolute statements, especially "always" and "never." Qualifiers are words like "almost," "often," "probably," "may," etc. (Examples of absolute statements: "Stucco application requires an expert." Better: "Stucco application *may* require an expert." Absolute statement: "An efficient light bulb will last 1000 hours." Better: "An efficient light bulb *may* last up to 1000 hours.")

Commonly Confused Words – Top Ten Tricky Words

Affect / effect – *Affect* is a verb meaning to impact or change; *effect* is a noun (usually), the result of a change. (Example: Weather will *affect* the project, but the *effect* should be minimal.)

Among / between – *Among* refers to three or more members of a group; *between* is used for two distinct individuals or items. (Example: *Between* you and me, there is disagreement *among* the group.)

Amount / number – *Amount* refers to a quantity; *number* refers to countable things. (Example: The *amount* invoiced for service seemed high, but the *number* of parts listed seemed accurate.)

Compliment / complement – To c*ompliment* is to give a kind comment; to *complement* means to complete or fit in. (Example: Adding an engineer will *complement* the team, but do not *compliment* her on her clothes.)

Continually / continuously – *Continually* means for a certain duration, off and on, but with interruptions; *continuously* means for a certain duration, uninterrupted. (Example: The operator *continually* called for assistance as the equipment hummed *continuously*.)

Ensure / insure – *Ensure* means to make sure; *insure* refers to financial protection. (Example: These funds will *ensure* that the company can *insure* its employees.)

Farther / further – *Farther* refers to physical distance; *further* refers to figurative distance (Example: There will be no *further* discussion on how much *farther* the road will be paved.)

Fewer / less – *Fewer* refers to countable things; *less* refers to quantity. (Example: There will be *fewer* complaints if we have *less* paperwork.)

Imply / infer – When not explicitly stated, to imply gives the information, and to *infer* receives the information. (Example: Try not to *imply* that his lunch break is too long, or he will *infer* that his work is sub-par.")

Principal / principle – *Principal*, as a noun, means the person in charge, as an adjective it means main or key. P*rinciple* refers to a rule or guideline. (Example: The *principal* objection was trying to follow a vague *principle*.)

CONCLUSION

Engineering reports are documents aimed at specific audiences designed to help them solve problems, understand issues, make decisions, and carry out tasks. The elements of language, organization, visual support, supplementary materials, and documentation all contribute to the effectiveness of the report and the resulting decisions and actions. A well-written report does not flow easily from the pen or keyboard but is a result of drafting, revising, editing, and proofreading. The standard rule of thumb for carpenters, to measure twice and cut once, applies here to double-check and check again until you get it right, before you submit a report.